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Cooke, C. Allan ... ... ... ... Bulsar.
Cooke, E. B. ... ... ... ... Cawnpore.
Cooke, J. V. ... ... ... ... *Europe.*
Cooper, H. C. H. ... ... ... ... Quetta.
Cooper, R. W. ... ... ... ... Karachi.
Copeland, T. B. (I.C.S.) ... ... ... Peshawar.
Coppinger, Capt. W. V. (I.M.S.) ... ... *Europe.*
Corbett, Capt. W. F. ... ... ... *Europe.*
Cordue, Major W. G. R. (R.E.) ... ... Bombay.
Cornelius, Stephen ... ... ... ... Mahim, Bombay.
Cosens, Lt. G. P. ... ... ... ... Lucknow.
Cossart, Capt. A. R. B. (R.F.A.) ... ... Trimulghery, Deccan.
Cosserat, L. (C.E.) ... ... ... ... Baroda.
Cotton, C. W. E. (I.C.S.) ... ... ... Calcutta.
Cotton, W. B. (I.C.S.) ... ... ... Etáwa, U. P.

Courthope, E. A. ... ... ... ... Dehra Dun, U. P.
Coventry, B. O. (I.F.S.) ... ... ... *Europe.* [C. P.
Coventry, F. C. ... ... ... ... Seoni Chappara,
Covernton, Professor A. L. ... ... ... *Europe.*
Cowie, Rev. A. G. G. ... ... ... Cawnpore.
Cox, Major P. Z. (F.Z.S., F.R.G.S., C.I.E.) ... Bushire.
Cox, S. (I.F.S.) ... ... ... ... Russellkonda.
Cox, Capt. W. H. (I.M.S.) ... ... ... Santa Cruz.
Coxon, S. W. (I.C.S.) ... ... ... Damoh, C. P.
Craddock, W. H. (I.F.S.) ... ... ... Rangoon.
Crawford, F. L. ... ... ... ... Buldana, Berar.
Crawford, Leslie ... ... ... ... Bombay.
Crawford, W. L. ... ... ... ... Saklaspur, Hassan.
Crawford, W. M. (I.C.S.) ... ... ... Sambalpur, Bengal.
Creaghe, P. F. S. ... ... ... ... *Europe.*
Crerar, J. (I.C.S.) ... ... ... ... Hyderabad, Sind.
Crommelin, C. A. R. ... ... ... Bombay.
Cross, R. G. ... ... ... ... Doloo, P.O., Cachar.
Crum, W. E. ... ... ... ... Bombay.
Cubitt, G. E. S. (I.F.S.) ... ... ... Kindat, Burma.
Cuffe, F. W. ... ... ... ... Bombay.
Cumming, J. W. N. ... ... ... Quetta.
Cumming, W. D. ... ... ... ... Karachi.
Cumming, Lt.-Col. W. H. (R.G.A.) ... ... *Europe.*
Curran, G. F. ... ... ... ... Tarekere P. O., Kadur District
Currimbhoy Ebrahim, Sir ... ... ... Bombay.
Currey, E. S. ... ... ... ... *Europe.*
Currey, Lieut. V. F. ... ... ... *Europe.*
Cursetji, Khan Bahadur C. M. (Life Member) ... Bombay.
Cutch, H. H. Sir Shri Kengarji Sawai Bahadoor, the Rao Saheb of (G.C.I.E.) (Life Member) ... Bhuj, Cutch.

Dadachanji, R. K. ... ... ... ... Bombay.
Daintrey, W. M. ... ... ... ... New York.
D'Albedyhll, C. C. ... ... ... ... Hyderabad (Sind).
Dalgliesh, G. ... ... ... ... *Europe.*
Dallaporta, J. N. ... ... ... ... Bombay.
Dalrymple-Hay, Mrs. L. ... ... ... Trichinopoly.
Daly, The Hon'ble Major Hugh (C.S.I.) ... Indore, C. I.
Daly College, The Librarian ... ... ... Indore, C. I.
Dames, Felix L. ... ... ... ... *Europe.*
Daniell, Col. A. C. (R.A.) ... ... ... *Europe.*
Danson, J. W. W. ... ... ... ... *Europe.*
Darjeeling, The Vice-President, Natural History Museum ... ... ... ... Darjeeling.
Davidson, J. (I.C.S.) ... ... ... *Europe.*
Davidson, Norman ... ... ... ... Quilon, Travancore

Clarke, L. O. (I.C.S.) (Life Member) ... ... Mymensingh, E. Bengal.
Clarke, Robt. L. H. (I.C.S.) ... ... ... Gorakhpore.
Clarkson, Lt.-Col. J. W. (I.M.S.) ... ... *Europe.*
Clayton, E. ... ... ... ... *Europe.*
Clifford, Capt. R. ... ... ... ... *Europe.*
Clutterbuck, P. H. (I.F.S., F.Z.S.) ... ... Kheri, Oudh.
Coates, Lt. E. C. ... ... ... ... Muttra.
Cobbe, Capt. C. C. ... ... ... ... *Europe.*
Coen, W. W. ... ... ... ... Hubli, S. M. Ry.
Coggan, R. T. ... ... ... ... *Europe.*
Coghill, Capt. N. S. (I.A.) ... ... ... *Europe.*
Cogill, Dr. H. (M.R.C.S., L.R.C.P.) ... ... Bombay.
Cole, Lt. A. G. M. ... ... Nasirabad.
Coleman, G. B. ... ... ... ... Bombay.
Collings, F. W. ... ... ... ... Gangaw, Pakokku, U. Burma.
Colomb, Lt.-Col. R. P. ... ... ... Buldana, Berar.
Colombo Museum, The Librarian ... ... Colombo.
Colston, Captain H. K. ... ... ... Quetta.
Coltart, Dr. H. N. (Life Member) ... ... Samastipur, T.S.Ry.
Comber, Edward (F.Z.S.) ... ... ... Karachi.
Combi, A. ... ... ... ... Poona.
Conduitt, W. A. (C.E.) ... ... ... Rangoon.
Coninghana, M. E. ... ... ... ... *Europe.*
Conley, Andrew ... ... ... ... *Europe.*
Connor, Capt. F. P. (F.R.C.S., I.M.S.) ... ... Calcutta.
Cooch Behar, H. H. Col. the Maharaja Sir Nripendra Narayen Bhup Bahadoor of (G.C.I.E.) (Life Member) ... ... ... ... Cooch Behar.
Coode, J. M. (Life Member) ... ... ... Rawal Pindi.
Cook, Geo. ... ... ... ... Sinbo, Myitkyina, Burma.
Cooke, C. Allan ... ... ... ... Bulsar.
Cooke, E. B. ... ... ... ... Cawnpore.
Cooke, J. V. ... ... ... ... *Europe.*
Cooper, H. C. H. ... ... ... ... Quetta.
Cooper, R. W. ... ... ... ... Karachi.
Copeland, T. B. (I.C.S.) ... ... ... Peshawar.
Coppinger, Capt. W. V. (I.M.S.) ... ... ... *Europe.*
Corbett, Capt. W. F. ... ... ... *Europe.*
Cordue, Major W. G. R. (R.E.) ... ... Bombay.
Cornelius, Stephen ... ... ... ... Mahim, Bombay.
Cosens, Lt. G. P. ... ... ... ... Lucknow.
Cossart, Capt. A. R. B. (R.F.A.) ... ... Trimulghery, Deccan.
Cosserat, L. (C.E.) ... ... ... ... Baroda.
Cotton, C. W. E. (I.C.S.) ... ... ... Calcutta.
Cotton, W. B. (I.C.S.) ... ... ... Etah, U. P.

Courthope, E. A. ... ... ... ... Dehra Dun, U. P.
Coventry, B. O. (I.F.S.) ... ... ... *Europe.* [C. I.
Coventry, F. C. ... ... ... ... Seoni Chappara,
Covernton, Professor A. L. ... ... ... *Europe.*
Cowie, Rev. A. G. G. ... ... ... Cawnpore.
Cox, Major P. Z. (F.Z.S., F.R.G.S., C.I.E.) ... Bushire.
Cox, S. (I.F.S.) ... ... ... ... Russellkonda.
Cox, Capt. W. H. (I.M.S.) ... ... ... Santa Cruz.
Coxon, S. W. (I.C.S.) ... ... ... Damoh, C. P.
Craddock, W. H. (I.F.S.) ... ... ... Rangoon.
Crawford, F. L. ... ... ... ... Buldana, Berar.
Crawford, Leslie ... ... ... ... Bombay.
Crawford, W. L. ... ... ... ... Saklaspur, Hassan.
Crawford, W. M. (I.C.S.) ... ... ... Sambalpur, Bengal.
Creaghe, P. F. S. ... ... ... ... *Europe.*
Crerar, J. (I.C.S.) ... ... ... ... Hyderabad, Sind.
Crommelin, C. A. R. ... ... ... ... Bombay.
Cross, R. G. ... ... ... ... Doloo, P.O., Cachar.
Crum, W. E. ... ... ... ... Bombay.
Cubitt, G. E. S. (I.F.S.) ... ... ... Kindat, Burma.
Cuffe, F. W. ... ... ... ... Bombay.
Cumming, J. W. N. ... ... ... Quetta.
Cumming, W. D. ... ... ... ... Karachi.
Cumming, Lt.-Col. W. H. (R.G.A.) ... ... *Europe.*
Curran, G. F. ... ... ... ... Tarekere P. O., Kadur District
Currimbhoy Ebrahim, Sir ... ... ... Bombay.
Currey, E. S. ... ... ... ... *Europe.*
Currey, Lieut. V. F. ... ... ... *Europe.*
Cursetji, Khan Bahadur C. M. (Life Member) ... Bombay.
Cutch, H. H. Sir Shri Kengarji Sawai Bahadoor, the Rao Saheb of (G.C.I.E.) (Life Member) ... Bhuj, Cutch.

Dadachanji, R. K. ... ... ... ... Bombay.
Daintrey, W. M. ... ... ... ... New York.
D'Albedyhll, C. C. ... ... ... ... Hyderabad (Sind).
Dalgliesh, G. ... ... ... ... *Europe.*
Dallaporta, J. N. ... ... ... ... Bombay.
Dalrymple-Hay, Mrs. L. ... ... ... Trichinopoly.
Daly, The Hon'ble Major Hugh (C.S.I.) ... Indore, C. I.
Daly College, The Librarian ... ... ... Indore, C. I.
Dames, Felix L. ... ... ... ... *Europe.*
Daniell, Col. A. C. (R.A.) ... ... ... *Europe.*
Danson, J. W. W. ... ... ... *Europe.*
Darjeeling, The Vice-President, Natural History Museum ... ... ... ... Darjeeling.
Davidson, J. (I.C.S.) ... ... ... *Europe.*
Davidson, Norman ... ... ... ... Quilon, Travancore

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| Davies, H. J. ... ... ... | ... Yenangyaung, U. Burma. |
| Davis, Lt.-Col. R. E. S. (I.M.S.) ... | ... Rangoon. |
| Davys, Capt. G. Irvine (I.M.S.) ... | ... Amritsar. |
| Dawson, W. H. (I.C.S.) (Life Member) ... | ... *Europe*. |
| Deakin, Mrs. M. E. ... ... | ... Bombay. |
| Deane, Dr. A. H. ... ... ... | ... Bombay. |
| Deane, H. H. (C.E.) ... ... | ... Bulsar. |
| De Carteret, St. G. ... ... | ... Banda, U. P. |
| De Cruz, A. M. ... ... ... | ... Bombay. |
| DeSouza, A. B. ... ... ... | ... Larkana, Sind. |
| Delmé-Radcliffe, Lieut. A. ... ... | ... Karachi. |
| Delmé-Radcliffe, Major H. ... ... | ... Agra. |
| Delmé-Radcliffe, Capt. S. ... ... | ... Jhansi. |
| Dempster, F. E. (C.I.E.) ... ... | ... Calcutta. |
| Dempster, Lieut. G. H. ... ... | ... Delhi. |
| Des Vœux, Major H. ... ... | ... Thaton, Burma. |
| Dewar, D. (I.C.S.) ... ... ... | ... Lahore. |
| Dewes, Major F. J. (I.M.S.) ... ... | ... Tunggyi, S. Shan States. |
| Dhar, H. H. the Rája of ... ... | ... Dhar, C. I. |
| Dharampur, Kumar Shree Vijayadevji of | ... Dharampur. |
| Dhunjibhoy Bomanji (Life Member) ... | ... Bombay. |
| Dick, Lt.-Col. A. R. ... ... | ... Kohat. |
| Dickson, Major, J. H. ... ... | ... Bombay. |
| Dimmock, Lt.-Col. H. P. (M.D., I.M.S.) ... | ... Bombay. |
| Dixey, Revd. Mr. Duncan (C.M.S.) ... | ... Quetta. |
| Dixit, D. L. (B.A.) ... ... ... | ... Poona. |
| Dixon, R. M. (B.A.) ... ... ... | ... Poona. |
| Dodd, Lt.-Col. J. R. (R.A.M.C.) ... | ... Dehra Dun, U. P. |
| Donaghey, J. O'B. ... ... ... | ... Bangalore. |
| Donald, C. H. ... ... ... | ... Srinagar, Kashmir |
| Donovan, Major C. (I.M.S.) ... ... | ... Madras. |
| Doughty, Capt. E. C. ... ... | ... *Europe*. |
| Douglas, S. M. (B.A.) ... ... | ... Rangoon. |
| Douglas, Commander W. R. B. (R.I.M.) | ... Bombay. |
| Douie, The Hon'ble Mr. J. M. (C.S.I., I.C.S.) | ... Lahore. |
| Downing, A. K. Weld ... ... | ... Coonnoor P. O., Nilgiris. |
| Drake-Brockman, Major D. H. ... | ... Lansdowne, Garhwal, U. P. |
| Drake-Brockman, Maj. H. E. (I.M.S., F.Z.S.) (Life Member) ... ... | ... Bombay. |
| Drake-Brockman, Maj. V. G. (I.M.S.) ... | ... *Europe*. |
| Dreckmann, Rev. F. (S.J.) ... ... | ... Dombay. |
| Drummond, J. R. (B.A., F.L.S.) ... | ... *Europe*. |
| Drury, E. N. ... ... ... | ... Thaye'myo, Burma. |

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| DuBoulay, J. H. (I.C.S., C.I.E.) | *Europe.* |
| Dudgeon, G. C. (F.R.S.) | *Europe.* |
| Duke, Lt.-Col. J. (I.M.S.) | Kapurthala. |
| Dumayne, F. G. | Calcutta. |
| Dunbar-Brander, A. (I.F.S.) | Hoshangabad. |
| Dunn, C. W. (I.C.S.) | Rangoon. |
| Dunn, Major H. N. (R.A.M.C.) | Umballa. |
| Dunsterville, Col. K. S. (R.A.) | Poona. |
| Dunsterville, Major L. C. | Dera Ismail Khan. |
| Durie, G. A. | Keng Tung, S. Shan States. |
| Dwane, E. H. | *Europe.* |
| Dwane, F. C. | Yellandu, Deccan. |
| Dwane, Major J. W. | Jubbulpore, C. P. |
| Dyson, Lieut. Col. T. E. (I.M.S.) | Poona. |
| Eardley-Wilmot, S. (I.F.S.) | Simla. |
| Ede, F. J. (A.M.I.C.E.) | Silchar, Cachar. |
| Edulji Nusserwanji, Dr. | Bombay. |
| Edwards, W. N. | Majuligh.r, Assam. |
| Egerton, B. (C.I.E.) | Hyderabad, Deccan. |
| Elgee, Major J. W. L. | Lebong, N. Bengal. |
| Eliot, Capt. Neville (R.G.A.) | *Europe.* |
| Elliott-Lockart, Major P. C. | Mardan, N.-W. F. Provinces. |
| Elliot, Lieut. C. | Myitkyina, U. Burma. |
| Elliot, Major W. H. W. (F.L.S., I.M.S.) | Simla. |
| Elliott, A. (C.I.E.) | *Europe.* |
| Ellis, E. V. (I.F.S.) | Toungoo, L. Burma. |
| Ellis, Col. P. M. (R.A.M.C.) | Quetta. |
| Ellis, R. H. (I.C.S.) | Malappuram, Malabar District. |
| Elwes, H. J. (F.R.S.) | *Europe.* |
| Emanuel, A. E. L. (I.C.S.) | Satara. |
| English, A. E. (I.C.S.) | Bassein, Burma. |
| Enthoven, R. E. (I.C.S.) | Bombay |
| Evans, Evan | Planters Stores, Dibrugarh, Assam. |
| Evans, Percy C. | Bindgei, Lankat, Sumatra. |
| Evans, Vety.-Major G. H. (F.L.S.) | Rangoon. |
| Evans, Capt. W. H. (R.E.) | Jubbulpore, C. P. |
| Fagan, Capt. E. A. | Bombay. |
| Fagan, H. R. | Rangoon. |
| Falkiner, Dr. J. M. | Dibrugarh, Assam. |
| Farrel, R. C. (I.F.S.) | Secunderabad (Deccan). |

Farrington, Sir H. A., Bart. (I.F.S.) ... ... Khulna, Bengal.
Faulkner, P. L. ... ... ... ... Shillong, Assam.
Fayrer, Capt. F. D. S. (I.M.S.) ... ... *Europe.*
Fearon, H. M. ... ... ... ... Madras.
Fenton, Col. L. L.... ... ... ... *Europe.*
Fenton, Lieut. L. S. ... ... ... Bombay.
Ferguson, H. S. (F.Z.S., F.L.S.) ... ... *Europe.*
Ferris, Col. W. R. ... ... ... ... Kolhapore.
Few, H. W. ... ... ... ... Monywa, Upper Burma.
Field, Frank ... ... ... ... Gaya.
Field, J. A. (R. E.) ... ... ... Jubbulpore, C. P
Filson, J. T. W. ... ... ... ... Sivakasi, Tinnevelly Dist.
Finlay, C. K. ... ... ... ... Rangoon.
Fischer, C. E. C. (I.F.S.) ... ... ... Dehra Dun, U. P.
Fisher, C. P. ... ... ... ... Nagpur, C. P.
Fisher, W. F. D. (I.F.S.) ... ... ... Bandra.
Fitz-Gerald, Capt. O. A. G. ... ... ... Calcutta.
Fletcher, Lieut. T. Bainbrigge (R.N., F.E.S.) ... Ceylon.
Florence, James ... ... ... ... Bombay.
Forbes, Capt. A. H. M. ... ... ... Bareilly.
Forbes, C. H. B. ... ... ... ... Bombay.
Forbes, Col. James ... ... ... Bombay.
Forbes, J. D. ... ... ... ... Jubbulpore, C. P.
Forbes-Sempill, Major The Hon'ble D. ... Nowshera, Punjab.
Forbes-Sempill, The Hon'ble R. A. ... ... Rangoon.
Forel, Monsieur Auguste (Hon. Correspg. Member). *Europe.*
Forster, T. W. (B.F.S.) ... ... ... Pyinmana, Upper Burma.
Forsyth, Dr. W. ... ... ... ... Calcutta.
Foster, Capt. R. B. B. (I.M.S.) ... ... Secunderabad, Deccan.
Foster, R. Guy ... ... ... ... Sallabile P. O., Kadur District.
Foulkes, George F. F. (I.F.S.) ... ... *Europe.*
Foulkes, Capt. H. D. ... ... ... *Europe.*
Foulkes, R. ... ... ... ... Calicut.
Foulkes, Major T. H. (I.M.S.) (Life Member) ... Madras.
Fox, Col. H. C. (R.E.) ... ... ... Dharwar.
Fraser, Prof. J. N. ... ... ... Bombay.
Fraser, The Hon'ble Mr. S. M. (I.C.S., C.I.E.) ... *Europe.*
Fraser, W. S. ... ... ... ... Bandikui, Rajputana.
Frederick, Capt. E. B. ... ... ... Secunderabad (Deccan).
Frenchman, Lt.-Col. E. P. (I.M.S.) ... ... Rangoon, Burma.
Friedlander and Son, Messrs. R. ... ... *Europe.*

Frost, G. ... ... ... ... Quetta.
Fry, J. F. ... ... ... ... *Europe.*
Fuller, Dr. Chas. A. ... ... ... Cawnpore.
Fulton, Capt. H. T. (D.S.O.) (Life Member) ... Dehra Dun.
Fulton, Col. R. ... ... ... *Europe.*

Gale, Capt. E. S. ... ... ... ... Kohima, Assam.
Galloway, R. ... ... ... ... Secunderabad.
Gamble, J. S. (I.F.S., F.L.S.) ... ... ... *Europe.*
Gammie, Prof. G. A. ... ... ... Poona.
Garrett, H. B. G. (S.F.S.) ... ... ... Papan, Burma.
Garrett, J. H. (I.C.S.) ... ... ... Ratnagiri.
Gaye, W. C. ... ... ... ... Secunderabad.
George, C. P. ... ... ... ... Secunderabad.
Gerhardt, Paul ... ... ... ... Bombay.
Ghosal, J. (I.C.S.) ... ... ... ... Dhulia.
Gibson, R. E. (I.C.S.) ... ... ... Hyderabad, Sind.
Gilbert, C. E. L. (I.F.S.) ... ... ... Bandra, Salsette.
Gilbert, Reg. (F.Z.S.) ... ... ... *Europe.*
Gilbert-Cooper, W. J. (I.F.S.) ... ... ... Kado, Moulmein.
Giles, A. R. ... ... ... ... Patna.
Gill, Capt. C. A. (I.M.S.) ... ... ... Jhelum.
Gill, C. G. ... ... ... ... Madras.
Gill, H. ... ... ... ... ... Bombay.
Gillum, S. J. ... ... ... ... Bombay.
Gimlette, Lt.-Col. G. H. D. (C.I.E., I.M.S.) ... Hyderabad, Deccan.
Gimlette, Dr. J. D. ... ... ... Singapore.
Gladstone, H. S. (F.Z.S.) ... ... ... *Europe.*
Glaeser, John ... ... ... ... Bombay.
Glascock, L. C. ... ... ... ... Phillour, Fort, Punjab.
Glazebrook, N. S. ... ... ... ... Bombay.
Gleadow, F. (F.R.M.S., I.F.S.) ... ... ... Bandra, Salsette.
Gloster, Capt. J. H. (I.M.S.) ... ... ... Tarn-Taran, Amritsar Dist.

Godden, A. L. ... ... ... ... Tezpur, Assam.
Godwin-Austin, H. ... ... ... ... *Europe.*
Gonsalves, Dr. J. F. ... ... ... Bandra.
Gordon, D. M. ... ... ... ... Keng Tung, S. Shan States.
Gordon, E. B. ... ... ... ... Fort William Cal.
Gordon, R. G. (I.C.S.) ... ... ... Jetalsar.
Gore, F. W. ... ... ... ... Hoogrijhan P. O., Assam.

Gore, Col. St. G. C. (R.E., C.S.I.) ... ... *Europe.*
Gossage, F. H. ... ... ... ... Maskeliya, Ceylon.
Gough, Major C. ... ... ... ... *Europe.*
Gover, A. A. ... ... ... ... Kurnool, Madras Presy.

Graham, Lt. B. C. ... ... ... ... Dharamsala, Punjab.
Graham, D. N. ... ... ... ... Bombay.
Graham, G. E. R. (I.C.S.) ... ... ... Mundla, C. P.
Graham, J. A. ... ... ... ... Mercara, Coorg.
Graham, L. (I.C.S.) ... ... ... ... Dharwar.
Grant, C. F. (I.C.S.)... ... ... ... Rangoon.
Grant, F. A. ... ... ... ... Thayetmyo, Burma.
Grant, John F. ... ... ... ... *Europe.*
Gray, Chas. ... ... ... ... Coonoor.
Gray, P. B. ... ... ... ... Poona.
Greaves, H. R. ... ... ... ... Bombay.
Greaves, S. E. ... ... ... ... Bombay.
Green, E. Ernest (F.E.S.) ... ... ... Ceylon.
Green, James ... ... ... ... *Europe.*
Greer, W. (I.C.S.) ... ... ... ... Ahmednagar.
Gregerson, Dr. J. D. ... ... ... *Europe.*
Gregorson, T. S. ... ... ... ... Bombay.
Greig, Joseph ... ... ... ... Bagh-o-Bahar, Cachar.
Greig, Capt. W. B. ... ... ... Sakesar-Mianwali District.
Griffith, Capt. K. H. (R.F.A.)... ... ... Hyderabad, Deccan.
Grönvold, H. ... ... ... ... *Europe.*
Grubbe, Major E. A. ... ... ... *Europe.*
Habibuddin, S. (N.C.S.) (Life Member) .. ... Hyderabad, Deccan.
Hyeberle, Capt. (I.F.S.) ... ... ... Perumbavoor P. O., Travancore.
Haffenden, Ed. D. H. ... ... ... Mandalay, Burma.
Hale, Major C. H. (R.A.M.C.) ... ... ... Rangoon.
Hall, W. D. ... ... ... ... Bombay.
Hamburg Natural History Museum, The Director, Hamburg.
Hamilton, A. G. ... ... ... ... *Europe.*
Hamilton, J. D. (B.F.S.) ... ... ... Rangoon.
Hammond, A. H. ... ... ... ... Bombay.
Hampson, Sir George F. (Bart.), (F.L.S., F.E.S.) ... *Europe.*
Hankin, A. C. (C.I.E.) ... ... ... Hyderabad, Deccan.
Hannyngton, W. O. ... ... ... Shwebo, Burma.
Harcourt, Capt. J. S. M. ... ... ... Bombay.
Hardy, A. W. ... ... ... ... Talup, Assam.
Harington, Major H. H. ... ... ... Rangoon.
Harington, Col. V. (I.M.S.) ... ... ... Mount Abu.
Harker, O. Allen ... ... ... ... Dhulia, Khandesh.
Harper, E. W. (F.Z.S.) ... ... ... Bedford, England.
Harris, Capt. O. M. (R.H.A.) ... ... ... Saugor, C. P.
Harrison, A. J. ... ... ... ... Lakhimpur, Assam.
Harrison, Capt. C. B. (I.M.S.)... ... ... *Europe.*
Hart, E. H. ... ... ... ... Londvla.

Harter, R. W. ... ... ... ... Bombay.
Harvey, Capt. W. F. (I.M.S.) ... ... Kasauli, Punjab.
Harvey, W. L. (I.C.S., C.I.E.) ... ... ... Simla.
Hasted, Major A. W. ... ... ... Kasauli.
Hasted, H. R. G. ... ... ... ... Mangalore, S. India.
Hasted, J. E. H. ... ... ... ... Masulipatam, Kistna District.
Hasted, W. A. ... ... ... ... Palamcottah, Tinnevelly District.
Hatchell, D. G. ... ... ... ... Madras.
Hate, Vinayek N. ... ... ... ... Bombay.
Haughton, Samuel (C.C.S.) ... ... ... *Europe.*
Hauxwell, T. A. (I.F.S.) ... ... ... Rangoon.
Hawkins, A. B. ... ... ... ... Pigboi P. O., U. Burma.
Hayden, H. H. ... ... ... ... Calcutta.
Hearsey, Mrs. L. D. ... ... ... Lakhimpur, Kheri, Oudh.
Hearsey, T. N. (I.F.S.) ... ... ... Nilambur, S. Malabar.
Heath, R. H. (C.E.) ... ... ... Fatehgarh, B. B. & C. I., including R.-M. Ry.
Heeckerenz, Baron Von (Hon. Corrpg. Member) ... Java.
Henderson, Capt. R. R. ... ... ... Sialkote.
Hendley, Lt.-Col. Harold (M.D., I.M.S.) ... ... Amritsar.
Hepburn, W. ... ... ... ... Mandalay.
Herbert, Lt.-Col. H. (I.M.S.) ... ... ... *Europe.*
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Hide, P. (Life Member) ... ... ... Indore, C. I.
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High Range Natural History Society, The President Munnar P. O., S. India.
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Hopwood, J. C. ... ... ... ... Mingin, U. Burma.
Hosken, A. Fayrer ... ... ... ... Secundarabad, Deccan.
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Howell G. C. (I.C.S.) ... ... ... Asst. Naggar Comr., Kulu, Punjab.
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Huggins, J. R. ... ... ... ... Hosar, Salem Dist.
Hughes, Lieut. F. L ... ... ... Dehra Ismail Khan.
Hughes, T. O. ... ... ... ... Mekran, Baluchistan.
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Hutchinson, F. T. ... ... ... *Europe.*
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Hyam, Judah (G.B.V.C., F.Z.S.) (Life Member) ... Pusa, Bengal.
Hyde-Cates, Lt.-Col. G. E. ... ... ... Palanpur.

Ichalkaranji, The Hon'ble Narayenrao Govind *alias* Babasaheb Ghorpade, Chief of (Life Member) ... Kolhapur.
Ilbert, L. G. ... ... ... ... Sibsagar, Assam.

Inglis, C. C. ... ... ... ... Mirpurkhas Sind.
Inglis, Chas. M. (Life Member) ... ... Durbhanga.
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Innes, Capt. H. (I.M.S.) ... ... Barisal, E. Bengal.
nverarity, J. D. (B.A., LL.B.) (Life Member) ... Bombay.
relan, S. G. deC. (I.C.S.) ... ... ... Allahabad, U. P.
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Ivens, J. H. (P.W.D.) (Life Member) ... ... Agra.
Iyer, V. Subramania (M.A.) ... ... ... Dehra Dun, U. P.

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Jackson, H. (I.F.S.) ... ... ... ... Naini Tal, U. P.
Jackson, Major J. (I.M.S.) ... ... ... Poona.
Jacob, W. R. Le Grand (I.F.S.) ... ... Rajabhatkhawa, E. B. S. Ry.
James, Major C. H. (I.M.S.) ... ... ... Patiala, Punjab.
James, Lt. F. H. ... ... ... ... *Europe.*
Jamkhandi, Shrimant Parashram Ramchandra Patwardhan, The Chief of (Life Member)... ... Kolhapore.
Jamsetji, M. Doctor ... ... ... Bombay.
Janjira, H. H. Sir Sidi Ahmed Khan (K.C.I.E.), Nawab of (Life Member) ... ... ... Janjira.
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Jardine, E. R. ... ... ... ... Lucknow.
Jardine, M. R. ... ... ... ... Bombay.
Jardine, W. F. ... ... ... ... Karwar.
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Jellett, H. H. ... ... ... ... Calcutta.
Jencken, Lt.-Col. F. J. (R.A.M.C.) ... ... Deolali.
Jenkins, S. E. F. (I.F.S.) ... ... ... Loilem, S. Shan States, Burma.
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Jesse, William ... ... ... ... Meerut.
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Jones, Major M. D. Goring ... ... ... Lucknow.
Jones, T. M. ... ... ... ... Rangoon.
Jones, Capt. T. W. H. ... ... ... Jubbulpure, C. P.
Jones, W. Harvey ... ... ... ... Calcutta.
Jowitt, John F. ... ... ... ... Bandarwella, Ceylon.
Jukes, J. C. E. (I.C.S.) ... ... ... Ahmedabad.

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| Kagal, Meherban Piraji Rao Bapu Saheb Ghote, Chief of ... ... ... | ... Kagal, S. M. C. |
| Karachi, The Curator, Victoria Museum | ... Karachi, Sind. |
| Keary, Col. H. O ... ... ... | ... Bhamo Burma. |
| Keddie, D. L. ... ... ... | ... Mong Nai, S. Shan States, Burma. |
| Kelly, B. P. ... ... ... | ... Mansi, Banmauk Katha, Burma. |
| Kelly, Capt. C. R. (R.G.A.) ... ... | ... Kohat. |
| Kelsall, Capt. H. J. (R.A.) ... ... | ... Hongkong. |
| Kemball, H. L. ... ... ... | .. Mount Abu. |
| Kemball, H. V. (C.E.) ... ... | ... *Europe.* |
| Kemp, Capt. D. C. (I.M.S.) ... ... | ... Cuddapah, Madras. |
| Kendall, C. H. B. (I.C.S.) ... ... | ... Fyzabad. |
| Kendall, Capt. C. J. (R.I.M.) ... ... | ... Bombay. |
| Kennedy, R. M. (I.C.S.) ... ... | ... Ahmedabad. |
| Kennion, Major R. C. (F.Z.S.) ... | ... Seistan. |
| Kenny, S. D. (I.F.S.) ... ... | ... *Europe.* |
| Kenyon, James ... ... ... | ... Karachi. |
| Kenyon, J. H. ... ... ... | ... Peermade, Travancore. |
| Ker, L. B. ... ... ... | ... Bombay. |
| Kergarion, Comte de ... ... | ... Paris. |
| Kerkhoven, E. J. (Hon. Correspg. Member) | ... Java. |
| Kerr, Dr. A. F. G.... ... ... | ... Chiengmai, Siam. |
| Kerr, H. R. ... ... ... | ... Sinbo, Burma. |
| Kerr, N. ... ... ... ... | ... Bombay. |
| Kettlewell, Capt. H. W. ... ... | ... Fyzabad, Oudh. |
| Keys, H. W. (I.F.S.) ... ... | ... *Europe.* |
| Keys, Capt. W. D. A. (I.M.S.) ... | ... Bombay. |
| Khan, Muncherji Framji (Life Member) | ... Colombo, Ceylon. |
| Khareghat, M. P. (I.C.S.) ... ... | ... Ratnagiri. |
| Kiddle, J. A. C. ... ... ... | ... Hmine tong yee Papan, L. Burma. |
| Kilby, R. G. (I.C.S.) ... ... | ... Mozufferpore. |
| Kilkelly, Major P. P. (I.M.S.) ... | ... Bombay. |
| Kilner, Dr. J. N. (M.B.) ... ... | ... Chinpina, Adra, Bengal. |
| King, O. A. ... ... ... | ... Coonoor P. O., Nilgiris. |
| King, R. C. H. Moss (I.C.S.) ... ... | ... Saugor, C.P. |
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| Kinloch, A. M. ... ... ... | ... Kil-Kotagiri, Nilgiris. |
| Kirk, R. T. F. (I.C.S.) ... ... | ... Jalgaon, East Khandesh. |
| Kirkpatrick, W. McColin ... ... | ... Delhi. |
| Kirtikar, Lt.-Col. K. R. (I.M.S.) ... | ... Andheri, Salsette. |

Knox, Major A. R. (R.F.A.) ... ... ... Jubbulpore, C. P.
Knyvett, W. A. ... ... ... ... Gaya, Bengal.
Kolhapur, H.H. the Maharaja Sir Shahu Chhatrapati (G.C.S.I, G.C.V.O.) (Life Member) ... Kolhapur.
Kotah, H.H. the Maharaja Sir Umed Sing, Bahadoor (K.C.S.I.) (Life Member) ... Kotah.

Kushal Pal Singh, Raja ... ... Kotla P. O., Agra District.

Kynaston, E. ... ... ... ... Yantiyantola, Ceylon.

Lace, John H. (I.F.S., F.L.S.) ... ... ... Dehra Dun, U. P.
Lahore Veterinary College, The Principal ... Lahore.
Lahore Zoo, The President, Committee of Management ... ... ... ... Lahore.
Laird-MacGregor, E. G. L. (I.C.S.) ... ... Belgaum.
Lamb, Major Geo. (I.M.S.) ... ... ... Kasauli, Punjab.
Lamb, The Hon'ble Mr. R. A. (I.C.S., C.I.E.) (Life Member)... ... ... ... ... *Europe.*
Lamington, H. E. Lord (G.C.M.G., G.C.I.E.) ... *Europe.*
Land Records and Agriculture, The Director of ... Poona.
Lane, Capt. W. H. ... ... ... Mandalay, Upper Burma.

Lang, Capt. C. F. C. ... ... ... *Europe.*
Lawrie, A. S. (P.W.D.) ... ... ... The Nagavalli Project, Vizagapatam Dist.

Lawrence, Revd. Mr. F. (C.M.S.) ... ... Quetta.
Le Mesurier, H. P. (C.E.) ... ... ... Calcutta.
Lee, Capt. A. W. H ... ... ... Prome, L. Burma.
Lee, Major F. ... ... ... ... Poona.
Lees, D. H. (Life Member) ... .. ... Tezpur, Assam.
Leeson, G. W. ... ... ... ... Barisal, Bengal.
Leete, F. A. (F.C.H., I.F.S.) ... ... ... *Europe.*
Lefroy, H. M. (M.A., F.E.S., F.Z.S.) ... ... Pusa, Bengal.
Lehmann, Dr. Adolf ... .. ... Bangalore.
Lennox, Capt. G. M. ... ... ... Lashio, N. Shan States.

Leslie, A. K. ... ... ... ... Bombay.
Leslie, Major G. A. J. (R.E.) ... ... ... Kirkee.
Leslie Major W. C. C. ... ... ... Chakrata.
Lester, Major C. D. ... ... ... Agra.
Lethbridge, Capt. W. (M.D., I.M.S.) ... ... *Europe.*
Light, Col. R. H. ... ... ... ... *Europe.*
Light, Capt. W. A. ... ... ... Bombay.
Lightfoot, S. St. C. ... ... ... Taunggyi, U. Burma.

Lincoln, Capt. C. H. (I.M.S.) ... ... ... Dhulia, Khandesh.
Lindley, E. S. (C.E.) ... ... ... Karnal, Punjab.
Lindsay-Smith, Capt. J. ... ... ... Lyallpur.
Linnell, Fred. ... ... ... ... Rangoon.
Liston, Capt. W. G. (I.M.S.) ... ... ... *Europe.*
Little, F. D. ... ... ... ... Toungdwingyee, U. Burma.
Lloyd, Capt. R. A. (I.M.S.) ... ... ... Jhelum.
Loam, Mathew ... ... ... ... *Europe.*
Loch, Maj. F. R. E. (I.S.C.) ... ... ... *Europe.*
Lodge, G. E. ... ... ... ... *Europe.*
Logan, The Hon'ble Mr. A. C. (I.A.) ... ... Bombay.
Logan Home, Lt. G. R. S. ... ... ... Ferozepore.
Long, G. R. (I.F.S.) (Life Member) ... ... Tunggyi, U. Burma.
Long, Capt. H. W. (R.A.M.C.)... ... ... Jullundur.
Longden, C. C. ... ... ... ... Colombo, Ceylon.
Lonsdale, J. W. ... ... ... ... Madras.
Lory, F. B. P. (M.A.) ... ... ... Ahmedabad.
Lovegrove, W. H. (I.F.S.) ... ... ... Naini Tal.
Lowis, Major R. M. ... ... ... Umballa.
Lowndes, G. R. ... ... ... ... Bombay.
Lowrie, A. E. (I.F.S.) ... ... ... Raipur, C. P.
Lowsley, C. O. ... ... ... ... Jacobabad, Sind.
Luard, Capt. C. E. ... ... ... ... *Europe.*
Lucknow, The Curator & Sec., Provincial Museum Lucknow.
Lumsden, O. E. (I.C.S.) ... ... ... *Europe.*
Lushington, P. M. (I.F.S.) ... ... ... Manantoddy, N. Malabar.
Lushington, R. H. ... ... ... ... Berhampur.
Lyall, Capt. R. A. ... ... ... ... Kohat.
Lyell, Lt. A. G. ... ... ... ... Killa Drosh, Chitral.
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Macaulay, L. A. ... ... ... .. Ghatkopar.
MacDonald, Dr. D. (Life Member) ... ... *Europe.*
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MacDonald, K. C. (D.S.P.) ... ... ... Pokokku, Burma.
MacGregor, Lieut. R. D. (I.M.S.) ... ... Bombay.
MacMillan, R. W. M. ... ... .. Rajamundry, Godavari Dist.
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Madras, The Professor of Zoology, Madras Christian College ... ... ... ... Madras.
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Madras, The Librarian, Govt. Central Museum ... Madras.
Magrath, Major H. A. F. ... ... ... Bannu, N.-W. F. P.
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Manders, Lt.-Col. N. (R.A.M.C., F.Z.S., F.E.S.) (Life Member) ... ... ... ... *Europe.*
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Manson, C. E. F. ... ... ... ... Insein, near Rangoon, Burma.

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Marjoribanks, N. E. (I.C.S.) ... ... ... Madras.
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Maxwell, Capt. W. F. (R.E.) ... ... ... Kirkee.
Mawson, Mrs. O. S. ... ... ... *Europe.*
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McConaghey, Major A., Political Agent ... Quetta.
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McDonough, A. D. ... .... ... ... Campbellpore and Attock.
McDougall, E. (D.S.P.) ... ... ... Myilkyina, U. Burma.
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McIntosh, Alex. (C.E.) ... .... ... Trichinopoly.
McIntosh, R. (I.F.S.) ... ... ... ... Minbu, Burma.
McKerron, R. G. (M.A., I.C.S.) ... ... Rangoon.
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McKenna, Lieut. J. C. ... ... ... Manipur, Assam.
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McNeale, J. H. ... ... ... ... Seoni, C. P.
McNeill, J. (I.C.S.) ... ... ... ... *Europe.*
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McPherson, Capt. J. (I.M.S.) .. ... ... Bombay.
Mead, P. J. (I.C.S.) ... ... ... ... Poona.
Meade, Col. M. J. (C.I.E.) ... ... ... Baroda.
Mears, Capt. A. (I.A.) ... ... ... *Europe.*
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Menon, K. G. ... ... ... ... Trichor, Cochin.
Merewether, Major H. D. ... ... ... Palanpur.
Mess President, 1st Royal Sussex Regt. ... Umballa.
Mess President, 1st Battn. 10th Gurkhas ... Maymyo, Burma.
Mess President, 29th Lancers... ... ... Sirur, Poona Dist.
Mess President, 32nd Pioneers ... ... Umballa.
Mess President, 2nd Worcestershire Regt. ... Ahmednagar.
Mess President, 1st Battn. 39th Garhwal Rifles, Lansdowne ... .. ... ... Garhwal, U. P.

Mess President, 44th Merwara Infantry ... Ajmer.
Mess President, 85th Regiment (K.S.-L.I.) ... Fyzabad.
Mess President, 110th Mahratha L. Infantry ... Poona.
Mess President, 130th Baluchis ... ... Chaman.
Mess, 74th Punjabis, Hon. Secy., Book Club ... Saugor, C. P.
Mess, R. E., Hon. Secretary ... ... ... Roorkee.
Mess, R. F. A. (40th and 45th Battery) Hony. Secretary ... ... ... ... Hyderabad, Sind.
Mess President, 1st South Wales Borderers ... Karachi.
Messent, P. G. (C.E.) ... ... ... Bombay.
Meyer, Dr. F. A. ... ... ... ... Bombay.
Meyer, O. ... ... ... ... Bombay.
Meyrick, E. (F.R.S.) ... ... ... ... *Europe.*
Millard, W. S. (F.Z.S.) (Life Member) ... ... Bombay.
Miller, G. A. ... ... ... ... Darjeeling.
Millett, G. P. (I.F.S.) ... ... ... Karachi.
Milne, Mrs. Leslie ... ... ... ... Rangoon.
Milne, Major C. J. Robertson (I.M.S.) ... ... Berhampore, Bengal.
Mills, J. D. (Life Member) ... ... ... *Europe.*
Minns, Mrs. H. C. ... ... ... Sandoway, Burma.
Miraj, Shrimant Gungadharrao Ganesh, *alias* Baba-saheb Patwardhan, Chief of (Life Member) ... Miraj.
Mitchell, H. H. G. ... ... ... ... Madras.
Mitchell, J. C. H. ... ... ... ... Derrang, Halem P. O., Assam.
Moberly, Mrs. B. M. ... ... ... Hyderabad (Deccan).
Mockler, Major G. F. ... ... ... Deolali.
Modi, Bomanji Edulji ... ... ... Kaira.
Moggridge, C. B. ... ... ... ... Rangoon.
Molesworth, W. G. ... ... ... Waltair.
Mollison, J. ... ... ... ... Nagpur, C. P.
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Monteath, G. (I.C.S.) (Life Member) ... ... Bombay.
Monteath, J. (I.C.S.) ... ... ... Satara.
Montresor, Capt. L. B. (R.F.A.) ... ... Agra.
Moore, T. D. ... ... ... ... Bombay.
Moore, T. ... ... ... ... Madras.
Moore, W. (F.I.C.) ... ... ... ... Dibrugarh.
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Morgan, V. G. (I.F.S.) ... ... ... Mundia, C. P.
Morgan, W. de (C.E.) ... ... ... *Europe.*
Morris, Capt. A. H. (R.A.M.C.) ... ... Free Town, Sierra Leone, W. Africa.
Morris, Major D. O. ... ... ... Akola, Berar.
Morris, Capt. G. M. ... ... ... Bombay

Mosse, Capt. A. H. E. (Life Member) ... ... Aden.
Mowbray, G. B. De... ... ... ... Maskeliya, Ceylon.
Moylan, W. ... ... ... ... Calcutta.
Muir, G. B. F. (I.C.S.) ... ... ... Fatehgarh, U. P.
Muir Mills Co., Ltd., The Manager and Secretary.. Cawnpore.
Mudhol, Shrimant Malojirao Rage Ghorpade, Chief of ... ... ... ... Mudhol, S. M. C.
Müller, Professor O. V. ... ... ... Bombay.
Mullins, Lt.-Col. W. B. ... ... ... *Europe.*
Mumford, J. ... ... ... ... Bombay.
Mundy, B. H. H. (F.R.G.S.) ... ... ... Bombay.
Mundy, N. S. ... ... ... ... Silchar, Cachar.
Munna Lâl, Dr. (L.M. & S.) ... ... ... Ballia, N.-W.P.
Murison, Capt. C. C. (I.M.S.) ... ... ... Sukkur.
Murphy, Capt. A. (I.M.S.) ... ... ... Bombay.
Murray, S. B. (P.W.D.) ... ... ... Madras.
Muspratt, Major F. C. ... ... ... Shau-h a i-K w a n, N. China.

Mysore, The Superintendent, Mysore Government Museum ... ... ... ... Bangalore.
Mysore, H. H. the Maharaja Krishna Raj Woodayar Bahadoor of (Life Member) ... ... ... Mysore.

Nagpur, The Curator, Central Museum... ... Nagpur.
Nangle, H. C. ... ... ... ... Thaton, Burma.
Nangle, Capt. M. C. ... ... ... Rangoon, Burma.
Napier, A. G. Fitz.... ... ... ... Bombay.
Naranji Dwarkadas (Life Member) ... ... Bombay.
Narrotumdas Morarji Goculdass (Life Member) ... Bombay.
Nasrulla Khan, H. H. Nawab Mahomed ... Bhopal, C. I.
Nawab Mahomed Salamulla Khan, Khan Bahadur. Buldana, Berar.

Nene, Sadashive Sitaram ... ... ... Sangamner, Ahmednagar Dist.
Neale, W. N. ... ... ... ... Tankari, B r o a c h District.
Newill, T. N. C. ... ... ... ... *Europe.*
Newbold, Major A. W. ... ... ... Kohat, Punjab.
Newcome, Lionel ... ... ... ... Coorg, S. India.
Newnham, Lieut.-Col. A. (F.Z.S.) ... ... Kasauli, Punjab.
Nicholson, E. F. ... ... ... ... Bombay.
Nicholson, Capt. W. C. ... ... ... Benares.
Nisbet, J. E. S. ... ... ... ... Shwebo, Burma.
Nisbett, Major W. G. ... ... ... Port Blair.
Nunn, H. (I.C.S.) ... ... ... ... Khandwa, C. P.
Nurse, Lt.-Col. C. G. (F.E.S.) (Life Member) ... Jubbulpore, C. P.
Nuttall, W. M. ... ... ... ... Dibrugarh, Assam.

Oakes, M. H. (D.S.P.) ... ... ... Gonda, Oudh.
Oates, E. W. (F.Z.S.) (Hon. Corresp. Member) ... *Europe.*
Oberholser, H. C. ... ... ... ... Washington, U. S. A.
O'Brien, Capt. Edward ... ... ... Aden.
O'Donnell, Lt.-Col. T. J. (D.S.O., R.A.M.C.) ... Quetta.
Ogilvie, A. W. (S.F.S.) ... ... ... Paknamps, Siam.
Ogilvie, Major E. C. (R.E.) ... ... ... Attock.
Okeden, W. P. ... ... ... ... Rangoon.
Oldham, Capt. L. W. S. (R.E.) ... ... Nagpur.
Oliver, A. K. ... ... ... ... Bombay.
Oliver, J. W. (I.F.S.) ... ... ... *Europe.*
Oliver, Major L. G. ... ... ... Lebong, Bengal.
Olivier, Col. H. D. (R.E., F.Z.S.) (Life Member) ... *Europe.*
Ollenbach, O. C. ... ... ... ... Dehra Dun, U. P.
Ollivant, Capt. A. H. (R.G.A.) ... ... ... *Europe.*
Opiumwalla, Dorab E. ... ... ... Bombay.
Orr, Capt. H. M. C. ... ... ... Secunderabad, Deccan.
Orr, J. P. (I.C.S.) ... ... ... ... Ahmednagar.
Orr, Sutherland ... ... ... ... Madras.
Osborn, Genl. W. ... ... ... ... Naggar Kullu, Kangra District.
Osmaston, B. B. (I.F.S.) ... ... ... Port Blair.
Osmaston, L. S. (I.F.S.) ... ... ... Nasik.
Ostermayer, G. ... ... ... ... Bombay. [P.
Oxley, Capt. J. C. S. (I.M.S.) ... ... ... Seoni-Chappara, C.
Packard, Capt. H. N. (R.A.) ... ... ... Naini Tal.
Page, W. G. ... ... ... ... Indore, C. I.
Page, W. T. (F.Z.S.) ... ... ... *Europe.*
Page, W. W. K. ... ... ... ... Calcutta.
Painter, H. L. (I.C.S.) ... ... ... Surat.
Pallant, Lieut. S. L. (R.A.M.C.) ... ... *Europe.*
Palmer, W. L. ... ... ... ... Dehra Dun, U. P.
Panter, Lt. G. A. E. ... ... ... Jersey, Channel Islands.
Parasu Ramdas Patro, A. (B.A.) ... ... Berhampur.
Parker, R. N. (I.F.S.) ... ... ... ... Nurpur, Kangra Dist., Punjab.
Parnell, R. (I.F.S.) ... ... ... ... Lahore, Punjab.
Parrington, Lt. J. W. (R.A.) ... ... ... Kirkee.
Parsons, M. D. ... ... ... ... Pyinmana, U. Burma.
Parshotumdas Vishram Maoji ... ... Bombay.
Partridge, E. A. ... ... ... ... Secunderabad, Deccan.

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| Partridge, Henry (Life Member) ... | ... Pyinmana, Burma. |
| Pasco, J. Harding ... ... ... | ... Kulla Kambay, Nilgiris. |
| Pasteur Institute of India, The Director | ... Kasauli, Punjab. |
| Patel, Khan Bahadoor Burjorji D. ... | ... Quetta. |
| Patterson, Dr. R. L. ... ... | ... Sibsagar, Assam. |
| Patton, Capt. W. S. (I.M.S.) ... ... | ... Madras. |
| Pawalla, Jamsetji C. ... ... | ... Bombay. |
| Payn, Capt. W. A. ... ... ... | ... Quetta. |
| Payne, F. (B.A.) ... ... ... | ... Bankipur, E. I. Ry. |
| Pearce, Capt. C. R. (I.M.S.) ... ... | ... Mavmyo, Burma. |
| Pearless, S. H. ... ... ... | ... Ceylon. |
| Pearse, Lt. G. ... ... ... | ... Kohat. |
| Pearson, R. S. (I.F.S.) ... ... | ... *Europe.* |
| Pechey-Phipson, Mrs. (M.D.) ... ... | ... *Europe.* |
| Penno, Dr. F. L. (M.R.C.S, L.R.C.P.) ... | ... Bombay. |
| Percival, A. P. (I.F.S.) ... ... | ... *Europe.* |
| Percival, G. S. P. ... ... ... | ... Mercara, Coorg. |
| Perreau, Capt. G. A. ... ... | ... Bakloh, Punjab. |
| Perrot, Lt. H. S. (R.G.A.) ... ... | ... *Europe.* |
| Pershouse, Lt. S. ... ... ... | ... Middelburg, Transvaal. |
| Pestonji Jivanji (N.C.S.) (Life Member) ... | ... Hyderabad, D. |
| Peters, Col. C. T. (I.M.S. Retd.) ... | ... Dinajpur. |
| Petit, Bomanji Dinshaw (Life Member) ... | ... Bombay. |
| Petit, Dhunjibhoy Bomanji (Life Member) | ... Bombay. |
| Petit, Jehangir Bomanji (Life Member) ... | ... Bombay. |
| Peto, Lieut. Clement H. ... | ... Rawal Pindi. |
| Phillimore, Lieut. R. H. (R.E.) ... | ... Bangalore. |
| Phipson, H. M. (C.M.Z.S.) (Life Member) | ... *Europe.* |
| Pickersgill-Cunliffe, Lt. J. C. ... | ... Ahmednagar. |
| Pilcher, Major A. J. (R.E.) ... ... | ... Lahore, Punjab. |
| Pilcher, Col. J. G. (I.M.S.) ... ... | ... *Europe.* |
| Pile, J. ... ... ... ... | ... Secunderabad, Deccan. |
| Pinhey, Major A. F. (C.I.E.) ... ... | ... Oodeypur. |
| Polovtseff, Mons. A. ... ... | ... Bombay. |
| Polwhele, A. C. (C.E.) ... ... | ... Agra. |
| Poncins, Baron Edmond de (Life Member) | ... *Europe.* |
| Porch, Capt. C. F. ... ... ... | ... Mhow, C.I. |
| Porter, W. R. S. ... ... ... | ... Quetta. |
| Pottinger, Lieut. J. A. ... ... | ... Nasirabad. |
| Pottinger, Capt. R. S. ... ... | ... Kolhapur. |
| Powell, J. E. ... ... ... | ... Dehree-on-Sone, Shahabad Dist. |
| Praed, Lt. G. A. M. ... ... | ... Dinapore. |
| Prain, Lt.-Col. D. (I.M.S., F.R.S.) ... | ... *Europe.* |
| Prall, Major S. E. (I.M.S.) ... ... | ... Aden. |

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| Pratt, Capt. E. G. W. ... ... | ... Bombay. |
| Pratt, H. C. ... ... ... | ... Selangor, Federated Malay States. |
| Prescott, Lieut. C. W. ... ... | ... Peshawar. |
| Preston, F. J. ... ... ... | ... Bombay. |
| Price, Sir Fred. ... ... ... | ... Ootacamund. |
| Prichard, G. M. ... ... ... | ... Ramtek, C. P. |
| Prideaux, C. C. A. ... ... ... | ... Wanalli P. O. *via* Raichore. |
| Prideaux, G. W. B. ... ... | ... Taunggyi, Burma. |
| Priestley, E. ... ... ... | ... Sholapore. |
| Primrose, Alex. M. ... ... | ... Tamarhat P. O., Gauripur, Assam. |
| Procter, The Hon'ble Mr. H. E. ... | ... Bombay. |
| Proctor, Lt. Alfred H. (I.M.S.) ... | ... Amritsar. |
| Purkis, F. C. (B.F.S.) ... ... | ... Rangoon. |
| Purkis, H. V. ... ... ... | ... Tissa P. O., Chumba State. |
| Raby-Noble, W. ... ... ... | ... Behali P.O., Assam. |
| Raikes, The Hon'ble Mr. E. B. ... | ... Bombay. |
| Raikes, G. T. ... ... ... | ... Karachi. |
| Rajkumar College, the Principal ... | ... Rajkote. |
| Ramsay, N. ... ... ... | ... Rangoon. |
| Ralston, Lt. W. H. ... ... | ... Tientsin, N. China. |
| Ramsden Lt.-Col. W. C. ... ... | ... Dehra Dun, U. P. |
| Rattray, Col. R. H.... ... ... | ... *Europe.* |
| Ravenshaw, Col. C. W. (Life Member) ... | ... *Europe.* |
| Readymoney, N. J. ... ... | ... Bombay. |
| Rebello, Revd. João ... ... | ... Margoa, Goa. |
| Rees, H. C. ... ... ... | ... Pegu, Burma. |
| Rees, W. E. ... ... ... | ... Gaya, Bengal. |
| Reeve, R. ... ... ... | ... Bombay. |
| Reid, Cecil H. (I.C.S.) ... ... | ... Calcutta. |
| Reid, M. F. (C.I.E.)... ... ... | ... Madras. |
| Reid, W. J. (I.C.S.) ... ... ... | ... Shillong, Assam. |
| Reilly, N. E. ... ... ... ... | ... Panjgur, Mekran Coast. |
| Rendall, H. D. (I.C.S.) ... ... | ... Rajkote. |
| Rennick, Alex. de C. ... ... | ... Nagpur. |
| Rennie, Thos. (I.C.V.D.) ... ... | ... Rangoon, Burma. |
| Reynolds, D. (R.F.A.) ... ... | ... Neemuch, C. I. |
| Reynolds, L. W. (I.C.S.) ... ... | ... Indore, C. I. |
| Rhé-Philipe, G. W. V. de ... ... | ... Bombay. |
| Rhenius, C. E. ... ... ... | ... Tuticorin, Madras Presidency. |
| Rhodes, T. M. ... ... ... | ... Darrah P. O. Kotah, Rajputana |

Richards, B. D. .. ... ... ... Bombay.
Richardson, Cecil ... ... ... ... Ajmer.
Richardson, Lt. G. G. ... ... ... Karachi.
Richardson, H. L. ... ... ... ... Bombay.
Richmond, R. D. (I.F.S.) ... ... ... *Europe.*
Ritchie, Capt. C. Mcl. (R.H.A.) ... ... Sialkote.
Ritchie, F. ... ... ... *Europe.*
Roberts, Capt. A. S. B. ... ... ... Rangoon.
Roberts, Major M. B. (Life Member) ... ... Lansdowne, U. P.
Robertson, B. (I.C.S., C.I.E.) ... ... ... Simla.
Robertson, J. H. (I.C.S.) ... ... ... Salem, Madras Presidency.
Robertson, L. (I.C.S.) ... ... ... Calcutta.
Robinson, H. K. (I.F.S.) ... ... ... Kurseong.
Rodger, A. (I.F.S.) ... ... ... ... Thayetmyo, Burma.
Rodon, Major G. S. (F.Z.S.) ... ... ... Dharwar.
Rogers, C. G. (I.F.S.) ... ... ... Bombay.
Rogers, Capt. F. C. (I.M.S.) ... ... ... Multan.
Rogers, J. B. Leslie ... ... ... Bombay.
Rogers, Rev. K. St. A. ... ... ... Rabai, East Africa.
Rome, Lt. H. C. ... ... ... ... Dehra Ismail Khan.
Ronald, A. G., Asst. Engineer ... ... Madras.
Ross, Major Tyrell (Life Member ... ... Dinapore.
Row, Dr. R. (M.D.) ... ... ... Bombay.
Rowland, Dr. S. ... ... ... ... Bombay.
Ruddle, W. H. ... ... ... ... Secundrabad.
Russell, J. B. ... ... ... ... Saklaspur Hassan, Mysore District.
Russell, Hon'ble Mr. Justice L. P. ... ... Bombay.
Ryan, G. M. (I.F.S.)... ... ... ... Poona.
Rylands, H. R. ... ... ... ... Delhi.
Ryves, A. E. ... ... ... ... Allahabad.

Sale, Edward L. (I.C.S.) ... ... ... Sukkur, Sind.
Salkeld, Ca . . .... ... ... ... Kismayu, British East Africa.
Salmon, Lt. W. H. B. ... ... ... *Europe.*
Salt, H. F. (R.H.A.)... ... ... ... Meerut.
Saone, G. Prier De ... ... ... Bombay.
Sassoon, Mrs. S. D. ... ... ... *Europe.*
Saunders, Capt. F. W. (R.N.) ... ... ... Bombay.
Savile, L. H. ... ... ... ... Bombay.
Schelling, A. ... ... ... ... Bombay.
Scindia, H. H. the Maharaja Madho Rao (G.C.S.I., G.C.V.O.) (Life Member) ... ... ... Gwalior, C. I.
Scot, J. S. (I.F.S.) ... ... ... ... Nandyal, Kurnool District.

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| Scotson, J. T. (I.C.S.) ... ... | ... Surat. |
| Scott, Edmund ... ... ... | ... Ceylon. |
| Scott, Capt. G. B. ... ... ... | ... Mooltan. |
| Scott, G. C. ... ... ... | ... Ceylon. |
| Scovell, C. E. ... ... ... | ... Loilem, S. Shan States. |
| Scroggie, Capt. W. R. J. (I.M.S.) ... | ... Bombay. |
| Scroope, H. W. P. (I.C.S.) ... ... | ... Naya-Dumka, Sonthal Parganas, Bengal. |
| Seale, Dr. C. E. B.... ... ... | ... Darjeeling. |
| Sealy, Capt. A. E. ... ... ... | ... Bakloh, Punjab. |
| Sears, R. H. (C.E.) ... ... ... | ... *Europe.* |
| Seervai, Dr. Rustom F. ... ... | ... Bombay. |
| Selous, Capt. R. ... ... ... | ... Quetta. |
| Service, Geo. ... ... ... | ... Bombay. |
| Seton-Karr, H. W. (Life Member) ... | ... *Europe.* |
| Sewell, J. H. ... ... ... | ... Toungoo, Burma. |
| Shakespear, Major J. ... ... | ... Manipur, Assam. |
| Sharp, Professor W. H. ... ... | ... Bombay. |
| Shaw, Capt. W. S. J. (I.M.S.)... ... | ... Rajkote. |
| Shepherd, W. C. (I.C.S.) ... ... | ... Dhulia. |
| Shepperson, C. I. W. ... ... | ... Coimbatore. |
| Shipp, W. E. ... ... ... | ... Ajmer. |
| S. V. Shevade, B. Sc. ... ... | ... Pusa, Bengal. |
| Shortland, C. V. N. (A.M.I.C.E.) ... | ... Chakradharpur, Bengal. |
| Shoubridge, H. O. B. (C.E.) ... ... | ... Nasik. |
| Shuttleworth, Capt. A. R. B. ... | ... Quetta. |
| Sikes, F. ... .. ... ... | ... Ceylon. |
| Silvester, C. J. ... ... ... | ... Sealdah, E. B. S. Ry. |
| Simcox, A. H. A. (I.C.S.) ... ... | ... Jalgaon, Khandesh. |
| Simcox, Lt. C. T. ... ... ... | ... Sitapur. |
| Simpson, J. Hope (I.C.S.) ... ... | ... *Europe.* |
| Simson, Lt. R. ... ... ... | ... Allahabad. |
| Sinclair, R. L. ... ... ... | ... *Europe.* |
| Sind Club, The Hony. Secretary ... | ... Karachi. |
| Singh, Bhai Sudhu, Forest Officer ... | .. Baluchistan, Quetta. |
| Sitwell, Capt. N. S. H. (R.A.) ... | ... Dum Dum. |
| Skilling, W. ... ... ... | ... Mussoorie, U. P. |
| Skinner, Capt. R. B. (R.E.) ... ... | ... Nowshera. |
| Skipwith, Capt. J. W. (R.E.) ... ... | ... Kirkee. |
| Sladen, Dr. R. J. L. ... ... | ... Bhusawal. |
| Slater, H. Kelshall ... .. ... | ... Bangalore. |
| Slater, J. Sanders ... ... ... | ... Bombay. |
| Smales, Chas. B. (I.F.S.) ... ... | ... Pyinmana, Upper Burma. |

Smith, Capt. F. A. (I.M.S.) ... ... ... Sehore Bhopal.
Smith, Lt. H. H. ... ... ... Allahabad.
Smith, Major C. A. ... ... ... Mooltan.
Smith, S. D. (B.A.) ... ... ... ... Dhulia.
Smyth, S. W. ... ... ... ... *Europe.*
Somerville, Lt.-Col. T. C. F. ... ... ... Shwebo, Burma.
Souter, C. A. (I.C.S.) ... ... ... Masulipatam, Madras.
Southon, Capt. C. E. (I.M.S.) ... ... ... Bombay.
Sparke, W. ... ... ... ... Rangoon, Burma.
Sparling, A. H. ... ... ... ... Rajghat, O. & R. Ry.
Spence, J. R. ... ... ... ... Ahmedabad.
Spence, L. H. (D.S.P.) ... ... ... Belgaum.
Spence, R. A. ... ... ... ... Bombay.
Spooner, T. J. (C.E.) (Life Member) ... ... Gadag, S. M. Ry.
Stables, Major Alex. (R.A.M.C.) ... ... *Europe.*
Stack, Mrs. C. S. ... ... ... ... Secunderabad, Deccan.
Standen, R. (I.C.S.) ... ... ... ... Betul, C. P.
Stanton, W. C. ... ... ... ... Lucknow.
Staples, E. W. H. (C.E.) ... ... ... Dum Dum.
Stebbing, E. P. (I.F.S., F.L.S., F.E.S., F.Z.S.) ... Dehra Dun.
Steel, Capt. D. (I.M.S.) ... ... ... Bombay.
Steen, Capt. R. (I.M.S.) ... ... ... *Europe.*
Steffen, O. ... ... ... ... Bombay.
Stephens, L. B. ... ... ... ... Karachi.
Stevens, Herbert ... ... ... ... Lakhimpur, Assam.
Stewart, Capt. G. H. (I.M.S.) ... ... ... Falam, Chin Hills.
Stewart, J. Lee ... ... ... ... *Europe.*
Stewart, R. B. (I.C.S.) ... ... ... Poona.
Stockley, Lt. J. P. ... ... ... ... Kherwara, Rajputana.
Stoney, R. F. ... ... ... ... Mopad, Nellore District.
Stonor, W. ... ... ... ... Nagasamudram, S. M. Ry.
Storey, Thos. H. ... ... ... ... Oodeypur.
Story, S. S. ... ... ... ... Bombay.
Stringfellow, H. P. ... ... ... ... Bombay.
Strong, F. W. (I.C.S.) ... ... ... *Europe.*
Stuart, Capt. A. G. ... ... ... ... Simla.
Stuart, C. J. ... ... ... ... Nellore.
Stuart, G. A. D. (I.C.S.) ... ... ... Nellore, Madras.
Stuart, J. D. ... ... ... ... Mandalay.
Stuart, Major J. R. (R.A.M.C.) ... ... Mhow, C. I.
Sulivan, Col. G. D. F. ... ... ... Srinagar, Kashmir.
Summers, Thos. (C.E.) ... ... ... Karachi.

Surveyor, Dr. N. F. (M.D.) ... ... ... Bombay.
Swan, H. H. .. ... ... ... *Europe.*
Swayne, Herbert (Life Member) ... ... *Europe.*
Swinhoe, Genl. C. ... ... ... ... Mandalay.
Swinhoe, R. C. J. ... ... ... ... Dhar, C. I.
Sykes, C. M. (C.E.)... ... ... ... Nellore, Madras Presidency.
Sykes, M. G. (I.C.S.) ... ... ...
Symes, W. C. ... ... ... .... Bombay.
Symington, J. H. ... ... ... ... Bombay.
Symons, Lieut. H. (R.G.A.) ... ... ... *Europe.*

Tagart, Major H. A. L. (D.S.O.) ... ... Meerut.
Talbot, W. A. (I.F.S.) ... ... ... Kirkee.
Tambe, Dr. Gopal Ramchandra, (M.A., B.SC., L. M.& S.) Indore, C. I.
Tanner, Major C. O. O. ... ... ... Ahmednagar.
Tata, Dorabji J. (Life Member) ... ... Bombay.
Tailor, J. Stopford ... ... ... ... Bombay.
Taylor, James H. ... ... ... ... *Europe.*
Tejpal, Goverdhundas Goculdas (Life Member) ... Bombay.
Temulji B. Nariman, Dr. .. ... ... Bombay.
Tenison, Lt. W. P. C. (R.F.A.) ... ... Ferozepore, Punjab.
Thanawala, Y. D. (M.A.) ... ... ... Bombay.
Thevenard, C. W. ... ... ... ... Calicut, Malabar.
Thomson, Lt.-Col. Henry (I.M.S.) ... ... Madras.
Thomson, R. H. E. (I.F.S.) ... ... ... Mussoorie, U. P.
Thomson, St. C. ... ... ... ... Lucknow.
Thomson, Major D. B. ... ... ... Bombay.
Thornhill, Col. H. B. (C.I.E.) ... ... ... Simla.
Thornton, H. A. (I.C.S.) ... ... ... *Europe.*
Thubron, J. B. S. ... ... ... ... Nasik.
Tibbs, Rev. P. G. ... ... ... ... Aden.
Tilly, T. H. (Life Member) ... ... ... Mingin, Burma.
Tichborne, Sir Henry, Bart. ... ... ... *Europe.*
Tinley, Col. G. F. N. ... ... ... Meerut.
Tinne, P. (I.F.S.) ... ... ... ... Kalimpong, Bengal.
Tipper, G. H. ... ... ... ... Calcutta.
Tipping, P. G. ... ... ... ... Sidapur, Coorg.
Tod, Alex. M. ... .. ... ... Bombay.
Todd-Naylor, H. P. (I.C.S., C.I.E.) ... ... Rangoon.
Tomkins, Capt. E. L. (R.A.) ... ... ... Jubbulpore, C. P.
Tomkins, S. ... ... ... ... Lahore.
Tottenham, W. F. L. (I.F.S.) ... ... .. Rangoon.
Townsend, Major E. ... ... ... Mandalay.
Traill, W. H. ... .. ... ... Bombay.
Travancore, H. H. The Maharaja Sir Sultan Rama Raja Bahadoor (G.C.S.I., G.C.I.E.) (Life Member). Trivandrum.
Trench, C. G. C. (I.C.S.) ... ... ... Nagpur, C. P.

Trevor, Surg.-Genl. F. W. (R.A.M.C.) ... ... Poona.
Trivandrum, Hon. Sec., Government Museum and Public Gardens ... ... ... ... Trivandrum.
Trotter, E. W. ... ... ... ... Bangkok, Siam.
Troup, N. F. T. ... ... ... ... Kousanie P. O., Almora.
Truninger, L. ... ... ... ... Calcutta.
Turnes, Capt. C. H.... ... ... ... Mandalay.
Turner, H. J. C. (F.G.S.) ... ... ... Fyzabad, Oudh.
Turner, Sir Montague ... ... ... *Europe.*
Tweedie, Lt. J. L. ... ... ... Lahore.
Twiss, Lt. A. M. (R.E.) ... ... ... Kirkee.
Tyabji, S. B. ... ... ... ... Dharwar.
Tyler, H. H. F. M. (I.C.S.) ... ... ... Koraput.
Tyrrell, Capt. J. R. (I.M.S.) ... ... ... Bombay.
Tytler, Maj. H. C. ... ... ... ... Agra.

Uehlinger, H. ... ... ... ... Bombay.
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United Service Library, Hon. Secretary ... Poona.
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Vaughan, W. (F.E.S.) (Life Member) ... ... Ceylon.
Venour, Major W. E. (I.A.) (Life Member) ... Kohat.
Vernede, Fred. E. ... ... ... ... Munda Kayam, Travancore.
Vernon, H. A. B. (I.C.S.) ... ... ... Madras.
Viccaji, Framji R. (Life Member) ... ... Bombay.
Vidal, G. W. ... ... ... ... *Europe.*
Vincent, W. H. H. (I.C.S.) ... ... ... Ranchi, Chota Nagpur.
Vithaldas Damodhar Thakersey, The Hon'ble Mr.... Bombay.

Wadeson, Major F. W. G. ... ... ... Loralai, Baluchistan.
Wadia, D. N., Prof. of Biology at Jammoo ... Kashmir.
Wadia, Sorab P. N. ... ... ... Bombay.
Walker, Capt. G. K. (A.V.D.)... ... ... Lahore.
Walker, J. S. E. ... ... ... ... Purnahia, Bengal.
Walker, Capt. W. B. (R.A.) ... ... ... Bombay.
Wall, Major F. (I.M.S., C.M.Z.S.) ... ... Dibrugarh, Assam.
Wallace, John (C.E.) ... ... ... Bombay.
Wallace, R. ... ... ... ... Rangoon.
Wallace, W. V. (I.C.S.) ... ... ... Myingyan, Burma.
Wallinger, W. A. (I.F.S.) ... ... ... Dharwar.
Walsh, E. P. (I.C.S.) ... ... ... Penukonda, Madras Presidency.

| | |
|---|---|
| Walton, Capt. H. J. (I.M.S., C.M.Z.S.) ... | ... Agra. |
| Ward, Col. A. E. ... ... ... | ... Srinagar, Kashmir. |
| Ward, Capt. C. H. ... ... | ... Meerut. |
| Ware, Major F. C. Webb (C.I.E.) ... | ... Political Agent, Chagai, Quetta. |
| Wasey, G. K. ... ... ... | ... *Europe.* |
| Waterfield, E. H. (I.C.S.) ... ... | ... Bandra, Thana Dist. |
| Watkins, C. R. ... ... ... | ... Pyinmana, Burma. |
| Watson, Lt. H. R. ... ... ... | ... Aden. |
| Watson, H. W. A. (I.F.S.) ... ... | ... Taunggyi, Burma. |
| Watson, Capt. J. W. (I.M.S.) ... ... | ... *Europe.* |
| Watson, Lt.-Col. W. A. (C.I.E.) ... | ... 39th C. I. Horse, Agar, C. I. |
| Watson, W. M. ... ... ... | ... Parel, Bombay. |
| Watts, Capt. G. A. R. ... ... | ... Lahore. |
| Watts, Lt. N. H. L. ... ... | ... Rangoon. |
| Webb, G. R. ... ... ... | ... Parel, Bombay. |
| Webb, M. (I.C.S.) ... ... ... | ... Hyderabad, Sind. |
| Wein, J. ... ... ... ... | ... Bombay. |
| Weldon, W. L. ... ... ... | ... Bombay. |
| Wells-Cole, Major H. ... ... | ... *Europe.* |
| Wenden, H. (C.E., C.I.E.) ... ... | ... Bombay. |
| Weston, A. T. ... ... ... | ... Hinainelongyee, Papan, L. Burma. |
| Weston, W. V. ... ... ... | ... Gonatea, Sainthea, Bengal. |
| Whalley, P. ... ... ... | ... Rangpur. |
| Whately, Richard ... ... ... | ... Delhi, R.-M. Ry. |
| Whiffin, F. D. ... ... ... | ... Rourkela, B.-N. Ry |
| Whitcombe, Major E. G. R. (I.M.S.) ... | ... Aden. |
| White, Lt. A. W. ... ... ... | ... Karachi. |
| White, C. W. ... ... ... | ... *Europe.* |
| White, W. P. ... ... ... | ... Saugor, C. P. |
| Whitehead, Lt. C. H. T. ... .. | ... *Europe.* |
| Whitehead, John (I.F.S.) ... ... | ... Pilibheet, U. P. |
| Whittall, Lt.-Col. F. V. ... ... | ... Bombay. |
| Whittell, Lt. H. M. ... ... | ... Ambala. |
| Whitworth, G. C. (Life Member) ... | ... *Europe.* |
| Whymper, S. L. ... ... ... | ... Jeolikote, U. P. |
| Whyte, Lt.-Col. C. W. ... ... | ... *Europe.* |
| Wickham, P. F. (C.E.) ... ... | ... Port Blair. |
| Wigram, Major H. ... ... | ... Srinagar, Kashmir. |
| Wiles, G. (I.C.S.) ... ... ... | ... Godhra. |
| Wilkinson, Major E. (I.M.S.) ... ... | ... Lahore. |
| Williams, A. (I.C.S.) ... ... | ... Quetta. |
| Williams, Capt. C. F. (I.M.S.) ... | ... Rangoon. |
| Williams, J. K. ... ... ... | ... Nasik. |
| Williams, Stanley Price ... ... | ... Bannu, N.-W.F.P |

Williamson, K. B.... ... ... ... Jabalpore, C. P.
Williamson, W. J. F. ... ... ... Bangkok, Siam.
Willis, Lt.-Col. C. F. (I.M.S.) ... ... ... Satara.
Willis, R. A. ... ... ... ... Bombay.
Wiliock, Lt. A. (R.I.M.) ... ... ... Bombay.
Wilson, Major Alban ... ... ... Shillong, Assam.
Wilson, A. K. ... ... ... ... Almora, U. P.
Wilson, Lt. Col. C. H. L. F. (R.A.) ... ... Madras.
Wilson, H. C. ... ... ... ... Ootacamund.
Wilson, R. A. (I.C.S.) ... ... ... Buldana, Berar.
Wilson, William Burns ... ... ... Calicut.
Winterscale, J. C. (F.Z.S., F.E.S.) ... ... *Europe.*
Witham, Dr. E. Wells (M.D.)... ... ... Doom-Dooma, Assam.
Witt, D. O. (I.F.S.) ... ... ... Khandwa.
Wood, Capt. A. E. (R.A.M.C.)... ... ... Fyzabad, Oudh.
Wood, C. W. (C.E.) ... ... ... ... Calicut, Malabar.
Wood, Capt. H. (R.E.) ... ... ... Amraoti, Berar.
Wood, Major H. S. (I.M.S.) ... ... ... Calcutta.
Wood, R. B. M. ... ... ... ... Bhamo, Burma.
Wooster, W. G. ... ... ... ... Yawng Hwe, S. Shan States.
Wright, Major E. H. (I.M.S.)... ... ... Madras.
Wright, F. A. (C.E.) ... ... ... Calcutta.
Wright, R. Barton... ... ... ... Sivaganja P. O., Madura Dist.
Wright, H. C. ... ... ... ... *Europe.*
Wright, R. R. ... ... ... ... *Europe.*
Wroughton, R. C. (Life Member) ... ... *Europe.*

Yeatman, Lieut. M. E. ... ... ... Karachi.
Yeo, Edwin W. ... ... ... ... Bombay.
Yerbury, Col. J. W. (R.A.) (Life Member) ... *Europe.*
Young, E. H. ... ... ... ... Ajmer.
Young, Major F. DeB. ... ... ... Lucknow.
Young, F. B. ... ... ... ... Sangli, S. M. C.
Young, L. C. H. (B.A., F.E.S.,) ... ... *Europe.*
Young, Lt. M. J. D. ... ... ... Bangalore.
Yule, Lt. R. A. ... ... ... ... Chilas, Kashmir.

# BOMBAY NATURAL HISTORY SOCIETY.

## *STATEMENT OF ACCOUNTS (from 1st January 1905 to 31st December 1905).*

| RECEIPTS. | Rs. | a. | p. | Rs. | a. | p. |
|---|---|---|---|---|---|---|
| Balance in Bank on 1st Jan. 1905... | 3,199 | 3 | 3 | | | |
| Cash in hand on 1st Jan. 1905 ... | 177 | 8 | 0 | | | |
| Petty cash balance on 1st Jan. 1905 | 6 | 13 | 2 | | | |
| | | | | 3,383 | 8 | 5 |
| Subscription for 1903 (in arrears) ... | 75 | 0 | 0 | | | |
| Do. 1904 ( do. )... | 795 | 15 | 0 | | | |
| Do. 1905 ... ... | 9,667 | 3 | 11 | | | |
| Do. 1906 (in advance).. | 856 | 4 | 0 | | | |
| Do. for Journal from Members residing out of India ... ... | 445 | 13 | 2 | | | |
| Do. for Life Membership... | 750 | 8 | 0 | | | |
| | | | | 12,590 | 12 | 1 |
| Entrance Fees ... ... ... ... ... | | | | 1,240 | 0 | 0 |
| Sale of back Journals, &c.... ... ... ... | | | | 1,540 | 5 | 8 |
| Grant from the Government of Bombay for 1905... | | | | 2,500 | 0 | 0 |
| Interest on Government Paper ... ... ... | | | | 187 | 8 | 10 |
| Interest allowed by Bank ... ... ... ... | | | | 103 | 15 | 1 |
| Total... Rs. | | | | 21,550 | 2 | 1 |

| EXPENDITURE. | Rs. | a. | p. | Rs. | a. | p. |
|---|---|---|---|---|---|---|
| Rent of the Rooms from 1st December 1904 to 30th November 1905 ... ... ... | | | | 1,500 | 0 | 0 |
| Salaries from 1st December 1904 to 30th November 1905 ... ... ... ... ... | | | | 1,718 | 2 | 3 |
| Library Account ... ... ... ... | | | | 153 | 4 | 0 |
| Furniture Account ... ... ... ... | | | | 722 | 6 | 0 |
| Printing and Stationery ... ... ... | | | | 151 | 15 | 0 |
| Journal Account, Cost of printing Journal and Coloured Plates from England ... ... | | | | 9,289 | 15 | 10 |
| General Expenses ... ... ... ... | | | | 960 | 10 | 8 |
| Postage ... ... ... ... ... | | | | 865 | 11 | 0 |
| Balance in Bank on 31st December 1905 .. | Rs. 4,509 | 13 | 4 | | | |
| Cash in hand on 31st December 1905... ... | 1,678 | 4 | 0 | | | |
| | | | | 6,183 | 1 | 4 |
| Total ... Rs | | | | 21,550 | 2 | 1 |

Examined and found correct.
(Sd.) R. A. SPENCE,
*Hony. Auditor.*

(Sd.) N. C. MACLEOD,
*Hony. Treasurer.*

BOMBAY, 1st *January* 1906.

# BOMBAY NATURAL HISTORY SOCIETY.

## *INVESTMENT ACCOUNT (from 1st January 1905 to 31st December 1905).*

| | Rs. | a. | p. | | Rs. | a. | p. |
|---|---|---|---|---|---|---|---|
| Balance of 3½ °/₀ Government Paper, deposited with the National Bank of India on 1st January 1905 ... ... ... ... | 7,000 | 0 | 0 | Balance of 3½ °/₀ Government Paper deposited with the National Bank of India on 31st December 1905 ... ... ... ... | 7,000 | 0 | 0 |
| Rs. ... | 7,000 | 0 | 0 | Rs. ... | 7,000 | 0 | 0 |

Examined and found correct.

(Sd.) R. A. SPENCE,
*Hony. Auditor.*

(Sd.) N. C. MACLEOD,
*Hony. Treasurer.*

BOMBAY, *1st January* 1906.

# BOMBAY NATURAL HISTORY SOCIETY.

## *STATEMENT of ACCOUNTS (from 1st January 1906 to 31st December 1906).*

| RECEIPTS. | Rs. | a. | p. | Rs. | a. | p. |
|---|---|---|---|---|---|---|
| Balance in Bank on 1st January 1906 | 4,509 | 15 | 7 | | | |
| Cash in hand on 1st January 1906... | 1,678 | 4 | 0 | | | |
| | | | | 6,188 | 1 | 7 |
| Subscriptions for 1900 (in arrears)... | 9 | 0 | 0 | | | |
| Do. do. 1901 ( do. )... | 11 | 0 | 0 | | | |
| Do. do. 1902 ( do. )... | 20 | 0 | 0 | | | |
| Do. do. 1903 ( do. )... | 90 | 0 | 0 | | | |
| Do. do. 1904 ( do. )... | 240 | 0 | 0 | | | |
| Do. do. 1905 ( do. )... | 940 | 14 | 7 | | | |
| Do. do. 1906 | 12,550 | 0 | 3 | | | |
| Do. do. 1907 (in advance).. | 861 | 2 | 8 | | | |
| Do. do. 1908 ( do. ).. | 25 | 0 | 0 | | | |
| Do. do. Journal from Members residing out of India ... | 798 | 9 | 2 | | | |
| Do. do. Life Membership... | 1,100 | 0 | 0 | | | |
| | | | | 16,645 | 10 | 8 |
| Entrance Fees ... ... ... ... ... | | | | 2,080 | 0 | 0 |
| Sale of back Journals, &c. ... ... ... | | | | 2,868 | 9 | 0 |
| Grant from the Government of Bombay for 1906 ... | | | | 2,500 | 0 | 0 |
| Donation ... ... ... ... ... ... | | | | 31 | 0 | 2 |
| Refunded by Mr. J. C. Bond the amount advanced to him ... ... ... ... ... ... | | | | 190 | 0 | 0 |
| Interest on Government Paper ... ... ... | | | | 272 | 12 | 2 |
| Interest allowed by Bank ... ... ... ... | | | | 112 | 6 | 0 |
| Total ... Rs. | | | | 30,258 | 7 | 7 |

| EXPENDITURE. | | Rs. | a. | p. | Rs. | a. | p. |
|---|---|---|---|---|---|---|---|
| Rent of the Rooms from 1st December 1905 to 30th November 1906 ... ... ... | | | | | 1,500 | 0 | 0 |
| Salaries from 1st December 1905 to 30th November 1906 ... ... ... ... | | | | | 2,347 | 8 | 0 |
| Library Account ... ... ... ... | | | | | 92 | 4 | 0 |
| Furniture Account ... ... ... ... | | | | | 94 | 14 | 0 |
| Printing and Stationery ... ... ... | | | | | 498 | 9 | 9 |
| Journal Account—Cost of printing Journals and Coloured Plates from England ... ... | | | | | 11,749 | 0 | 1 |
| General Expenses ... ... ... ... | | | | | 1,243 | 15 | 2 |
| Postage ... ... ... ... ... | | | | | 1,026 | 14 | 0 |
| Invested in 3½ per cent. Government Paper Rs. 7,000 ... ... ... ... ... | | | | | 6,824 | 1 | 0 |
| Balance in Bank on 31st December 1906 ... | Rs | 4,798 | 1 | 8 | | | |
| Cheques in hand on 31st December 1906 ... | ,, | 46 | 0 | 0 | | | |
| Petty Cash balance on 31st December 1906 ... | ,, | 37 | 3 | 11 | | | |
| | | | | | 4,881 | 5 | 7 |
| Total ... Rs. | | | | | 30,258 | 7 | 7 |

Examined and found correct.
(Sd.) BEN. H. MUNDY,
*Hony. Auditor.*

BOMBAY, 1st *January* 1907.

N. C. MACLEOD,
*Hony. Treasurer.*

# BOMBAY NATURAL HISTORY SOCIETY.

*INVESTMENT ACCOUNT (from 1st January 1906 to 31st December 1906).*

| | Rs. | a. | p. | | Rs. | a. | p. |
|---|---|---|---|---|---|---|---|
| Balance of 3½ % Government Paper, deposited with the National Bank of India on 1st January 1906 ... ... ... ... ... | 7,000 | 0 | 0 | Balance of 3½ % Government Paper, deposited with the National Bank of India on 31st December 1906 ... ... ... ... | 14,000 | 0 | 0 |
| Purchased 3½ % Government Paper on 7th March 1906 ... ... ... ... | 2,000 | 0 | 0 | | | | |
| Purchased 3½ % Government Paper on 22nd November 1906 ... ... ... ... | 5,000 | 0 | 0 | | | | |
| Rs. ... | 14,000 | 0 | 0 | Rs. ... | 14,000 | 0 | 0 |

Examined and found correct.
(Sd.) BEN. H. MUNDY,
*Hony. Auditor.*

BOMBAY, 1st *January* 1907.

(Sd.) N. C. MACLEOD,
*Hony. Treasurer.*

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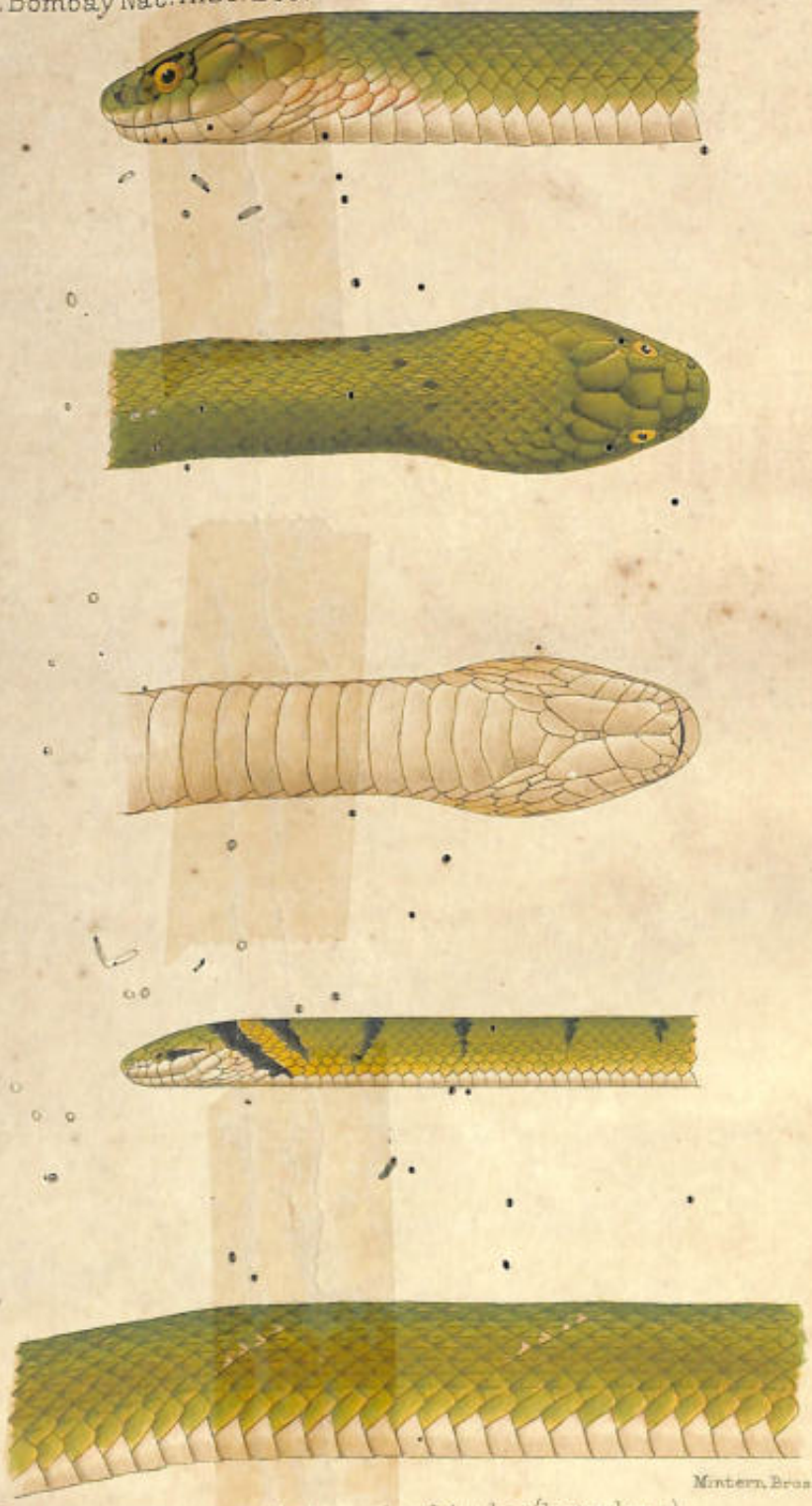
| zizyphus ... ... ... | 184, 902 |
| Zollikoferia ... ... | ... ... 907 |
| zonatus... ... ... | ... ... 213 |
| zonorhyncha ... ... | ... 558, 559 |
| Zoothera ... ... ... | ... ... 960 |
| Zopherops ... ... ... | ... ... 408 |
| Zosterops | 111, 156, 186, 768, 789, 835 |
| Zurobata ... ... ... | ... ... 648 |
| Zygæna ... ... ... | ... ... 254 |
| Zygodactyli ... ... ... | ... ... 964 |
| Zygophyllum ... ... ... | ... ... 901 |



J. Green del.

Mintern Bros. Chromo.

Macropisthodon plumbicolor (harmless)

JOURNAL
OF THE
BOMBAY
Natural History Society.

Vol. XVII. BOMBAY. No. 1.

# A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

ILLUSTRATED BY COLOURED PLATES AND DIAGRAMS.

BY CAPTAIN F. WALL, I.M.S., C.M.Z.S.

*Part II.—With Plate II, and Diagrams IV, V and VI.*

(*Continued from page 554 of Vol. XVI.*)

## THE GREEN KEELBACK.

*Macropisthodon plumbicolor.*

*Nomenclature. Scientific.*—The generic name is derived from the Greek words "*makros*" great, "*opisthe*" back, "*odous*" tooth, and calls attention to an unusual feature in the dentition of this snake inasmuch as the maxillary at its hindmost extremity is provided with a pair of very large teeth separated by a short interval from the normal array met with in other snakes (see Fig. 1). These teeth may be very easily mistaken for poison fangs, but a careful scrutiny will show that they possess neither canal nor groove. Until recently this snake was included with the genus *Tropidonotus*, several members of which have enlarged teeth similarly situated (see Fig. 2) notably among familiar kinds the common buff-stripes (*Stolatus*), and the painted Keelback (*Subminiatus*). None, however, exhibit a development of these teeth to the degree which has led Mr. Boulenger to separate this snake with its two Malayan congeners under the generic title of *Macropisthodon*.

The specific name is derived from the Latin words "*plumbum*" lead, and "*color*" colour, a title for which Cantor is responsible, but it is a most inapt and misleading one, since its prevailing colour is a dark foliage green.

*English.*—The Green Keelback is, I think, the best name for it, closely allied as it is to the genus *Tropidonotus*,* and manifesting in its scales a degree of keeling in no way inferior to any representative of that genus.

*Vernacular.*—I know of none.

*Dimensions.*—The largest specimen I have heard of is one obtained by Col. Light at Poona which measured 3'1". Boulenger† gives 2'6", but I think the majority of adult specimens range nearer 2'.

*Bodily configuration.*—Head subovate. The eye is set laterally with a very slight inclination forwards, the iris exhibiting a bright golden pupillary margin which clearly reveals the rounded contour of the pupil. The body is stoutish, subcylindrical, and thickest near the middle from which spot the snake attenuates in both directions. The tail which is short and tapers rather rapidly, measures from one-seventh to one-ninth of the total length, being longer in males than females. The upper surface is rough with ridges in its whole length formed by the pronounced keeling of the dorsal scales.

*Colour.*—The prevailing colour is grass-green (often dull olive-brown in spirit specimens). Young specimens have a well defined, lamp-black, chevron-shaped collar with the point directed towards or on to the frontal shield. Behind this is a broad gorget of bright yellow or orange (dirty whitish in old spirit specimens) abruptly defined behind by a lamp-black bordering. A black fillet extends from the eye to the gape and usually some black or blackish spots or markings are present in the forebody with a tendency to a transverse distribution. With age the green acquires a more dusky tone, but I have never seen a specimen that deserved the cognomen plumbicolor. Many of the black marks become obscured, or lost with age, but the fillet from the eye to the gape is, I think, always more or less in evidence. The belly which is usually uniform in colour may be whitish, yellowish, plumbeous green, or even blackish. The throat and chin are yellow or buff.

* *Tropidonotus* is derived from the Greek "*tropis*" signifying keel and "*notus*" back.

† Fauna of Brit. Ind., 1890, p. 351.

Fig. 1.

Fig. 1. Maxillary of Macropisthodon flaviceps. (After Boulenger.)

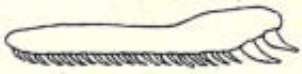


Fig. 2.

Fig. 2. Maxillary of Tropidonotus tigrinus. (After Boulenger.)

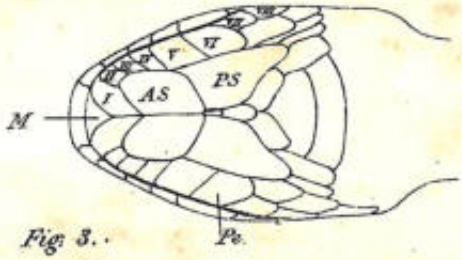



Fig. 3.

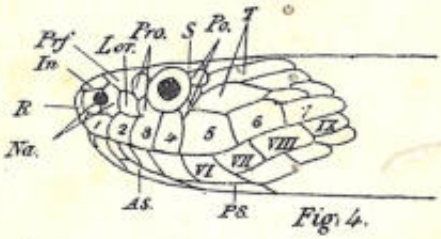



Fig. 4.

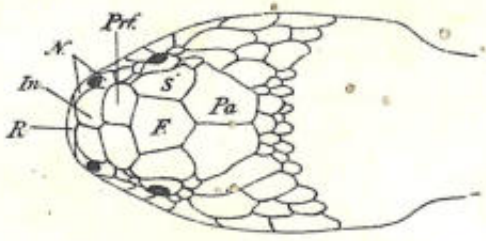



Fig. 5.a.

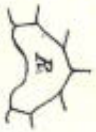



Fig. 5.b.

Fig. 3, 4, 5. *Macropisthodon plumbicolor* (×1½.)

INDIAN SNAKES (WALL.)

A. P. CORTEZ & Co. LITH. BOMB.

*Identification.*—Any grass-green snake which has 17 rows of scales in the hind body (*i.e.*, two heads lengths in front of the vent), and has a frontal shield in contact with 6 shields only must be *Macropisthodon plumbicolor*. With a very little attention to scale characteristics and shape of pupil it could never be confounded with either of the foregoing snakes discussed in this series. The round pupil serves to distinguish it as readily from all the Green Pit-Vipers, as it does to separate it from all the Green Whip-Snakes. The appended remarks at the conclusion of this paper will serve to differentiate this from all other green snakes in which the pupil is round.

*Habits.—Haunts.*—Its prasinous coloration indicates a foliaceous environment, but it is not in the foliage of either bushes or trees that it is met with, but among low terrestrial vegetation, and especially grass. It not infrequently, however, strays from the kindly protection which verdure offers it. Mr. Kinlock says that about Kotagiri (Nilgiri Hills, 5,700′) he usually finds it in grass among scrub jungle, and not necessarily in a marshy vicinity. Mr. Gray tells me that at Coonoor (Nilgiri Hills, 6,000′) he has now and then known it wander into his rooms, and has frequently seen it about habitations. Günther,* too, remarks that it frequently enters houses.

*Disposition.*—The formidable armature of its upper jaws (see Fig. 1), belies its disposition, for not only is it a perfectly harmless snake, but it possesses a singularly gentle and inoffensive nature. Mr. Kinloch remarks on its gentleness, and says it never attempts to bite. A remarkable feature in the behaviour of this snake, and one hardly likely to escape observation is its habit of crouching on the ground when molested. The whole body down to the vent is involved in this flattening effort, the object of which does not seem clear. It appears to be a manifestation indicative of fear. I have noticed the same behaviour to an equal degree in the Himalayan Viper (*Ancistrodon himalayanus*), the common Chinese Viper (*A. blomhoffii*) and to a lesser degree in Siebold's Water-Snake (*Hypsirhina sieboldii*) and the common Burrowing Snake (*Eryx conicus*). In several other snakes a muscular effort akin to this is evinced locally but whilst the creature is in an attitude of menace with the forebody erect. The cobra displays this peculiarity in a very pronounced degree, in the production of its so-called hood and the hamadryad does too, to a lesser degree. Many others behave

* Rept., Brit. Ind., 1864, p. 272.

similarly to these last two under excitement, but the flattening is far less pronounced. Among these may be enumerated the common Pond Snake (*Tropidonotus piscator*), the common Buff-stripes or Robed Snake (*Tropidonotus stolatus*), and several others of this genus, also *Helicops schistosus*, and *Pseudoxenodon macrops* which last Günther has figured* so as to emphasise this peculiarity.

*Food.*—Both Mr. Phipson and Mr. Kinloch tell me it feeds on toads. Mr. Gray mentions frogs, and says he knew one eat a small earth-snake on one occasion.

*Breeding.*—Mr. Phipson tells me it breeds during the S.-W. monsoon about Nasik (Deccan), and produces eggs which he has found, and kept till they hatched out.

*Distribution.*—Geographical.—It is found throughout the Peninsula of India, including Ceylon. Its northern boundary may be taken roughly as the 30th parallel, and its western and eastern limits are comprised roughly between the 70th and 85th meridians.

Local and numerical.—It is not nearly so abundant in the plains as in certain uplands, in fact my own experience teaches me to regard it as an uncommon snake in the plains. Russell's work, which may be taken as dealing with a fairly representative collection of the common snakes of India, makes no allusion to this species. Mr. Kinloch and Mr. Gray tell me it is quite a common snake in the Nilgiris (Kotagiri and Coonoor 5,700-6,000′). Mr. Phipson says it is perhaps the commonest snake about Nasik in the Deccan (1,900′). Col. Light mentions it as fairly common around Poona (1,800′). Nicholson† says it is a very common snake about Bangalore (3,000′), and Ferguson mentions it as fairly common in Travancore both on the hills and in the plains.

*Description.*—*Rostral* contact with six shields, of which the anterior nasals form the longest sutures (see Fig. 5*b*). *Internasals* a pair. Suture between them subequal to, or rather shorter than the suture between the præfrontal pair, subequal to or rather shorter than the suture between the internasal and præfrontal of each side. *Præfrontals* a pair. In contact with the internasal, postnasal, loreal, upper præocular, supraocular, and frontal, on each side. Suture between them subequal to or rather less than the suture

* Rept., Brit. Ind., Pl. XXII., C.

† Indian Snakes, p. 94.

between the præfrontal, and frontal on each side. *Frontal* in contact with six other shields of which the supraoculars form the largest sutures. Length subequal to the supraoculars. Breadth opposite centres of eyes twice or nearly twice each supraocular. *Parietals* a pair. Each in contact with one postocular. *Nasals* two placed laterally on each side, and completely divided by a suture in which the nostril occupies the upper two-thirds to three-fourths. In contact with the 1st and 2nd supralabials. *Loreal* single. Sometimes continued backwards to touch the eye, more usually not. *Præoculars* two. *Postoculars* three or four. *Temporals* two. The lower in contact with the 5th and 6th supralabials, the suture made with the 5th being about $\frac{2}{3}$ that with the 6th. *Supralabials* 7 of which the 3rd and 4th touch the eye. *Infralabials.* The first meet behind the mental to form a suture about half the length of that between the anterior sublinguals. 6 (rarely 7) come into contact with the sublingual shields, 4 or 5 with the anterior pair, the rest with the posterior pair. The pentagonal is usually the 6th (rarely the 7th) of the series. It is about as broad as the posterior sublinguals of the same side, and touches 3 scales behind.* *Posterior sublinguals* are longer than the anterior, and are quite separated by one or two small scales succeeded by a pair. *Dorsals* anteriorly in 23-25 rows; midbody 25-27; posteriorly 17.† The vertebral row is similar to its contiguous rows in size and form. The last row is largest. The scales are longer than broad, have straight margins, rather acute apices set pointing directly backwards, and are keeled‡ and facetted. Lines drawn across the apices of alternate rows are about vertical. The keels are pronounced in all rows except the last where they are absent for a variable extent anteriorly. They extend completely from base to apex of each scale. Apical facets are present in pairs, but often are difficult to see. *Supracaudals* are in even numbers of rows numbering six in the middle of the tail, and ending in a very few twos. Keels are present in all rows from base to tip of tail, also apical facets as in dorsals. *Ventrals* 144—160

* This does not appear so in Fig. 3, as the posterior sublinguals are overlapping the inner part of the pentagonal.

† Wherever reference is made to anterior and posterior parts of the body in this paper it is to be understood that the former refers to a point two heads lengths behind the head, and the latter to a point two heads lengths in front of the vent. Midbody is to be reckoned exclusive of the tail.

‡ The presence of a ridge on the scale similar to the midrib on the underside of a leaf is technically called a keel.

(Boulenger). Evenly rounded from side to side and so broad that when the snake is laid on its back, only part of the last dorsal row is visible on each side simultaneously. *Anal* usually divided. *Subcaudals* 35—50 (Boulenger) are in pairs. *Dentition.* The maxillary supports 12—13 small teeth anteriorly which are succeeded after an interval by a pair of large teeth behind. Mandibular teeth subequal (Boulenger).

The grass-green snakes that inhabit India and its Dependencies are thirteen in number. Three of the commonest of these have been discussed, and figured in this, and a preceding paper. A few remarks will now be made about the remainder so as to facilitate their recognition.

Three of this number are pit-vipers and differ from all the rest in having a loreal pit, a vertical pupil, no labial touching the eye, and only one pair of sublingual shields which touch 3 infralabials. In two of these (viz., *Purpureomaculatus* and *Gramineus*) the head is covered in front with small scales about the same size as those on the body and in the third (*Macrolepis*, see Fig. 13) the enlarged shields are a modification of the arrangement normally seen in colubrine snakes. Should, however, a specimen be brought with the head so mutilated that none of these characters can be discerned, the following additional points mentioned with each will differentiate them.

(1) *Lachesis gramineus* has been described in a preceding paper. The arrangement of the dorsal scales which number 21 normally (rarely 19) in the anterior and middle parts of the body, and 15 in the posterior part of the body will suffice to distinguish this from the rest.

(2) *Lachesis purpureomaculatus.*—The green variety of this snake (*bicolor*) is extremely like *gramineus*, in fact it is probable the two have been frequently confounded. The arrangement of the dorsal scales which number normally 25 (rarely 23 or 27) in the anterior and middle parts of the body, and 19 in the posterior part will distinguish this from the rest. This snake is as far as I know similar to the last in habits, rarely exceeds three feet in length, and within our limits has been recorded from the Himalayas, Bengal, Assam and Burma.

(3) *Lachesis macrolepis.*—In this the scales number 18-15 anteriorly, 14-12 in mid-body, and 11-10 posteriorly. The ultimate (or lowest) row is much the smallest, and this feature alone will, I believe, distinguish this from every other snake in India. It is arboreal in habit, grows to two feet, and inhabits hills in Travancore (Ferguson), Malabar, and S. India, *i.e.*, Anamallays and Pulneys.

Fig. 6.

*Dryophis prasinus.* ( × 1½ )

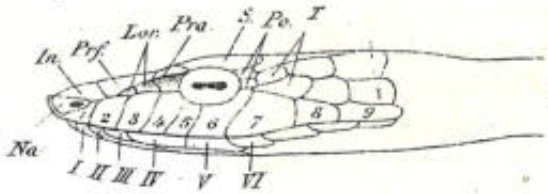



Fig. 7.

*Dryophis prasinus.* ( × 1½ )

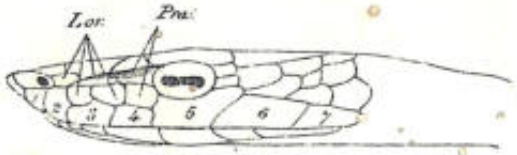



Fig. 8.

*Dryophis fronticinctus* ( × 2. )

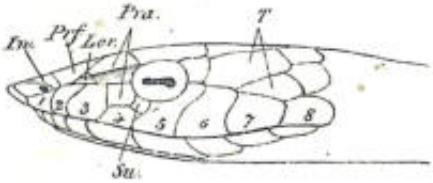



Fig. 9.

*Dryophis dispar* ( × 2. )

INDIAN SNAKES ( WALL. )

A. P. CORTEZ & CO. LITH. BOMB.

Of the remaining ten, five are Whip-Snakes, and distinguished from all other snakes by their horizontal pupil (see Figs. 7, 8 and 9). Their tails are extremely long and slender, measuring more than a quarter and in some species (*mycterizans* and *prasinus*) even more than a third of the total length of the snake. Should the head be damaged, the dorsal scales which number 15 in the anterior, and middle parts of the body, and 13 to 11 in the posterior part will suffice to proclaim the specimen a whip-snake, and the species may often be guessed at from the habitat.

(4) *Dryophis mycterizans.*—Has been already described.

(5) *Dryophis fronticinctus* (see Fig. 8).—Has like the last only one labial (the 5th or 6th) touching the eye, but has 3 or 4 loreals, and no nasal appendage. It grows to about 3 feet, takes readily to water, and is found on trees and bushes about rivers in Assam and Burma where it is often locally abundant (Moulmein and Rangoon rivers).

(6) *D. dispar* (see Fig. 9).—Resembles the preceding in having only one labial (the 5th usually) touching the eye, but differs in the absence of a nasal appendage and in having one or two loreals. It grows little more than two feet and has been recorded from hills in Travancore (Ferguson), and the Anamallays in S. India.

(7) *D. perroteti.*—Is distinguished from the rest of the Whip-Snakes in that two labials (the 4th and 5th) touch the eye. It grows to about 2 feet, and inhabits the Nilgiri Hills and N. Canara.

(8) *D. prasinus* (see Figs. 6 and 7).—This differs from the other Whip-Snakes in having three labials (the 4th, 5th and 6th) in contact with the eye. Its length exceeds 5 feet, and it is found in the Eastern Himalayas, Hills of Assam, and also in Burma where it is more abundant in the upper than the lower part of the Province, and is not confined to uplands.

The remaining five snakes agree in having the pupil rounded in contour, they are—

(9) *Macropisthodon plumbicolor* (see Figs. 3, 4, 5) which has been dealt with in this article. If the head is intact the labials which number 7, of which the 3rd and 4th touch the eye, will suffice to separate this from all the rest. The frontal is in contact with 6 shields. Should the head be too mutilated to observe these, the dorsal scales must be counted and will be found to number 23 to 25 in the anterior, and middle parts of the body, and 19 to 17 posteriorly. If in addition the median

rows of scales in the anterior part of the body are boldly keeled, its identity will be established.

(10) *Coluber oxycephalus* (see Figs. 10 and 11) has 8-10 upper labials three of which usually (rarely two) touch the eye, and a frontal in contact with 8 other shields. It may be identified by the co-existence of two characters which are (i) the dorsal scales number 23-27 anteriorly, 23-25 in the middle of the body, and 17-15 posteriorly; (ii) the median scales in the anterior part of the body are not keeled. It grows to 7 feet, and is known from the Eastern Himalayas, Tenasserim, Burma, Andamans and Nicobars, extending into the Malayan region. It is, says Dr. Stoliczka, generally seen on bushes near brackish water creeks, and is always ready to take to water.

(11) *Coluber frenatus* (see Fig. 12) is peculiar in having no loreal, its place being occupied by the extension of the præfrontal so as to meet the 2nd or 2nd and 3rd labials. This in itself would distinguish this from all the other snakes, but if the head is mutilated the dorsal scales should be counted, and will be found to number 19 in the anterior, and middle parts of the body, and 15 posteriorly. It grows to 3 feet, appears to be rare, and is peculiar to the Khasi Hills in Assam.

(12) *Coluber prasinus*.—Like the last two, has three labials touching the eye, usually the 4th, 5th and 6th, and has a frontal which is usually in contact with 8 other shields. The dorsal scales number 19 in the anterior, and middle parts of the body and 15 posteriorly. It appears to be uncommon, grows to 3 feet, and has been recorded from the Eastern Himalayas, Khasi Hills and Burma.

(13) *Ablabes doriæ* is easily distinguished from all the rest by the dorsal scales numbering 15 throughout the body. This is a rare snake, until recently only recorded from the Kachin Hills in Burma. I discovered a young specimen in 1901 in a Museum in Shanghai, which has extended its known habitat into China (Yangtse Valley). It grows to 3 feet.

*(To be continued.)*

Fig. 10

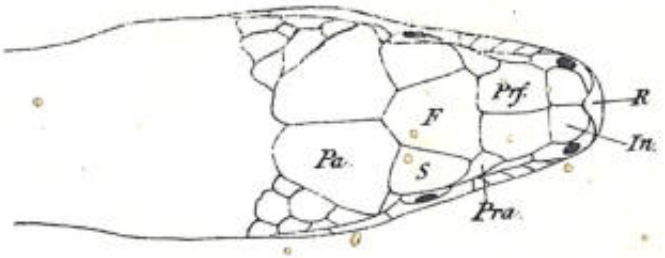
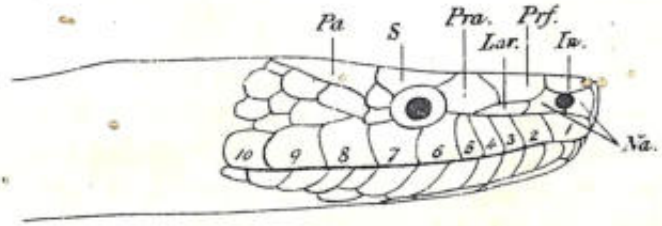
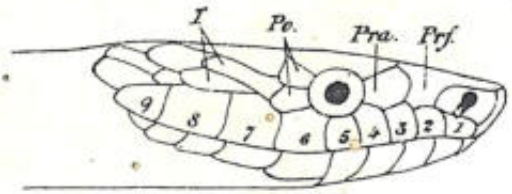



Fig. 11



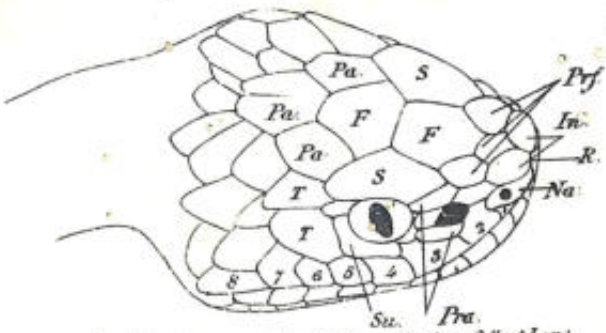

*Coluber oxycephalus (Life size.)*

Fig. 12




*Coluber frenātus (×2) (After Boulenger)*

Fig. 13




*Lachesis macrolepis (×2) (After Günther)*

**INDIAN SNAKES (WALL.)**

A. H. CORTET & Co. LITH. BOMB.

## EXPLANATION OF THE ABBREVIATIONS USED IN DIAGRAMS IV, V, AND VI.

A.S. Anterior sublinguals.
F. Frontal.
In. Internasals.
Lor. Loreal.
M. Mental.
Na. Nasals.
Pa. Parietals.
Pe. Pentagonal.
Po. Postoculars.
Pra. Præoculars.
Prf. Præfrontals.
P.S. Posterior sublinguals.
R. Rostral.
S. Supraoculars.
Su. Suboculars.
T. Temporals.
1, 2, 3, etc. Supralabials.
I, II, III, etc. Infralabials.

# ON SOME NEW SPECIES OF SILVER-PHEASANTS FROM BURMA.

By Eugene W. Oates, F.Z.S.

(*Read before the Bombay Natural History Society on 25th January* 1906).

During the past twelve months I have received a considerable number of Silver-Pheasants from some of my correspondents in Burma and among them are three well-defined new species.

### Gennæus prendergasti, sp. n.

The adult male is entirely black except that the rump-feathers are terminally fringed with sullied white or pale cream-colour and the upper tail-coverts margined with white. Length about 24 inches; wing 9·2 inches; tail 10·75 inches.

The female is of an umber-brown colour, very finely vermiculated with black, and each feather having a pale shaft and a grey margin. The wing-coverts are conspicuously tipped with white or pale rufous. The four middle tail-feathers are of a chestnut colour; the remaining feathers are rufous progressively more and more suffused with brown, the outermost feather becoming brown with a rufous tinge. Length about 20 inches; wing 8·4 inches; tail 8 inches.

The legs in both sexes are brown in the dried skins.

Two pairs of this bird, which appears to be the ordinary common Silver-Pheasant of Northern Arracan, have been sent to me by Mr. C. M. Prendergast, the Deputy Commissioner of the Arracan Hill Tracts, and I have much pleasure in naming this species after him.

### Gennæus macdonaldi, sp. n.

The adult male has the crest black. The head, sides of neck, back of neck, mantle, back, scapulars, wing-coverts and secondaries are black closely and firmly vermiculated with white across the feather; the feathers of the mantle and back with dark metallic blue margins. The rump is black, each feather broadly fringed with white and with several very firm distinct white vermiculations separated from each other and from the white fringe by black bands as wide as the fringe itself. The primaries have the outer web mottled with white, the inner web plain black. The two middle tail-feathers are black closely vermiculated with white; the others are black more or less vermiculated with white on the outer webs, the inner webs being almost entirely black. The

whole lower plumage is glossy black. Length about 24 inches ; wing 9·2 inches ; tail 11 inches. Young males have the white vermiculations on the upper plumage less firm, and the shafts of many of the feathers of the breast are white.

A hen bird which, there can be little doubt, is the female of this species has the crest umber-brown. The whole upper plumage is umber-brown with pale shafts and greyish margins, very finely and obsoletely vermiculated with black. The wing-coverts are tipped with white and the longer feathers have a blackish patch in front of this white tip. The primaries are brown, the outer webs paler than the inner. The secondaries are brown, the outer webs vermiculated with black. The two middle tail-feathers are pale chestnut mottled with brown ; the others are black cross-barred with white. The whole lower plumage is very dark brown, almost black on the breast, each feather with a broad rufous-grey streak and a grey margin. Length about 20 inches ; wing 8·5 inches ; tail 8·5 inches.

In both sexes the legs are of a brown colour in the dry skin.

The male has a close general resemblance to the male of *G. williamsi* but differs in many respects, among which may be noted the absence of white bars or mottlings on the inner webs of the primaries, and the aspect of the under surface of the closed tail which is black with little or no trace of diagonal white barring. The female differs in having the lower plumage of a dark-brown colour, not umber-brown like the upper plumage, and in having streaks, not mere pale shafts as in *G. williamsi*.

This species inhabits the Chin Hills and eastern slopes from Mount Victoria to Fort White. I have received specimens from Mr. A. C. Bateman, Mr. P. F. Wickham and Mr. K. C. Macdonald, and I wish this pheasant to bear the name of the last mentioned gentleman in recognition of his kindness in sending me this and other Silver-Pheasants.

GENNÆUS BATEMANI, sp. n.

The male is black throughout with the exception of the rump, the feathers of which are terminally fringed with white. Length about 26 inches ; wing 9 inches ; tail 13 inches.

The female has the chin and throat grey with paler shafts. The general colour of the whole plumage, including the crest, is umber-brown, each feather with a pale shaft and a white or greyish margin.

The wings coverts are conspicuously tipped with white. The primaries are plain brown. The whole plumage is finely vermiculated with black. The two middle tail-feathers are chestnut, either plain or finely barred with black; the others are plain black. Length about 21 inches; wing 8·5 inches; tail 9 inches.

In the adult male the legs are light green; iris hazel; bill greenish Nisbett). In a female the legs were brownish blue; iris hazel; weight 2½ lbs. (Nisbett).

The male of this species differs from the male of *G. horsfieldi* in having a pointed and much longer tail of 13 inches against a tail of 10·5 inches in the oldest male of *G. horsfieldi* that I have been able to examine. It also differs in having the rump-fringes narrower, thus causing the rump to exhibit more black than white, whereas in *G. horsfieldi* the contrary is the case, the fringes being so broad that the rump appears more white than black.

The female differs from the female of *G. horsfieldi* in having the tail constantly longer by half an inch.

Many years ago, just after the annexation of Upper Burma, a collector that I sent to Bhamo brought me a pair of Silver-Pheasants. The male was young, as shown by the rufous margins to many of the feathers of the upper plumage, and the tail was short. Ever since I got this bird I have been much puzzled by its narrow rump-fringes which I could not match with any specimen of *G. horsfieldi*, young or old, from Assam and Munipur. Quite recently, however, Mr. R. Clifford sent me a fine old male of this species from Sadône and Captain Nisbett has also sent an old male and a female from the Myitkyina district and also a female from Katha. The six birds thus available for study, establish the fact that *G. batemani*, which I have named after my friend and correspondent Mr. A. C. Bateman, is a perfectly recognizable and distinct species, taking the place of *G. horsfieldi* in the Katha, Myitkyina and Bhamo districts.

# SNAKE VENOMS AND THEIR ANTIDOTES: AN ACCOUNT OF RECENT RESEARCH.

BY

CAPTAIN GEORGE LAMB, M.D., I.M.S.

(*Read before the Bombay Natural History Society on 23rd November* 1905.)

On two previous occasions within recent years you have had to listen to papers which had as their subject matter an account of the physiological actions of snake venoms and of the anti-bodies which scientists have given us to combat intoxication from these poisons. And now I have been asked by our Honorary Secretary to bring this fascinating subject again before you, so that you may be thoroughly abreast of the times and know exactly what progress has been made, and in what directions we have still to seek knowledge, in order that we may be in a better position to turn to therapeutic use all the resources of science.

Let me, in the first place, carry you back to the 21st January 1902, when I placed before you a short resumé of the position of the subject as it stood at that time. I, then, gave you a description of the methods of scientific research and of the procuring of venoms; I indicated a few of the important physical and chemical properties of venoms and of the effect of heat upon these poisons. Further, we considered the physiological actions of two venoms, namely, those of the Cobra (*Naia tripudians*) and of the Daboia (*Vipera Russellii*), and saw the great and broad differences which exist between these two poisons as far as their effects on the animal organism are concerned. Finally, I told you of the scientific antidote which had been prepared for one of these poisons, *viz.*, that of the Cobra, by the French savant, Dr. Calmette. I stated that while Calmette claimed that his serum was equally effective against every kind of snake venom, we had good reasons, both *à priori* and experimental, for combating this claim. In fact, this serum, even at that date, had been shown to be practically specific for cobra venom, that is to say, that it neutralised cobra venom but no other poison. Nearly two years later, namely, on Guy Fawke's day of 1903, Colonel Bannerman, I.M.S., took up the wondrous tale and brought your knowledge of the subject well up to date. He tabulated in three parallel columns the physiological actions of the venoms of the Cobra, of Russell's Viper and of the Banded Krait (*Bungarus*

*fasciatus*), and again emphasized the fact that these poisons encompass the death of their prey in very different ways. Colonel Bannerman was also able to state authoritatively that antivenoms, that is, serums prepared with different venoms, were practically specific. He told you that Dr. Tidswell of Sydney had prepared a serum with the poison of one of the Australian species (*Notechis scutatus*) and that this serum while effective for its homologous venom was quite useless for the poisons of three other Australian species and also for the poisons of three of our Indian snakes, *viz.*, *Naia tripudians*, *Bungarus fasciatus* and *Vipera Russellii*. Further, at that date, I had already tested Calmette's serum against three Indian venoms and had found it to be of no value whatever in the treatment of bites from these snakes, namely, *Vipera Russellii*, *Bungarus fasciatus* and *Echis carinata*. Such then was the position of our knowledge two years ago.

Since that time a considerable amount of work has been done in the direction both of elucidating the exact physiological actions of the venoms of the different species, and of preparing various anti-serums. In view of the fact that we are commencing in the Journal a series of articles with coloured illustrations on the Snakes of India it appears to be an appropriate time to bring our knowledge of these other questions up to date. Let us begin then with the physiological actions of the poisons, first dealing with the colubrine snakes.

On the two previous occasions on which this subject was brought before you the actions of the poisons of the Cobra and of the Banded Krait were considered somewhat in detail and the differences which exist between them were pointed out. We saw that probably these two venoms were poisons which act chiefly on the central nervous system. This probability has now been fully confirmed by the demonstration histologically of marked changes in the large nerve cells of the brain and spinal cord. These changes are the more marked the longer the animal lives after the injection of the poisons and are especially well marked in the case of those animals which show the chronic nervous symptoms of intoxication after an injection of *Bungarus fasciatus* venom. If the animal dies within three hours of the bite no changes such as I have mentioned are to be observed, but when death is delayed longer than this period unequivocal changes can be easily demonstrated. Further, cobra venom has been shown to have a direct action on the heart and circulatory apparatus. This action is, however, quite

subsidiary, as far as we are concerned, to its effect in causing paralysis of the muscles of respiration, through which action death takes place in the great majority of cases.

While the researches with the two venoms mentioned above have been extended the poisons of other species have also received a considerable amount of attention, especially the venoms of the King Cobra, of *Bungarus cæruleus* (common Krait), and of *Enhydrina valakadien* (the common Sea-Snake).

The venom of the King Cobra closely resembles that of *Naia tripudians*, but finer differences in the physiological action are to be observed. It causes gradual paralysis throughout the body, death taking place from interference with the respiratory apparatus. As regards the symptoms resulting from this action no difference can be observed between the symptoms caused by this poison and those resulting from the venom of the ordinary cobra. While it is most probable that we are here also dealing with an action on the cells of the central nervous system, no actual demonstration of this hypothesis has yet been made in the manner which has been done in the case of the venoms of the Cobra and of the Banded Krait. When I am relieved of my present duties I propose to take up this point. Its action on the blood cells and on the coagulability of the blood is similar to that of cobra poison. It breaks up the red blood corpuscles and prevents the blood from clotting. While this is so in a general way, there are minor differences in these actions of the two venoms which show the scientist that the constituents which bring about these effects are not absolutely alike.

The differences between the two venoms are well brought out when we test them side by side against an anti-serum prepared with pure cobra venom. Such a serum neutralises well all the actions of cobra venom. It has no hindering action on the venom of the King Cobra, as far as the effects of this venom on the red blood corpuscles and the blood plasma are concerned. But when tested against the general action *in vivo* of this latter poison, it is found that cobra venom anti-serum delays death considerably but does not, even in large amounts, completely ward off the fatal issue. Therefore the most delicate physiological test which we possess shows at once that the constituents of the two poisons are not of an identical chemical composition.

When an animal is injected with the poison of the ordinary Krait (*Bungarus cæruleus*) symptoms very similar to those seen in cases of

cobra venom intoxication are observed. Still these symptoms differ so much in relative degree as to render it doubtful if they can be spoken of as identical. Further when we come to consider the question of antivenomous serums, we shall see that cobra venom is quite different from the poison of the Krait.

Nevertheless, experiments show that death by krait poisoning is due to failure of the respiratory mechanism, probably due to a direct action of the venom on the respiratory centre in the *medulla oblongata*. There is no doubt that this poison has also a direct action on the heart and on the circulatory apparatus through the nervous system. There are, however, many problems still to be solved. We have, nevertheless, been able to demonstrate that *Bungarus cœruleus* poison also causes a breaking up, chromatolysis as it is technically called, of the nerve cells in the spinal cord and brain. Further, this poison has no action on the coagulability of the blood, but has a power to break up, under certain circumstances, the red corpuscles of the blood.

There is no doubt that bites from *Bungarus cœruleus* are extremely dangerous and that a considerable percentage of the total deaths from snake bite in India, especially in Northern India, is due to this snake. Although the snake is small and injects only a comparatively small quantum of poison, the venom is very deadly, being at least four times as strong as that of the cobra. It is of interest here to put down in tabular form the minimum lethal doses for rabbits, of the more important poisons expressed in milligrammes per kilogramme of weight, when the injection is made subcutaneously.

| Species of snake. | Minimum lethal dose in milligrammes per kilogramme. |
|---|---|
| *Naia tripudians* (Cobra) ... ... .. .. | 0·35 |
| *Naia bungarus* (King Cobra) ... ... ... | 0·35 |
| *Bungarus cæruleus* (Common Krait) ... ... | 0·08 |
| *Bungarus fasciatus* (Banded Krait) ... ... | 2·5—3 |
| *Enhydrina valakedien* (Sea Snake)... .. ... | 0·05 |
| *Notechis scutatus* (Australian Tiger Snake) ... | 0·05 |
| *Vipera Russellii* (Daboia or Russell's Viper) ... | 1—2 |
| *Echis carinata* (Phoorsa or Kupper) ... .. | 1—2 |

From this table it is seen that the most poisonous of all snakes are the common Sea Snake and the Australian Tiger Snake: then comes the Krait followed by the Cobra and the King Cobra. The Banded Krait

is the least poisonous of all, its venom being about half the strength of the poisons of the two common Indian Vipers.

I have now to say a few words on the venom of the common Sea-Snake (*Enhydrina valakadien*).

This snake is very abundant along the coasts of India and Burma to the Malay Archipelago and New Guinea.

The poison, as we have just seen, is very deadly, being about eight times stronger than cobra venom.

There are no authentic cases on record of bites in the human subject, so that any description of symptoms and of physiological action must be taken from animal experiments. The symptoms observed are very similar to those of cobra venom intoxication. The local reaction is, however, very slight, and further no symptoms pointing to any action of the poison on the coagulability of the blood or on the red cells occur. There is progressive paralysis, accompanied by difficulty in breathing, which latter symptom is much more marked than in cases of cobra venom poisoning. The heart goes on beating for several minutes after the respiration has ceased. While, however, the action of this poison is similar to that of cobra venom there are slight differences which show that the two poisons are not identical. These differences are too technical to enter into here. Suffice it to say that the respiratory mechanism appears to be the part of the organism which is chiefly affected by *Enhydrina* venom, while some of the actions which cobra venom has on the circulatory apparatus are wanting in the case of the poison under consideration. These differences are clearly brought out, as we shall see later, when the two poisons are tested against a serum prepared with one of them.

I have little to say about the viperine poisons, which now claim our attention. I have already given you a description of the symptoms and of the physiological action of the venom of *Vipera Russellii*. The venom of *Echis carinata* has to all intents and purposes a similar action but again shows slight differences, which we shall see are of great importance in connection with the problem of serum-therapeutics. This poison has a much more powerful action on the coagulability of the blood than any other venom with which I have worked. A very small quantity injected directly into the blood stream of an animal causes solid clotting throughout in a few seconds. This action of the viperine poisons, an action which is also exhibited by those poisons of

the Australian colubrine species which have been investigated, is of the greatest interest and importance. For a long time no satisfactory explanation of the phenomenon was forthcoming. It has now, however, been definitely proved that the coagulation which takes place is due to the action of a katalyst or ferment, which in some way or other brings about the formation of fibrin, a phenomenon analogous to the formation of curd which takes places on the addition of rennet to milk.

Another point which has been settled as regards the action of the viperine poisons is that they, at least the venom of *Vipera Russellii*, had no chromatolytic action on the nerve cells of the brain and spinal cord, such as we have seen can be demonstrated in the case of the venoms of the cobra and of the *Bungari*. There is still another point which is of special importance as regards the treatment of cases of bites from these two vipers. It is well known, and I have mentioned it to you before, that these poisons cause great faintness and collapse. These symptoms are due to an action of the poisons on the circulatory apparatus, a rapid, well marked and persistent dilatation of all the small arteries throughout the body taking place. This action no doubt helps to bring about the serious and alarming bleedings which take place in such cases from almost all the orifices of the body. Now there is one drug which has an effect antagonistic to this, and that drug is adrenaline chloride, a preparation made from the small ductless glands which are placed like caps on the upper ends of the kidneys. I have just heard from a friend on the Baluch Frontier that he has found this drug to be of immense value in the treatment of these symptoms ; in fact, he assured me that it was the only drug which was of any use. We have here an instance of research pointing the way to therapeutics.

While these are the main actions of the Indian venoms which have been investigated, there are, of course, other problems of the greatest interest and importance to those working at the subject. It is, however, not only on account of its intrinsic interest that snake venom research has received so much attention from scientists. There is another and most important aspect of the subject. For owing to the analogy which has been found to exist between venoms and the toxins elaborated by some micro-organisms, such as diphtheria and tetanus bacilli, the results of experiment with snake poisons have taken a not unimportant place in the development of our knowledge of immunity. For, it has been shown that by continued treatment of an animal with injections of

venom one is able to produce an anti-toxic serum. I have already indicated to you how such a serum is won and the use to which it can be put. I have told you that Calmette was the first to prepare a serum for therapeutic use and that this serum, claimed by Calmette to be efficacious against the venoms of all species of snakes, was soon shown to be practically specific for cobra poison, the venom which preponderated in the mixture with which it was prepared. Dr. Martin was the first to show that this serum was of little or no value for any of the Australian snakes against which it was tested, and in India it was soon demonstrated that Calmette's serum, while anti-toxic to cobra venom, had no neutralising effect for the venoms of the following snakes:—*Bungarus fasciatus*, *Vipera Russellii* and *Echis carinata*.

I have already indicated that Calmette's serum was at first prepared with a mixture of venoms, the constitution of which mixture was uncertain, but in which cobra venom greatly preponderated. You will, therefore, understand that in order to test thoroughly this question of specificity it was necessary to prepare different serums, each with a single pure venom. This has now been done in Australia, in America and in India, and the results obtained are in complete harmony with each other. Let me in a few words summarise these observations.

Dr. Frank Tidswell in Sydney has prepared a serum with the pure venom of the Australian Tiger Snake (*Notechis scutatus*). This serum was found to be active for the corresponding venom, but failed to neutralise the poisons of three other Australian snakes, namely, the brown and the black snakes and the death-adder. Further, this serum was found to be inactive against the venoms of the following Indian snakes:—cobra, king cobra, krait, banded krait, *Enhydrina valakadien*, Russell's viper, phoorsa, green pit-viper and also the Californian rattle-snake.

Two pure serums have been prepared in India, one with the venom of the cobra and the other with the venom of the Russell's viper.

The cobra venom anti-serum was found to be strongly anti-toxic for the venom used in its preparation; in large quantity it has a neutralising power for the venom of *Enhydrina valakadien*; further, it delays death in cases of intoxication with the venom of the king cobra, a species belonging to the same genus as the cobra, and also in cases of intoxication with the venom of *Bungarus fasciatus*. It does not, however, even when used in large quantities, completely neutralise these

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poisons. The serum, therefore, would be of little or no therapeutic value in cases of bites from these three snakes. Finally, this serum contains no anti-toxic substances which are active against the venom of *Bungarus cœruleus* or against the venoms of the following viperine snakes:— *Vipera Russellii, Echis carinata, Lachesis gramineus* and *Crotalus adamanteus.*

With the *daboia* venom anti-serum very similar results were obtained. It was found that this serum has no action whatever on any of the colubrine poisons, five in number, against which it was tested; that it neutralises well its homologous venom; that it has a certain, but not very marked, neutralising effect on the venom of another viper, namely, the American *rattle snake:* and that it has no anti-toxic action for the venom of a closely allied viper, *Echis carinata,* nor for that of another Indian viper, *Lachesis gramineus.*

These results which I have collated above only refer to observations made in animals, that is to say, when the life of an animal is used as the index of the neutralisation of the poison by the serum. In other words these experiments only refer to the neutralising power of the serums for the complete general actions of the venoms on the organism. But there are other and very delicate methods outside of the animal body of testing this specificity question. We can test them in test-tubes against the actions which the various poisons exert on the red blood corpuscles and on the coagulability of the blood plasma. This has been done with the three serums mentioned above. When tested against the hæmolytic actions of the different venoms, that is to say, the actions which they exert on the red blood corpuscles as evidenced by the dissolving up of these bodies, cobra venom anti-serum was found to have a high neutralising effect for its homologous venom; to prevent, when used in relatively large amount, this action of the venom of *Bungarus cœruleus,* but to have no hindering effect at all on the hæmolysing actions of eight other venoms, amongst which was the poison of the King Cobra. Very similar results were obtained with Tidswell's serum which, however, proved not quite so specific in its action as the serum prepared with cobra venom. The serum prepared with *daboia* venom has also been tested against this action of the various venoms. It was found to have no neutralising effect for any colubrine poison; to neutralise the venom of *Echis carinata* as well as it did that of the poison with which it was

prepared; to have a marked but not equally great effect on the venom of *Crotalus adamanteus;* and to have no neutralising action on the venom of another viper, namely, *Lachesis gramineus.*

These three serums have also been tested *in vitro* against the action of the different venoms on the coagulability of the blood. In this respect specificity was well marked. Thus, it was found that cobra venom anti-serum neutralised well its homologous poison, but had no effect on this action of the venom of the King Cobra; that *notechis* and *daboia* anti-serums neutralised the fibrin ferments of their respective poisons but had no effect in preventing the clotting actions of the other poisons which possess this remarkable property.

I have still to refer to the anti-serums which have been experimented with in America. Flexner and Noguchi have prepared serums with the venoms of *Crotalus adamanteus* and of the water *Mocassin.* After testing these serums in detail, they conclude that the action of anti-venines is highly, if not strictly specific, both *in vivo* and *in vitro*, a conclusion which is in perfect harmony with the results I have put forward above.

We have now in conclusion to consider the bearing which these observations have on the problem of the serum therapeutics of cases of snake bite. It is very evident that at the very outset we are met with the almost insurmountable difficulty that only the specific anti-serum must be used in any case of snake-venom intoxication. Therefore, for India alone we should require at least six different anti-venines, namely, serums for the venoms of the cobra, the king cobra, the krait, the banded krait, the daboia and the phoorsa. There is no difficulty in the actual preparation of these anti-venines, but there are other difficulties in the way. In the first place, it seems almost impossible to collect these poisons in quantities sufficient for the purpose of immunisation of large animals. For the last five years arrangements for the collection of venoms, backed by the Government of India and complete in every detail, have been working in the Laboratory at Parel. Even under these most favourable conditions only a very small, quite insufficient, amount of venoms, except the poisons of the cobra and the daboia, has been collected. In the second place, granted that it was possible to prepare serums for these different poisons, the practical use of them would be beset with difficulty. For when a person, especially a native of India, is bitten by a snake, he is rarely able to tell the species of snake

which has inflicted the bite and further, as an anti-venomous serum to be of much practical utility must be injected before any symptoms of intoxication have set in, the medical man who is called on to treat a case of snake bite with anti-toxin is not as a rule in a position to form an opinion, either from the history of the case or from the symptoms, as to the nature of the venom which has been injected. He would have, therefore, either to use one of the anti-toxic serums at haphazard or to inject the whole of them at once, neither of which methods would commend itself as a trustworthy or scientific therapeutic measure.

As far as is possible we have already overcome these difficulties. At the Pasteur Institute at Kasauli a polyvalent serum is now prepared with a mixture of equal parts of cobra and daboia venoms. This serum is highly efficacious for both the poisons with which it is prepared but it would be of little or no value for the bites of other Indian poisonous snakes. It is now the only anti-venine issued from that Institute. It is supplied free to all Government Hospitals and Institutes and at a small charge to private individuals. Let us hope that it may be used freely and that it may save many lives which are now lost for lack of scientific treatment.

# SAMBER HORNS.

BY

J. D. INVERARITY.

(*With 4 Plates.*)

(*Read before the Bombay Natural History Society on 25th January* 1906.)

The antlers of the Indian Samber (*Cervus unicolor*), like others of the deer of the Rusine group, such as the Cheetul and Hog Deer, are of a simple character, having normally three tines only on each horn the brow antler and two at the top. The object of this paper is to illustrate the different types of antlers carried by the Samber, all of them from my own collection. The first thing to be observed is the different manner of growth of the upper tines. In the Cheetul and Hog Deer I think the outer tine is invariably the longer. I speak only of good adult heads. In the Samber, on the contrary, in the great majority of instances the inner tine is the longest one. The head pictured as No. 1 is a very typical head, length 44 inches, span between outer upper points 33¼ inches and round burr 10 inches. No. 2 is a specimen of the wide spreading head, and measures, length 42 inches, span 41½ inches, round burr 10½ inches. This is a remarkable head for stoutness of horn, the thinnest part of the beam being 7 inches in circumference, gradually thickening to a circumference of 10½ inches just below where the upper points divide. The weight of this head with the small piece of skull attached six months after it was shot was 19 lbs. I do not think the piece of skull can weigh 1 lb. An ordinary 40-inch head with a similar small piece of skull attached, only weighs about 12 or 13 lbs. A single horn picked up, 41 inches long, thinnest part of the beam 8 inches, weighs 7 lbs. 13 oz.

Both the heads, Nos. 1 and 2, have the inner upper tine the longest. No. 3 has the outer tine the longest and measures, length 40 inches, span 36 inches, round burr 9 inches. It is very seldom one meets with a head where the horns are not symmetrical, the longer tine being on the outside of one horn and on the inside of the other. I have only two heads of this description, and, curiously enough, got them both within a few days of each other. No. 4 is one of them and measures, length 43 inches, span 34 inches, round burr 9 inches, an inch or two is broken off the outer tine of the left

horn. There are some good Samber heads, about a dozen, in the Natural History Museum at South Kensington, but they are placed so high up that it is difficult to see them properly. With one or two exceptions, the inner upper tine is the longest. The stuffed Samber there is a moderate specimen: judging by the eye the horns appear to be about 3 feet long. Samber occasionally have an extra tine in one of the horns at the top. There is a remarkable head in the Natural History Museum at Kensington, where each horn shoots out at the base of the upper points an extra very thick tine which again divides into two. A small extra point also sometimes appears at the base of the brow antler. I have 3 heads, one of which has an extra point in both brow antlers sticking up between the brow antler and beam, the other two throw the extra point below the right brow antler proper, in each case it is about 3 inches long. I have never seen a switch horn in Samber, *i.e.*, a horn without any tines at all. I have one head, the left horn, 35 inches long, bifurcates in the usual manner. The right horn, 34 inches long, does not bifurcate but consists of a single beam. The brow antlers are normal. Of course very young stag's horns are simple spikes in the first year of growth. The next illustration, No. 5, is of an unusually narrow spreading head. Length 38¼ inches, span between outer points 19 inches, between inner points 11¾ inches, round burr 9 inches. The horns curve so little that although the measurement round the curve is 58¼ inches in a straight line from tip to burr, it measures 34 inches. This stag had both brow antlers broken off. He jumped up close to me. Seeing the points of his horns were close together, I did not fire as I thought he was a small one, so he nearly escaped, as he had run a long way before I saw he was worth shooting. No. 6 I consider to be an unique head as it has no brow antlers at all, nor any trace of any, in other respects the horns appear normal, although the left horn has a twist in it. The outer tines of this head are the longest; 2 or 3 inches are broken off the inner tine of the left horn. It measures, length 38 inches, span 31 inches, round burr 8 inches. This stag had hardly any hair on its neck; it had all been rubbed off in fighting. The want of brow antlers had allowed the brow antlers of his opponent to scrape his neck. Although you could clearly see the scoring along the skin made by the points of the horns, very few of these thrusts had drawn blood. No. 7 is another instance of no brow antlers, but the horns are abnormal.

No. 1.

No. 2.

SAMBER HORNS.

No. 3.

No. 4.

SAMBER HORNS.

No. 5.

No. 6.

SAMBER HORNS.

No. 7.

No. 8.

SAMBER HORNS.

The pedicle on which the left horn grows instead of being perpendicular to the skull, grows outwards; the horn also grows outwards for 3 inches, and then turns at a right angle to the usual position. The pedicle of the right horn is also abnormal; except at the lower portion it cannot be seen, the horn appearing to grow straight out of the skull. The inner tine of the left horn has been broken off. The beam of the right horn splits into a fork in a curious manner. This head measures, length 38 inches, span 40½ inches. Both Nos. 6 and 7 were well grown stags in good condition, and there was nothing to indicate any reason for their peculiar heads. No. 6 was a solitary stag. No. 7 was in company of two hinds and two calves. No. 8 is an instance of a third horn growing on a separate root or pedicle of its own—a rare kind of malformation. The third horn is a mere knob, nearly an inch from the left horn; this space was covered by skin. The left horn seems to have little or no pedicle. The base of the left horn is 1¼ inch lower than the burr of the right horn. There is no burr to the left horn, except at the front. The right horn measures 32 inches, the left horn 26 inches, and the knob 1½ inches at the rear and 1 inch at the front. I have no heads of which the upper tines are of equal length. I do not think you will ever find this to be the case in good heads of over 3 feet in length. There is no means of knowing exactly at what age a Samber has his best head. Animals in captivity are not under natural conditions. It is well known that all deer grow worse horns after they are past their prime. Their heads go back. When in their prime, their antlers are thicker, longer and better beaded than in old age. An old stag's head may be known by its smoothness and worn appearance. I have often had it remarked to me by those who know no better when looking at a very good head, "that must have been a very old stag." On the contrary the best heads are those of stags in their prime. Some of the very old stags are hardly worth shooting. A Red Deer kept in a park begins to go back in his head, I believe, when he is about 8 or 9 years old, so it seems probable that a Samber is at his best when about that age too. Samber usually shed their horns in April, but on the 2nd January 1903, I saw a young stag in velvet. His horns were about 8 inches long, cylindrical, with the thickening at the top characteristic of the growing horn. As he stood for several minutes within 40 yards of me, I had a good look at him with glasses. I do not think I could have made

a mistake. In the month of January 1905, I also saw a young stag with horns a few inches long which appeared to be in velvet; but as he was more than 100 yards off, I am not certain of it.

Sambers are very fond of rubbing their horns against trees long after the horns are hard. The front of the beam above the brow antler is generally worn smooth by this practice. The interstices between the beads on the antlers are packed tight with bark from the trees. The horns are seldom of equal length, one being one or two inches longer than the other. I have one head the horns of which are exactly the same length *viz.* 40 inches. The custom is to measure the longest horn. The thickest horn round the burr I have seen is a single shed horn in our Museum which measures 12¾ inches in circumference at the burr. The longest upper tine I have measures 22 inches. The longest brow antler measured from the burr is 24 inches. In the jungles I know I see no diminution in the number of Samber since I first came out to India nearly 35 years ago. Fair shooting at good heads only will, in my opinion, never do any injury to the stock of deer. I often see old stags with poor heads that I do not fire at that ought to have been shot long ago. Hinds are numerous. On one occasion I saw a single stag lying out on an open bank in the sun, which is quite unusual as they generally sit in shade. I fired at him and missed; I tracked him some way and came to a place where he had galloped across a small stream; the water being about 2 feet deep. A small fish, 4 inches long, was floating on the surface, and I found it had been cut nearly in half by the Samber's hoof. It was not crushed, so had not been trodden on. The hoof must have struck it when swimming in the water. Another stag I hit plunged into a long deep pool of a river and swam up and down the pool several times. He swam with his body low in the water, horns thrown back and only the top of his face and points of his antlers showing. The pictures one sees of deer swimming usually show the whole head out of the water, which appears to be incorrect. This particular stag had a 40-inch head, and he eventually swam to the opposite side of the river and stood in deep water, which enabled me to shoot him through the neck, when he sank to the bottom.

# A NEW SNAKE (*MELANELAPS McPHERSONI*) FROM THE ADEN HINTERLAND.

BY

CAPT. F. WALL, I.M.S., C.M.Z.S.

(*Read before the Bombay Natural History Society on 5th October* 1905.)

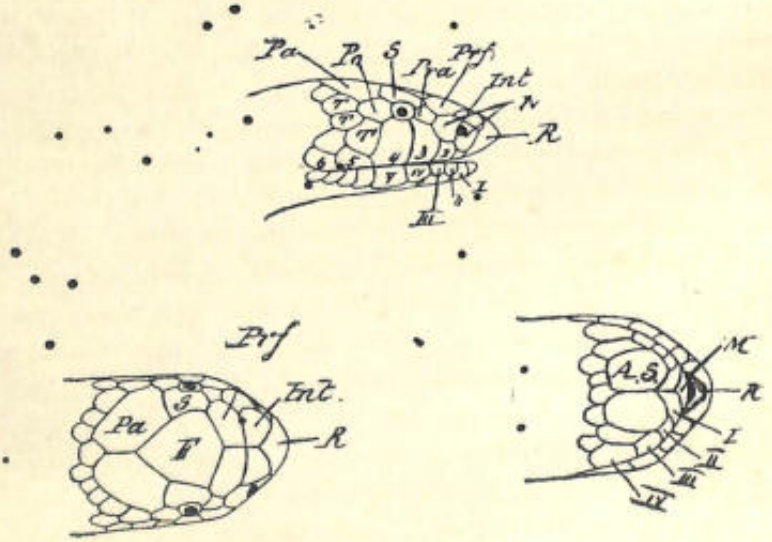
An interesting addition to the Asian fauna has recently been made by the discovery of a new poisonous colubrine snake by Captain G. McPherson, I.M.S., at Dthali in the Aden Hinterland. It presents a combination of external characters so distinctive that I consider it deserves generic rank, and I have accordingly called it *Melanelaps* in conjunction with the discoverer's name. Whether this opinion will be supported by osteological peculiarities must remain *sub judice* until more specimens have been obtained. The mandibular and palatine teeth appear to be singularly few and small, but the fang unusually well developed for members of the Elapinæ.

It must be placed in the *Family* Colubridæ; *Series* Proteroglypha; *Sub-family* Elapinæ.

Judging from external characters (the scales, subcaudals, rostral, frontal, supralabial, and posterior chin shields), it has no very close affinities with any of the Indian poisonous colubrines, nor indeed with any other known members of this sub-family.

Description.—*Rostral* unusually large. Breadth fully twice height; projecting; in contact with 6 shields, of which the internasal sutures are the largest (about one-third greater than the anterior nasals), and the 1st labial sutures smallest, and inferior. *Internasals* a pair. Suture between them rather less than that between the præfrontal pair; about one-third the internaso-præfrontal suture. *Præfrontals* a pair. The suture between them about half the præfronto-frontal suture: in contact with, internasal, postnasal, præocular, supraocular and frontal. *Frontal* very large. In contact with 6 shields, of which the supraoculars make the smallest sutures (about $\frac{3}{4}$ the rest which are subequal); length greater than parietals and much greater than distance to end of snout. *Supraoculars.* Length about $\frac{3}{5}$ frontal; breadth about $\frac{1}{4}$ frontal. *Nasals* two, divided; in contact with the 1st, 2nd and 3rd supralabials; nostril slitlike, placed almost entirely in the anterior shield and occupying the upper $\frac{3}{4}$ of the suture. *Loreal* absent. *Præocular* one, small. *Eye* small. Its horizontal diameter rather more than half its distance

to the nostril, vertical diameter about half its distance to the labial margin; pupil round. *Postocular* one, large. *Temporals* three; the lowest largest, and in contact with the 4th and 5th supralabials. *Supralabials* 6. The first very small, second rather larger, third and fourth very deep, fifth and sixth moderate. The third and fourth touch the eye. *Mental* very broad. *Anterior sublinguals* large. *Posterior sublinguals* small and widely separated by 5 scales. *Infralabials* 3 touch the anterior sublinguals on the left side, 4 on the right; the 3rd and 4th touch the posterior sublinguals on the left side; the 4th and 5th on the right; the 4th is the largest of the series on the left side, the 5th on the right; the suture between the 1st is about half that between the anterior sublinguals. *Scales* 2 heads lengths behind head 26, midbody 25, 2 heads lengths in front of vent 21; smooth, no apical pits; the vertebral row is not enlarged, and the last row very slightly so. *Supracaudals* in odd rows. *Ventrals* 229 rounded, broad. *Anal* entire. *Subcaudals* 30, all entire, except the first which is divided. *Colour* uniform glossy blue-black everywhere. The head is broad, blunt, and declivous from occipital region. Neck not constricted. Body subcylindrical. Tail short.




*Melanelaps mephersoni.* ( × 2 )

# A NEW HIMALAYAN SNAKE (*LYCODON MACKINNONI*).

By Capt. F. Wall, I.M.S., C.M.Z.S.

(*Read before the Bombay Natural History Society on 5th October* 1905.)

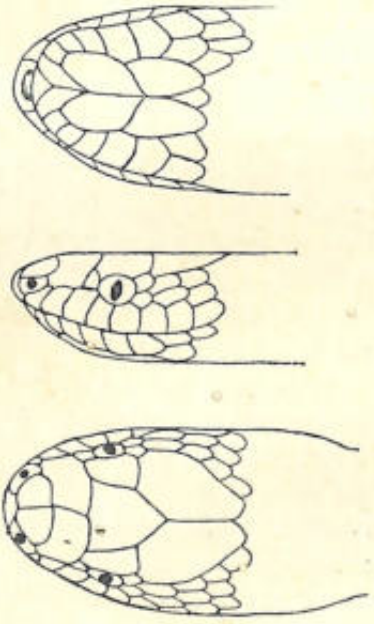
I have lately received from Mr. P. W. Mackinnon a few snakes collected by him in the neighbourhood of Mussoorie, among which is a small snake of the genus *Lycodon* hitherto undescribed. The specimen was killed in his own garden at an altitude of 6,100 feet.

Unfortunately, the specimen has been badly mutilated about the head. With some difficulty I have managed to clean and repose the parts sufficiently to make drawings which, though accurate, I believe, in the actual relationship of the shields, are probably not quite so with regard to the shape of the head. The following is a description of it :—

*Rostral*, in contact with 6 shields, of which the nasal sutures are the largest, and about twice the length of the internasals. *Internasals*, a pair. The suture between them subequal to that between the præfrontal fellows; less than the internaso-præfrontal suture. *Præfrontals*, a pair. The suture between them subequal to the præfronto-frontal suture. In contact with the internasals, nasals, 1st, 2nd and 3rd supralabials, præocular, supraocular and frontal. *Frontal* in contact with 6 shields, of which the sutures are subequal. *Supraoculars* are half the breadth and about two-thirds the length of the frontal. *Nasal* whether divided or not uncertain ; in contact with only one supralabial (the first). *Loreal* absent. *Præocular* one. *Eye* with vertical pupil. *Postoculars* two, subequal. *Temporal* two ; the lower in contact by equal sutures with the 6th and 7th supralabials. *Supralabials* 8, with the 3rd, 4th and 5th touching the eye on the left side ; 7 with the 2nd, 3rd and 4th touching the eye on the right side (owing to a confluence of the 1st and 2nd ? ). *Anterior sublinguals* subequal to the posterior ; in contact with 5 infralabials. *Posterior sublinguals* in contact with the 5th and 6th infralabials. *Infralabials*. The first form a suture about $\frac{3}{4}$ the length of the suture between the anterior sublinguals ; the 5th and 6th are subequal and largest and the 6th pentagonal, and in contact with 2 scales behind. *Scales*. Two heads lengths behind the head 17 ; midbody 17 ; two heads lengths before the vent 15. At the step where the scales reduce from 17 to 15 behind the middle of the body, this is effected by the blending of the 3rd and 4th

rows above the ventrals. *Ventrals* 192, slightly angulate. *Anal* divided. *Subcaudals* 54 divided. *Colour* chocolate, with short white linear streaks copiously distributed dorsally. *Head* blackish-brown with white streaks. *Labials* white. *Belly* yellowish-white, with a row of lateral spots one on each ventral. *Length* about 1 foot 1½ inches.

It thus approaches nearest to the *effrenis* of the Malayan fauna, in that there is no loreal ; the scales are in 17 rows, and three labials touch the eye. The only other Indian species without a loreal is *atropurpureus*.



*Lycodon mackinnoni.* ( × 3 )

Mintern Bros Chromo London

# DENDROBIUM BARBATULUM, Lindl.

Fig. 1. An entire plant. Fig. 2. [illegible] (enlarged).
Fig. 3. Column (enlarged). Fig. 4. Pollen masses and cap (enlarged).

# THE ORCHIDS OF THE BOMBAY PRESIDENCY.

By G. A. Gammie, F.L.S.

Part III. (With Plate II.)

(*Continued from page 569 of Vol. XVI.*)

5. Dendrobium barbatulum, *Lindl.* Fl. Br. Ind., V., 719 ; Dalz. and Gibs., p. 261.

*Stems* usually more robust and shorter than the last, also bearing flowers on the second year's leafless stems. *Leaves* lanceolate acuminate, 3 to 4 inches long, *racemes* lateral and terminal, many flowered, *bracts* very small. *Flowers* 1 inch in diameter, white more or less suffused with rose, dorsal *sepal* narrow, *lateral* lanceolate falcate, *petals* larger elliptic lanceolate, *spur* conical acute, *lip* flat, side lobes enclosing the ovary short, midlobe large ovate acute, *disk* hairy and with a short ridge between the side lobes.

*Distribution.*—Throughout the Ghats and Konkan to Coorg. It flowers during the hot weather from March to May.

Plate II. Fig. 1. An entire plant. Fig. 2. Lip (enlarged). Fig. 3. Column (enlarged). Fig. 4. Pollen masses and cap (enlarged). This is an unusually bright-coloured specimen drawn by Mr. Bhide. The colour has been exaggerated in reproduction. As a rule the flowers are only flushed with rose-pink. They are fragrant and have the habit of almost closing up in the evenings and during the night, a fact which I have never observed in any other orchid.

[2. *Dendrobium barbatulum, Lindl.*—

The native name of this plant is not known. "Bechu," or "Nangli," is the native name of *D. crepidatum*, Lindl. Dalzell and Gibson say that it is common in the North and South Konkans. Mr. H. M. Birdwood has found it on the Matheran Hill. Hooker says, at p. 719, Fl. B. I., that the flowers are whitish. They are generally pale pink, and shining bright in appearance, when fresh. The brightness vanishes in drying. Unfortunately, our plate is printed by Mintern Bros. in a deeper pink colour. This pink colour, deeper than natural, is often met with when the flowers have remained in bloom for some time under a strong sun after the first opening of the flowers. They are to be met with in Thana on the branches of the Mango in a bed of Lichen, named generically the Parmelias. It is found in Dapoli (Ratnagiri District). A couple of plants of this species were brought to me from Dapoli in 1904 by Mr. T. S. Greenaway, then the District Superintendent of Police, Ratnagiri District. The plants flowered in my Outram House Garden, under a shed of cocoanut palm jhowlis in the open air at the beginning of the hot weather, March of 1904. I am therefore able to say that the

colour of the flowers is not *deep* but *light* pink, bright shining. The petals are almost translucent.

Nairne says that the flowers, in racemes, are "cream-coloured with some green." Not so! The colour is distinctly rosy like that of *Dendrobium Fytchianum*, Bateman, found in Moulmein (Burma).

There is a natural hybrid named *Dendrobium barbatulo-chlorops*, Rolfe, between *D. barbatulum*, and *D. chlorops* mentioned by Williams (p. 326 op. cit.) which would account for the confusion made as stated already in my foregoing remarks on the colours of *D. chlorops* and *D. barbatulum*. There is yet room for a fresh examination of the *D. barbatulum* from specimens either fresh obtained, or examined in their natural condition.—K. R. K.]

(*c*) *Stems* slender, excessively branched, *flowers* small, white.

6. DENDROBIUM HERBACEUM, *Lindl.* Fl. Br. Ind., V., 719; *D. ramosissimum*, *Wight*. Dalz. and Gibs., p. 261.

A much branched plant, branches slender, pendulous, their lower parts naked and shining, the upper with short sheaths, branchlets leafy, *leaves* linear, lanceolate, soon falling, up to 2 inches long, *racemes* terminal on the branchlets, very short, usually three-flowered, *bracts* very small, *flowers* white with a greenish tinge, $\frac{1}{3}$ inch broad, *sepals* and *petals* subequal, linear oblong obtuse, *spur* very short and rounded, *lip* oblong, side lobes almost obsolete, granular, midlobe smooth, ovate.

*Distribution.*—The Western Ghats and Konkan to Coorg; Godaveri District and Parasnath in Behar.

A common orchid at Mahableshwar. Flowers in the hot weather.

Section III.—*Eudendrobrium*.

*Stems* tufted, flowers yellow or pink in short racemes or in pairs from the joints of the leafless stems.

7. DENDROBIUM MACROSTACHYUM, *Lindl.* Fl. Br. Ind., V., 735.

*Stems* 1 to 2 feet long, pendulous, slender, *leaves* thin, 3 to 4 inches long, ovate oblong acute, *racemes* short, from leafless stems of the previous year's growth, *bracts* small. *Flowers* 2 to 3 on moderately long stalks, fragrant, 1 inch long, not spreading, *sepals* and *petals* subequal, broadly lanceolate acute, yellow tinged with pink, nerves greenish, *lip* convolute, obovate, *disk* strap-shaped, slightly ribbed, limb with purple nerves and with thick soft hairs on its upper surface and margins, *spur* formed by the united bases of the lateral sepals, thick, shortly funnel-shaped.

*Distribution.*—Common on trees on the Belgaum and Kanara Ghats, also recorded from Travancore and Ceylon.

Flowers during the hot weather.

8. DENDROBIUM CREPIDATUM, *Lindl.* Fl. Br. Ind., p. 740. ; *D. Lawanum*, Dalz. and Gibs., p. 261.

*Stems* fleshy, forming erect tufts, about a foot high, surfaces loosely sheathed and elegantly striated with green and white.

*Leaves* 2 to 3 inches long, linear lanceolate, acute, falling away at the end of the first season. *Flowers* in small clusters, from the joints of the leafless stems, up to 1½ inch in diameter, of a waxy texture and a shining rose colour, *sepals* oblong obtuse, *petals* almost obovate, spur short and obtuse, *lip* yellow, side lobes short broadly obovate, pubescent or ciliolate.

*Distribution.*—Common on the Belgaum and Kanara Ghats especially on the branches of trees overhanging ravines. It is also recorded from the Eastern Himalayas, Assam and the Khasia Hills.

Flowers during the hot weather.

DENDROBIUM CREPIDATUM, *Lindl., var. nov.* AVITA.

Differing from the type in the flower being composed of six absolutely equal perianth segments, the side lobes of the lip forming short ascending spurs on each side of the lower part of the column. The midlobe of the lip is of exactly the same colour and texture as the sepals and petals.

This is not an accidental variation, as some plants I have in cultivation produce these flowers normally every year.

Found throughout the Belgaum and Kanara Ghats in association with the type.

## 5. BULBOPHYLLUM.

*Pseudobulbs* ovoid arranged on a creeping stem. *Leaf* solitary *Raceme* rising from the base of the pseudobulb. *Flowers* crowded towards the apex, *dorsal sepal* short and broad, *lateral sepals* much longer and narrower, *petals* very short, *lip* jointed on the foot of the column, mobile, recurved, *column* short, with two awn-like teeth at the top, *anther* 2-celled, *pollinia* 4.

1. BULBOPHYLLUM NILGHERRENSE, *Wight.* Fl. Br. Ind., V., 761.

*Pseudobulbs* 1½ inch long, ovoid, *leaf* 4 or 5 inches elliptic oblong, base of raceme sheathed, *peduncle* and *rachis* up to 5 inches long *bracts* lanceolate acute, sheathing the base of the ovary which they slightly exceed in length, *sepals* dull yellow suffused with red at their bases, *dorsal* short broadly ovate, *lateral* ovate oblong acute, *petals* half as long as the dorsal sepal, triangular ovate acuminate, pale yellow, *lip* yellow, side lobes short purple, midlobe triangular ovate yellow.

*Distribution.*—On the Belgaum and Kanara Ghats ; also recorded from the Nilgiri Hills. Flowers in December.

## 6.—CIRRHOPETALUM.

*Pseudobulbs* clustered, ovoid, compressed, *leaves* absent at the flowering period. *Inflorescence* an *umbel* of 5 or more flowers radiating from the apex of a peduncle which rises from the base of a pseudobulb on which are a few scattered bractlike scales. *Dorsal sepal* small, *lateral* very long, *petals* small densely fimbriate, *lip* small, thickened, strap-shaped jointed on the foot of the column. Apex of column with two horizontally spreading acute teeth, *anther* 2-celled, *pollinia* 4.

1. CIRRHOPETALUM FIMBRIATUM, *Ldl.* Fl. Br. Ind., V., 774 ; Dalz. and Gibs., p. 261.

*Dorsal sepal* yellow suffused with red, triangular ovate caudate, margin long fringed, *lateral petals* up to 1½ inch long, green, linear acute, coherent throughout their length, *petals* almost white with long purple tails which also bear long fringes of the same colour. *Lip* ruddy brown with a lighter disk. *Column* yellow, suffused with red.

The so-called umbrella orchid of Mahableshwar, flowering in the cold weather.

*Distribution.*—Throughout the Ghats, the Konkan and Kanara.

## 7. TRIAS.

Small epiphytes with the habit and foliage of Bulbophyllum. *Scape* lateral, one-flowered. *Sepals* subequal, spreading, 7-nerved, lateral adnate to the foot of the column. *Petals* small, oblong or linear. *Lip* small, coriaceous or fleshy, jointed on to the foot of the column, inflexed, incumbent, mobile. *Column* short, broad, tip angled, winged or toothed ; *anther* erect, caducous, 2-celled, produced into a long horn ; *pollinia* subcoherent in pairs in each cell.

1. TRIAS STOCKSII, *Benth.* Fl. Br. Ind., V., 781.

*Pseudobulbs* ¾ inch. *Leaves* 1 inch, elliptic acute. *Scape* ½ inch. *Flowers* ½ to ⅝ inch in diameter, *sepals* obtuse, *petals* ovate lanceolate erect, *lip* oblong, convex, smooth, shoulders convex, tip rounded, horn of anthers slender, *lip* entire.

*Distribution.*—Kanara, N. and S. Konkan.

I have not met with this plant. The foregoing description is from the Flora of India, l.c.

## 8.—ERIA.

Epiphytes of various habits. *Sepals* usually free, adnate to the elongate foot of the column and with it forming a short or long and spur like saccate mentum. *Lip* sessile on the foot of the column.

*Anther* imperfectly 4 or 8-celled; *pollinia* normally 8, pear-shaped or broadly obovoid, attached in fours by narrow bases to a viscus.

Section I, *Porpax* (character given in list of genera).

*Flowers* dark, purple, bell-shaped ... ... 1. *E. reticulata.*
*Flowers* yellowish, 2-lipped ... ... 2. *E. lichenora.*

Section II. *Conchidium.*

*Flowers* solitary, large white ... ... 3. *E. reticosa.*

Section III.—*Bryobium.*

*Flowers* green, *sepals* and *petals* without glandular hairs ... ... ... ... 4. *E. Dalzellii.*
*Flowers* green, *sepals* and *petals* with glandular hairs ... ... ... ... 5. *Eria microchilos.*

Section IV.—*Hymeneria.*

*Sepals* and *petals* white, *lip* yellow, side lobes purple ... ... ... ... 6. *E. mysorensis.*

Section I.—*Porpax.*

1. ERIA RETICULATA, *Benth.* Fl. Br. Ind., V., 786.

*Pseudobulbs* button-like, $\frac{3}{4}$ inch in diameter, densely crowded on the bark of trees, grey with darker blotches. *Leaves* 2, broadly oblong, less than one inch long. *Flower* solitary, $\frac{3}{4}$ inch long, dark purple brown rising from between the leaves, stalk very short, sheathed and with a large orbicular retuse bract. *Sepals* united into a bell-shaped 3-lobed tube, spur almost obsolete, *petals* spoon-shaped, *lip* half the length of the petals, fiddle-shaped, margins crenulate, base with a short erect spur, *pollinia* 8, pear-shaped.

*Distribution.*—Throughout the Western Ghats. *Flowers* appear in June.

As the pseudobulbs are small and disk-like and so closely resemble the bark on which they rest, this humble plant is very difficult to discover.

2. ERIA LICHENORA, *Lindl.* Fl. Br. Ind., V., 787.

*Pseudobulbs* depressed, disk-like, small, covered with a fibrous network. *Leaves* 2 on each pseudobulb, orbicular, ovate, ciliate, up to 1 inch long, brownish purple beautifully tessellated with green. *Flowers* $\frac{1}{3}$ inch long, yellowish, two-lipped, *dorsal sepal* orbicular, ovate, *lateral* united, hairy, *petals* linear, *spur* small, rounded, *lip* very small, shortly clawed, ovate cordate, sides toothed, tip acute.

*Distribution.*—Found by G. M. Woodrow in flower at Sampkund, N. Kanara, in July and by T. J. Spooner, during the same month, on the Belgaum and N. Kanara Ghats; also recorded from the Bababuden Hills and Travancore.

Section II.—*Conchidium.*

3. ERIA RETICOSA, *Wight.* Fl. Br. Ind., V., 787: *E. braccata,* Dalz. and Gibs., p. 262.

*Pseudobulbs* disk-like, ¾ inch in diameter enclosed in a network of fibres. *Leaves* 2, about 3 inches long, linear, oblong. *Flowers* solitary, on a thread-like stalk, 1½ inch in diameter, *bract* below the flower large, boat-shaped. Sepals white lanceolate acute, the lateral falcate and joined at the base into a short, broad sac. *Petals* white lanceolate acute, slightly shorter and narrower than the sepals, *lip* nearly as long as the sepals, linear oblong acute, 3-lobed, side lobes white flushed with pink long rounded, midlobe ovate acute, yellow at base and white towards the end, margins slightly crenulate, *disk* between the side lobes with two crested ridges.

*Distribution.*—Throughout the Western Ghats and Nilgiris. Flowers in July. This plant is difficult to find during the greater part of the year, but in the rainy season it is a conspicuous object, as its large white flowers often completely clothe large parts of the branches of trees. It is very common round Lonavla.

Section III.—*Bryobium.*

4. ERIA DALZELLII, *Lindl.* Fl. Br. Ind., V., 789; Dalz. and Gibs., p. 262.

A very small plant, scarcely ever more than 3 inches in height.

*Pseudobulbs* flattened ovoid, up to ½ inch in diameter, reticulated, principal venation pinnate. *Leaves* two, 1 to 2 inches long, oblanceolate obtuse, *raceme* rising from between the leaves, few flowered, *flowers* green with a yellow tinge ⅛ inch in diameter, *bracts* longer than the ovary lanceolate abruptly long pointed, *sepals* subequal, lanceolate acute recurved towards apex, the two lateral cohering into a short, broad, blunt sac, *petals* shorter and narrower than sepals, *lip* about half the length of the petals ovate, lanceolate *side lobes* long, narrow, *midlobe* acute with a crenulated margin, two distinct callosities at base of lip, anther imperfectly 8-celled, pollinia 8, pear-shaped.

*Distribution.*—Throughout the Ghats and Konkan. *Flowers* in July.

5. ERIA MICROCHILOS, *Lindl.* Fl. Br. Ind., V., 789; Dalz. and Gibs., p. 262; *E. Dalzellii, Lindl. var.* fimbriata, *Hook f.* Fl. Br. Ind., V., 789.

*Pseudobulbs* flattened, irregularly shaped, up to ½ inch in diameter, reticulated, principal venation flabellate. *Leaves* two (with one or two reduced ones at base) oblong, lanceolate obtuse, up to 2 inches long, raceme rising from between the leaves and scarcely exceeding them,

*flowers* few, $\frac{1}{3}$ inch in diameter, *bracts* lanceolate, not abruptly pointed, longer than the ovary, *flowers* green, *sepals* and *petals* ciliate with gland-tipped hairs, *sepals* lanceolate acute, the two lateral conniving at base into a short, blunt but distinctly forward pointing spur, *lip* half the length of the petals, fiddle-shaped, lateral lobes almost obsolete, midlobe broadly ovate rounded, margin crenulated, *disk* with almost obsolete ridges which coalesce in a single line towards the apex, *pollinia* 8, pear-shaped, unequal.

*Distribution.*—Throughout the Ghats and Konkan. Flowers in July.

These two species have been treated as varieties of one in the Flora of British India. They are, however, quite distinct. The venation of the pseudobulbs differs in both. The lip of *Eria Dalzellii* is ovate lanceolate with two thickened ridges near the base, while that of *E. microchilos* is fiddle-shaped and the almost obsolete ridges extend to the middle of the lip where they join to form a single line towards the apex. The coloration of the lip of *E. microchilos* is yellow on the lower half and white on the upper; that of *E. Dalzellii* is green suffused with yellow on the basal half and white on the upper; the column in the former is nearly white, in the latter it is green.

Section IV.—*Hymeneria.*

6. ERIA MYSORENSIS, *Lindl.* Fl. Br. Ind., V., 793.

*Pseudobulbs* cylindric when young, slender, with equitant scales, suddenly passing into the 5 membranous leaves, older pseudobulbs thicker, fusiform, 3 inches long, with a strongly wrinkled skin. *Leaves* lanceolate, from 4 to 8 inches long by $\frac{3}{4}$ inch broad, main parallel nerves very distinct. *Racemes* generally two on each pseudobulb springing from the axils of the two lowest leaves. *Flowers* about 12, $\frac{1}{2}$ inch in diameter, *bracts* lanceolate acute, equalling the pedicels and ovary, *sepals* white, lanceolate acute, distinctly nerved, the two lateral just conniving at base, *petals* similar to but a little shorter than the sepals, *lip* shortly clawed, almost fiddle-shaped, lateral *lobes* narrow rounded purple, midlobe shortly apiculate, yellow, *disk* with two slightly raised ridges which meet at the apex. *Anther* imperfectly 8-celled, *pollinia* 8, pear-shaped, equal.

*Distribution.*—Throughout the Western Ghats. Flowers in July. It is a common orchid at Mahableshwar.

*(To be continued.)*

# ON THE SPECIES OF BEAN-GEESE.

BY

EUGENE W. OATES, F.Z.S.

*(With a Plate.)**

*(Read before the Bombay Natural History Society on 25th March, 1906.)*

Of all our Indian birds, the Bean-Geese are in the most unsatisfactory state, owing to their comparative rarity and, probably, to the fact that they are not recognised by sportsmen and consequently not preserved. There is not a single specimen in the Hume collection.

When some years ago I was about to write the 'Game Birds of India' it became necessary for me to investigate this group. I could not find anywhere an Indian-killed skin, but bearing in mind what Blyth, Jerdon, Hume and, more recently, Mr. E. C. Stuart Baker had written, I felt bound to recognise the Pink-footed Goose as the sole Indian Bean-Goose, improbable as its occurrence in India was.

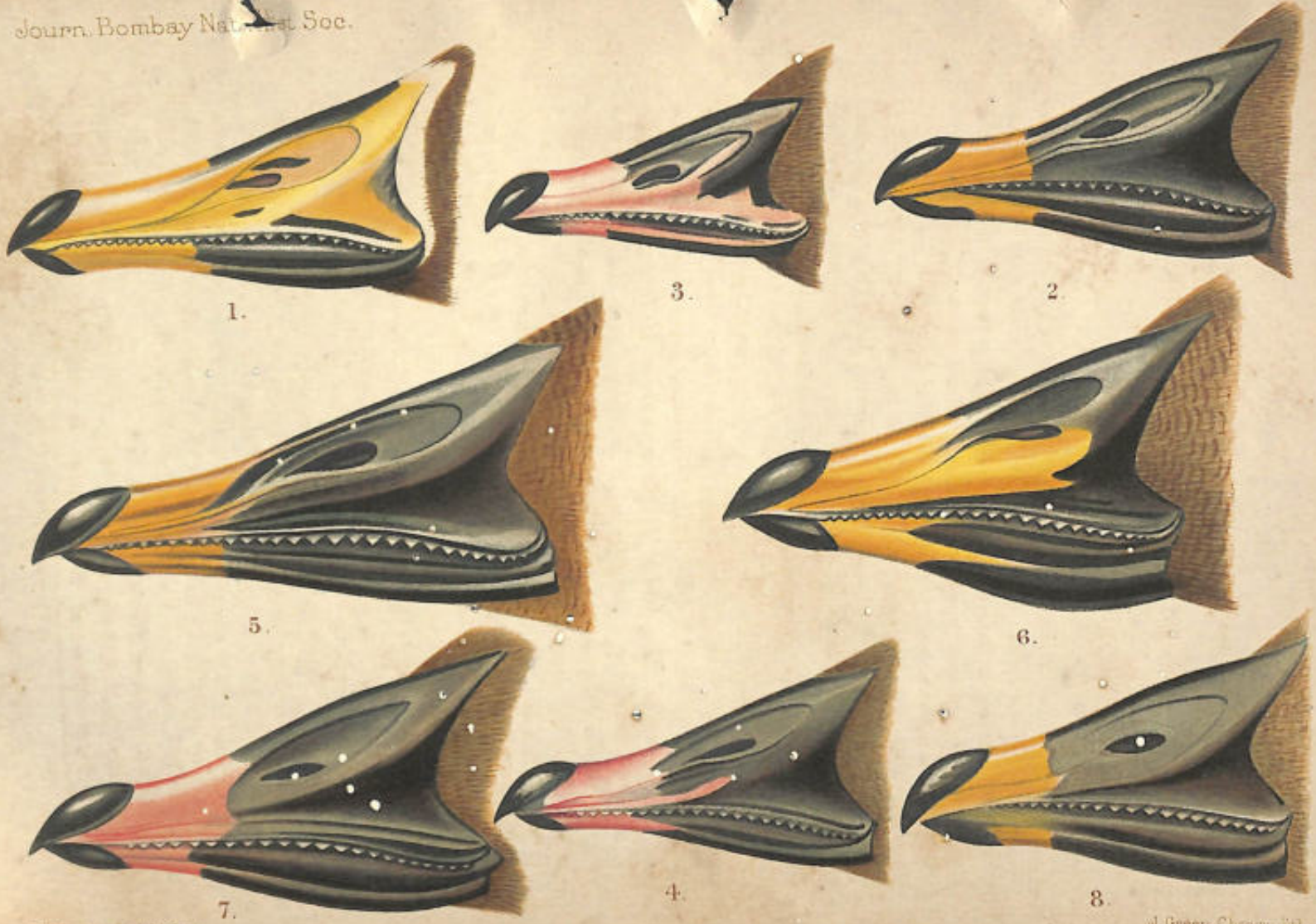
The acquisition of a specimen of a Bean-Goose from Burma, kindly sent by my friend Captain J. H. Whitehead, gave an additional impetus to my work. The British Museum also about this time received a considerable number of Bean-Geese, of two species, from Holland, and I was therefore in possession of plenty of material for study—not quite enough, but about as much as one could reasonably expect.

When Mr. E. Comber was in England, he saw some beautiful coloured drawings of the heads of these geese that were in my house and he suggested that I should contribute an illustrated article on the Bean-Geese to the pages of our journal. Although the time has hardly arrived for it to be possible to write a full and satisfactory account of these birds, yet a beginning can now be made, and I think that my imperfect paper, for such it is, will answer one purpose,—that of enabling sportsmen to recognise a Bean-Goose and also to determine the species.

The Bean-Geese are found only in Europe and Asia : in summer, far north ; in winter, as low down as the Mediterranean, Persia, India and China. They are not very dissimilar to the Grey Lag-Goose in colour, but they are darker ; have no black bars on the lower plumage ; and their bills are coloured with a combination of black and yellow, or black and red, as shown on my plate.

I have dealt with eight species of Bean-Geese, of which one, *A. segetum*, is not represented in the British Museum and I have not been

* For explanation of Plate see page 50.




BILLS OF BEAN-GEESE.

able to examine a specimen anywhere. Mr. Frohawk, however, has found a skin from which to draw the bill (fig. 2).

There is a ninth species of Bean-Goose, *A. carneirostris*, of Buturlin, of which I can learn little at present. I do not wish to ignore or suppress it, but I simply have no details of it, and consequently I cannot include it in this paper. It is said to be like *A. segetum*, but with the pale parts of the bill flesh-coloured. Unless the bill also differs in size and shape, it is hardly likely to prove a species.

Bean-Geese, under very various names, are of course repeatedly mentioned in books and papers relating to ornithology, but the authors fail to indicate by any precise description the species of Bean-Goose they are writing about; consequently it is impossible to get any correct notion of the distribution of these birds. Careful writers like Naumann, Middendorff, Stejneger and a few others fix their species either by a careful description or by a figure of the bill, and these are the only authors that can be understood.

Owing, therefore, to the general confusion prevailing about these geese, I determined from the first to deal only with well ascertained facts and to base my paper entirely on the British Museum specimens and those records in which the geese mentioned could be correctly and unhesitatingly identified. Consequently, my paper will be found to be very defective in the matter of the distribution of the species and in many other respects, but it is not intended to be anything more than a sketch, and no further apology is necessary for its shortcomings.

The identification of the Bean-Geese presents no difficulties if the proper characters are looked for. These consist solely of the size or length of the bill and the relative proportions of its various parts. The length of the bill in each species varies with the age of the bird and may be taken as varying about half an inch in the larger-billed species and a quarter of an inch in the smaller-billed ones. The proportions of the parts are, as far as my experience goes, absolutely constant, and every specimen shot in India will be found to have a bill which corresponds with one or other of the bills figured. I have given measurements of the length of bill in each species. This is taken by a pair of compasses and is the direct straight distance from the edge of the feathered portion of the forehead on the culmen, or central line of the head, to the tip of the nail of the upper mandible. The other dimensions of the bill, or the proportions of the several

parts, are best taken from the figures: the eye should suffice for this. The height at the forehead; the greatest depth of the lower mandible; the curve or outline of the edge of the lower mandible; and the depth of the bill just behind the nail are the chief points to observe. I believe that this side-view, or elevation of the bill as it may be termed, is the only character of any real value.

Other characters in these Geese to which importance is sometimes attached, are entirely fallacious, and obscure what is otherwise quite simple. The colour of the plumage is useless, for all the species are so similarly plumaged that the existing slight differences cannot be made out without actual comparison of specimens, and even then there is not much to be made of it. Size is also of doubtful value, unless the bird is sexed, for the males of the smaller species approach in size the females or younger males of the larger species. When the bird is sexed, size, as shewn by the length of the wing, is no doubt of some, but not of extreme, value. It merely serves to corroborate the identification from the bill.

Then there are other characters of the bill which many writers harp upon and think of great importance. First, there is the colour of the bill. The black portion always remains black, but the pale portion, be it orange or some shade of red, soon after death, becomes of a dingy yellow colour. It is obvious, therefore, that the colour of the bill cannot be of any use. It may be recorded on a label and it is no doubt satisfactory to know how the bill of a specimen was coloured in life; yet the fact remains that birds must, as a rule, be studied and identified as dry skins, and consequently the colour of the bill, though interesting to be known, cannot be treated as a character of value.

Secondly, there is the amount of and the distribution of the two colours on the bill of a Bean-Goose, the black and the pale colour. The proportion of each of these varies with age. Generally speaking, the younger birds have merely a ring or zone of pale colour behind the nail. With increasing age, some of the black disappears and is replaced by the pale colour under the nostrils and along the edges of the upper mandible; and in an extreme case, such as *A. arvensis*, the pale colour occupies nearly the whole bill in very old birds. It is plain that the distribution of the two colours on the bill cannot be made of any practical value.

Then there remains another character, the number of teeth on the edges of the mandibles. The teeth, I believe, vary greatly in number and are, moreover, so difficult to count that no two persons will arrive at the same result. I attach no importance whatever to the number of the teeth.

It may be gathered from the above remarks that the characters for the identification of a species of Bean-Goose are really very few. There is, first, the size and general outline of the bill as seen from the side. This ought to suffice. Corroborative characters are: length of wing in a sexed bird, and the colour of the pale part of the bill in life.

When, therefore, a sportsman has shot a Bean-Goose and he has neither time nor inclination to skin the whole bird, he should preserve the head. He should, if possible, also note the sex and the colour of the bill, and, in the event of his preserving the head only, the length of the wing.

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## POSTSCRIPT.

I wrote this paper more than a year ago, and its publication has been delayed owing to difficulties connected with the reproduction of the plate. In the meantime an English translation of Mr. Alphéraky's work on "Russian Geese" has appeared. The translation, entitled "The Geese of Europe and Asia," does not, as might be expected, enlarge the scope of the book. It is still a monograph of Russian Geese as found in the Russian Empire, and most of the information given by the author is from Russian sources.

Twenty-two species of Geese, afterwards finally reduced to twenty, are treated of in 195 pages and the book is well illustrated by 24 plates executed by Mr. Frohawk. The book is of quarto size. Notwithstanding the large amount of space devoted to each species, the author does not give us the full synonymy, but refers us in his preface to Count Salvadori's British Museum Catalogue of the Ducks (Vol. XXVII), a very inconvenient course to adopt, and for which there is little or no justification.

The Bean-Geese naturally occupy a considerable amount of Mr. Alphéraky's attention and space in his book, but with, I am sorry to say, little success. He has rendered the study of these birds more difficult in future by suppressing one species and ignoring another, as I have shewn in my remarks further on. There is reason to suppose

that Mr. Alphéraky has never seen a specimen of either species, and to act in the manner he has done is in direct opposition to the sensible remark he makes in his preface, that "I cannot regard the present work otherwise than as preparatory to future investigation."

Altogether I do not see my way to incorporate Mr. Alphéraky's conclusions regarding the Bean-Geese with my own brief remarks on these birds, and I have thought it preferable to adhere to my resolution to treat these birds entirely from the point of view I have kept before me, namely, to deal only with the British Museum specimens and to avoid speculation and conjecture.

1. *Anser arvensis*, Brehm (fig. 1).

THE COMMON BEAN-GOOSE.

This Bean-Goose is a winter visitor to many parts of Great Britain. The British Museum contains numerous specimens shot in Holland and a single skin obtained by Seebohm on the Petchora river. It appears to be spread in winter over a considerable portion of Northern and Central Europe and probably Western Asia, breeding in the extreme North of Europe.

The length of the bill in a large series of this goose varies from 2 to 2·45 inches, but Mr. Frohawk has figured a larger bill, probably that of a very old gander. The pale parts of the bill are of an orange-yellow colour. At first, probably for two or three years, this colour is confined to a ring or zone behind the nail as shewn in the figure of the bill of *A. segetum* (fig. 2). It then increases in extent, spreading out under the nostrils, and then upwards, until nearly the whole bill is yellow, the only parts remaining black being a band on the basal half of the culmen and small lines and patches elsewhere, as in fig. 1.

This is one of the larger Bean-Geese, the wing reaching a length of 19 inches. The feet in life are orange-yellow.

Two of the specimens in the British Museum, sexed as females, have the chin white as in my type of *A. mentalis* from Japan.

Mr. Alphéraky would have us call this species the Yellow-billed Bean-Goose, but I do not think that many persons will care to follow him in this.

2. *Anser segetum*, Gmelin (fig. 2).

THE EUROPEAN BEAN-GOOSE.

This species is so rare in collections that I have never seen a specimen, and I have had to trust to Mr. Frohawk for the drawing of the bill

of this Goose, taken from a bird which he had the opportunity of examining.

Naumann very carefully explained (Naumannia, 1853, p. 5, pl. i.) the differences between this species and *A. arvensis* and figured the bills of both. Mr. Frohawk has recently (Zoologist, 1903, p. 41, pl. ii.) also given us an account of the two species, and from these sources I am able to give some particulars of *A. segetum*.

It will be seen that the bill of *A. segetum* (fig. 2) is of a different shape from that of *A. arvensis*, being much shorter, but at the same time of the same depth at the forehead. In *A. segetum* the combined length of the culmen and nail is considerably less than four times the length of the nail itself. In *A. arvensis*, it is considerably more. The pale parts of the bill of *A. segetum* are orange-yellow, but this colour appears to be confined at all ages to a ring or band behind the nail and does not spread over nearly the whole bill as it does in *A. arvensis* when old. Mr. Frohawk states that the number of teeth on the upper mandible of *A. segetum* is about twenty, whereas in *A. arvensis* the number is about twenty-eight. I do not know if this character will prove of any value. The two species are of much the same size and colour.

It will be noticed that the bills of *A. segetum* (fig. 2) and *A. oatesi* (fig. 8) appear to be very similar, but it must be remembered that the former bird is a large Goose, the latter a small bird like *A. brachyrhynchus*.

3. *Anser brachyrhynchus*, Baillon (fig. 3).

THE PINK-FOOTED BEAN-GOOSE.

This Goose has such a small bill that it is hardly possible to confound it with any other species. A considerable number of birds in the British Museum from Holland have the length of the bill varying from 1·6 to 1·8 inches. The colour, in life, of the pale part of the bill is a beautiful rosy-pink, crimson-pink or carmine, and this spreads back with age under the nostrils, almost to the gape. The wing measures from 16·3 to 17·5 inches. This species when in good plumage has the mantle of a rather bright fulvous colour and the greater part of the wing a fine grey. The feet appear to be coloured like the pale parts of the bill.

This is the species which has for very many years figured as the sole Bean-Goose of India, and in recent years Mr. E. C. Stuart Baker has confirmed the occurrence of this species in the North-East of India.

But in turning back to Mr. Stuart Baker's descriptions of the birds he has on two occasions recorded from India as *A. brachyrhynchus* we are met by a very grave difficulty. In the latest record (Journ., Bombay Nat. Hist. Soc., XV., p. 718, 1904) he states that the bill was of a "brilliant crimson-pink ; commissure of mandible yellowish ; nail black, but the edges paler." Now in this description no mention is made of any portion of the bill (except the nail) being black, and consequently I am under the impression that the specimen could not have been a Bean-Goose at all, but rather an example of *Anser erythropus*, the Small White-fronted Goose. Of course I go on the assumption that Mr. Stuart Baker's description of the bill is correct and that there was no black on the bill.

Again in his previous description of another specimen shot in India (tom. cit. XI., p. 359, 1898) he states that the bill of the specimen in question, a dry skin, was "now of a uniform dirty grey-white," and he accounted for the bill of a Pink-footed Goose being of this peculiar colour by stating that the skin had passed through a series of accidents. I feel bound however to express my opinion that no accident of any kind could ever obliterate the black colour which is found rather expensively on the bill of a Pink-footed Goose and of every other kind of Bean-Goose, or convert it to a dirty grey-white colour, uniform with the remainder of the bill. Under these circumstances I shall now expel the Pink-footed Goose from my list of Indian birds.

This species visits Great Britain in winter and at that time of the year also occurs generally over North-Western Europe. It breeds in Spitzbergen, whence I have seen specimens with nest and eggs. It appears also to breed in Iceland. Of all the species of Bean-Geese, it is the one least likely to be shot in India.

4. *Anser neglectus*, Sushkin (fig. 4).

SUSHKIN'S BEAN-GOOSE.

This is an excellent species, easily separated from the others by a mere inspection of the bill, which is much larger than that of *A. brachyrhynchus*, much smaller than that of *A. arvensis* and more slender than that of *A. segetum*. The bill is still more markedly different from that of the following four Asiatic species (figs. 5—8).

The pale parts of the bill of this species in life are pink, and this Goose is probably the species which Blyth and Hume recorded as *A. brachyrhynchus*. The pink colour is chiefly confined to a ring

behind the nail and spreads out under the nostrils with age. The legs are pinkish flesh-colour.

In the British Museum there is a skin of this species from Russia (Sushkin); one from the valley of the Yenesei river in Siberia, latitude 66½° (Seebohm); one from Novaya Zembla (Markham) and lastly a specimen which is said to have been procured in Great Britain (register number 222a).

The bill of this species varies in length from 2·4 to 2·6 inches and the wing from 17·5 to 18·6 inches.

This Goose breeds in Novaya Zembla, Markham's specimen recorded above having been shot in July and being in full moult. In winter it has been found in Russia and Hungary. From the fact that this Goose occurs in the valley of the Yenesei river, it is highly probable that it may be found in India in winter.

5. *Anser middendorffi*, Severtzoff (fig. 5).

MIDDERNDORFF'S BEAN-GOOSE.

In 1902 Captain J. H. Whitehead sent me a skin of a Bean-Goose which he shot on the 24th December of the previous year at Myitkyna on the Irrawaddy river. It was in the company of a Barred-headed Goose and two Brahminy Ducks. It was sexed as a male and turns out to be a Goose of the present species. It weighed seven and a half pounds; the pale parts of the bill and the legs were orange; the iris was brown. The bill measures 2·75 inches in length and the wing 18 inches.

It is very satisfactory to have got a good skin of a Bean-Goose from Burma for we now know of at least one species which undoubtedly occurs in the Indian Empire. I have deposited the specimen in the British Museum.

Middendorff obtained this species in the Taimyr Peninsula in Siberia, and figured the head very well in his book of travels in Siberia.

A very fine specimen of this Goose procured by Radde on the 5th May is in the British Museum. From its size it is presumably an old male. It was shot on the Tunka river in Trans-Baicalia in approximate latitude 50° and longitude 115°. The length of the bill is 3·25 inches and the wing measures 18·5 inches. Middendorff describes the feet and the pale parts of the bill as being of an orange colour.

This Goose has probably a wide range in Siberia and Central Asia. It is a very fine large species with a long and somewhat slender

bill. In summer the head and neck, as exhibited in Radde's specimen, are of a beautiful golden fulvous colour, and a slight trace of this tint is present on the head of Captain Whitehead's example.

I find that Mr. Alphéraky has bestowed a new name on this Goose on the ground that we do not know to which species of Bean-Goose Severtzoff's name of *A. middendorffi* applies. I have not the least doubt in my own mind that Severtzoff meant to apply the name to the Goose which Middendorff figured so well, and for my part I shall continue to use Severtzoff's designation for this Bean-Goose.

6. *Anser mentalis*, Oates (fig. 6).

THE JAPANESE BEAN-GOOSE.

It seems probable that there are two species of Bean-Goose in Japan. Messrs. Blakiston and Pryer (Ibis, 1878, p. 212) say:—"There are two forms, a large and small, possibly separable." Again, Blakiston, writing of the Bean-Goose in Japan (Trans. As. Soc. Jap., p. 94, 1882), says:—"This Goose seems pretty generally distributed throughout Japan. Specimens in all the museums. There seem to be two forms, a large and small, possibly separable."

In the British Museum there are two specimens of this species, one procured by Pryer at Yokohama, another procured by Blakiston at Hakodadi in October, sexed as a male. Both these birds are obviously of the larger form. The smaller form has not come under my notice.

The Japanese Bean-Goose may be known by its large size and thick, massive bill with a strong, curved lower mandible.

The Yokohama bird, the type of *A. mentalis*, has the bill 2·85 inches in length and the wing 19·5 inches. Its plumage is of the ordinary bean-goose colour, but its chin is white. The orange of the bill extends in a broad band under the nostril.

The Hakodadi bird is smaller. It is a male, but probably a young one, for the reason that the orange of the bill does not extend back but is confined to a ring behind the nail. The bill of this bird measures 2·7 inches in length and the wing 18·7 inches.

The meaning of a white chin in some specimens of Bean-Geese is not apparent at present, but may be discovered when some one takes the trouble to collect these birds in large numbers. I have already stated that two specimens of *A. arvensis* in the British Museum have their chins white. It is not a character of species, but is probably assumed at a certain age only, or at a certain season.

A most interesting account of this Goose has been written by Stejneger (Bull. U. S. Nat. Mus., No. 29, p. 141, pl. vii, fig. 1, 1885) accompanied by a figure of the bill which fixes the species at once without any doubt. In fact his figure and the one drawn for this paper might have been taken from the same specimen, so similar are they.

Stejneger obtained three of these Geese on Bering Island, off the coast of Kamtchatka. The first, a male shot on the 10th May, had the wing 495 mm. (19·48 inches) in length. The iris was darl. brown. The bill was brownish black with a clear yellow band across. The feet were orange with the webs more yellow and the nails were black. There was no trace of white on the feathers bordering the bill.

The second bird was a female, shot on the same date as the above male. The wing measured 463 mm. (18·22 inches) in length. The iris was dark brown. The bill was of much the same colour as that of the above male, the yellow, however, being of a paler shade and not extending behind the nostrils. The feet were as in the above male. The feathering along the base of the bill exhibited faint traces of white semi-lunes, these being strongly tinged with rusty.

The third example was shot on the 22nd May and appears to have been a female. The wing measured 435 mm. (17·12 inches).

None of the above birds apparently had a white chin as in my type specimen.

So far as we know therefore this species winters in Japan and is found in summer in the islands off Kamtchatka.

Mr. Alphéraky does not admit this species. It seems doubtful, however, whether he has ever seen a specimen of the Large Japanese Bean-Goose. He speaks of a skin of a Bean-Goose from Manchuria as a specimen of *A. mentalis*, but I entertain doubts of this. Then he has a copy of Stejneger's paper quoted above, and a drawing of the goose which is in the British Museum and served me as the type of *A. mentalis*. Equipped with these materials which Mr. Alphéraky terms "three specimens," he proceeds to show that *A. mentalis* is only a large form of *A. serrirostris*.

Mr. Alphéraky is entitled to hold this opinion, but he is not entitled to present his readers with my original description of this Goose in a mutilated form. He quotes my description, but suppresses the only portion of it to which I attach particular importance, *viz.*, the measurement of the wing and the dimensions of the bill. These important

characters, which show how distinct this large goose really is, are omitted and their place taken by asterisks. What is left of my original description, as presented by Mr. Alphéraky to his readers, is mere commonplace and of no interest whatever, and yet this omitted matter, a few words only, would not have occupied more than a line of type in Mr. Alphéraky's ample pages.

7. *Anser serrirostris*, Swinhoe (fig. 7).

THE LARGE CHINESE BEAN-GOOSE.

Nearly all that we know of this Goose is derived from Swinhoe's writings in the "Ibis" and in the Proceedings of the Zoological Society of London from 1860 to 1871. It is obvious from what Swinhoe states that he was acquainted with only one Bean-Goose, the present species. He met with it between Takao and Peking, at Foo-chow and at Amoy and Canton.

He gives the following account of an old gander :—"Length 31·5 in., wing 18·5 in., measured with the curve, 17·6 in. from carpus across to tip. When closed, the wing extends to over 5 in. beyond the tail which is of fourteen feathers and about 7 in. long. Bill black with a pinkish red ring behind the dertrum, ·5 in. broad on the upper and ·25 in. on the lower mandible. Legs very bright orange with black claws. Bill from vertex of frontal angle 2·8 in., from rictus 2·6 in., depth at base 1·5 in. Tarse 3·4 in., middle toe and claw 3·2 in."

A specimen in the British Museum, obtained by Swinhoe at Ningpo, has the wing 18·2 inches in length, and the measurement of the bill is 2·45 inches.

Another specimen obtained by Mr. Styan at Chinkiang has the wing 18·6 inches in length and the bill measures 2·5 inches.

Both these specimens have the pale part of the bill confined to a band in front of the nostril; and in both, this part is now of a dull yellow colour.

Mr. F. W. Styan (Ibis, 1891, p. 495) remarks of this species :—"The commonest goose at the mouth of the Yangtse and (except *A. erythropus*) on the upper reaches too. The size and shape of the bill vary much and I do not think species can be founded on it." It is probable, however, that Mr. Styan shot both the present species and the next, but did not discriminate them as Mr. Rickett has since done.

The Large Chinese Goose may be recognised by the great depth of the lower mandible when compared with the length of the bill.

Mr. Alphéraky has represented the bill of this goose as of a yellow colour (pl. 23) and he states that the bill of this goose is always described as being of a yellow-orange colour. I have failed to find anything to support this assertion, nor does Mr. Alphéraky himself quote a single observer to confirm his statement. On the contrary, we find that excellent naturalist Swinhoe, whom Mr. Alphéraky never quotes, telling us that the pale part of the bill of *A. serrirostris* is of a pinkish-red colour.

8. *Anser oatesi*, Rickett (fig. 8).

THE SMALL CHINESE BEAN-GOOSE.

Mr. C. B. Rickett described this Goose in 1901 in the following terms :—"Similar in size and plumage to *A. brachyrhynchus*, but with a *much* larger bill and a white chin. The upper mandible, measured in a straight line from the feathered edges of the forehead to the tip of the nail is 2·3, and the depth of the bill at the forehead 1·3 inches, similar measurements in *Anser brachyrhynchus* being 1·8 and 1·0 in., respectively. Other measurements of *A. oatesi* are : wing 16·4 inches, tarsus 2·9 and mid-toe and claw 3·1 inches.

"This description is taken from a single specimen shot near Foochow, Fohkien Province, South China, in January. The bird was unfortunately not sexed, and only the head and neck, one wing and a leg have been preserved."

Another specimen sent to the British Museum by Mr. Rickett is a complete skin, and is a larger bird than the one described above. The wing measures 17·2 inches in length and the bill 2·5 inches.

I do not think this Goose requires any further description. Mr. Rickett informs me that he has a recollection that the pale part of the bill was yellow in life.

The bill of this species appears to be similar in many respects to that of *A. segetum*, but is longer and higher at the base. The length of the wing will, I am of opinion, suffice to separate the two species. Of course, geographically, they are very widely divided and will not be found to encroach on each other's limits.

No attempt is made by Mr. Alphéraky to deal with this species. He devotes neither a remark nor a word of comment to it, and disposes of it in his book as a synonym of *A. neglectus*, with two notes of interrogation preceding the name.

## THE SPECIES OF BEAN-GEESE.

### Explanation of Plate.

Figure 1. Bill of *Anser arvensis*.
" 2. " " *segetum*.
" 3. " " *brachyrhynchus*.
" 4. " " *neglectus*.
" 5. " " *middendorffi*.
" 6. " " *mentalis*.
" 7. " " *serrirostris*.
" 8. " " *oatesi*.

# THE POISONOUS SNAKES OF INDIA AND HOW TO RECOGNISE THEM.

By

Capt. F. Wall, I.M.S., C.M.Z.S.

## Part I.

(*Read before the Bombay Natural History Society on the 25th January* 1906.)

### Introductory Remarks.

During the last decade a vast advancement in our knowledge of snake venoms has been acquired, both in the province of toxicology and in the all-important one of therapeutics.

Whilst many observers have been engaged in the intricate, laborious, and minute researches connected with the investigation of the toxic properties of various venoms, very little, if any, advance has been achieved in that equally important and sister branch of the subject which deals with the identification of snakes, and especially with the distinction of the poisonous from the non-poisonous varieties.

In the treatment of snake-bite these two fields, though very distinct, are mutually interdependent. It is of little use to have the knowledge derived from one set of investigators at one's finger's ends, and its fruits—*viz.*, antivenene—to hand in all our hospitals, if the medical attendant is incompetent to recognise a poisonous snake. It is only this knowledge in conjunction with the other that can make rational treatment possible, by teaching him when to withhold antivenene, and when to administer it.

It is to meet the unsatisfactory state of our knowledge on the subject of the identification of snakes, that these papers have been contemplated, in the hope that they may bring this part of the subject up to the standard approaching that to which we have arrived in the study of snake venoms. Fully appreciating the already over voluminous and ever-increasing subjects which the profession of medicine embraces I have endeavoured to make the subject as practical as possible to the oriental practitioner by avoiding technicalities, or, where this cannot be done, explaining them with the aid of outline drawings, by which means I hope to bring the matter of identification within the easy grasp of hospital assistants and assistant surgeons, as well as medical officers.

In Volume XIV of the Bombay Natural History Society's Journal I wrote a paper on the distinguishing characters between poisonous and non-poisonous snakes, and appended a key in which I attempted to frame easy rules for their separation. This key far from satisfied me at the time, its length and complexity detracting from its practical value; however, in spite of its shortcomings it has been favorably received, and I have been repeatedly asked for spare copies till my stock is exhausted. Recently the Inspector-General of Civil Hospitals in the Central Provinces wrote asking if he might circulate this paper in his Province, and the compliment conveyed in this request has caused me to revise it. Since its publication, in 1901, I have examined many hundreds of snakes collected by myself and others as well as large collections in various institutions, including the British Museum, and I am, therefore, now better qualified to deal with this subject. As a result I find that I can simplify and curtail the original key so as to considerably enhance its practical utility.

The good reception accorded to this first brief paper has prompted me to extend my remarks, so that in the present paper I propose to deal in detail with every known poisonous snake within our Indian possessions. The easy identification of these is my first object, and one which I hope to assist by means of outline drawings, but I hope to do more, and to incorporate with each species a few remarks so as to make the paper useful to the medical profession as well as to the naturalist.

The abbreviations marked on the shields in the outline figures attached to these papers are the same throughout, and read as follows:—

| | | | |
|---|---|---|---|
| An. | Anal. | Prf. | Præfrontal. |
| A.S. | Anterior sublinguals. | P.S. | Posterior sublinguals. |
| C. | Costals. | R. | Rostral. |
| F. | Frontal. | S. | Supraocular. |
| Int. | Internasal. | Sc. | Subcaudal. |
| L. | Loreal. | Sl. | Supraloreal. |
| M. | Mental. | So. | Subocular. |
| N. | Nasal. | Sub. | Sublingual. |
| Oc. | Occipital. | T. | Temporal. |
| Pa. | Parietal. | V. | Ventrals. |
| Po. | Postocular. | Val. | Vertebrals. |
| Pra. | Præocular. | Arabic numerals—Supralabials. | |
| | | Roman numerals—Infralabials. | |

With reference to *midbody* the point indicated is midway between the snout and the anus or vent (a transverse slit in the hinder part of the belly). *Anterior* with reference to scales indicates a point 2 head lengths behind the head; *posterior* similarly implies a point 2 head lengths in front of vent.

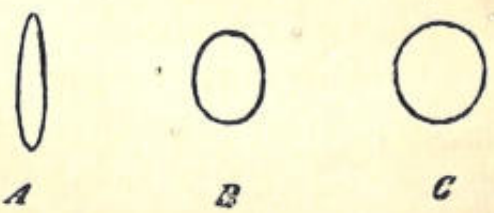
The conception of a poisonous snake, as alluded to hereafter, demands some remarks on the classification of these reptiles.

Boulenger considers the *Ophidia* (snakes) a suborder of the Order *Squamata* (which includes lizards and chameleons). He divides snakes into nine families based on osteological peculiarities which can only be made apparent by the minutest and most careful dissection or disintegration of the soft tissues, and hence are of far too complicated a character for the general enquirer to readily investigate or comprehend. I venture to think the same end may be equally well attained by attention to external characters alone. The recommendation for such a method is obvious, since it enables the enquirer to ascertain at a glance the requisite points by an examination of the creature as it lies dead before him. I divide them, therefore, as follows:—

TAILS NOT MARKEDLY COMPRESSED.

(*i.e.*, not flattened like an eel's—*see* fig. 1 B and C.)

FIG. 1.




A—Highly compressed tail typical of the seasnakes (Hydrophlidæ). Poisonous.
B and C—Slightly compressed and round tails of landsnakes (including fresh water forms) seen in both harmless and poisonous species.

| | | |
|---|---|---|
| *A—VENTRALS ABSENT.* *Snakes in which the belly and back are clothed with identical scales (see fig. 2).* | Family. | Small blind snakes worm-like, and living beneath the ground. HARMLESS. |
| | 1 Typhlopidæ. | |
| | 2 Glauconiidæ. | |

| | Family. | |
|---|---|---|
| *B—VENTRALS NARROW.* *Snakes with the belly covered with transverse plates (ventrals) which however do not extend completely across the belly, so that when the specimen is laid on its back the* whole *of the last costal row, or even many costal rows are visible on each side (see figs. 3 and 4).* | 3 Boidæ. | |
| | 4 Ilysiidæ. | |
| | 5 Uropeltidæ. | |
| | 6 Xenopeltidæ. | |
| | 7 Colubridæ. (*Subfamily* Homalopsinæ.) | HARMLESS. |
| *C—VENTRALS BROAD.* *Snakes with the belly shields stretching so far across as to permit only* part *of the last costal row to be seen when the specimen is laid on its back (see fig. 5).* | 7 Colubridæ (except the Sub-families Homalopsinæ and Hydrophiidæ.) | INCLUDES HARMLESS AND POISONOUS VARIETIES. |
| | 8 Amblycephalidæ. | HARMLESS. |
| | 9 Viperidæ. | POISONOUS. |
| | TAILS COMPRESSED. (*i.e.*, flattened like an eel's—*see* fig. 1 A.) | |
| Sea snakes. | *Family* Colubridæ. *Subfamily* Hydrophiidæ. | POISONOUS. |

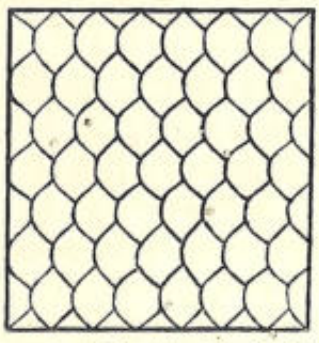


FIG. 2.—Belly of Typhlops (× 5)

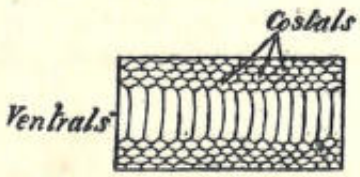



FIG. 3.—Belly of Hipistes hydrinus (nat. size).

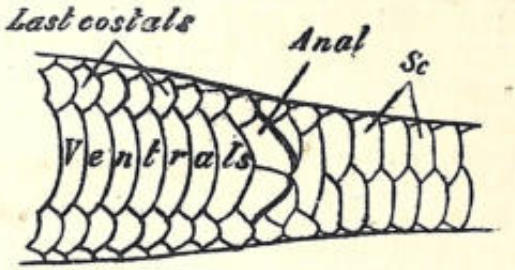



FIG. 4.—Xenopeltis unicolor.

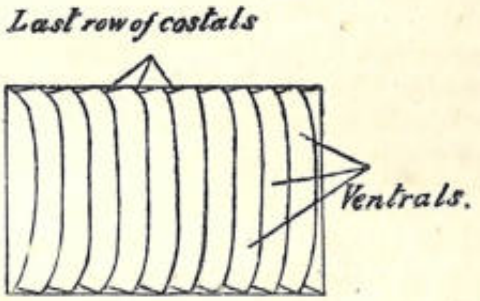



FIG. 5.—Belly of Russell's viper.

A glance at this simple key will enable the enquirer to isolate two large groups of harmless snakes, by an inspection of the belly shields above, and a third group of poisonous snakes by the conformation of the tail (sea snakes).

It is a somewhat difficult matter to decide where to draw the line between the so-called non-poisonous and the poisonous varieties. To begin with, all the *viperine* snakes are poisonous, and from investigations conducted by Alcock and Rogers* in Calcutta in 1902 it appears probable that all *colubrine* snakes contain in their saliva a toxic element identical with that to which the poisons of the cobras, kraits, and other deadly colubrines owe their lethal properties. If this is so, strictly speaking, *all* colubrines are poisonous, and their various salivas merely differ in degrees of toxicity.

The *Colubridæ* are divided into three groups: (1) *Aglypha*, characterised by the absence of a poison fang, (2) *Opisthoglypha*, snakes furnished with a specialised tooth in the form of a grooved fang situated at the back of the maxilla (upper jaw bone), and (3) *Proteroglypha*,

* Proceedings of the Royal Society, 1902, p. 446.

snakes endowed with a specialised grooved tooth (fang) in the front of the maxilla. It is to the third group that I reserve the term "poisonous," purely as a term of convenience however, for although all the snakes whose bite is known to prove fatal to man fall into this category, many of the group are known to produce baneful effects usually falling short of death, whilst the effects of many others remain in obscurity.

The difficulty in laying down hard and fast rules by which to distinguish the poisonous varieties and separate them one and all from their non-poisonous allies may be appreciated from the fact that there are no less than 290 species already known within our limits, of which 62 are poisonous. All the poisonous species fall into one of the following 5 groups with one solitary exception, *viz.*, *Azemiops feae* the existence of which may be ignored for all practical purposes since only one specimen is known. It was found in the Kachin Hills, Burma.

*Key to distinguish the Poisonous Snakes.*

| | | | |
|---|---|---|---|
| 1. | Tail compressed (*i.e.*, flattened like an eel's) (*see* fig. 1A). Snout and crown covered with large plate-like shields (*see* fig. 6). | Sea snakes (29 species). | Poisonous colubers. |
| 2. | Tail round (*see* fig. 1C) Median row o scales down the back distinctly enlarged (*see* fig. 7). Only 4 infralabial shields, the 4th largest (*see* I to IV, fig. 8). | Kraits (7 species). | |
| 3. | Tail round (*see* fig. 1C). 3rd supralabial touching the nasal shield and the eye (*see* fig. 12). | Cobras and coral snakes (10 species). | |
| 4. | Tail round (*see* fig. 1C). A conspicuous opening in the side of the face between the eye and the nostril (*see* fig. 24 B). | Pit vipers (12 species). | Vipers (all poisonous). |
| 5. | Tail round (*see* fig. 1C) Snout and crown covered with small scales as on back of body (*see* fig. 37). Only part of the last row of costals visible on either side of the ventrals when the specimen is laid on its back (*see* fig. 5 and contrast with figs. 3 and 4). | Pitless vipers (4 species.) | |

A specimen which cannot be brought into one of these five groups is harmless.

Group 1—Sea Snakes.

*Identification.—Tail compressed* (i.e., flattened like an eel's—see fig.* 1A). *Snout and crown covered with large plate-like shields (see fig.* 6).

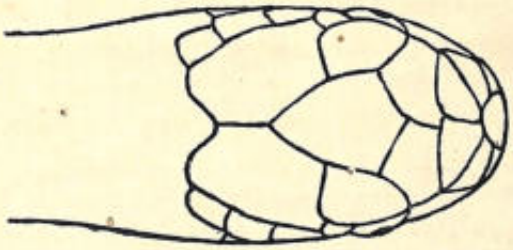


FIG. 6.—Platurus laticaudatus ( × 4 ).

The sea snakes (*Hydrophiidae*) are all reputed highly venomous. Recent investigations by Rogers † show that the venom of our commonest species (*Enhydrina valakadyen*) is eight times more potent than that of the binocellate cobra! There are many published records of fatalities owing to bites from sea snakes, but the name of the offender is rarely, if ever given, so that our knowledge of the venoms of this family of snakes is extremely meagre,—in fact, we have no certain knowledge of any one of them with the exception quoted above. The recognition of many of the species is extremely perplexing, and in consequence the confusion in terminology is great. Even our best books are very disappointing, and fail to make the recognition of many of them possible.

I hope before long to be in a position to simplify the methods now in vogue, but a larger material than that to which I have had access is necessary so enable me to complete my work on these creatures. I hope by means of a supplementary paper to fill this gap in due course; in the meantime I will pass on to the kraits.

Group 2—The Kraits (*Bungarus*).

*Identification*—(1) *Tail round.* (2) *Median row of scales down the back distinctly enlarged (see fig.* 7). (3) *Only* 4 *infralabial shields, the* 4*th largest (see I to IV, fig.* 8‡).

* Only one harmless snake has a compressed tail, *viz.*, *Cherydrus granulatus*, an aquatic species found in rivers and seas. In this the snout and crown are covered with small scales only.

† "The Lancet," February 6th, 1904.

‡With reference to this latter point, care must be taken not to count the first median shield which is called the mental (M). Again, the last shield along the border of the lower lip which touches the posterior sublinguals (P.S.) is invariably to be considered the last infralabial.

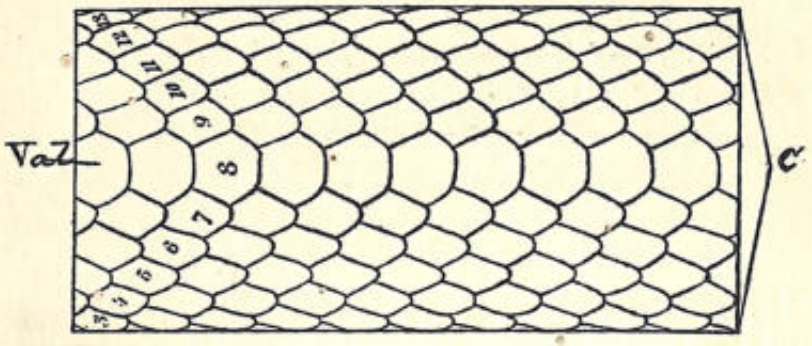



FIG. 7.—Back of Common Krait (Bungarus candidus) (× 2).
Val = Vertebrals.
C = Costals.

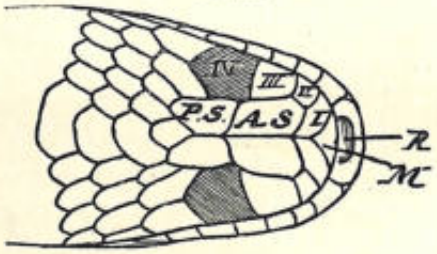
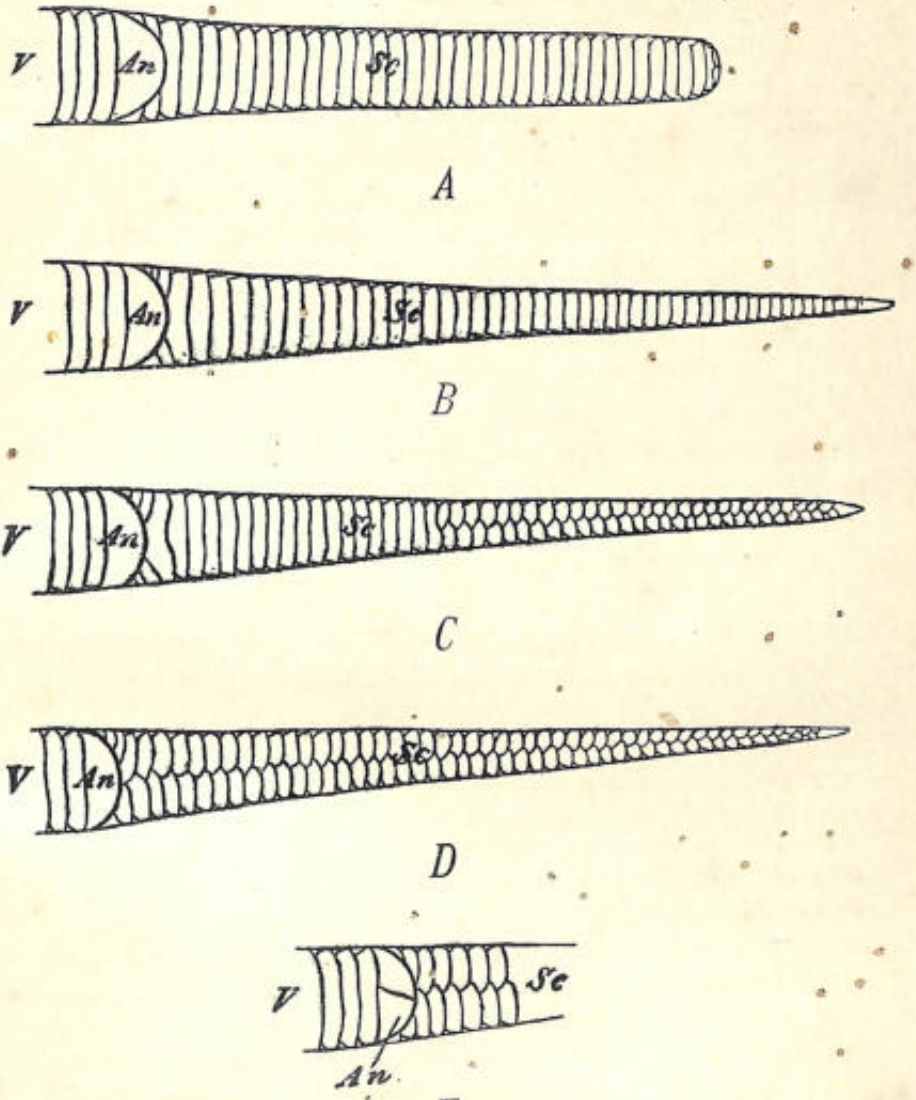



FIG. 8.—Chin shields of Bungarus candidus (× 1½).
A. S.—Anterior sublinguals.
P. S.—Posterior do.
M.—Mental.
R.—Rostral.
I. to IV.—Infralabials.

The first essential point in the identification of a krait is to find the enlarged vertebral row of scales The enlargement is very obvious, and without this the specimen *cannot* be a krait. Unfortunately, however, for our purpose this distinction is not absolutely confined to the kraits, since a few harmless snakes are similarly distinguished, *viz.*, the genera *Dipsadomorphus*, *Dendrophis*, and *Dendrelaphis*, some species of *Amblycephalus* and *Xenelaphis hexagonotus*, and it is due to this fact that other supplementary characters are necessary to formulate a rigid rule. As the recognition of a krait is of the greatest importance I offer an alternative diagnosis which demands the co-existence of the three following points:—

(1) *Enlarged vertebrals* (*see Val., fig.* 7).
(2) *Entire anal* (*see An., fig.* 9).
(3) *Round pupil** (*see fig.* 10).

* In most of the kraits the iris is so intensely black that the shape of the pupil cannot be discerned until the head has been soaked an hour or two in spirit, when the lens becomes opalescent, and reveals the true pupillary form.




V.—Ventrals.—An.-Anal.—Sc.-Subcaudals.

FIG. 9.

A. Bungarus fasciatus. } Subcaudals all entire.
B. „ candidus. }
C. „ flaviceps.—Subcaudals entire at base, divided at tip of tail.
D. Naia tripudians.—Subcaudals all divided.
E. Hemibungarus nigrescens.—Anal divided.

*Supplementary generic characters.*—Other important characters to be observed in the scale arrangement of kraits, but not necessarily peculiar to them, are as follows:—The *nasal* shield touches the 1st and 2nd supralabials, but never the 3rd. *Loreal* absent, so that only two scales intervene between the eye and the nostril. *Temporal*, a single shield touching the 5th and 6th supralabials. *Supralabials* 7, the 3rd and 4th touching the eye. *Posterior sublinguals* touch the 4th infralabial shield (rarely 3rd also). The 4th *infralabial* is the largest of the series, and touches only 2 scales behind. The *scales* are the same number in the whole length of the body, *Anal* entire. *Subcaudals* entire throughout, or in some species only at the base, the remaining shields being divided. The *iris* is black in all species except *B. fasciatus*, in which the pupillary edge is thinly margined golden, and the pupil which is round in form is only discernible during life in this one species.

The shields on the heads of all kraits are so closely similar in number and form that they are of little if any assistance in separating the seven species. The numbers of rows of scales over the back, however, vary from 13 to 19, and the vertebral row varies in breadth in some of the species. The colour, too, is very distinctive in certain species, and habitat is of great importance.

Every known member of the genus occurs within our Indian limits. Two are common, *viz.*, *Bungarus candidus* and *B. fasciatus*, but the rest are local and uncommon, some being specially rare.

They may be distinguished from one another as follows:—

SCALES IN 13 ROWS (*see* fig. 7) ..... *Bungarus flaviceps.*

SCALES IN 15 ROWS (*see* fig. 7).

*A—SOME OR ALL THE SHIELDS BENEATH THE TAIL DIVIDED (see fig. C. and D)* ,, *bungaroides.*

*B—ALL SHIELDS BENEATH THE TAIL ENTIRE (see fig. 9—A and B).*

(*a*) Alternate black and yellow bands right round body ,, *fasciatus.*

(*b*) Uniform black ..... ,, *lividus.*

(*c*) Black with white lines or bars.

*Habitat.—Ceylon* ..... ,, *ceylonensis.*

,, *whole of British India, exclusive of Ceylon* ... ,, *candidus.*

SCALES IN 17 OR 19 ROWS (*see* fig. 7) ..... ,, *sindanus.*

*Bungarus flaviceps*—The Yellow-headed Krait.

*Identification.*—It is the only one of the genus with the scales arranged in 13 rows.

*Supplementary characters.*—The vertebral scales are as broad as long, or even broader in the middle of the body. The subcaudals are entire at the base, and divided towards the tip of the tail (*see* fig. 9 C).

*Distribution.*—This rare snake belongs to the Malayan fauna, but extends through the Malay Peninsula as far north as Tenasserim, where it encroaches upon our Burmese Province.

*Poison.*—Nothing seems to be known about the effects of its poison.

*Dimensions.*—Grows to 6 feet and over.

*Colour.*—I quote from Boulenger*:—"Black above, with or without a yellow vertebral line, two outer rows of scales black and yellow; head red or yellow; tail and sometimes posterior part of body orange red."

*Bungarus bungaroides*—The Northern Hill Krait.

*Identification.*—It is the only krait with scales in 15 rows, that has any shields beneath the tail divided. In all the others these shields are entire throughout (*see* fig. 9).

*Supplementary characters.*—The vertebral scales are as broad as long, or rather broader in the posterior part of the body.

*Distribution.*—This is a very rare species, and a very local one. Hitherto it has only been recorded from the Himalayas in the vicinity of Darjeeling, and the Khasi Hills in Assam.

*Poison.*—Nothing known.

*Dimensions.*—Grows to 3 feet.

*Colour.*—Black with white linear chevrons or crossbars.

*Bungarus fasciatus*—The Banded Krait.

The "Raj samp" and "Saùkni" of Bengal. Fayrer† says it is called "Koclea Krait" in the North-West. I presume he means N.-W. Bengal, for I do not think it exists in N.-W. India. According to Russell it is called "Bungarum pamah" on the Coromandel Coast. In Burmah it is known as "Gnandawja," "Ngan-wa," "Ngan-thankwin-syut," "Nat-mywe," and "Mywe-min."

*Identification.*—Its colour, is very distinctive, but, as I have often pointed out, colour is a very fallacious guide to the identity of any snake. The only snake I know which on the score of colouration might reasonably be confused with it, is the *Lycodon fasciotus*, an uncommon harmless Burmese species. This also is completely banded yellow and

* Cat. Snakes. Brit. Mus., Vol. III, p. 371.

† Thanatophidia, p. 11.

black. It grows to about 20 inches, and it lacks *all* the points given above as peculiar to kraits.

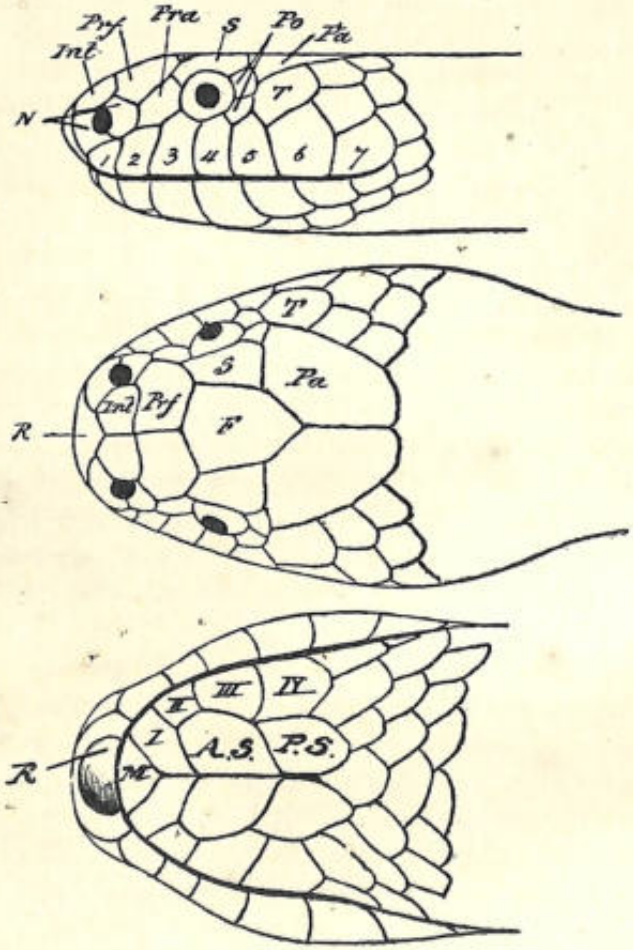



FIG. 10.- Bungarus fasciatus (× 2).

*Supplementary characters.*—The vertebral row is more enlarged than in any others of the genus, the scales being considerably broader than long. The back is ridged along the spine, and the tail is blunt, and finger-like (*see* fig. 9 A).

*Distribution.*—Extending from the Malayan region, this species is found distributed over an extensive area on the eastern side of our Indian possessions. It is common in Upper and Lower Burmah and Assam, and extends westward to Bengal. Its extreme southern and western limits in Peninsular India are somewhat doubtful. I believ

the Godavery and Son rivers approximately demarcate its bounds in these directions. South of the Godavery its occurrence in Southern India appears to rest on the single specimen in the British Museum, procured, according to Colonel Beddome, from the Anamallay Hills. I have never seen nor heard of this snake in the Madras Presidency except north of the Godavery, where I found it common in Orissa (Ganjam District). I have lately written to several observers in the South who are familiar with the plains and hills, and all without exception have never heard of, nor seen this snake in that part. It is also very significant that no Southern Indian example exists in the Museums—in Calcutta, Bombay, or Madras, nor in the Medical College collection, Madras, nor those of Travancore and Bangalore. The Jesuit Fathers at Trichinopoly and at Shambaganur in the Palneys possess no specimen in their collections.

It occurs plentifully in the plains throughout the area indicated above, and it would be a very striking circumstance if it were restricted to a single isolated upland region of another large tropical area as Colonel Beddome's specimen makes it appear, so that I cannot help thinking there has been some mistake in labelling the habitat of this specimen.

*Poison.*—Rogers* estimates the virulence of the poison at about $\frac{1}{2}\frac{1}{8}$ that of the common krait *B. candidus*. Burmans, who as a race are good observers and not given to romancing like so many of their oriental brethren, declare that the bite is not fatal to man, and as the snake is a very common one in their province, and very distinctively coloured, I think this testimony worthy of credence. Fayrer† mentions one case of bite from this snake. A woman at Tavoy was bitten on the dorsum of the right foot. She suffered tingling, and swelling locally, and some pain in the leg and thigh of that side, but recovered without any constitutional effects. She was treated with ammonia internally, and ipecacuanha, chloroform, and ammonia locally, none of which we know have the slightest beneficial effects in snake bite.

Russell's‡ experiment on a fowl caused it to die 26 minutes after being bitten. Fayrer § tested its effect on fowls, death being caused

* "Lancet," February 6th, 1904, p. 349 *et seq.*
† "Thanatophidia," p. 45.
‡ Indian Serpents, pp. 4 and 5.
§ Ibid., pp. 81, 85, 101, 120, 134.

in 17, 18 and 26 minutes, 1 hour 55 minutes, and 26 hours 18 minutes.

Again Fayrer's* experiments on dogs produced a fatal issue in intervals varying between 4 hours and 28 minutes to 10 days. All these creatures were bitten in the thigh. They appeared to suffer little pain, but exhibited restlessness, and then walked a bit lame. Dejection of spirits followed, and salivation, retching, or vomiting were very constant, and in one case persistent cough. The gait became uncertain, and staggering, till muscular weakness prompted a recumbent posture. The breathing became affected, and in two cases some muscular spasms were noted. In at least 3 cases the animals partially recovered or the symptoms abated for a time, but death supervened after some days. In one case there was diarrhœa, and in another some mucosanguineous dejecta were occasioned. The blood in all cases coagulated firmly after death. These experiments all tend to confirm the veracity of Burmese statements. Compare for instance these with experiments with cobra and daboia poisons (*q. v.*).

*Dimensions.*—It grows to 6 feet and over.

*Colour.*—Alternately and completely banded black and yellow.

*Bungarus lividus.*—The Black Krait.

*Identification.*—Its uniform black colour combined with the habitat should make its identity easy. Two other uniform black snakes, which somewhat resemble it, are the poisonous *Melanelaps mcphersoni* (*q. v.*), and the harmless *Xenopeltis unicolor*. The former I have only very recently had the privilege of describing for the first time. Its vertebrals are not enlarged, nor is it like a krait in several other shield characters. The latter is a common snake in Burmah. The extreme northern range of its distribution is uncertain. It presents none of the characters given above as peculiar to the kraits.

*Supplementary characters.*—The vertebrals are less enlarged than in any of the other kraits, so that in the middle of the body the breadth of these scales is rather less than their length, still the enlargement is obvious.

*Distribution.*—A rare snake. Of 4 specimens in the British Museum 3 are from Assam, and 1 from India; precise locality not stated.

*Poison.*—Nothing known.

*Dimensions.*—Grows to about 3 feet.

* "Thanatophidia," pp. 68, 69, 84, 99, 101, 107 and 118.

*Colour.*—Uniform glistening black.

*Bungarus ceylonicus*—The Ceylon Krait.

*Identification.*—The habitat alone will suffice to declare its identity. It is the only krait found in that island.

*Supplementary characters.*—The vertebral row is unusually large, the breadth of the scales considerably exceeds the length, and in this respect it almost compares with *B. fasciatus*.

*Distribution.*—Peculiar to Ceylon.

*Poison.*—I can find no allusion to the effects of its poison.

*Dimensions.*—Grows to 3 feet, and over.

*Colour.*—Glistening black with white cross bars.

*Bungarus candidus*—The Common Krait.

(Synonyms—*B. cæruleus* and *B. arcuatus.*)

The "Karait" and "Dhomum chitti" or "chitti" of Bengal. "Valla pamboo" of Malabar. "Kattoo virian" and "Anali" of Madras. The "Godi nägera" of Mysore according to Rice, and the "Gedi paragoodoo" and "Pakta poola" of the Coromandel Coast (Russell).

*Identification.*—The colour, habitat, and the fact that all the shields beneath the tail are entire suffice to declare its identity (see fig. 9 B). One important feature for those to note who in spite of all precautions persist in trying to identify their specimens by colour and markings instead of by conformation and relationship of shields, is the fact that in all the snakes which resemble this species in colour, *viz.*, *Lycodon aulicus* (certain varieties), *L. striatus*, and *L. jara*, together with *Dryocalamus nympha*, *D. gracilis*, and *D. davisonii*, the white cross bars are most evident in the anterior part of the body, and gradually fade posteriorly till they are often lost. It is characteristic of the krait, however, at least the common Indian colour variety, that the white bars are most distinct posteriorly, and fade away anteriorly,—in fact, the anterior one-third or one-half of the body is frequently without marks in adults.

*Supplementary characters.*—In the vertebral row the scales are about as broad as long in the middle of the body (see fig. 3).

*Distribution.*—It ranges throughout the Indian Peninsula from Cape Comorin to the Himalayas. On the west it extends into Sind, and on the east through Burma into the Malayan region. It is not found in Ceylon. East of Calcutta it is uncommon, but in the Indian Peninsula it is almost everywhere an abundant species. It prefers the plains, but has been found in hilly regions up to 4,000 feet.

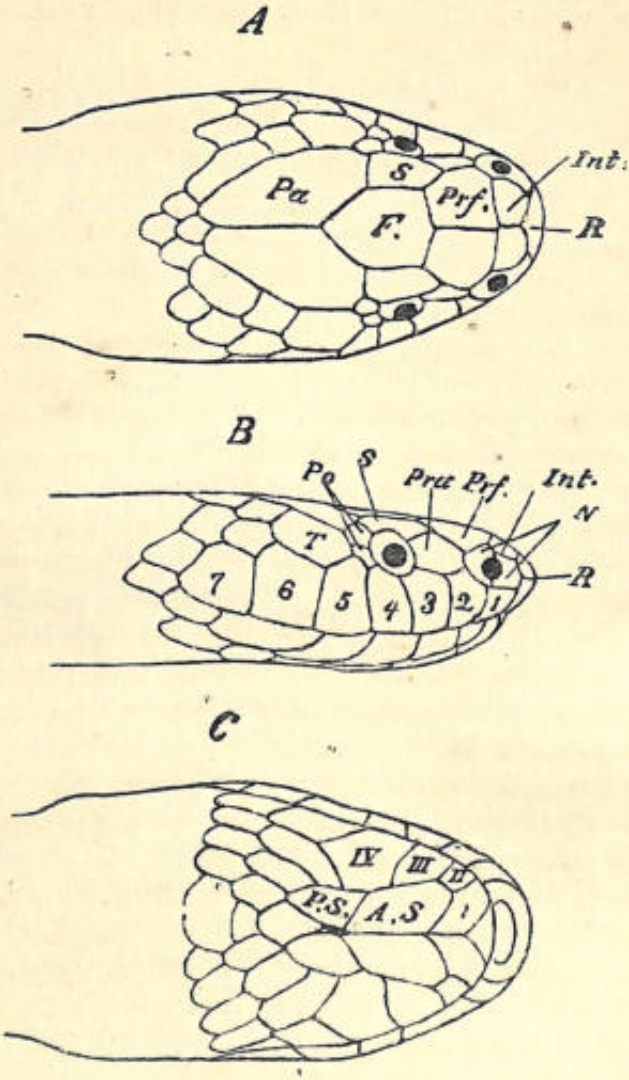



FIG. 11.—Bungarus candidus.

*Poison.*—This is known to prove fatal to man, but the literature on this very common species makes remarkably few references to cases of its bite. The reason must be assigned, in great measure, to the inability of medical men to recognise it. Rogers* estimates that the poison is nearly twice as virulent as that of the binocellate cobra.

* Ibid., p. 349 *et seq.*

Fayrer* records a case where 4 men were bitten by the same krait. This occurred at night, all men being prevailed upon to submit themselves to the bite of a specimen about 3 feet long in the possession of some snakemen, who vouched that no evil effect should befall them. The first man bitten, complained of thirst and foamed at the mouth, and died before dawn. The second and third men died at about noon the next day, and the fourth man recovered. He described his symptoms as giddiness, perspiration, pain in the stomach and unconsciousness, and he remained in hospital 5 or 6 days. Fayrer† records another case where a chowkidar was bitten in the forefinger. He suffered burning pain in the finger, later on in the head, and then over the whole body; he became weak, could hardly articulate, and then got drowsy. He vomited after some native medicine, then lost the power of swallowing, and died in 6 hours. Again Fayrer‡ records the case of a man bitten in the finger who experienced great pain in the wound, and the hand swelled up to the wrist. His breathing became short and hurried, he complained of constriction round the chest, became drowsy, and then insensible He died in 3 hours, frothy mucus oozing from the mouth and nostrils. Elliot§ records a case where a sepoy was bitten on the inner side of his ankle, and death supervened in 31 hours.

The results of Fayrer's experiments on fowls were that death supervened in 4, 7, 17, 20, 32, 43½ and 44 minutes, 1 hour 48 minutes, and 2 hours 22 minutes. On dogs, death occurred in 52 minutes, 2 hours 15 minutes, 3 hours 42 minutes, and on the third day after the bite was inflicted. These dogs exhibited the following symptoms:—restlessness, salivation, vomiting, depression, paralysis, involuntary discharges, laboured breathing, convulsions passing on to death. In all cases where mention is made of the blood both in fowls and in dogs it clotted firmly after removal from the blood vessels.

*Dimensions.*—Grows to 4½ feet. I have measured a skin 4 feet 6½ inches.

*Colour.*—Glistening black with linear, narrow, or broad white cross bars, usually most apparent in the posterior part of the body.

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* Ibid., p. 51.

† Ibid., p. 54.

‡ Ibid., p. 60.

§ Trans. Brit. Med. Association, S. Ind. Br., 1895, p. 31.

*Bungarus sindanus*—The Sind Krait.

Called by the natives of Upper Sind "Pee-un".

*Identification.*—This is the only one of the group that has the scales over the back in 17 (or 19) rows.

*Supplementary characters.*—The vertebrals are about as broad as long in the middle of the body. The subcaudals are sometimes divided towards the tip of the tail (as in fig. 9 C).

*Distribution.*—Peculiar to Sind, where it is reported to be common in the upper part of that region.

*Poison.*—Nothing known.

*Dimensions.*—Grows to 6 feet.

*Colour.*—Black with white cross bars most evident posteriorly. It is exactly like the common krait, *B. candidus*, its chief distinction being in the number of the scales across the body.

Group 3—Cobras and Coral Snakes.‖

*Identification.*—(1) *Tail round.* (2) *The 3rd supralabial shield touches the nasal, and the eye (see fig.* 12).*

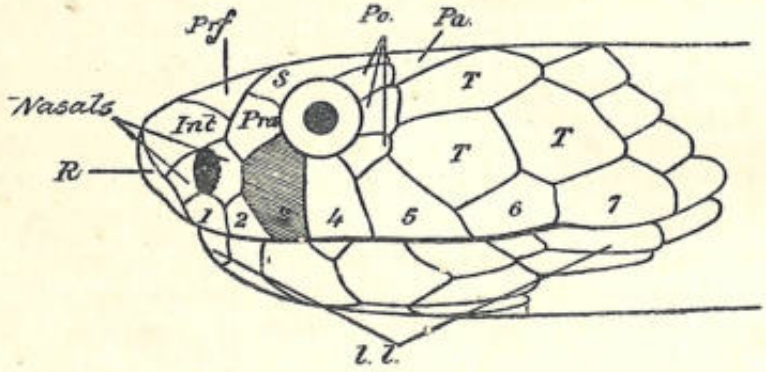


FIG. 12.—Naia tripudians (× 1½).

This second feature alone separates the members of this group from *all* other snakes. The group comprises 5 genera, and includes 10 species.

‖ The name coral snake is applied to a South American poisonous species, *Elaps corallinus*. I use the title here for those snakes which are allied to the above and to which I think the term singularly appropriate, since most of them have bellies adorned with a most beautiful colouring resembling pink coral. This, however, disappears after a day or two's immersion in spirit.

* I am only aware of one harmless snake in which the 3rd supralabial touches the nasal shield, *viz.*, *Xenopeltis unicolor*, and in this case it fails to touch the eye. (See fig. 13.)

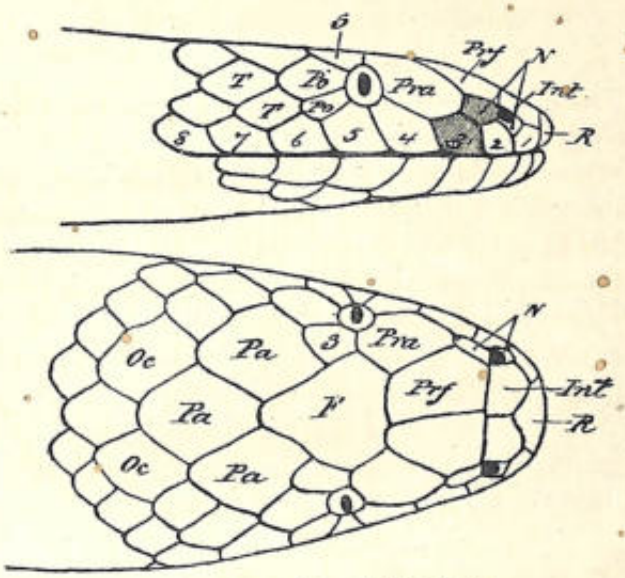


FIG. 13.—Xenopeltis unicolor (× 2).

*Key to Identification of the Species.*

ANAL ENTIRE. (*See* An, *fig.* 9 A).

*TEMPORAL TOUCHES 4th AND 5th SUPRALABIALS ONLY.* (*See T, fig.* 14). — *Melanelaps mcphersoni.*

*TEMPORAL TOUCHES 5th AND 6th SUPRALABIALS ONLY* (*See T, fig.* 15 B).

Internasal not touching præocular (*See* Int. and Pra., *fig.* 15 B).

*Belly uniform red* ..... — *Doliophis bivirgatus.*

*Belly barred with black* ..... — *Doliophis intestinalis.*

Internasal touching præocular. (*See* Int. and Pra. *fig.* 16 B). ..... — *Naia tripudians.*

*TEMPORAL TOUCHES 5th, 6th, AND 7th SUPRALABIALS.* (*See T, fig.* 18 *A*).

Subcaudals at base of tail entire (*See* Sc., *fig.* 9 C) ..... — *Naia bungarus.*

Subcaudals divided throughout (*See* Sc., *fig.* 9 D)..... — *Callophis bibronii.*

ANAL DIVIDED (*See* An, *fig.* 9 E).

*TEMPORAL TOUCHES 5th AND 6th SUPRALABIALS ONLY.* (*See T, fig.* 20 *B*). — *Callophis macclellandii.*

*TEMPORAL TOUCHES 5th, 6th AND 7th SUPRALABIALS.* (*See T, fig.* 18*A*).

Supralabials 6 only. (*See fig.* 21 B) ..... — *Callophis trimaculatus.*

Supralabials 7. (*See fig.* 22 B).

*Tail with 2 black bands* ..... — *Callophis maculiceps.*

*Tail with no black band*..... — *Hemibungarus nigrescens.*

*Melanelaps mcphersoni*—McPherson's Coral Snake.

*Identification.*—The anal entire, and the temporal touching only the 4th and 5th supralabials will isolate it from others of the group.

(*For Fig.* 14, *see page* 28 *of this number.*)

*Supplementary characters.*—*Præfrontals* touch the internasal, posterior nasal, præocular, supraocular, and frontal. *Temporals.*—3. The lowest largest. and touching the 4th and 5th supralabials. *Supralabials.*—6. *Anterior sublinguals* touch 3 or 4 infralabials. *Posterior sublinguals* widely separated by many scales. *Scales* anterior 26, midbody 25, posterior 21. *Anal* entire. *Subcaudals* entire.

*Distribution.*—The only specimen known was discovered by Captain McPherson, I.M.S., at Dthala in the Aden Hinterland.

*Poison.*—Nothing known.

*Dimensions.*—The specimen is about 18 inches.

*Colour.*—Uniform glistening black.

*Doliophis bivirgatus*—The White-striped Coral Snake.

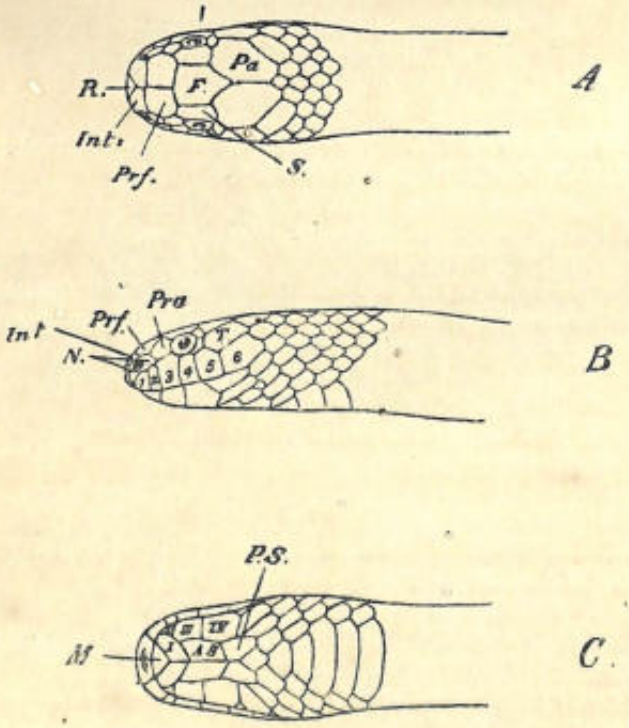


FIG. 15.—*Doliophis bivirgatus* (× 1).

*Identification.*—This and the next species agree in having only 6 supralabials, and the anal shield entire, which characters serve to dis-

tinguish them from all the rest of the group. The belly in this snake is, however, uniform red in colour.

*Supplementary characters.*—*Præfrontals* touch the internasal, posterior nasal, præocular, supraocular and frontal. *Temporal.*—One, which touches the 5th and 6th supralabials. *Supralabials* 6. *Anterior sublinguals* touch the 1st, 3rd and the 4th only of the infralabials. *Posterior sublinguals* touch the 4th infralabial only. *Infralabials.*—The 4th is the largest of the series, and touches 2 scales behind. *Scales* are 13 in whole body. *Anal* entire. *Subcaudals* divided throughout.

*Distribution.*—This Malayan form extends into our Burmese territory, where, however, it is rare.

*Poison.*—Nothing is known about it. The poison glands in this and the next are peculiar ; unlike all our other poisonous snakes, instead of being confined to the temple they extend back into the abdominal cavity as far as the heart.

*Dimensions.*—Grows to 5 feet.

*Colour.*—Blackish above with two or four white lines down the back. Head and tail red, Belly red.

*Doliophis intestinalis*—The Belted Coral Snake.

*Identification.*—Like the last it has only 6 supralabial shields, and the anal is entire, but the belly is barred with black.

*Supplementary characters.*—*Præfrontals* touch the internasal, posterior nasal, præocular, supraocular and frontal. *Temporal.*—One, which touches the 5th and 6th supralabials. *Supralabials* 6. *Anterior sublinguals* touch the 1st, 3rd and 4th infralabials. *Posterior sublinguals* touch the 4th infralabial. *Infralabials.*—The 4th is the largest of the series, and touches 2 scales behind. *Scales* are 13 in whole length of body. *Anal* entire. *Subcaudals* divided throughout.

*Distribution.*—This like the last belongs to the Malayan fauna, but extends into Burmah.

*Poison.*—Nothing known as far as I am aware, though it appears to be fairly common in parts of the Malayan region.

*Dimensions.*—Grows to 2 feet.

*Colour.*—Boulenger* says: " Brown or blackish above, with darker or lighter longitudinal streaks; tail pink or red beneath ; belly with black crossbars."

(*To be continued.*)

* Cat. Snakes, British Museum, Vol. III, p. 402.

# THE OOLOGY OF INDIAN PARASITIC CUCKOOS.

By E. C. Stuart Baker, f.z.s.

(With Plate I.)

## Part I.

(*Read before the Bombay Natural History Society on 25th January* 1906.)

To those who follow Indian Oology either as a hobby or as a science there cannot well be a more interesting branch of it than that pertaining to our parasitic Cuckoos. It is one in which I am specially interested, and I have long been very anxious to collect all the information obtainable and compile it into one article, such as would be easy for reference to our collectors. It is only, however, during the last few years that information of a sufficiently sound character and of sufficient volume has been obtained to make it worth while putting into print. Even now the following article is intended more to induce people to take the subject up and try and fill some of the numerous existing gaps, than it is to shew how much is already known.

The great difficulty to be overcome in collecting Cuckoos' eggs is not so much to get hold of eggs which are Cuckoos' beyond all doubt, but to obtain proof as to what particular Cuckoo they may belong to. For this reason it is absolutely necessary to get eggs direct from the oviduct of the female, and, because Cuckoos' eggs vary so much, it is no use getting one only, but series are required. We already know how enormously the eggs of the Common English Cuckoo (*Cuculus canorus*) vary, and our knowledge, as far as it goes, shows that some of our Indian Cuckoos vary to a greater extent still.

Those who would get oviduct eggs must also avoid the mistake made by a friend of mine who shot every Cuckoo he heard *calling* during the breeding season and was grievously disappointed to find he got no eggs. Of course, with the majority of Cuckoos it is the male only who is so persistently noisy, but, though it is no good shooting the calling bird itself, the call may often show that a female is somewhere near.

I owe to Colonel R. Rattray, Major Buchanan, Messrs. B. B. Osmaston, Chas. Inglis, Bell, Colonel Wilson and others thanks for all they have done to help in this article, not only in supplying me with notes, but also, in many cases, for giving me specimens of eggs and birds. Colonel Rattray's success in the collection of authentic eggs must stand almost, if not quite, without parallel, and to him I owe special thanks

E. C. STUART BAKER, DEL. J. GREEN, CHROMO-LITH.

## INDIAN CUCKOOS' EGGS.

1-6. Cuculus canorus. 4. C. canorus ex oviduct.
7-8. C. saturatus. 9-12. C. poliocephalus.

for help and specimens and for the generosity with which he has given me the use of all his notes and the loan of his fine series of eggs.

I feel that apologies are due in advance for the risk run of hurting the feelings of anyone who has helped me with notes and specimens by the appearance of doubt. I hope, however, that they will understand that my intentions are of the best, and when they see how I rate the value of the evidence which I myself can produce, they will realize that a verdict of "non proven" carries no insult with it, and is merely an incitement to the production of such proof as cannot be gainsaid, *viz.*, an actual oviduct egg.

I have shot Cuckoos off other birds' nests which contained Cuckoos' eggs, yet the bird I shot might possibly only have been exploring and the egg laid by some other Cuckoo; I have trapped Cuckoos on other birds' nests which contained undoubted Cuckoos' eggs, yet the same trapped birds, again, might have been intent on pilfering, &c., and not have laid the eggs so found. Of course, when such captures take place twice, and the eggs and birds are identical in the two cases, there is a very strong presumption that the identification is correct.

Our Indian Cuckoos of the family *Cuculidæ* are divided by scientists into two sub-families—the *Cuculinæ* and *Phœnicophainæ*: the genera composing the former have the shanks or tarsi more or less feathered, whereas those of the latter have them quite naked. The only parasitic Cuckoo belonging to this second group is the Common Indian Koel (*Eudynamis honorata*), all our other parasitic Cuckoos belonging to the former.

As this article is one on eggs more than on the layers of them, no minute description of the birds will be given, but it is hoped that the keys will suffice to enable the genera and species to be identified without difficulty.

The general outward appearance of the family is passerine, but the feet are zygodactyle, *i.e.*, the first and the fourth toes both point backwards, as in woodpeckers and others. The feet and legs are also, as a rule, exceptionally feeble, but the wings are strong, and generally long and pointed, so that Cuckoos have swift flight: the bill is slightly curved throughout, the gape rather wide and frequently conspicuously coloured.

The species of the genus *Cuculus*, containing the Common English Cuckoo, and of the genus *Hierococcyx*, which contains the Brain-fever Bird, are very hawklike in their barred and banded plumage.

Our Indian parasitic Cuckoos, numbering 17, are divided into eight genera which may be distinguished as follows :—

*Family* CUCULIDÆ.

A. Tarsus partly feathered.
  a. No crest.
    a'. Plumage neither metallic nor black.
      a''. Wing over 5·6.
        a'''. Secondaries in closed wing about up to half primaries ..... *Cuculus.*
        b'''. Secondaries ⅔ length of primaries or more.. *Hierococcyx.*
      b''. Wing under 5·2.
        c'''. Bill compressed, tail feathers equal throughout..... *Cacomantis.*
        d'''. Bill not compressed, tail feathers narrowing towards tip ..... *Penthoceryx.*
    b'. Plumage partly metallic green or violet .. ..... *Chrysococcyx.*
    c'. Plumage all black and white ..... ..... *Surniculus.*
  b. Head crested ..... ..... ..... *Coccystes.*
B. Tarsus quite naked ..... ... ..... ..... ..... *Eudynamis.*

The genus *Cuculus* contains four species which differ mainly in size, all having dark ashy or brown backs and barred under plumage, with unicoloured breasts (in old birds) and barred inner webs to the primaries.

They may be distinguished as follows :—

A. No sub-terminal black band on the tail.
  a. Wing 8" or over ..... ..... .. *C. canorus.*
  b. Wing under 8"
    a'. Edge of wing white... ..... ..... ..... .. *C. saturatus.*
    b'. Edge of wing ashy ..... ..... .. *C. poliocephalus.*
B. A black sub-terminal band on the tail..... *C. micropterus.*

The two large Cuckoos *canorus* and *micropterus* may always be distinguished from one another at all stages by the band sub-tipping the tail.

The young of *C. saturatus* (the Himalayan Cuckoo) and *canorus* (the Common Cuckoo) may be difficult to discriminate, but the former very rarely has the white nape patch which is always present in the latter.

The edge of the wing in the Common Cuckoo is mixed brown and white, and is not pure white as in the Himalayan Cuckoo. The two birds when compared together also vary in the barring of the lower parts, the former having these bands considerably narrower and more numerous. This, of course, is a matter of comparison only, so is not of much use unless one has specimens of both species.

*C. poliocephalus* (the Small Cuckoo) can always be recognized by its comparatively small size, the wing seldom exceeding 6" and never reaching 6"·5,—a size always exceeded by all three of the other species of *Cuculus*.

CUCULUS CANORUS (Linn.).

*The Common Cuckoo.*

*Cuculus canorus.* Jerdon, B. of I., I, p. 322; Cock and Marsh, S. F., I, p. 351; Adam, *ibid*, p. 373; Hume, *ibid*, IV, p. 288; XI, p. 69; *id.*, Cat. No. 199; Butler, S. F., VII, p. 181; Ball, *ibid*, p. 206; Scully, *ibid*, VII, p. 253; *id.*, Ibis, 1881, p. 430; Legge, B. of C., p. 221; Oates, B. B., II, p. 103; Barnes, B. of Bom., p. 124; St. John, Ibis, 1889, p. 159; Oates, *ibid*, p. 355; *id.*, Hume's Nests and Eggs, 2nd Ed., II, p. 379; Shelly, Cat. B. M., XIX, p. 245; Blanford, F. B. I., III, p. 205; Stuart Baker, Jour., Bom. N. H. Soc., X, p. 365; Yerbury, *ibid*, XI, p. 75; Inglis, *ibid*, p. 476; Davidson, *ibid*, XII, p. 51; Butler, *ibid*, p. 565.

Within Indian limits the Common Cuckoo breeds freely throughout the Himalayas and Sub-Himalayas, the Burmese Hills, the Hilly Forest Country of Chota Nagpur and the Neilgheries. It also breeds in the plains of Assam at the foot of the Hills and extend some way into the plain districts. Col. McMaster found it in Saugor, Kamptee and Chikaldor during the breeding season, and at this season also Adam obtained it at Sambhur.

Kashmir is *par excellence* the breeding ground in which its eggs are to be taken, and my notes thence are very numerous; but Col. Rattray, Col. Wilson and others have worked the neighbourhood of Murree with great success, and it is thence that most of the specimens have come which have passed through my hands.

From Col. Wilson I have received 4, from Col. Rattray 4 and have seen others from his collection; 3 have been taken by myself, and some 20 others have passed through my hands, so that altogether I have notes on about 40 eggs of *Cuculus canorus* taken in India.

So far I have totally failed to obtain a blue egg or to get any notice of an Indian-taken blue egg, about which there was no doubt. As, however, it is accepted by some naturalists now that this bird does sometimes lay blue eggs, collectors will still have to take this possibility into consideration whenever they may come across a blue cuckoo's egg; should they do so, the texture of the egg may help them more than

anything else to determine to what species it may belong, and this matter of texture is one which will be minutely dealt with for each species.

Mr. J. Davidson is the only collector who has taken a blue cuckoo's egg in India, about which the collector himself feels confident. I have not seen the egg myself, so can pass no opinion on it. He wrote to me: "I also got there (Kashmir) a pale-blue egg from a nest of Hodgson's short-wing (*Hodgsonius phœnicuroides*), which lays dark-blue eggs. The nest contained one egg also of *phœnicuroides*. I am sure that the egg was that of *canorus*, as I saw a cuckoo flying about in the underwood several times that day and two days previously. There were several more nests of *Hodgsonius* in the immediate neighbourhood, either building or with one or two eggs, and, if I could have stayed a day or two longer, I have no doubt I should have got more of the same type." We all know Mr. Davidson to be such a close, accurate observer that due weight must be given to his opinion ; but, I am afraid, "non-proven, though probable," is the most that can be said for it, and, in the light of later discoveries, it looks as if this egg might have been that of *micropterus*. Other descriptive notes of blue eggs have been sent me, but the senders have, generally, on hearing the evidence obtainable, come to the conclusion that they were *micropterus*' eggs, so I leave their notes unquoted.

The British Museum possesses a magnificent series of cuckoos' eggs, numbering no less than 277 specimens ; yet, out of this huge number there are only four *reputed* cuckoos' eggs which are blue. These are all continental eggs, except one in the Crowley Collection, and were all taken in the nests of *Ruticilla phœnicura*, the exception is an egg taken in Dorking, Surrey, which was purchased. This last cannot be accepted as authenticated beyond all doubt, and the history of the three Crowley eggs taken in Finland, I do not know. It is very noticeable, however, that all the eggs, 8 in number, found in nests of the Hedge-sparrow, are of the ordinary type and not blue.

Another egg, calling for remark in the above collection, is one of the many contained in the Seebohm Collection, and is described by Reid (Cat. of Eggs of B.M.) as "blue, sparingly spotted at the broad end with pale-blue, and closely resembling the fosterer's eggs." It was taken in a nest of *Saxicola melanoleuca* in Greece.

The normal cuckoo's egg, as taken in India and exemplified by the specimens passing through my hands, is a stout, blunt oval, seldom at all compressed towards the smaller end ; still they are all oval, and I

have seen none of the semi-spherical or elliptical shape which is so often typical of cuckoos' eggs. The texture is somewhat coarser than it is in the egg of any other of the Cuculinæ known to me, and though it is sometimes close and may exhibit a very faint gloss, it never has the beautiful satiny texture of some cuckoos' eggs or the fine gloss of some of the others.

The ground colour varies between pale-stone, pink or yellowish, and all the lighter shades of grey, olive, olive-yellow, olive-brown and brown, and the markings seem, as a rule, to follow the general tone, though of course much darker, of the ground colour. Thus, an olive-green ground colour will probably be profusely spotted with various tints of olive-brown and brown, a grey will be blotched and spotted with grey-brown and purple-brown, a pink or yellowish ground colour with speckles of reddish and reddish-brown. As a rule, I have found that the more sparse the markings, the paler the ground colour.

All eggs, nearly, in addition to the primary markings, have secondary ones of a pale-purple, grey or inky character.

In the great majority of eggs the character of primary markings is rather indefinite and very seldom at all bold ; they consist for the most part of speckles, spots and tiny blotches, heavy blotches being uncommon, and are distributed fairly evenly all over the egg, in a few cases being more numerous at the larger end and, on still more rare occasions, forming a ring or cap.

The most common Indian type—*vide* Davidson, Rattray and Buchanan, &c.—is one which is, on the contrary, most uncommon in English eggs. The ground colour is a pale clear cream, pink or yellow stone colour, and the markings are very sparse and indistinct, consisting of tiny freckles, specks, and spots of reddish with underlying ones of grey. In most cases the markings are pale and scattered over the whole surface of the egg ; in a few they are bolder and darker, and are more numerous towards the larger end where they may form a ring. The boldest marked egg in my collection is one taken by Col. Rattray from the oviduct of a female and very kindly given to me. This is shown in Plate I, fig. 4.

Figs. 5, 6, Pl. I, show types of the most common-coloured form of Indian-taken cuckoos' eggs.

Dresser gives the average size of eggs as ·88″ by ·65″. The Museum collection specimens vary between ·76″ and ·98″ in length and ·57″ to ·73″ in breadth.

An egg lent me by Major Wilson measures ·1″ by ·69″, and is the longest egg I have seen. One of Col. Rattray's eggs measures ·75″ in breadth, this measurement also exceeding that of any European egg. Those which have passed through my hands average ·91″ by ·67″, so that it would appear that tropical-laid eggs exceed in average size those laid in temperate regions.

Oates (Nest and Eggs) gives the size of the eggs as ranging between ·93″ and ·1″ in length and ·7″ to ·73″ in breadth, whilst Blanford (A. of B. I.) gives the average as being ·97″ by ·72″. This seems far too big, as eggs of this size are quite the exception amongst those which have passed through my hands.

In India the cuckoo lays its eggs in the nests of Pipits, Larks and Stone-chats perhaps more than in those of others, but eggs have been found in nests of all the following birds :—

*Pratincola maura.* The Indian Bush-Chat. Davidson, Rattray, Brooks, Ward, Scully.
*Pratincola caprata.* The Common Pied Bush-Chat. Davidson, Cock.
*Hodgsonius phœnicuroides.* Hodgson's Short-wing. Davidson.
*Petrophila cinclorhyncha.* The Blue-headed Rock-Thrush. Wilson, Rattray.
*Oreicola ferrea.* The Dark-grey Bush-Chat. Rattray, Ward, Marshall, Scully.
*Larvivora brunnea.* The Indian Blue-Chat. Rattray.
*Molpastes leucogenys.* The White-cheeked Bulbul. Rattray.
*Merula unicolor.* Tickell's Ouzel. Rattray.
*Henicurus maculatus.* The Western Spotted Forktail. Rattray.
*Henicurus schistaceus.* The Slaty-backed Forktail. Baker.
*Anthipes monileger.* Hodgson's White-gorgeted Flycatcher. Baker.
*Drymochares nepalensis.* The Nepal Short-wing. Baker.
*Crateropus canorus.* The Jungle Babbler. Cock.
*Lanius erythronotus.* The Rufous-backed Shrike. Cock.
*Copsychus saularis.* The Magpie-Robin. Brooks.
*Oreocorys sylvanus.* The Upland Pipit. Hume, Rattray.
*Anthus similis.* The Brown Rock-Pipit. Marshall.
*A. rosaceus.* Hodgson's Pipit. Whymper.
*Suya crinigera.* The Brown Hill-Warbler. Baker. (Supposed to be *saturatus* at the time when taken.)

From the above it will be seen that the common cuckoo usually selects a nest which contains eggs that are *not* very conspicuously coloured and which are much the same in size as its own eggs. Exceptions are the bright blue eggs of *Larvivora* and the much greater eggs of *Petrophila* and *Merula*. I have not, however, found that there is any proof of the

cuckoo trying to match its eggs with those of the intended foster-mother or that it selects a foster-mother whose eggs shall match its own. Not one of my correspondents has advanced this suggestion, and there appears to be little doubt that convenience of site and propinquity to the cuckoo about to lay its egg is the main requisition. We may, probably, also assume that, under normal circumstances, the female cuckoo lays its egg on the ground and carries it in her mouth until she finds a suitable nest in which to deposit it. Hume actually shot a cuckoo carrying an egg in its mouth, and the situation, or shape, of the nest selected in many other cases shows that the cuckoo could place her egg in it by no other means. This mode of procedure is greatly facilitated by the fact that most cuckoos lay eggs which are very small in proportion to themselves and are, provided with wide mouths and *curiously flexible gapes*.

An egg of the Cuckoo taken by Mr. S. L. Whymper in the nest of *Anthus rosaceus* in the Liddar Valley, Kashmir, so closely resembled the four eggs of the fosterer that it was some time before Mr. Whymper realized that he had a Cuckoo's egg and put down the clutch as an abnormally large one of *Anthus rosaceus*.

In the Ibis for 1889, p. 219, is given a translation of an article from "Gartenlaube," Vol. XXVII, showing that the cuckoo sometimes hatches its own eggs and rears the young. It is too long to quote *in extenso*, so only extracts are taken.

"On the morning of the 16th May, 1888, ... a cuckoo rose suddenly out of the bushes close to me ... ...I soon discovered in a slight depression of the ground ... ..three eggs, which attracted my attention from not being all of the same colouration, and from one of the three being of considerably smaller size than the other two ... ...I resolved to conceal myself under a neighbouring hedge in order to watch the l more closely. After I had been there for a few moments, I saw the cuckoo alight on the ground and crawl towards the place where the eggs were ... ...I remained in my hiding place at least three-quarters of an hour without seeing the cuckoo take its departure ... ...I therefore cautiously approached the spot and soon saw the cuckoo again rise from the ground . . . .

"I quickly withdrew to a rather more elevated position in the under-wood of the beech forest... ... Within six minutes the cuckoo came back, alighted near the resting-place, and proceeded with a characteristic

waddle on to the nest. For more than an hour and-a-half I kept the spot in view. During all this time the cuckoo sat quiet on the nest, so that there could be no further doubt in my mind that it was sitting on its own eggs.

"Until the 25th May I left the cuckoo to sit undisturbed. On the morning of that day I visited the spot again, and, on the bird flying off, found to my great joy a young cuckoo in the nest."

In Europe the foster-parents selected, cover a large assortment, ranging from the Fire-crested Wren to the larger shrikes. Dr. Rey gives a list of 146 such.

CUCULUS SATURATUS. (Hodgson.)

*The Himalayan Cuckoo.*

*Cuculus saturatus.* Blyth, J. A. S., XII, p. 942 ; Blanford, Fauna of B. I., III, p. 207 ; Reid, Cat. of Eggs, B. M., III, p. 114 ; Sharpe, Hand. L., II, p. 158 ; Dresser, Pal. Birds, p. 470.

*C. himalayanus.* Jerdon, B. of I., I, p. 323.

*C. striatus.* Hume, S. F., II, p. 190 ; IV, p. 288 ; XI, p. 70; *id.* Cat. No. 200 ; Blyth, B. of Burm., p. 79 ; Hume and Davis, S. F., VI, p. 156 ; Scully, S. F., VIII, p. 254 ; Davison, S. F., X, p. 359 ; *Oates*, B. of Burm., II, p. 105 ; *id.*, Ibis, 1889, p. 356.

*C. intermedius.* Shelly, Cat. B. M., XIX, p. 252 ; Oates, Nests and Eggs, 2nd Ed., p. 381 ; Stuart Baker, Jour., Bom. N. H. Soc., X, p. 365.

The first authentic egg taken of this species was one extracted from the oviduct of a female Himalayan Cuckoo by Brooks who shot the bird at Ruttun Pir in Kashmir on the 17th June. This egg is described by Oates (*in loc. cit.*) as follows:—"Is a very perfect elongated oval, a shade narrower at one end. The ground colour is a pure white, with a slight gloss. The markings, which are everywhere very sparse, are somewhat more numerous towards the larger end, and consists of minute specks and tiny lines, not more than 0·05 in length, of dingy olive-brown and very pale inky-purple or purplish-grey.

"The egg measures 0·85 by 0·6 inch."

An egg in the British Museum is described as "pinkish-white colour, thickly freckled with purplish-grey. It measures ·67 in breadth." This is probably wrongly ascribed to this cuckoo and is more likely a *canorus's* egg.

Col. Rattray has given me most important notes on this bird, and I quote these in full :—

"On 10th June 1903 I saw a bird (*Cuculus saturatus*) harrying a pair of *Acanthopneuste occipitalis* (the Large Crowned Willow-Warbler) near where I knew they had a nest, so I shot it. It was a female and contained a broken egg ready for expulsion.

"On 15th June 1903 I shot a second female in a similar condition.

"On 17th June 1903 I again shot a third female containing an egg ready for laying. All these eggs were broken by the shots or fall, but they were exactly similar to those found on the 27th of May and 9th and 11th June, all in nests of *Acanthopneuste occipitalis*.

"They are pure white, rather long eggs with a fine shell with a lot of tiny black and brown specks."

Col. C. L. Wilson wrote me :—"On the 9th June 1889 I found in an old tree stump above Sonamurg a grass nest containing four eggs, three of which proved to be of *Phylloscopus humii* (Hume's Willow-Warbler). The fourth egg was a long oval, somewhat blunt at both ends, pure white, a faint ring of brownish specks at the larger end and a few scattered elsewhere. There was barely room in the diminutive nest for this egg, which measures ·85″ by ·6″, the other three eggs being of the normal Warbler's size.

"I was much puzzled to account for it until, after a long wait, I noticed a cuckoo which kept hovering round.

"It would have been impossible, from the nature of the nest, for the egg to have been laid in it : it must have been placed there after laying.

"I took a similar egg, measuring ·82″ by ·58″, in a nest of *Acanthopneuste occipitalis* (on the 16th June 1898) in a hole at the roots of a pine.

"At Murree I took a third on the 17th July 1899 in a nest of the same species of Warbler in a similar position."

This third egg, which I have seen, measures ·83″ by ·53″.

Finally, Mr. B. B. Osmaston, writing from Darjeeling, notes :—"They were both laid in the nests of *Niltava sundara* (the Rufus-bellied Niltava in one case along with three eggs of the latter and in the other *alone*, the eggs of the *Niltava* having evidently been ejected (the shells were lying in the ground below the nest). The eggs are similar in shape to the cuckoos' eggs described by you, *i.e.*, almost elliptical in section. They are pure white, with a few small reddish or brownish specks near the big end. I found them at 6,000 ft. elevation, and the only cuckoos

which occur here at that elevation are *Cuculus canorus, saturatus, poliocephalus* and *micropterus* and *Hierococcyx sparverioides.*"

Colonel Rattray's and Brooks' discoveries settle once and for all what is the main type of the egg laid by the *Cuculus saturatus*, and so far there is no reason to suppose that this cuckoo lays any other type of egg.

The eggs mentioned above are for the most part almost perfect ellipses in shape, one or two inclined to be somewhat pointed at both ends, and in one case the egg is perhaps more oval than elliptical, the smaller end differing distinctly in size from the other.

The ground in each case is the same pure satiny-white, and the specks, which are the only form of marking, except for a few microscopical lines, are of dark amber or black, occasionally lighter and reddish. They are generally sparsely scattered over the whole surface, sometimes more numerous towards the larger end, where they rarely form a zone.

The only egg I have seen differing from these was one brought to me in a nest of *Henicurus schistaceus* (the Slaty-backed Forktail), which contained four eggs of the owner of the nest in addition to the cuckoo's. It is a perfect ellipse in shape, but the ground colour has a faint tinge of green in it, and the markings are more numerous and larger than usual, and are of a dull light reddish with a few underlying ones of purple-grey. The texture is like that of the others, and it measures ·84″ by ·58″. This egg may not, of course, be *saturatus*, but it is a cuckoo's egg of some kind, and is more like the authentic ones of that species than any other.

All the eggs have an exceedingly fine, closely grained shell, very smooth and very fragile for their size, the shell being very thin, although so compact.

The eggs which have passed through my hands, or about which I have obtained measurements, vary between ·80″ and ·89″ in length and ·52″ and ·6″ in breadth, the average of a dozen being ·85″ by ·55″.

Dresser, quoting Taczonowski, describes the eggs as " pale-greyish, marked with innumerable irregular pale violet shell-spots and brown surface spots or blotches which are more numerous round the larger end, and measure 0·92″ by 0·69″, that is to say, the eggs are said to be just like a common type of egg of *Cuculus canorus*. I leave my readers to judge for themselves whether these can be accepted or not.

Almost as curious as the " Ibis " history of the common cuckoo hatching its own egg are Capt. Hutton's remarks on the manner in which this cuckoo sometimes returns to feed young birds of the same species,

either its own or some other birds'. He writes (Oates' Nests and Eggs, II, p. 381):—"When the young bird is old enough to leave the nest, the foster-parents feed it no longer, and it is then supplied by the old cuckoo, or, at all events, by one of its own species. This I have myself repeatedly witnessed . . At Jeeripanee, below Mussooree, I have seen the young cuckoo sitting for hours together on a branch waiting for the return of the adult which continued every now and then to bring supplies of caterpillars wherewith to satisfy the apparently insatiable appetite of the nestling until at last both would fly off to another spot. To satisfy myself that it was really this cuckoo that fed the young, I shot one in the very act."

Capt. Hutton seems to consider it probable that it is the usual thing for the parent cuckoos to return to feed their young, but the experience of a great number of observers has undoubtedly proved that such is not the case. The return of the cuckoo to its duties must be quite exceptional, though Capt. Hutton appears to have been very fortunate in coming across these exceptions.

The Himalayan cuckoo may be found during the breeding season throughout the Himalayas and, possibly, in the Hills of the Chota Nagpur District. South of this it is not found, as far as records go at present in India proper, but it extends right through Burmah, and probably breeds wherever there are hills of any size. From Burmah it extends southwards and eastwards throughout the Malay Peninsula, Borneo and again to New Guinea and even Australia. In this portion of its habitat it seems to be more or less resident and remains to breed even in the plains. I have had eggs sent me from Borneo and Java under the names of other cuckoos which I very strongly suspect to be of this cuckoo.

Its cry is a four-syllable one of four deep whistles or hoots, very much like that of the hoopoe, but rather higher in tone. It is a pleasant musical call. Jerdon says that prior to these four notes it gives higher whistle which cannot be heard unless one is very close by. This note I have seldom heard until this year, when I found the bird very common on the North bank of the Brahmapootra in this district. I was repeatedly able to stand within a few yards of the calling bird, and then heard the preliminary high note quite distinctly.

(*To be continued.*)

# THE "PECTINATE ORGANS" OF *TRAPA BISPINOSA*, ROXB. (WATER-CHESTNUT).

By

E. Blatter, S.J.

(*With a Plate.*)

(*Read before the Bombay Natural History Society on 25th January*, 1906.)

Cooke in his excellent "Flora of the Bombay Presidency," when describing *Trapa bispinosa* speaks of "numerous opposite pairs of root-like spreading pectinate organs," and adds immediately "(? floating roots")[1].

"I think it is well known that the uppermost leaves with their rhomboidal blades lie on the surface of the water and are grouped into rosettes. There are, besides, for each leaf a pair of scaly, deeply divided stipules[2], and just from below these stipules arise those 'pectinate organs,' which have caused so great a variety of opinion."

In the "Genera plantarum" the genus Trapa is described as follows:—"*Herbæ natantes, Folia 2-formia, submersa opposita, pinnatisecta, radiciformia; emersa rosulata, petiolata, rhombea, dentata, petiola inflata spongiosa.*"[3] Baillon writes to the same effect: "The slender floating stems bear two kinds of leaves. The lower, submerged, are opposite, pinnatisect, not unlike finely pectinate roots."[4] W. Roxburgh gives the following description:—"Stipules two pairs, the superior are simple, semi-lanceolate, and caducous, the inferior pair at first simple and filiform, but becoming ramous by age, permanent."[5] The same opinion as regards *Trapa bispinosa* is expressed by Trimen in the following:—"The more submerged part of the stem," he says, "is thickly set with pair of green pectinate spreading organs (? roots) coming off from immediately below the position of stipules of fallen leaves, and 1—1½ in. long."[6] Later on he continues: "The pectinate submerged organs cannot be considered as leaves (as in Flora British India, following Wight); their position suggests a stipular nature, and they are so called

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[1] Cooke, "Flora of the Bombay Presidency," Vol. I., p. 518.

[2] There has crept in a mistake in Cooke's Flora (p. 515) where the author describes the order *Onagraceæ* as extipulate, though, later on, he speaks of the stipules of *Trapa bispinosa*.

[3] Bentham et Hooker, *Genera plantarum*, Vol. I., p. 793.

[4] Baillon, Natural History of Plants, Vol. VI., p. 477.

[5] W. Roxburgh, Flora Indica, p. 144.

[6] Trimen, Flora of Ceylon, Vol. II., p. 235.

by Roxburgh, who has well figured and described them (Roxb. Pl. Cor., t. 234), but there are real stipules also present with the young leaves."[7]

In the Flora of British India, alluded to by Trimen, I find these lines : " Leaves (of the genus Trapa) dimorphic ; submerged opposite root-like, pinnatipartite, with filiform segments."[8] Duthie gives the following characteristic of the genus : " Stem long, flexuose, ascending in the water, the more submerged portions giving off at intervals pairs of green pectinate spreading organs from below the margins of the scars of fallen leaves. Leaves alternate, approximate in the form of rosettes"[9]. Loudon speaks of *Trapa natans* as of a " curious aquatic with long brown and green roots and floating leaves, with petioles inflated into a tumour as in the marine algæ."[10] According to Cooke those " pectinate organs " are termed " adventitious floating roots " by Barneoud.[11] De Candolle gives this description of the genus Trapa : " *Herbæ aquis innatantes. Radices fibrosæ, folia infima opposita, cetera alterna, inferiora pinnatipartita, capillacea, fere ut in Myriophyllis, summa in rosulam conferta.*"[12] Cooke, too, calls those submerged organs pinnatipartite,[13] and adds in a note, that " considerable diversity of opinion exists as to the exact function of the pectinate organs."[14]

From the foregoing we may collect that there exist different opinions not only with respect to the morphology but also the function of the pectinate organs. They are considered by some to be stipules, by others true leaves, and, again, by several even roots. As regards their outer morphology they are described as being pectinate, pinnatipartite, pinnatisected, radiciform, capillary, ramous, as resembling the leaves of the Myriophylla.

In the following I shall give the external and internal morphology of the " pectinate organs " of *Trapa bispinosa*, and by drawing the conclusions from the given data, I shall try to arrive at a satisfactory explanation of those interesting organs.

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[7] Trimen, l. c., p. 236.
[8] Hooker, Flora of British India, Vol. II., p. 590.
[9] T. F. Duthie, Flora of the Upper Gangetic Plain, p. 357.
[10] Loudon, Encyclopædia of Plants, p. 104.
[11] *Mém. l. Trapa natans*, Ann. Sci. Nat. sér. 3, v. 9. [1848] p. 222.
[12] De Candolle, *Prodromus Syst. Nat. Regni Vegetabilis*, III., p. 63.
[13] Cooke, l. c., p. 515.
[14] Cooke, l. c., p. 518.

The so-called "pectinate organs" arise as cylindrical bodies from below the scaly stipules and on the sides of the floating leaves. (Fig. 1.) They grow to the length of ½—1 in. without showing any external differentiation; but, then, there appear round the lower half of the cylindrical axis small globular protuberances, apparently without any regular distribution. Growing in acropetal succession these globular bodies assume an elongated shape, but still remain comparatively stout. When the main axis has reached its full length, *i.e.* 2—2½ in., and the lateral structures have attained ½ in., the most regular arrangement of the latter can be detected very easily, and even better than after their full development. The lateral processes are arranged in four spiral rows, all turned to the right. Fig. 2 gives the successive stages of development, and Fig. 3 a diagrammatic view of the arrangement of the lateral cylindrical bodies on the main axis. As soon as the aerial leaves have fallen off, a rapid growth of the lateral structures begins till they attain capillary thinness. Their bases are now reduced in diameter compared with the same in their immature state. Their shape is not quite cylindrical, but slightly flattened, whereas the main axis is cylindrical. In this state of development it is extremely difficult to make out the arrangement of the lateral members. I was not able to trace their angular divergence and it seems to me that they are scattered irregularly on the spiral lines.

It cannot, therefore, be said, that those organs are pectinate, or pinnatisected, or pinnatipartite, as the lateral processes are distinctly arranged in four spiral rows; and even with the leaves of Myriophyllum they may be compared only so far as also in this water-plant similar capillary processes occur, though in a less perfect form. If the lateral members were arranged in two parallel opposite rows only, no objection could be raised against calling them pectinate, and even if they were located in two spiral rows, the difficulty could perhaps be overcome by explaining the spiral arrangement as effected by the torsion of the main axis; but as there are four distinct spirals, the best term applicable seems to be Roxburgh's "ramous", if we do not want to introduce an entirely new name for this special arrangement, which, s far as I know, has not been observed in any other phanerogamic plant.

The internal morphology exhibits, likewise, some peculiar features. Only one vascular bundle, situated in the centre, extends through the main axis, and smaller ones through the lateral processes. Besides, there

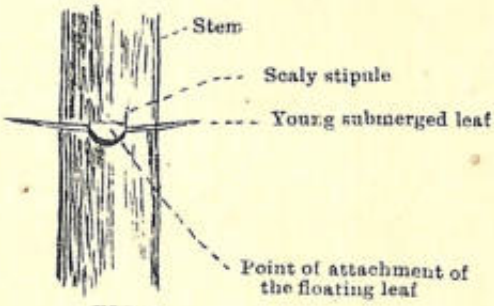


FIG. 1.

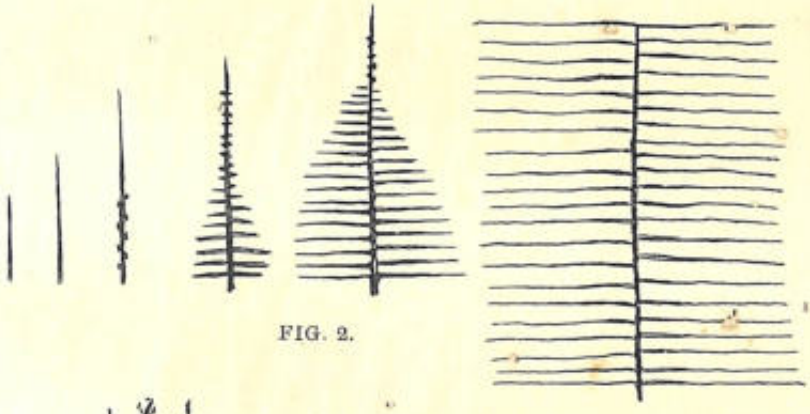

FIG. 2.

FIG. 3.

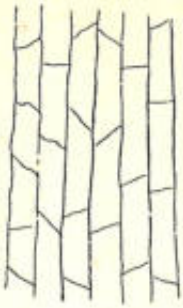

FIG. 4.

TRAPA BISPINOSA. ROXB.

A. P. CORTEZ & CO. LITH.

is no differentiation into palisade tissue, or spongy tissue, the vascular bundle being simply imbedded in a parenchymatous tissue. The epidermis consists of elongated cells (Fig. 4) which are possessed of extremely thin outer walls. This is the reason why the submerged organs begin to wither already after some minutes when exposed to the open air. Stomata could not be detected and most of the chlorophyll bodies were found to be located not in the tissue below the epidermis, but chiefly in the epidermal cells themselves.

Some of these characters seem to be incompatible with each other; but a closer examination of the relations between those internal and external contrivances and the surrounding factors will show that those organs are nothing but the most excellent adaptations to the medium in which they live. A differentiation of the mesophyll into palisade tissue and spongy tissue would be quite superfluous, as leaves submerged in water do not transpire. That the chlorophyll corpuscles are chiefly contained in the epidermal cells, is due to the circumstance that the light to which the leaves are exposed is not very intense, because it has to pass through the water before it reaches the tissues. The gradual decrease of the intensity of the light with the depth of the water is shown to evidence in the colour of the submerged organs. The chromatophores of the uppermost organs are dark-green: they become paler and paler as we follow the stem in a downward direction, and assume finally a brownish colour, where every assimilatory function of the chromatophores is rendered impossible for want of light. On the one hand the absence of stomata seems to indicate that respiration does not take place; but, on the other, the presence of chlorophyll corpuscles is a sufficient proof that the processes of photo-synthetic assimilation of carbon dioxide and, consequently, of respiration are going on in the usual way. It is just in order to facilitate these processes and to give at the same time a compensation for the absence of special respiratory organs, that the outer walls of the epidermal cells are so extremely thin as to allow not only the exchange of gases, but also the passage of salts dissolved in water. In order that the organs may present as large a surface as possible, they do not develop in the form of flat expansions, as the floating leaves do, but are much divided and extended into capillary processes.

The question now arises, whether we shall call these organs roots, leaves, stipules, or branches. If we take into consideration all the

anatomical characters of the submerged organs and compare them with the submerged leaves of other aquatics, we find that they agree in all the essential points. Nobody will doubt that the submerged, myriophyllum-like leaves of the *Cabomba aquatica* are true leaves, though they vastly differ from the disc-shaped floating leaves of the same plant. It is easy to adduce other examples of heterophyllous plantsof which it is equally sure that their submerged, finely divided leaves are true leaves, *e.g., Potamogeton heterophyllus, rufescens, spathulatus, Ranunculus aquatica, bandotii, hololeucus,* species of the genera *Helosciadum, Ceratophyllum, Œnanthe, Sium, etc.* The submerged organs of *Trapa bispinosa* agree with all these leaves in their anatomical structure, and exhibit also some common characteristic features in their outer appearance, though, of course, they differ as much from them as their floating leaves do in their external morphological development. An objection might be raised from the unusual position of the submerged leaves of *Trapa bispinosa.* I think, however, if the anatomical structure is such as to induce us to call a certain organ a true leaf, a mere displacement of the organ cannot be decisive in this question. If this were the case, we might as well say that the extra-axillary branches are not branches because they do not arise from the axils.

# ON THE TENTHREDINIDÆ & PARASITIC HYMENOPTERA COLLECTED IN BALUCHISTAN BY MAJOR C. G. NURSE.

By P. Cameron.

## Part I.

(*Read before the Bombay Natural History Society on 25th January* 1906.)

Up till now our information regarding the Tenthredinidæ and Parasitic Hymenoptera of Baluchistan has been a complete blank. The collection, small though it is, made by Major Nurse at Quetta and Peshin, forms a welcome addition to our knowledge of the Hymenoptera of that part of our Indian Empire. As we know practically nothing about the species inhabiting North-West India, of Afghanistan on the north and of Persia on the west of Baluchistan, it is useless to discuss the geographical relationship of the species. It may, however, be remarked that the affinity of the species appears to be with the Palæarctic, rather than with the Oriental Zoological Region. The occurrence of a species of *Nematus* (a large and typical Palæarctic and Nearctic genus, and found, too, only commonly in the northern parts of these regions) is very interesting. The occurrence of the common European Ichneumon, *Bassus lætatorius*, Fab., is not of much importance in deciding the geographical affinities of the Baluchistan species; for the reason that it has now spread itself (probably in comparatively recent years) all over the globe, following its host, some wide ranging Dipteron, no doubt.

The species in the collection are of small or medium size. The large species of *Ichneumonidæ* (*Ichneumon*, *Amblyteles*, &c.) appear to be comparatively rare. Undernoted is a summary of the collection :—

| | | |
|---|---|---|
| Tenthredinidæ ... ... ... ... | 1 | species. |
| Cynipidæ ... ... ... ... | 1 | ,, |
| Chalcididæ ... ... ... ... | 11 | ,, |
| Proctotrypidæ ... ... ... ... | 2 | ,, |
| Evaniidæ ... ... ... ... | 3 | ,, |
| Braconidæ ... ... ... ... | 13 | ,, |
| Ichneumonidæ ... ... ... ... | 25 | ,, |
| Bethylidæ ... ... ... ... | 1 | ,, |
| Total ... | 57 | ,, |

TENTHREDINIDÆ.

*Nematus orientalis*, sp. nov.

Pale straw-green (probably bright green when alive), the centre of the front and vertex and the mesonotum fulvous. The antennæ, a mark at the base of the scutellum on either side, a large elongate mark on its sides, a narrow line bordering the cenchri behind, a large mark behind them, a narrow line bordering the blotch and one or more transverse marks on the base of the abdomen, black. Wings hyaline, the costa and stigma green, the nervures black. Legs coloured like the body, the tarsi blackish. ♀.

Length 5-6 mm.

Quetta. August.

The 3rd joint of the antennæ is as long as the 4th. Head smooth and shining; frontal area flat, clearly defined laterally, the sides being raised, the raised part reaching to the inner side of the laterally ocelli; at its end are 2 large round tubercles, below which the front is depressed. Ocellar region raised; there is a deep furrow between the ocelli. Apex of clypeus rounded. Mandibles fulvous at the apex; the apical tooth long. Palpi green, infuscated. Middle lobe of mesonotum furrowed on the basal half in the middle. Cerci long, infuscated. Sheaths of saws broad, projecting, its apex infuscated, roundly narrowed from the top to the bottom. The 1st transverse cubital nervure faint in the middle; the 3rd cubital cellule is fully one-third longer than its width at the base, not much wider at the apex than at the base; the 2nd recurrent nervure is received not far from the 2nd transverse cubital—about one-fourth of the length of the latter. Tarsal joints not spinose at the apex; patellæ distinct, becoming gradually longer; claws bifid.

The ♂ is black above, including the middle of the vertex and front broadly and the occiput still more broadly; the antennæ are thicker, distinctly closely pilose; brownish, black above, longer than the body, the mesopleuræ are fulvous, as are also the hind femora; the hind tibiæ are broadly infuscated. It is smaller (3·5 mm.) than the ♀.

The occurrence of a species of *Nematus* in Baluchistan is of much interest. The genus is one of the most abundant in arctic and Northern Europe and America, being rare in the temperate regions and very rare in the South of Europe. Its occurrence clearly indicates the presence of a Palæarctic element in the Fauna. The species belongs to the group of *N. miliaris*, Pz.

CYNIPIDÆ.

*Onychia rufithorax*, sp. nov.

Black; the antennæ, thorax except the mesosternum, and base of abdominal petiole rufous, the forelegs rufous, the 4 posterior black, their coxæ rufous; wings clear hyaline, the nervures pale fuscous, the areolet knob-shaped, darker coloured. ♂.

Length 3 mm.

Quetta. August.

Head and thorax densely covered with white pubescence. Face closely, finely punctured; from each antennæ a stout keel runs down to shortly below the face; they converge below, the converging parts being much thinner than the upper. A stout keel runs down from the lower, innerside of the outer antennæ along the innerside of the eyes; on the upper part of the front are some irregular oblique striæ. Ocelli large, placed in a curve on the edge of the vertex. Occiput transverse; on its top are 2 stout and a thinner, lower curved keel. Basal slope of pronotum smooth, the sides bordered by a stout keel; the propleuræ irregularly, somewhat strongly striated. Mesonotum with 4 stout longitudinal keels, the central stouter than the others; it is irregularly transversely striated. Sides and centre of scutellum stoutly keeled, the central keel stouter than the others. There are 2 keels down the centre of the metanotum. Meso- and metapleuræ smooth and shining; the latter thickly covered with white pubescence. Abdominal petiole with the dilated basal part as long as the hind coxæ, smooth. The mesosternum is bordered laterally by a shallow furrow. Antennæ longer than the body, the 3rd joint twisted, slightly longer than the 4th; they are 14-jointed.

I have described in Manchr. Memoirs, 1888, an *Onychia striolata* from Bengal; it may be known by the thorax being entirely black, besides the structural differences.

CHALCIDIDÆ.

*Leucaspis quettaensis*, sp. nov.

Black, the sides of the head in front broadly, from the ocelli to shortly below the eyes, the pronotum except the basal slope and a broad tranverse line in the middle, a large mark in the centre of the mesonotum, transverse at the base and apex, and gradually, but not much, narrowed towards the apex, the scutellum, except at the base, the black on the base projecting as a triangular wedge into the yellow, a mark, longer than wide, on the sides of the metanotum, its innerside straight, the outer gradually narrowed to the middle, a small conical spot—the narrowed end below—under the wings, a large pyriform mark, extending from the top to the bottom and with the wide end below, on the base of the metapleuræ, a broad band on the apex of the 1st abdominal segment, the mark commencing near the top of the apical slope; following this are 2 broad transverse bands, the narrower, extending to the sides and curved; the 2nd broader, not reaching to the sides, not so curved and with the sides more rounded, followed by a large, longer than broad, mark, broadly rounded at the apex, and the apical three-fourths of the ventral surface, yellow. Legs yellow; the greater part of the 4 front coxæ, the hinder coxæ except for a triangular mark on the innerside at the base above, the sides from shortly below the middle and the underside from behind the middle and the teeth, all of which are black. Wings hyaline, suffused with fulvous at the base, the apex with fuscous; the basal nervures fulvous. The 3rd to 5th and the apical joints of the antennæ are fulvous; the scape is fulvous red. ♀.

Length 12 mm.

Quetta. August.

The markings on the head, antennal scape, thorax and legs are vermilion; probably this is owing to discolouration by cyanide of potassium. There are 10 teeth on the hind femora; the basal 5 are thick, blunt, closely pressed together; the following 4 are longer, sharper, more curved and clearly separated; the last is widely separated and is shorter than any of the others. The post-scutellum projects distinctly over the median segment; its apex is unequally bidentate. The entire body is covered with a short white pubescence and is closely, somewhat strongly punctured except the metanotum which is closely reticulated. The joints of the flagellum are distinctly longer than thick, except the 4th to 6th, which are about as wide as thick. There is a smooth broad transverse keel near the apex of the pronotum. The eyes do not converge below; the malar space is nearly as long as the antennal scape. In the centre of the face are 2 furrows which converge roundly towards each other in the centre. The centre of the clypeus is roundly incised, the sides rounded.

*Leucaspis nursei*, sp. nov.

Length 9-10 mm. ♂.

Quetta. May to August.

♂ This species is almost identical in colouration and markings with the preceding, but it is smaller; and may readily be known by there being only 8 teeth on the hind femora, namely, 3 stout, longish basal closely pressed, a stouter one near to them, but clearly separated, 2 longer and sharper ones, widely separated from it and from each other, and still more widely separated is a short stump; the post-scutellum is not so distinctly bidentate; the apex of the clypeus has the lateral lobes more distinct, and broader. As regards colouration the mark below the tegulæ is 3 times larger and pyriform, the black line on the pronotum is half the length and thickness, the post-scutellum is marked with yellow, and the 2 marks on the metanotum are much larger and more particularly broader, being not much longer than wide; the lines on the sides of the face are broader and are united at the top by a mark which projects upwards between the antennæ; the striation on the vertex is stronger and closer.

If there were only the colouration differences I should feel inclined to regard the 2 as forms of one species; but the structural differences are too great to warrant one in looking upon them as varieties of one species.

The ♀ is larger (14 mm.); the dark markings on the thorax are smaller and are brown rather than black; only the clypeus is black; the antennæ have no black; the black transverse marks or lines on the abdomen are narrower; the 3rd is broader than the others, especially on the sides; the ovipositor reaches to the middle of the basal segment; the post-scutellum is more distinctly bilobate; the lobes rounded.

*Dirrhinus erythroceras.*

Black; the antennæ, the 4 anterior femora, tibiæ and all the tarsi rufous, the

body and legs sparsely covered with silvery white pubescence; wings hyaline, the nervure fuscous. ♂.

Length 3-5 mm.

Quetta. May.

Centre of head above strongly punctured, the punctures round and clearly separated, the centre of the vertex with a broad, strongly aciculated longitudinal band. Occiput broadly roundly incised, the centre depressed. Frontal lobes twice longer than the width of the base; they are narrowed towards the apex, the inner edge has a distinct margin; it is depressed, the inner and apical edges raised, the outer less distinctly margined; the frontal incision becomes gradually widened towards the apex, it being there fully twice the width of the base. Pro- and mesonotum strongly punctured; the former has the apex smooth in the middle, this being also the case with the centre of the scutellum which is largely impunctate. Metanotum closely reticulated-striated; there is a short keel in the centre of the apex; on the sides are 2 keels which converge and unite near the apex, forming a longish triangular area. The sides, at the base, are broadly roundly dilated, in the middle is a stout triangular tooth; the apex projects into a shorter tooth. Propleuræ (especially above) strongly punctured; the base of mesopleuræ much less strongly and less closely punctured, opaque; the apex is somewhat strongly, but not very regularly striated, the two parts being separated by a curved keel. Metapleuræ distinctly irregularly reticulated. Abdominal petiole broader than long, the top with 4 stout, longitudinal keels; on the base of the 2nd segment, extending from the base to near the middle, is a closely striated space; the apical segment is broadly, deeply, roundly incised in the centre. The hind coxæ are flat above and finely closely striated in the middle; the basal joint of the trochanters is raised, compressed, oblique, and appears almost to form part of the coxæ; the lower is shorter and projects below into a ball-like mass, longer than broad, and appearing as if it were attached to the under side of the base of the femora.

This cannot well be confounded with any of the described species. Characteristic is the roundly, deeply incised apex of the abdomen. In the species known to me, *e.g.*, *D. excavatus*, Dàl. and *D. ruficornis*, Cam., the apex is trilobate, it having a large central, bordered by a small lateral lobe.

*Megacolus pruinosus*, sp. nov.

Black, densely covered with silvery pile, the hind coxæ and femora bright red; the 4 anterior tarsi of a darker red; the hinder tibiæ of a darker red colour; the wings hyaline, the nervures black. ♀.

Length 7 mm.; terebra 2 mm.

Quetta. August.

Head rugosely punctured, the cheeks and temples densely, the vertex more sparsely covered with long silvery hair. Malar space almost as long as the eyes; the inner side bordered by a distinct keel. Pro-mesothorax and scutellum strongly punctured, the punctures distinctly separated; the pleuræ closely rugosely punctured. Metanotum laterally bordered by a stout keel; the lower

spine obliquely turned upwards; the upper shorter, bluntly rounded; the central part is stoutly irregularly reticulated, the sides are more closely, irregularly, and less strongly reticulated. The apices of the abdominal segments are punctured, the basal weakly, the apical much more strongly and widely; the basal part of the ovipositor closely, weakly punctured; the sides of the segments, except the basal, are densely covered with silvery pubescence. Legs densely covered with silvery pubescence; the tarsal spines are rufous.

The hind femora are minutely closely serrate and densely pilose. The antennæ are inserted opposite the lower part of the eyes; the top of the antennal scape reaches to the ocelli. Parapsidal furrows distinct.

*Chalcis responsator*, Walk.

Specimens from Quetta and from Deesa (Bombay) taken by Major Nurse agree fairly well with Walker's description (Trans. Ent. Soc., 1862, 355) of this species from "North Hindostan". The apex of the scutellum is bilobate; the lobes are broader than long and are separated by a rounded incision. Walker calls the apex "bidentate".

*Chalcis fulvitarsis*, sp. nov.

Black; the apices of all the femora—the apical third of the anterior, the others more narrowly, the base and apex of the 4 posterior tibiæ broadly, all the tarsi and the anterior tibiæ, rufo-fulvous; the black on the tibiæ bordered by fulvous; wings hyaline, the apical nervures black; tegulæ yellow. ♂. Length 5 mm.

Quetta. May.

Apex of antennal scape broadly obscure yellow below, piceous above; the flagellum is stouter than usual, densely covered with white pile. Front and vertex reticulated-punctured; the outer orbits to near the bottom coarsely punctured; the lower part is smooth, shining; this smooth part, above, becomes gradually narrowed from the inner to the outer side; on the inner side it is bordered by a keel. Pro- and mesonotum with the scutellum closely covered with round punctures, each with a raised point in the centre; on the scutellum the punctures are more widely separated; and there is a smooth line down the centre of the basal half; its apex is broadly bilobate. Metanotum irregularly reticulated; the areola deep, about 3 times longer than wide. Basal 4 segments of abdomen smooth and shining; the 5th and 6th strongly, deeply punctured. Upper part of propleuræ smooth, the middle aciculated, the lower irregularly punctured. Base of mesopleuræ smooth; the middle with 3 large foveæ, below which are 3 pairs of irregular ones. Metapleuræ strongly, irregularly reticulated; below, the apex of metanotum roundly projects at the sides.

*Oncochalcis quettaensis*, sp. nov.

Black; the apical two-thirds of the fore femora, the apical third of the middle and the fourth of the posterior, the tibiæ, tarsi and tegulæ bright lemon-yellow, the wings clear hyaline, the nervures black. ♀ and ♂. Length 5 mm.

Quetta. June to August.

Densely covered with long, glistening white pubescence, except on the base of the abdomen. Apex of scutellum with a broad, rounded, smooth and shining, undivided projection. Metanotum stoutly, widely reticulated. The central basal area fully twice longer than wide; the sides rounded, not toothed. Femora with 12 teeth; the basal close together, the apical (except the penultimate, which is smaller and less clearly defined) larger and more widely separated. Basal segment of abdomen smooth and shining; the 2nd sparsely and not very strongly, the others strongly and closely punctured. Centre of face strongly, but not closely punctured above, the lower part smooth and shining; the sides strongly and closely punctured, more or less reticulated, this being also the case with the sides of the front and vertex; middle of front widely, deeply excavated, very smooth and shining, bare. Hinder ocelli separated from each other by more than double the distance they are from the eyes. The antennal scape and pedicle are shining, sparsely haired; the other joints opaque, stout, the third is narrowed at the base, twice the length of the pedicle and not much longer than the 4th, the apical joints are brownish. Pro- mesonotum and scutellum strongly, closely punctured. Upper part of propleuræ smooth, obscurely striated; the lower strongly, but not closely punctured. Meso- and metapleuræ coarsely, reticulated-punctured; the greater part of the base smooth, shining; of the former, the extreme base is bordered (except near the top) with a row of large foveæ, the one below the other. The inner side of the hind tibiæ is black. Parapsidal furrows shallow, broad.

Comes near to *C. marginata*, Cam.; the latter species has the abdomen much less strongly punctured; the mesopleuræ much more distinctly striated; there is only a small smooth space in the centre of the face and all the femora have the apices narrowly yellow, the yellow marks being of the same size on all of them. It is a larger and stouter species; the metanotal areola is longer, acutely pointed above and with a stout keel near the middle, and the reticulations on the apex of the metapleuræ are wider. *O. deesæ*, Cam., is also closely allied; the smooth space on the face is very small; the structure of the metanotal areæ is very different; there is no large central areola; there is a row of large basal areæ; the abdominal segments in *deesæ* are not punctured.

This species is not unlike *C. bilobatus*, Cam.; that species may be known by the weaker femoral teeth; by the mesopleuræ being only weakly striated above; by the face being more strongly punctured, the middle being also punctured, and by the much more strongly and regularly reticulated metanotum on which the areola is clearly defined, deep and triangular; and the sides do not project into a blunt tooth behind: in the present species they project into a broad, rounded tooth.

*Oncochalcis rufescens*, sp. nov.

Rufescent, densely covered with silvery pubescence; the vertex darker coloured, infuscated, the pleuræ brighter in tint than the mesonotum; the

tegulæ, apical half of fore femora, apical fourth of the 4 hinder, the 4 anterior tibiæ and tarsi, and the posterior tibiæ, except for a rufous band near the middle, pale bright yellow; the hind tarsi yellow, tinged with fulvous: wings clear hyaline; the costal nervure fuscous, the others black. ♀.

Length 5 mm.

Quetta. June.

Head closely, rugosely punctured. Frontal depression smooth, shining, not quite so wide as the sides, there is a thick, smooth, wide keel on the centre, bordered on either side by an oblique, somewhat pyriform, raised smooth and shining space. Pro-mesothorax and scutellum closely, strongly punctured; the scutellum large, somewhat broader than long, the apex broadly rounded above, projecting and bluntly bilobate above; the apex is more densely haired than the rest. Metanotum short, vertical, shining, widely reticulated, the central area long, extending from the top to the bottom, sharply, obliquely narrowed above; the bottom slightly roundly narrowed. Propleuræ closely, minutely punctured, a stout oblique keel below the middle. The upper part of the mesopleuræ at the base is smooth: in the centre are 5 round, deep foveæ; its apex is raised, it being thus separated from the posterior part, which is depressed above, raised below and stoutly irregularly striated, or keeled at the base. Metapleuræ reticulated closely; their sides behind broadly rounded. Abdomen closely minutely punctured, the 2nd and following segments densely covered with a longish silvery pile. The ovipositor is broad; it projects slightly beyond the top of the apical dorsal segment. Hinder femora closely serrate, pilose below.

*Neochalcis ? ferticaudis*, sp. nov.

Black, densely covered with silvery pubescence, the hind coxæ and femora bright red, the hind tibiæ of a darker red, darker behind, the 4 anterior tarsi red, tinged with yellowish fulvous; wings hyaline, the nervures black. ♀.

Length 7 mm.

Quetta. August.

Head rugosely punctured, the front laterally reticulated; the frontal depression finely closely transversely striated, except shortly below the middle and above the bottom. The temples are more closely reticulated, the malar space more strongly; it is stoutly keeled on the outerside; above, below the eyes, is a raised triangular space, sharply pointed below. Apex of scutellum not quite rounded, slightly roundly incised in the middle. Metanotum stoutly irregularly reticulated, with a small smooth triangular area near the top in the middle; the sides are broadly rounded, densely covered with long white hair. The basal 5 abdominal segments are shining, closely, finely punctured; except at the base the 6th segment is coarsely, rugosely reticulated-punctured; the apical segments on the sides are thickly covered with long white pubescence.

*Neochalcis* is the only described genus into which this species will fit. The single large tooth on the centre of the hind femora is bluntly pointed; the rest

is minutely serrate. The ovipositor is short, stout, obliquely narrowed at the apex.

*Etroxys xanthopus*, sp. nov.

Green variegated with brassy and blue tints, the metanotum indigo blue; the abdomen of a brighter colour than the thorax; the antennal scape dark fulvous; the flagellum fuscous; legs pale straw-yellow; the anterior coxæ, except at the apex, dark golden; wings clear hyaline, iridescent, the nervures pale testaceous. ♀.

Length 3 mm.

Quetta. June.

Head closely, distinctly punctured, the front and vertex slightly more strongly than the face; the clypeus indistinctly separated from the face, closely, longitudinally, slightly obliquely striated. Palpi yellow. Pro- and mesothorax with scutellum punctured like the head; the metanotum is much more obscurely punctured; there is a keel down the middle; at the base laterally is a distinct fovea, the obscure punctuation is intermixed with fine striæ. On the centre of the metapleuræ is a deep, wide longitudinal furrow, which is narrowed at the base. Abdomen as long as the head and thorax united, smooth and shining, gradually narrowed to a fine point at the apex.

The antennæ are more slender and the parapsidal furrows less distinct than they are in the British species of *Etroxys*. I have used the original spelling of this word as used by Ashmead in his "Classification of the Chalcid Flies." It has been spelled *Aetroxys* and *Hetroxys*.

*Etroxys ? marginicollis*, sp. nov.

Dark coppery green, the abdomen of a brighter green colour, largely tinged with coppery patches; the antennal scape and base of mandibles rufo-testaceous; the flagellum fusco-testaceous, darker above; the legs dark green, with coppery tints; the apex of femora, the tibiæ and tarsi pale straw yellow; wings clear hyaline, the nervures pale yellow. ♀.

Length 3 mm.

Quetta. June.

Head closely, finely, distinctly, but not deeply punctured; the clypeus not separated from the face, closely, regularly, distinctly striated. Thorax punctured like the head, the punctures running into reticulations, especially on the mesonotum; the sides of the metanotum are smooth, shining and bright green; its centre is somewhat more strongly punctured than the scutellum. Pleuræ darker coloured than the scutellum; the apex of the pro- and meso- smooth and shining; the rest closely punctured-reticulated. Abdomen not quite so long as the head and thorax united; the apical half is gradually narrowed towards the apex, and is covered with a white pubescence.

Apart from the difference in the colouration of the legs this species may be known from *E. xanthopus* by the shorter and broader abdomen and by the much more strongly and regularly punctured-reticulated metanotum. The abdomen is shorter and broader than it is in typical *Etroxys*; and it may not

really belong to that genus. The mandibles are 3-dentate; the apical tooth is larger and more clearly separated than the other two. The antennal scape is shorter, it not extending to the hinder ocelli as in *xanthopus*; the hinder ocelli are separated from each other by a slighter greater distance than they are from the eyes. The head is wider than the thorax. The pronotum is transverse and margined at the base, not broadly rounded, and narrowed laterally as in *xanthopus*, which has a larger prothorax. In the forewings, the stigmal branch is nearly as long as the ulna. The apical 3 joints of the antennæ are thickened.

SCELIONINI.

*Sparasion albo-pilosellus*, sp. nov.

Black, densely covered with long white pubescence; the antennal scape and the legs, except the coxæ, bright rufo-fulvous; the antennal flagellum fuscous below; wings hyaline, the nervures fuscous, the stigma black. ♂.

Length 4-5 mm.

Quetta. May.

Frontal ledge broad, smooth, shining. the edges broadly rounded; the front is raised above it, broadly rounded and with a raised border; immediately behind the border it is smooth; between this border and the ocelli it is irregularly, mostly obliquely striated. Except on the sides in front, the vertex is irregularly transversely striated-reticulated. Pro- and mesonotum shining; the hairs issue from punctures; there are no furrows, except on the apex, where they are deep. Scutellum smooth at the base, the rest strongly punctured; it is semicircular, large; the basal furrow is stoutly crenulated. The centre of the metanotum is depressed, bordered by a keel which, at the apex, curves outwardly, then runs backwards obliquely to the base of the segment, there being thus formed 2 areæ; shortly beyond the middle of the inner keels is a stout transverse keel, with a more irregular one on either side, besides a few broken keels; the sides have a stout keel which broadly projects and is united to the apex of the central keel; the apical slope is almost smooth. The upper part of the prothorax is margined on the outer side, broadly rounded; the basal slope is smooth. The base of the mesopleuræ is punctured, the rest smooth, except the apical half above which is raised and strongly striated. The upper part of the metapleuræ is strongly closely striated; the striæ curved and interlacing; the base above is punctured, the lower part stoutly striated, the upper apical smooth. The basal 3 abdominal segments are closely, strongly longitudinally striated; the 4th is weakly and irregularly striated and the 5th still more so; the segmental divisions are distinct and crenulated.

The post-scutellum is flat and strongly striated; the ventral segments are weakly striated at the base. Palpi rufo-testaceous.

HELORINÆ

*Helorus striolatus*, sp. nov.

Black; the tegulæ, tibiæ and tarsi testaceous, the hinder pair darker coloured;

mandibles and palpi dark piceous, the wings clear hyaline, the nervures black. ♂.

Length 4 mm.

Quetta. June.

The 3rd joint of antennæ as long as the 4th. Head and thorax covered with a minute white pile. Face closely, distinctly, the clypeus more sparsely punctured; it is separated from the face by a broad curved depression ending laterally in a round fovea. Front and vertex laterally closely punctured; in the centre they are more sparsely and less strongly punctured; above, and between the antennæ, is a large, broad fovea; there is a curved furrow behind the hinder ocelli. Mesonotum and scutellum shining, only minutely punctured; the apex of the latter has on the sides a few short keels. On the sides of the post-scutellum, at the base, are 3 deep foveæ clearly separated by keels. Metanotum stoutly irregularly reticulated. Upper part of propleuræ smooth; the lower part at the base rugose, on the apex are 5 stout keels which become gradually shorter from the top to the bottom. On the base of the mesopleuræ is a stout keel running from the top to the bottom, it is longitudinally irregularly striated on either side. Metapleuræ irregularly closely reticulated, almost rugose. Abdominal petiole nearly half the length of the rest of the abdomen; it is irregularly punctured-striated on the sides; on the basal half above are 2 keels, which unite at the apex and converge, but do not unite at the base; the dilated part is thickly covered with white pubescence. The basal abscissa of the radius is dilated below. The abdominal petiole is longer than usual.

EVANIIDÆ.

*Evania wurseana*, sp. nov.

Black, covered with a white down; wings clear hyaline, the nervures black; the metasternal process stout, long, widely diverging. ♀ and ♂.

Length 6-7 mm.

Quetta. June to August.

Face shining, strongly but not closely punctured; the sides of clypeus widely depressed, the central part gradually narrowed towards the apex, which is transverse. Malar space smooth, fully half the length of the eyes. Front and vertex almost impunctate; smooth, shining; from the ocelli a deep furrow runs down to the antennæ; below the middle they curve obliquely inwardly, then run parallel, close to each other, downwards; outside these a narrower furrow runs obliquely from the outerside of the ocelli to the outerside of the antennæ. Hinder ocelli separated from each other by a distinctly greater distance than they are from the eyes. Middle of mesonotum strongly, deeply, closely punctured; the sides almost impunctate; the furrows deep. Scutellum strongly, but not very closely, punctured all over. Metanotum strongly reticulated, more closely at the base; the apical slope covered with white pile. Abdominal petiole smooth, shining. Antennal scape long, as long as the pedicle and the following joint united; these two united are as long as the 4th and 5th joints united. Tibiæ and tarsi sparsely, minutely spinose. The base and lower part of the propleuræ are strongly deeply punctured, the

apex above smooth. The basal, upper half of the mesopleuræ is smooth and shining; the raised lower part bears round, clearly separated punctures, the apex bears stout, longitudinal keels and is more or less reticulated.

The tarsi are covered with a dense white pile; the long spur of the hind tibiæ does not reach to the middle of the metatarsus by a perceptible space; it is as long as the 2nd joint. Sides of thorax at the base broadly rounded, as are also the sides of median segment. Temples short, sharply oblique.

The ♂ is similar; it is, if anything, more densely pilose.

This species, in Schletterer's tables, as regards the ♂, would come in near *E. verrucosa*, Schl.; the ♀ near *E. princeps* with which it cannot be confounded. In size and appearance it is not unlike *E. appendigaster*, but that has not the tibiæ and tarsi spinose and the scutellum is not strongly and closely punctured as it is in the present species.

*Gasteruption baluchistanense*, sp. nov.

Black, the 2nd to 5th abdominal segments red; a line on the underside of the four anterior tibiæ and tarsi and a short ring near the base of the hind tibiæ, white; the end of the sheaths of the ovipositor white; wings clear hyaline, the nervures and stigma black. ♀ and ♂.

Length 13; terebra 15 mm.; ♂ 11 mm.

Quetta. May-July.

Head and thorax densely covered with white pubescence. The 3rd joint of the antennæ is distinctly shorter than the 4th; it and the 2nd together are not much longer than the 4th. The apex of the clypeus is shortly, roundly incised; the centre is depressed. Malar space as long as the 2nd antennal joint. Eyes parallel, not converging. Hinder ocelli separated from each other by double the distance they are from the eyes; the anterior half of the hinder are placed behind the eyes. Temples long, roundly narrowed. Occiput roundly incised, sharply margined. Collar short, as long as the width at the apex. Middle lobe of mesonotum somewhat strongly, but not very closely, punctured; the lateral are much more sparsely and finely punctured. Scutellum sparsely punctured along the sides. Metanotum irregularly reticulated, more widely and distinctly on the apex than on the base; on the apex are 2 longitudinal keels. Pro- and mesopleuræ finely rugose, densely covered with white pubescence; the apex of the latter is smooth above; the lower part is striated; the striæ are clearly separated.

In one specimen there is a white line on the apical half of the metatarsus. The upper discoidal cellule is closed and is longer than the lower. Comes near to *G. sabulosum* in Schletterer's arrangement.

*Gasteruption quettaense*, sp. nov.

Length 7-8 mm. Ovipositor longer than the body.

Quetta. May to August.

This species is much smaller than the preceding; has the abdomen much less narrowly red; may otherwise be known by the occiput not being incised, but transverse.

Head smooth, the upper part sparsely, the lower thickly covered with white pile. Hind ocelli separated from each other by double the distance they are from the eyes; they are placed slightly behind the hinder edge of the eyes. Temples about one-half the length of the eyes, roundly narrowed behind. Malar space about as long as the pedicle of the antennæ. Thorax alutaceous, opaque, covered with a white down; the metanotum almost rugose, a smooth shining line down its centre. The lower part of the propleuræ is shining, sparsely punctured and is separated from the upper part by a narrow furrow. The 3rd antennal joint distinctly shorter than the 4th; it is twice the length of the pedicle, the scape is not twice longer than wide. The 4 front tibiæ and tarsi are for the greater part white; there is a narrow white line at the base of the tibiæ and a wider one on the base of the metatarsus.

The amount of red colour on the abdomen varies; the ♂ appears to want the white mark on the metatarsus. Probably the quantity of white colour on the 4 anterior tibiæ and tarsi varies. The stigma is fuscous; the posterior discoidal cellule is shorter than the anterior. The punctuation on the thorax is sparse, but distinct.

BRACONIDÆ.

*Microgasterinæ.*

*Dapsilotoma*, gen. nov.

Antennæ 36-jointed. Radial cellule long, narrow, lanceolate, extending to the apex; areolet triangular, the basal nervure roundly curved, the apical straight, oblique; transverse median nervure received distinctly beyond the transverse basal; the recurrent nervure in the 1st cubital cellule clearly distant from the first transverse cubital. Basal abscissa of cubitus distinct. Eyes hairy; there is a distinct malar space. Clypeus separated from the face by a narrow furrow. Median segment reticulated, keeled down the middle. Basal two abdominal segments longer than the others; the 1st longer than wide, longer than the 2nd, which is square.

There is a crenulated furrow on the mesopleuræ; the legs are stout, the spurs short; the stigma large, broad; the radius issues from its middle; there is a distinct cubitus and radius in the hind wings. Ovipositor short, its sheath broad.

This genus should be readily known by the large number of joints in the antennæ. 28 is the largest number hitherto recorded, namely in the Brazilian genus *Oligoneurus*, the other genera having from 14 to 21 joints. The affinities of my genus are with *Microgaster* and *Microplitis*.

*Dapsilotoma testaceipes*, sp. nov.

Black, the flagellum of antennæ rufo-fuscous; the legs rufo-testaceous; the coxæ black; wings hyaline; the costa and apical two-thirds of stigma black, the base of stigma white, the nervures testaceous. Mandibles and oral region rufous; the palpi testaceous. Head and thorax obscurely, minutely punctured, covered with a white down. Metanotum strongly reticulated; the upper side of the pleuræ obliquely, closely striated. Abdomen smooth,

shining; the centre of the 1st segment raised, clearly separated from the sides. Hind tarsi stout, pilose; the metatarsus slightly longer than the following two joints united; the long spur of the calcaria about one-third of its length; the last joint of the hind tarsi is longer than the penultimate; the pulvillus large ♀.

Length 2½ mm.

Quetta. June.

*Protapanteles? nigrescens*, sp. nov.

Black, smooth and shining, covered with a white down; the base of 4 hinder tibiæ and anterior tibiæ and tarsi testaceous as are also the palpi; wings clear hyaline; the costa and stigma fuscous, the nervures pale. ♀

Length 2 mm.

Quetta. August.

Antennæ much longer than the body, stout, the joints elongated, the 3rd shorter than the 4th. Face with a broad smooth, impressed line down the middle. Eyes densely haired. Mesonotum and scutellum minutely shagreened; the metanotum smooth and shining. Central region of 1st abdominal segment narrowed towards the apex; the sides are paler coloured; the 2nd segment with oblique furrows enclosing a triangle, the apex of which is at the base of the segment.

Except that apparently *Protapanteles* does not possess grooved lines on the 2nd abdominal segment this species agrees better with it than with any of the Ashmeadian genera. *Protapanteles* is not adopted by Szepligeti, who sinks also 4 other of Dr. Ashmead's genera. Cf. Gen. Ins. Brac. 105.

CARDIOCHILINÆ.

*Cardiochiles nigricollis*, sp. nov.

Black, the apex of the fore femora and their tibiæ and tarsi testaceous; wings hyaline, the apex of the anterior from the 2nd transverse cubital nervure and the apex of the posterior more narrowly, dark fuscous; the stigma and nervures black. ♂.

Length 6 mm.

Quetta. May.

Smooth and shining, except the metanotum, which is coarsely rugosely punctured. In the centre of the latter is a large area which is wide in the middle, gradually narrowed to a sharp point at the base and apex; its sides are bordered by a stout keel. Pro- and mesopleuræ smooth and shining; their apices crenulated; below the middle of the latter is a curved striated band. Metapleuræ rugosely punctured, more strongly below than above.

The occiput is transverse. Middle of mandibles testaceous. Suturiform articulation and the oblique furrows on the 2nd abdominal segment deep, clearly defined. Calcaria black, the long spur of the hinder reaching to shortly beyond the middle of the metatarsus; the tarsal joints are densely pilose below.

*Cardiochiles erythronotus*, sp. nov.

Black, the mesonotum red; the apex of the fore femora, the tibiæ and tarsi

and a narrow band on the base of the middle tibiæ and the calcaria rufo-testaceous. Wings hyaline, the apex smoky from the apex of the stigma; costa and stigma black, the middle nervures testaceous. ♂.

Length 5 mm.

Quetta. May.

Smooth, shining, densely covered with white pubescence; the base of the metanotum irregularly rugose; the areola widely separated from the base, semicircular. Pro- and mesopleuræ smooth; the meta-smooth at the base; the rest closely rugosely reticulated-punctured; the centre at the base with 3 longitudinal keels. Temples roundly dilated; the occiput roundly incised.

Apart from the differences in colouration this species may be known from *C. nigricollis* by the areola being semicircular and by the occiput not being tranverse. In colouration it agrees with *C. ruficollis*, Cam., from Bombay. The differences between them may be expressed thus:

| | |
|---|---|
| Areola extending from the base to the apex of the segment, widened in the middle, narrowed towards the base and apex; a large square area on either side; occiput transverse; calcaria black ..... | *ruficollis.* |
| Areola not extending from the base to the apex, semicircular; no area on either side; occiput not transverse, calcaria testaceous..... .. | *erythronotus.* |

*Ruficollis* has the pubescence denser and longer, and the tubercles are red.

CHELONINÆ.

*Chelonus areolatus*, sp. nov.

Black, the 4 anterior knees, tibiæ and tarsi, the basal half of the hind tibiæ and the base of the tarsi narrowly, yellowish testaceous; wings hyaline, the costa and nervures pale testaceous, the stigma black. Base of metanotum with a large area, somewhat longer than wide, in the centre; it is slightly roundly narrowed at the base and apex. ♀.

Length 3 5 mm.

Quetta. May.

Antennæ 20-jointed. Face closely punctured; the clypeus shining, its apex depressed, broadly rounded. Front and vertex finely, closely punctured; below the ocelli finely closely transversely striated. Mesonotum finely closely punctured; the apex and sides of the scutellum closely striated. Metanotum closely rugosely punctured-reticulated; in the centre are 2 keels, roundly curved at the base, forming an area which is longer than broad; it is irregularly reticulated and has a stout keel down the centre; the apical slope is closely, strongly punctured; the lateral teeth short, broad. Pleuræ closely punctured, more or less striated. Radius short, not reaching to the apex of the basal third of the apical part of the wings; it is roundly curved; the basal two abscissæ are equal in length. Striation-reticulation on the abdomen strong at the base, becoming gradually weaker towards the apex.

*Chelonus fortispinus*, sp. nov.

Black, the apex of the 4 anterior femora, their tibiæ and tarsi testaceous, a broad band at and behind the middle of the hind tibiæ, the basal two-thirds

of the metatarsus and the calcaria, white. Wings hyaline, the costa, stigma and apical nervures black, the basal nervures and metatarsus white. ♀.

Length 5 mm.

Quetta. August.

Antennæ 28-jointed and over, as long as the body. Face transversely rugosely punctured. Clypeus closely punctured, broad at the base, gradually narrowed towards the apex; the latter is smooth, transverse. Malar space closely transversely rugose. Sides of front stoutly obliquely striated; the sides of the vertex longitudinally rugose, the posterior part transversely striated. Mesonotum longitudinally rugosely punctured, most strongly and coarsely behind. Middle of scutellum smooth at the base, the rest rugosely punctured; its sides keeled. Apical slope of metanotum keeled above, its sides projecting into sharp, longish teeth; the base is deeply depressed, crenulated; the basal part is closely reticulated; in the centre are 3 longitudinal keels, of which the central is thinner than the others; the apical slope is closely, strongly transversely reticulated-punctured. Propleuræ closely reticulated-punctured, below, at the base, striated. Mesopleuræ closely, the metapleuræ more strongly and widely reticulated. Base of abdomen strongly longitudinally striated, intermixed with weaker transverse striæ; the striæ are strongest at the base; the striæ are continued to the apex, becoming gradually weaker. The transverse basal nervure is thickened and white at its junction with the stigma; the basal abscissa of the radius is thickened and is not much shorter than the 2nd; the 3rd does not reach to the middle of the space between the stigma and end of wing and is slightly, but distinctly, longer than the 2nd abscissa of cubitus; the recurrent nervure is interstitial.

The puncturation and striation vary in strength.

MACROCENTRINÆ.

*Macrocentrus rufo-testaceus*, sp. nov.

Rufo-testaceous, the metanotum and the greater part of the back of abdomen black; legs rufo-fulvous; flagellum of antennæ blackish, the basal joints fuscous; wings clear hyaline, the stigma fuscous, its base broad, the apex narrowly white; nervures testaceous. ♀.

Length 4; terebra about 2 mm.

Quetta. July.

Smooth and shining; the median segment thickly covered with white pubescence. Middle lobe of mesonotum clearly separated; the part at its apex rugosely striated. Third joint of antennæ clearly longer than the fourth. Second cubital cellule much narrowed at the apex; the lower part of the 1st transverse cubital nervure and the 2nd abscissa of the cubitus at the base are faint, almost obliterated, the latter on the basal half; the transverse median nervure is received shortly beyond the transverse basal.

*Macrocentrus fuscipes*, sp. nov.

Black, shining, smooth, the legs fuscous; the 4 anterior paler, more testaceous in colour than the hinder pair, the coxæ black; clypeus and mandibles, except

the teeth, fulvo-testaceous; palpi fuscous; wings hyaline, the stigma and nervures fuscous; the base of the former broadly, its apex narrowly white. ♂.

Length 4 mm.

Quetta.

Antennal scape black, suffused with testaceous; the flagellum blackish, paler below, densely covered with a short pile; its first joint is not much longer than the second. Metanotum closely transversely striated, the base smooth and shining; the smooth part triangularly dilated laterally. Pro- and metapleuræ shagreened; the base of the former is testaceous below; the mesopleuræ obscurely punctured below. The lower part of the 1st transverse cubital and the basal half of the 2nd abscissa of the cubitus are pale.

BLACINÆ.

*Orgilus nigromaculatus*, sp. nov.

Rufo-testaceous, antennæ, ocelli, median segment except for a broad band on the sides, narrowed behind, a large mark on the apex of the mesopleuræ in the centre, a mark in the middle of the 1st abdominal segment, the apex of the 2nd and the greater part of the others, black. Anterior legs rufo-testaceous, their coxæ black at the base; the middle black, the coxæ, femora and base of tibiæ broadly dark red; the posterior black, the base of the femora and tibiæ dark red; the calcaria rufous. Wings clear hyaline, the costa and stigma black; the nervures white. ♀.

Length 4 mm; terebra 2 mm.

Quetta. May.

Densely covered with a white pile; minutely closely punctured. Antennæ 29-jointed; the third joint a little shorter than the 4th; the flagellum densely covered with a dense white pile. Malar space fully as long as the antennal scape. Clypeus less closely punctured than the face and more shining; its apex is broadly rounded. Scutellum broader than long, its apex broadly rounded. Metanotum sparsely irregularly striated, its base depressed. Pleuræ closely punctured; the lower part of the mesopleuræ smooth and shining; the longitudinal furrow wide, crenulated. First abdominal segment sessile, slightly widened towards the apex; it is nearly as long as the 2nd and 3rd united; these are wider than long; the 2nd longer than the 3rd; it has a narrow smooth line down the middle. Calcaria short. Stigma broad compared with its width

The transverse median nervure is received beyond the transverse basal; it is therefore an *Orgilus sensu str.*

BRACONINÆ.

*Bracon quettensis*, sp. nov.

Rufo-testaceous, palpi, antennæ, a large spot on the sides of mesonotum at the scutellum at the base, base of metanotum broadly, mesosternum, a mark at the base of the basal 2 abdominal segments and the sheaths of the ovipositor, black. Wings light fuscous, the stigma and costa testaceous, the nervures of a darker testaceous colour. ♀ and ♂.

Length 3 mm, the ovipositor slightly longer.

Quetta. May to August.

Shining, the head and thorax smooth ; the abdomen closely minutely punctured and striated. Body and legs thickly covered with short white pubescence. There is no area on the base of the 2nd abdominal segment. Sheaths of ovipositor thickly covered with short stiff black hair.

The amount of black on the legs varies. In the male they may be testaceous with the femora lined above with black ; the apex of the tibiæ broadly and the tarsi black. The mark on the base of the metanotum may be entire or divided ; its stigma, too, is darker. The apical abscissa of the radius is about one-fourth longer than the basal two united.

*Bracon iridipennis*, sp. nov.

Rufo-testaceous, the antennæ, ocellar region, palpi, mandibles, occiput broadly, apical half of mesonotum broadly on the sides, sternum, metanotum, the basal abdominal segment and the others, less distinctly in the centre, black. Legs black, the knees broadly testaceous, the spurs black. Wings hyaline, highly iridescent, the stigma dark fuscous, the costa and nervures black. ♂.

Length 3 mm.

Quetta. May.

Head and thorax smooth and shining, sparsely covered with white pubescence. The 2nd and 3rd abdominal segments are closely finely punctured, more or less obscurely striated laterally. Third abscissa of radius nearly twice the length of the basal two united. Suturiform articulation and the furrow at the base of the 3rd segment closely striated.

Apart from the differences in colouration this species should be known from *quettaensis* by the longer third and shorter second abscissa of the radius.

*Vipio nursei*, sp. nov.

Rufous, the antennæ, ocelli, a small spot on the base of the middle lobe of the mesonotum, a broad line on the apical half of the lateral, the meso- and metasternum, the 4 hinder coxæ below and the posterior at the apex above, the apex of the hind tibiæ and the hind tarsi, black. Wings dark fuscous, the nervures, costa and apical half of the stigma black, the basal half of the latter yellow. ♀ and ♂.

Length 8-12 mm.; terebra 4·0 mm.

Quetta. June—August.

Face minutely closely punctured ; malar furrow distinct ; there are a few long hairs over the clypeus. Mandibles covered with long fulvous hair. Thorax smooth ; the metanotum punctured, but not closely or strongly ; the apical slope with a shallow furrow. Basal two abdominal segments coarsely rugosely punctured ; the 3rd less strongly on the basal two-thirds, the 4th on the basal half. The basal triangular area on the 3rd segment smooth ; the furrows, tranverse and the curved ones on the base of the 3rd crenulated ; the apical segments are smooth. Hypopygium large, cultriform, projecting largely beyond the dorsal segment. The middle ventral segments are marked with black.

The ♂ is similar. In size the species varies considerably.

*Vipio unicolor*, sp. nov.

Rufo-testaceous, the flagellum of antennæ black; the wings fuscous, with the usual hyaline spots, the basal half of stigma ochraceous. ♀.

Length 13 mm.; terebra 28 mm.

Quetta. August.

Face closely punctured, the front and vertex smooth. Mesonotum strongly, but not closely punctured; the scutellum almost impunctate. Metanotum deeply closely punctured, almost reticulated in parts. Pleuræ smooth. Basal 3 abdominal segments closely rugosely reticulated-punctured; the furrows closely crenulated, wide.

(*To be continued.*)

# BIRDS OF THE PROVINCES OF KASHMIR AND JAMMU AND ADJACENT DISTRICTS.

By

A. E. Ward.

## Part I.

Years ago I made out a list of birds that might be found in the Jammu and Kashmir State, but as research progressed it was found needful to add many and to eliminate a few. From this list a catalogue was prepared, in 1903, for the use of the Pratab Singh Museum of Srinagar, during the last two years progress has been made with the collections and as the catalogue has now been brought up to date I venture to publish it in the Bombay Natural History Journal.

Probably some few additions may have to be made, and possibly it will be hereafter found that a few birds will have to be struck out, at present it is preferable to keep these on the list with the remark 'doubtful' against them.

The area dealt with is approximately 70,000 square miles; from the plains of Jammu to the Mountains of Ladak and Baltistan, &c., is a far cry, and every variety of climate is met with, hence we naturally expect to meet with a large number of birds. Many migrate through Kashmir in the spring, of these some stay to breed in Baltistan, Gilgit and Ladak whilst others doubtless go to far distant countries.

Some few of the species entered are excessively rare, and this claim to entry depends on one or two occurrences only. We have still a good deal to learn regarding the breeding places of larks, finches, chats, thrushes and warblers.

Order: Passeres. Fam: Corvidæ.

(1). *Corvus corax.*—The Raven, is common in Ladak and Baltistan, confined to high altitudes. A single specimen was shot at Chattasgul, Sinde Valley, during a severe winter.

(3). *Corvus corone.*—The Carrion-crow, is resident in Kashmir, nowhere have plentiful. Eggs have been taken in May and June in the side valleys at altitudes varying from 8,000′ to 10,000′.

(4). *Corvus macrorhynchus.*—The Jungle-crow, is the commonest crow in Kashmir, &c. Breeds from March to May from 5,000′ to 9,000′.

(5). *Corvus frugilegus.*—The Rook, is migratory, and is found on the banks of the Jhelum and on the Murree Road in winter only. Mr. Blunt shot two near the Anchai Lake in winter 1905.

(6). *Corvus cornix.*—The Hooded-crow, is a rare visitor; observed in Gilgit and near Domel, Jhelum Valley. A single specimen shot Febuary 1905 in Srinagar.

(7). *Corvus splendens.*—The Indian House-crow, is chiefly confined to Srinagar in Kashmir, but, of course, is common in the low country.

(9). *Corvus monedula.*—The Jackdaw, is abundant; eggs are found in the early spring, this bird ascends to about 8,000′, but, as a rule, breeds in the main valleys.

(10). *Pica rustica.*—The Magpie, is excessively rare in Kashmir and the only record is from the Sinde Valley. Very common in Ladak and parts of Baltistan. Eggs taken May and June.

(13). *Urocissa flavirostris.*—The Yellow-billed Blue Magpie, is common in Kashmir and the neighbouring districts, eggs found throughout May and June at elevations of about 6,000′ to 7,000′.

(16). *Dendrocitta rufa.*—The Indian Tree-pie, is apparently confined to Jammu.

(18). *Dendrocitta himalayensis.*—The Himalayan Tree-pie, is found in the Jhelum Valley, a solitary specimen recorded from Kashmir Vale Febuary 1905.

(26). *Garrulus bispecularis.*—The Himalayan Jay, obtained at Allahabad, Sarai Poonch, at 8,000′ in April and September. Breeds in the outer ranges.

(24). *Garrulus lanceolatus.*—The Black-throated Jay. Common in Poonch and the outer ranges.

(28). *Nucifraga multipunctata.*—The Larger-spotted Nut Cracker. Common in the larger forests. Breeds from May to July at altitudes varying from 8,000′ to 10,000′.

(29). *Graculus eremita.*—The Red-billed Chough, descends into the main valley in winter; in summer breeds at about 12,000′, in Ladak, but at lower elevations in Kashmir. Eggs taken on May 14th in Ladak; young birds on Gangong, 26th June.

(30). *Pyrrhocorax alpinus.*—The Yellow-billed Chough, is found at 5,500′ in winter but ascends to great altitudes in summer; it is said to breed in inaccessible cliffs in May and June. This bird is often caught in winter in traps set round carrion for foxes, &c.

(31). *Parus atriceps.*—The Indian Grey Tit, is common.

(34). *Parus monticola.*—The Green-backed Tit, is common.

(35). *Ægithaliscus erythrocephalus.*—The Red-headed Tit, appears to be confined to moderate altitudes, when it is plentiful.

(37). *Ægithaliscus leucogenys.*—The White-cheeked Tit, is resident in Kashmir and is found in Gilgit and Baltistan.

(38). *Ægithaliscus niveigularis.*—The White-throated Tit, is rare. Three were obtained in willow trees on February 19 at 6,000′ and one at 11,000′ on 25th August 1905.

(40). *Sylviparus modestus.*—The Yellow-browed Tit, recorded from Kashmir and Kishtwar.

(42). *Machlolophus xanthogenys.*—The Yellow-cheeked Tit, not observed personally but is recorded.

(44). *Lophophanes melanolophus.*—The Crested Black Tit, is a common bird at about 7,000'.

(47). *Lophophanes rufinuchalis.*—The Simla Black Tit, is widely distributed at various altitudes.

(49). *Lophophanes dichrous.*—The Brown-crested Tit. I am very *doubtful* about the locality of a specimen said to have come from Kishtwar.

FAM: CRATEROPODIDÆ.

(76). *Garrulax albigularis.*—The White-throated Laughing-Thrush, is recorded from Domel, Jhelum Valley Road.

(80). *Ianthocincla rufigularis.*—The Rufous-chinned Laughing-Thrush, a solitary specimen recorded from the Lolab.

(82). *Trochalopterum erythrocephalum.*—The Red-headed Laughing-Thrush, is said to be found in Badrawar.

(91). *Trochalopterum simile.*—The Western Variegated Laughing-Thrush, is widely distributed in the Kashmir side valleys, eggs found as late as 8th August 1904.

(99). *Trochalopterum lineatum.*—The Himalayan Streaked Laughing-Thrush. This bird is fairly common throughout Kashmir; constructs its nest amongst bushes; it is also found in Gilgit and Baltistan.

(105). *Argya caudata.*—The Common Babbler, is found in the outer ranges.

(110). *Crateropus canorus.*—The Jungle Babbler, is chiefly confined to the Jumna Province but is found in the Jhelum Valley up to an altitude of about 4,000'.

(116). *Pomatorhinus schisticeps.*—The Slaty-headed Scimitar Babbler, *doubtful.*

(129). *Pomatorhinus erythrogenys.*—The Rusty-cheeked Scimitar Babbler, specimens have been obtained from Tret below Murree, and a single bird within Kashmir territory from near Kohala.

(139). *Pyctorhis sinensis.*—The Yellow-eyed Babbler, found in Poonch and is probably common in Jammu.

(174). *Stachyrhidopsis pyrrhops.*—The Red-billed Babbler, is found on the outer ranges.

(187). *Myiophoneus temminckii.*—The Himalayan Whistling-Thrush, found throughout Kashmir and neighbouring districts at various altitudes up to 12,000', eggs are to be found in May and June at considerable elevations and in April at lower altitudes.

(191). *Larvivora brunnea.*—The Indian Blue Chat. This bird breeds in Kashmir up to an altitude of about 8,000'; eggs obtained in June and July; the eggs are blue.

(199). *Hodgsonius phœnicuroides.*—Hodgson's Short-wing. Eggs found in the Liddar Valley in June generally at altitude about 8,000'. Eggs deep blue.

(204). *Lioptila capistrata.*—The Black-headed Sibia, a fairly common bird but all our specimens are from the lower ranges bordering on the Plains.

(226). *Zosterops palpebrosa.*—The Indian White-Eye, is numerous in Poonch and Jammu, less so in Kashmir Proper, breeds in April in Kashmir.

(237). *Pteruthius erythropterus.*—The Red-winged Shrike-Tit, is to be found on the Murree Road.

(259). *Leptopœcile sophiæ.*—Stoliczka's Warbler-Tit. I have never secured a specimen in Kashmir but this is a fairly common bird on the Shyok Ladak, and on the Indus.

(260). *Cephalopyrus flammiceps.*—The Fire-cap, is plentiful, breeds in May and June at altitudes up to about 8,000′, perhaps higher.

(269). *Hypsipetes psaroides.*—The Himalayan Black Bulbul, common.

(283). *Molpastes intermedius.*—The Punjab Red-vented Bulbul, is found in Poonch and Jammu.

(284). *Molpastes leucogenys.*—The White-cheeked Bulbul, is very plentiful.

FAM: SITTIDÆ.

(316). *Sitta cinnamomeiventris.*—The Cinnamon-bellied Nuthatch, a fairly common bird in Kashmir. Eggs taken at 7,000′ in May.

(320). *Sitta kashmirensis.*—Brooks's Nuthatch, obtained on the Haji pir, April 15th.

(323). *Sitta leucopsis.*—The White-cheeked Nuthatch, is fairly common in Kashmir, Baltistan and Gilgit. Eggs taken at about 7,500′ in the Seddar Valley in May.

FAM: DICRURIDÆ.

(327). *Dicrurus ater.*—The Black Drongo. This drongo ascends the hills to about 7,000′ but generally nests not higher than at an altitude of about 6,000′.

(328) *Dicurus longicaudatus.*—The Indian Ashy Drongo. I have only observed this bird on the outer ranges.

FAM : CERTHIIDÆ.

(341). *Certhia himalayana.*—The Himalayan Tree-Creeper. Very plentiful at altitudes up to about 10,000′. Eggs taken in May.

(342). *Certhia hodgsoni.*—Hodgson's Tree-Creeper. This bird is found in Kashmir and Baltistan and in most parts of Kashmir at about 8,000′ up to the snows.

(348). *Tichodroma muraria.*—The Wall-Creeper, is a winter visitor, sometimes assumes the black feathers on the throat before migrating, but generally leaves as early as March.

(352). *Anorthura neglecta.*—The Kashmir Wren, breeds at elevations of about 7,000′ to 10,000′ in May and June. A nest found at about 10,000′ was under a pine log and was lined with feathers of the monal and musk deer hairs.

FAM: REGULIDÆ.

(358). *Regulus cristatus.*—The Goldcrest, cannot be considered a common bird in Kashmir, &c., but is found widely distributed. A specimen was obtained on March 2nd, in the Vale at about 5,500′.

FAM: SYLVIIDÆ.

Mr. Stuart Baker kindly identified a number of the specimens, but as before stated we have still much to learn regarding the breeding places of these birds. I am not at all confident of the list being complete.

(363). *Acrocephalus stentoreus.*—The Indian Great Reed-Warbler, breeds in Kashmir generally in June, and is to be found on the lakes, after breeding is sometimes met with in the side valleys but I have never found it later than October.

(366). *Acrocephalus dumetorum.*—Blyth's Reed-Warbler, is a summer visitor to the Kashmir Valley.

(367). *Acrocephalus agricola.*—The Paddy-field Reed-Warbler. I have never found the nest of this bird in Kashmir although my collectors have searched carefully.

(369). *Tribura major.*—The Large-billed Bush-Warbler, found in Kashmir, Baltistan and in Ladak in summer.

(371). *Tribura thoracica.*—The Spotted Bush-Warbler, recorded from Kashmir.

(374). *Orthotomus sutorius.*—The Indian Tailor-bird, found in Jammu Province but appears to be rare.

(382). *Franklinia gracilis.*—Franklin's Wren-Warbler. I have seldom obtained this bird in Kashmir.

(394). *Hypolais rama.*—Sykes's Tree-Warbler, doubtful.

(396). *Hypolais caligata.*—The Booted Tree-Warbler, migrates through Baltistan but appears to have been seldom secured.

(398). *Sylvia cinerea.*—White-throated Warbler.

(399). *Sylvia jerdoni.*—The Eastern Orphean-Warbler. I enter this on the strength of Fauna of India, Bird's, page 396, Vol. 1.

(401). *Sylvia althæa.*—Hume's Lesser White-throated Warbler. I cannot be sure of the correctness of the labelling, as the specimen I secured was marked "Shot, Kargil 4th May 1903, eggs taken."

(402). *Sylvia affinis.*—Indian Lesser White-throated Warbler, is a common bird in Kashmir in the summer where it breeds; it is also found in Baltistan.

(405). *Phylloscopus affinis.*—Tickell's Willow-Warbler. Breeds in Ladak at elevations up to 14,500' and also in Kashmir in June.

(406). *Phylloscopus tytleri.*—Tytler's Willow-Warbler, summers in Kashmir.

(407). *Phylloscopus tristis.*—The Brown Willow-Warbler. The eggs of this bird were taken in Ladak at high altitudes on 11th June and on 17th July.

(408). *Phylloscopus indicus.*—The Olivaceous Willow-Warbler.

(414). *Phylloscopus pulcher.*—The Orange-barred Willow-Warbler. I am doubtful whether the single specimen was rightly labelled "Kishtwar."

(415). *Phylloscopus proregulus.*—Pallas's Willow-Warbler. A common bird in Kashmir. Eggs found in Kashmir, 9,000', on 27th June.

(416). *Phylloscopus subviridis.*—Brooks's Willow-Warbler. I have not secured a specimen.

(418). *Phylloscopus humii.*—Hume's Willow-Warbler, breeds in Kashmir in the side valleys in May, June and July.

(421). *Acanthopneuste nitidus.*—Green Willow-Warbler.

(424). *Acanthopneuste magnirostris.*—The Large-billed Willow-Warbler. I have a single clutch of eggs obtained in Dashgam ravine at 6,000′. This is apparently a rare bird in Eastern Kashmir.

(428). *Acanthopneuste occipitalis.*—The Large Crowned Willow-Warbler, breeds in Kashmir at elevations of about 7,000′ to 8,000′ in June and July.

(429). *Acanthopneuste trochiloides.*—Blyth's Crowned Willow-Warbler. I have not found this bird in Kashmir; but as it occurs in Murree it is pretty sure to be a summer visitor.

(434). *Cryptolopha xanthoschista.*—Hodgson's Grey-headed Flycatcher Warbler.

(450). *Horornis pallidus.*—The Pale Bush-Warbler.

(455). *Horeites brunneifrons.*—The Rufous-capped Bush-Warbler. I have no specimens from Kashmir of either this or the pale Bush-Warbler, but both are undoubtedly to be found.

(458). *Suya crinigera.*—The Brown Hill-Warbler, common in Kashmir.

(462). *Prinia lepida.*—The Streaked Wren-Warbler, found in the outer hills, never observed in Kashmir Proper.

(466). *Prinia inornata.*—The Indian Wren-Warbler.

(*To be continued.*)

# FIRST HINTS ON COLLECTING BUTTERFLIES (BEING A SUPPLEMENTARY PAPER TO THE ARTICLES ON THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA).

By L. C. H. Young, B.A., F.Z.S., F.E.S.

I have never tried to write an article or series of articles before in what is called a "popular" manner, and I am quite aware that these I am now producing will have many faults from the popular point of view. Two have been pointed out to me by friendly critics of the first part which appeared in the last number of the Journal.

The first of these I am not at all inclined to admit, *viz.*, that I have given different names to certain insects to those which Indian collectors have been accustomed to for thirty years and more.

Now these articles are not intended for people who have been collecting butterflies for thirty years, nor even for much shorter periods, but for beginners only. From this point of view, it is only necessary to give one name, and that the right one. In fact, it is imperative not to give more than one, as it would merely confuse the reader for whom the article is intended; and an historical disquisition, explaining how the latest modern research in the sometimes rather obscure works of early naturalists leads us to conclude that a particular name has precedence over its synonyms, would be quite out of place, and can be found elsewhere. All I endeavour to do is to give a nomenclature which is not likely to be upset in our time.

The second criticism is a more reasonable one. That the series to be of real use to beginners should not merely teach them how to name their collections, but also how to make the collections first; and, with the permission of the editors, I propose to give very briefly a few hints on collecting.

*Hints on collecting Butterflies.*

There are two ways of collecting butterflies—one is to catch them, the other to breed them from the egg or caterpillar. The advantage of the latter is that you make sure of getting fresh specimens. On the other hand, very few of us in India have the leisure to do this properly, and most of us must be content with collecting the perfect insects only. I will deal with this process first. The first requisite is a net. There are apparently many different kinds of nets on the market; some evidently made expressly for beginners, since no one of any experience would ever buy them. The strongest form is made of thick steel wire with a loop at one end, through which the other end fits, this latter being in the form of a screw and fitting into a metal socket at the end of the stick or handle. On the other hand, this form is not very portable, and generally has to be made specially for you. The most practically serviceable is made of cane with two joints in it, so that it can be folded up and put in the pocket, if necessary, the ends fitting into a Y, the long arm of which fits on to the handle. The important thing is that the net should be circular.

The bag should be made of white or green leno, or any other colour, though, I think, these are the best, and are certainly the most easily procurable at short

notice. It should be of such a length that you can reach the bottom comfortably with your hand, not pointed, nor tapering, nor square, but gradually rounded.

It is best always to make one's own nets, and it requires very little skill as a seamster or seamstress. If, instead of fastening the leno itself to the frame of the net, a top of calico is made, it will last much longer.

The length of the stick or handle should be about that of an ordinary walking stick—I generally prefer it rather shorter. It should be remembered that though with a long stick you have a longer reach you have a much more uncertain aim.

There are two ways of catching an insect on the wing with a net. One is to hold it over your head and sweep downwards, bringing the net flat on the ground with the insect inside, but quite inaccessible. The other is to sweep sideways, and, having imprisoned the butterfly, to turn the wrist quickly, so that the bag of the net folds over the frame and closes the opening. I recommend the latter process. The first is bad for the net and necessitates kneeling on the ground, and holding up the end of the bag until the imprisoned insect chooses to fly to the top before you can get at him.

Having caught the specimen, the question arises, what to do with it? Some people carry pins with them, and, having pinched the thorax of the butterfly through the net so as to render it more or less powerless—though, as a rule, not actually killing it—pin it to the inside of their topies. Others carry a small cork-lined collecting box in their pockets to save their topies. Neither of these is to be recommended. If you try pinning an insect in the jungle when you are hot and dusty and with your hands, possibly trembling with excitement (why should they not be?), you will probably do it very badly; pinching often spoils an insect, and is, in practice, rather cruel.

Another way is to carry a killing bottle with you and inserting it from the bottom of the net, work it upwards till you are able to corner your fluttering prey in the mouth of it, and then fit the stopper in quickly. The disadvantages of this process are two. One is that, as soon as it is dead, the specimen starts shaking up and down in the bottle as you walk or run, and spoils itself. The other is that in the case of closely allied species it is often impossible to be certain of their identity through the meshes of the net, and you may in this way kill a number of common insects you do not want.

The method of avoiding all these difficulties is to carry a number of "pill-boxes" with glass bottoms of different sizes. These are readily procurable at any store where entomological apparatus is for sale, and cost, I believe, four a shilling at home, and properly cared for will last a dozen years. It requires no great skill to "box" the insect inside the net, and the glass bottom enables you to see what it is before killing it. They can in this way be carried home safely and put in the killing bottle at leisure. In boxing always have the end of the net uppermost, as a butterfly when it finds itself surrounded by anything from which it wishes to escape, whether long grass or green leno, always flies upwards.

The next requisite is a killing bottle. This can be obtained from any chemist, and is ordinarily made from cyanide of potassium, covered over to give a hard and dry surface with plaster of Paris.

These bottles will sometimes "sweat" in the monsoon, and, when this occurs, it is safest to get a new bottle at once, as a drop of the moisture on the wings of a dying insect will completely spoil it.

A good bottle should kill a butterfly or, at any rate, render it insensible in a minute, and if it takes much longer, it is time to renew the poison both from considerations of humanity, and because the less they flutter about in the bottle the less likely they are to injure themselves as specimens.

The insects become rather stiff when dead (though they are less so after twenty-four hours than after a longer or shorter period). Except during the monsoon, however, when they will always remain soft and pliant, it is best always to put the contents of the killing bottle into a relaxing tin for 12 hours before setting them. They should not be left much more than 12 hours in this climate or they will rot.

A relaxing tin is very simply made. An old cigarette tin will do with a thick pad of folded blotting paper at the bottom thoroughly soaked in water. The specimens only require to be laid on the top of it.

The next operation is setting, and for this purpose the collector must provide himself with a large store of the ordinary pin of commerce, a stock of two or three sizes of entomological pins, some thin strips of paper, and some setting boards. Before he can make or purchase his setting boards he must decide whether he is going to set his specimens in the "English" or "continental" fashion. I had better explain these terms. The following figure (Fig. 1) gives a sectional view of an "English" setting board :—

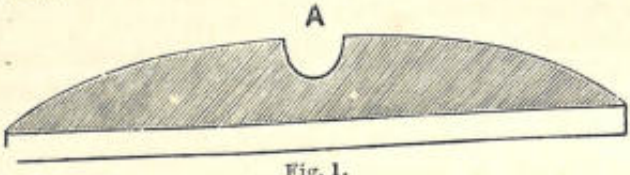


Fig. 1.

The shaded portion is cork, glued on to a thin strip of deal. A is the groove into which the body of the insect is pinned. The result of setting an insect on a board of this shape is that it will stand very low on the pin ; that is, when placed in the cabinet, it will be practically touching the cork and, in consequence, be more accessible to mites, grease or mould, or any other enemy that occasionally invades the cabinet, and further that there will be a great length of ugly pin above it, so that an "English" collection often looks as much a collection of pins as of anything else. Of course, you can have the boards specially made with a double thickness of cork, but even then the wings, having been bent in a curve to suit the rounded shape of the board, always have an untidy drooping appearance and look as though they had been taken off the setting board before they were dry. There is another drawback to English

set specimens. When packed away in collecting cases they cannot ordinarily be made to overlap, and this is a very important point for Indian collectors, who generally wish to pack up their collections as closely as possible, to send home.

The "continental" setting board is flat, and is either made with a great thickness of cork, or in the manner I am going to describe. The drawback to the "continental, method," pure and simple, is that continental entomological pins are too long for the depth of the drawers in the ordinary English-made cabinet, and owing to their length the finer qualities are very apt to get bent. The important point, however, is to have at least half an inch of pin protecting on the underside of the specimen, and personally I like to see as little pin on the upperside as is practicable.

The most preferable method is to use English pins and continental setting boards.

In Fig. 2 is shown one end of the kind of setting board I mean. It consists of two long strips of deal or other soft wood (AA) attached at the ends to legs such as (BB). (CC) is a small projecting foot to the leg by means of which the board may be slid into a groove in the setting case. A small space is left between the two strips (AA.)and on their underside a strip of cork is glued across it.

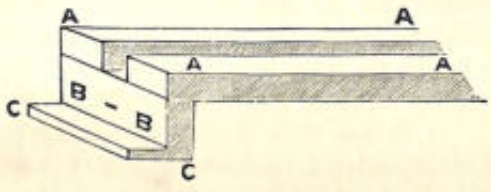

Fig. 2.

The body of the insect is placed in the space or groove between the (AA.) strips and its pin can pass right through the cork into the space below since the board is supported on two legs and the insect can thus be set as high on the pin as the height of the legs (BB.).

I do not think boards like these can be had readymade anywhere but the Society's carpenter has made me two setting-cases on this principle quite as well finished as the English-made model shown to him for a very reasonable price and is doubtless open to further orders.

The next requisite is entomological pins. There are only two makers of whom I have any experience, *viz.*, D. F. Tayler & Co. and Kirby. I will not give either the advertisement of a preference here but will only remark that for some reason—probably the terms of commission—dealers do not, as a rule, stock Tayler's pins and if you want them you must write direct to the factory in Birmingham. Kirby's pins can be got from any dealer.

Three different sizes will be all a beginner, who is collecting butterflies only, need purchase to start with. I would advise him also to purchase a pair of entomological forceps. He will probably find them a clumsy tool to start with but when once he is accustomed to them he will never think of handling an insect without them.

Armed with all this furniture and having properly relaxed our specimen we will now proceed to set it.

The first and most important operation of all is the pinning. If the rest of the setting is badly done it can always be relaxed and reset but if the insect is not pinned properly it will in 9 cases out of 10 be spoilt for all time. The pin should be inserted exactly through the middle of the thorax and perpendicular to it and the utmost care must be taken that it comes out exactly in the middle on the underside, *i.e.*, exactly between the middle pair of legs. If this is not done the legs will probably be broken off and the wings are almost certain to be put out of joint in the process of stretching them. It is almost equally important that the insect should be pinned exactly in the middle of the groove of the setting board and that the pin should be put in straight and not leaning forward or back or to one side. Not more than at most a quarter of an inch of pin should show above the thorax, just enough to catch hold of with the forceps. Pins are ugly. Unless these two operations are performed successfully the rest of the setting is mere waste of time so far as any hope of turning out a decent specimen is concerned.

The details of the process of stretching the wings on the boards will depend mainly on the attitude in which the insect died and are impossible to describe thoroughly. But supposing it has died with them closed above the body—the most common attitude for butterflies—take a strip of paper (E E in Fig. 3.), slide it between the wings, then put the forceps between them and press them open until you can get the strip (E F) flat and then pin it to the board at one end (D) (with the ordinary pin of commerce ; entomological pins will generally bend at once if you try to put them into any substance harder than cork).

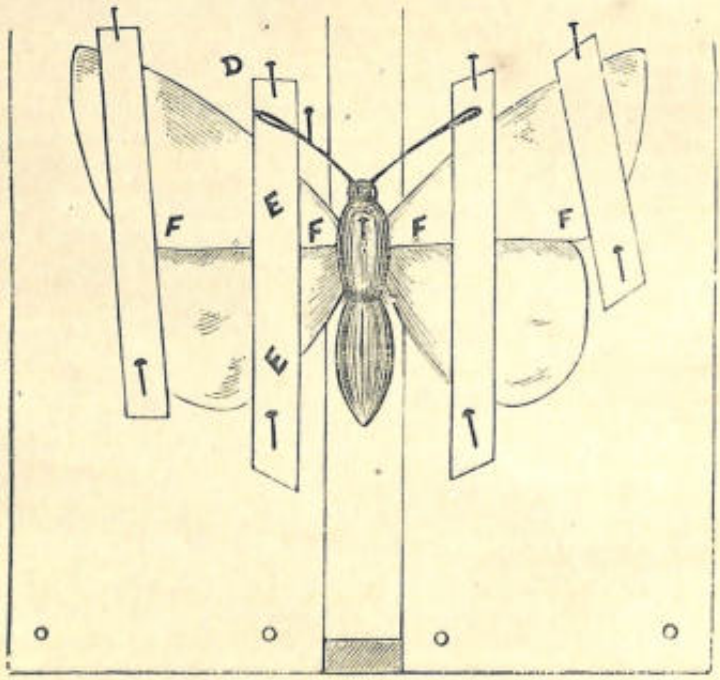


Fig. 3

Then take the other end of the strip in your fingers and hold it tight close to the board and gradually raise the wings to the required angle (as in Fig. 3) with the point of a needle, taking care that the point of the needle only catches against the stronger veins and does not actually pass through the wing. Generally speaking if this cannot be done easily the insect is not sufficiently relaxed but, of course, practice is required. This done pin the other end of the strip tightly. Except in the very small species a second strip is nearly always required to prevent the ends of the wings curling particularly in the case of relaxed specimens.

I have used the expression "raise the wings to the required angle"; the only way to set specimens so that the whole collection will be homogeneous, all the specimens being set with the wings at the same angle is to have the lower or inner margins of the forewings at right angles to the body so that the points (F F) in the figure are in a straight line. Then raise the hindwings until the pattern of the markings, if any, fit on to that of the forewings.

In I suppose by far the majority of butterflies there are bands or lines running continuously across both wings.

There are a few, but very few cases where it is impossible to fit the pattern of the hindwings on to that of the forewings if the latter are set at the angle described above (*Papilio sarpedon* is an instance in point); but it is worthwhile sacrificing the pattern for the sake of having the setting of the whole collection uniform.

In butterflies the legs are not as a rule visible from above and the only things left to arrange are the antennæ. These should be pinned wide open so as to lie close along the costa of the forewings. If they project at all they are almost certain to get broken off when the specimens are packed away closely in collecting cases or cabinets.

The setting is now finished and the specimen must be left to dry. This in the cold weather may take only 24 hours. In the monsoon, on the other hand, it may take a month and in a very wet season become almost impossible.

It will probably be less disappointing in the end to put all one's captures in the monsoon in papers at the time and relax and set them afterwards in the cold weather.

A drop of benzine on the insect will greatly assist the process of drying and does not injure the specimen in the least. It has the further advantage of absorbing or partially absorbing the greasy matter in the body and preventing the mischievous form of rot known as "greasing" setting in afterwards.

As soon as the specimen is dry the papers can be taken off and the insect put away in the cabinet or collecting box. People who have anywhere at home where they can send things to and any one there to look after them will be wise if they send their whole accumulations home every hot weather before the monsoon breaks.

Permanent or semi-permanent residents in the country will probably prefer to arrange their collections in cabinets. For such the principal enemy to be feared

is mould during the monsoon. A drop of carbolic acid on a tiny section of sponge pinned in the corner of each drawer so as not to touch the bottom or sides will keep this off fairly effectually but in addition it is as well to burn a sigari in front of the cabinet on wet days.

Another nuisance in connection with cabinets inseparable from the climate is that from the constant swelling and shrinking of the wood according to the humidity of the air the drawers will very soon become very ill-fitting. This can be partly avoided by "oiling" the grooves with ordinary black lead.

Another way of keeping off mould is by putting on the insect a drop of a mixture made by dissolving bichloride of mercury in spirits of wine. But if this touches the pin it will eat it away in a very short time and it is a process which needs very careful handling.

Every cabinet drawer or collecting box must contain naphthaline. In cabinets there is generally a groove made to contain it. In collecting boxes it should be tied up in a bag of muslin and firmly pinned in one corner. Naphthaline evaporates very quickly and needs constant replenishing.

Every specimen in the cabinet should have a small label attached giving the date, locality and altitude of the capture. Labels are very ugly and these should be made as small as possible so as looked at from above to be hidden by the wings.

A word now as to collecting butterflies by breeding. If you do not know the food-plant of a particular species and cannot find it out from any books, the only thing to do is to watch for a female which is fluttering slowly from bush to bush constantly settling and obviously egglaying and to follow behind, search till you find the egg deposited and make a note of the species of plant on which it was found. This is a most laborious process only pardonable in the interests of original research. When a collector discovers in this way the larvæ and food-plant of a species hitherto unknown he should make careful note of the facts and send a description of the larva to the Journal of the Society.

When the food-plant is known the collector can either search for the ready hatched larvæ upon it or else catch a female and keep her alive for a few days on sugar in the hope that she will lay some eggs. Butterflies are creatures that love the light and to make the latter process a success therefore she should not be shut up in the dark, but put in a box with a glass or muslin top to it.

Almost every one has bred caterpillars for amusement in his or her childhood and I need give very few hints on the subject. The main things to be considered in breeding caterpillars are the same as in breeding any other creatures *i.e.*, good food and clean sanitary quarters. Fresh food must be constantly supplied, never wet and not too dry and the box or whatever else they may be kept in should be regularly cleaned out. So far as possible never touch the caterpillars with your hands. Caterpillars do not mind the dark. Many prefer it and will not feed in the day time.

In the case of tree-feeding species, if you have the right tree in your own compound, by far the simplest way is to turn the larvæ loose on a branch

tie a bag of muslin tightly round it and leave them there till they pupate or have eaten all the leaves. This process is called slieving.

The keeping of pupæ or chrysalises in this country presents none of the difficulties experienced at home because the perfect insects emerge after a few weeks and there is no question of keeping them through the winter or in varying temperatures.

The only advice I have to give is—do not touch them.

I have suggested above that if the collector comes across the larva of any species which has not been previously described, he should send a record of it to the Society. The larvæ of I think all the species there will be any occasion to allude to in this series are familiar, but as a collector in any of the richer parts of the country might discover the previously unknown early stages of quite a number of species, it would be as well to give an outline of how to describe a larva, because a description of one which is not in accordance with the customary scientific methods is generally more or less unintelligible.

A larva is either smooth, hairy, spiniferous or tuberculous. If hairy it should be stated whether the hairs occur in tufts or not. If in tufts it will generally be found that those on the 2nd segment (or first excluding the head) and on the last, differ in size and colour from the rest. The same may be said of spines or tubercles. The ground colour should be stated first and then the colour of the tufts or spines and the colour of the head. On each segment above the legs are small trachæ or spiracles which are the breathing apparatus of the insect and are generally distinctively marked, and if so the colours should be described.

All other markings are generally linear and may occur in the following way: A central line down the back, called the dorsal line, a line or band through the spiracles on either side called the spiracular lines, narrow lines bordering the spiracular called the supra spiracular and subspiracular, and between these and the dorsal line two other pairs, the upper called the subdorsal and the lower the lateral. In any description it is extremely important to call these lines by their right names, and as they are generally not all present, the describer must judge for himself which those present actually are from their position. The dorsal and spiracular offer no difficulty and these are the ones most nearly universal.

The ground colour may also be spotted, and if the spots are few and conspicuous, the number, arrangement and colour on each segment should be stated.

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# NOTES AND OBSERVATIONS ON MAMMALS COLLECTED AND OBSERVED IN THE DARJEELING DISTRICT, INDIA.

By

Gordon Dalgliesh.

During a year's residence in the above district, where I was employed as assistant on a tea garden, I spent my spare time studying the mammals of that region. In those days I did not know the advantages of trapping, and all my specimens were either shot by myself or brought in by natives. The natives (Nepalese) I always found trustworthy and reliable, and were always willing to give their services when there was any shooting to be had, and many a pleasant day I have spent in their company in pursuit of game. My collecting and observations were confined from the base of the mountains to 8,000 feet elevation.

*Macacus rhesus*, And. The Bengal Monkey.

I found this species common at low elevations, and had several young ones brought to me; but they always came to an untimely end. They are a source of great annoyance to the natives, robbing their crops, and nothing seems safe from their mischievous fingers.

*Felis tigris*, Linn. The Tiger.

The tiger was common in parts of the Terai at the base, and an old tigress with two cubs once ascended the forest to 5,000 feet, and took up her quarters close to the Forest Ranger's house in Kurseong. Though much sought after, she was not shot.

*Felis pardus*, Linn. The Leopard or Panther.

The Leopard was common from the base right up to Darjeeling 8,000 feet. I have often heard them at night, and the sound they make is not unlike somebody sawing a piece of wood. They are especially fond of dogs, and have been known to snatch them off the verandahs in the evening before the eyes of their owners. I once saw the skin of a large python, and was told a half grown leopard had been taken out of its stomach.

*Felis nebulosa*, Griff. The clouded Leopard.

A pair of these beautiful animals' skins adorned the walls of a planter's house, and he informed me he had shot them on a garden about 4,000 feet.

*Felis bengalensis*, Ker. The leopard Cat.

A friend of mine had a pair of these handsome little cats in a large cage, with hopes of taming them. He was not successful, however, as they resisted all his efforts, and a pair of more nasty tempered little beasts I have never seen, always snarling and growling. I believe after a time they were given their liberty.

*Felis chaus*, Güld. The jungle Cat.

This cat was common at moderate elevations.

*Viverra zibetha*, Linn. The large Indian Civet.

I saw a beautiful specimen of this animal shot by my friend, Mr. Radford, on Ring-Tong Tea Estate, and have several skins offered me for sale by natives.

*Paradoxurus grayi*, Bennet. The Himalayan Palm-Civet.

The only specimen I saw of this was a hermaphrodite shot by a planter on a garden at 4,000 feet elevation, who was puzzled to know what he had got until I identified it for him.

*Herpestes mungo*, Gmel. The common Indian Mungoose.

Plentiful at low elevations.

*Canis aureus*, Linn. The Jackal.

Found from the Terai up to Darjeeling, but not in any numbers.

*Cyon dukhunensis*, Sykes. The Indian wild Dog.

Very common. One took up its quarters in some jungle near my bungalow, and used to howl every evening in answer to the bell calling the coolies in from work.

It once came right up on to the verandah in the evening, and on seeing me ran off. I tried several times to shoot it, but on these occasions it could not be found.

*Mustela flavigula*, Bodd. The Indian Martin.

I shot several of these in the forests at moderate elevations, and saw several others on the tea gardens. The native name for this animal is Mālsāmpra.

*Putorius subhemachalanus*, Hodgs. The Himalayan Weasel.

I had a skin of this species which I bought off a native in Darjeeling. This and the next species is also known to the Nepalese as Mālsāmpra.

*Putorius eathia*, Hodgs. The yellow-bellied Weasel.

I found this species common at elevations of 5,000 feet, and several were brought to me by my native collectors.

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The Leopard was common from the base right up to Darjeeling 8,000 feet. I have often heard them at night, and the sound they make is not unlike somebody sawing a piece of wood. They are especially fond of dogs, and have been known to snatch them off the verandahs in the evening before the eyes of their owners. I once saw the skin of a large python, and was told a half grown leopard had been taken out of its stomach.

*Felis nebulosa*, Griff. The clouded Leopard.

A pair of these beautiful animals' skins adorned the walls of a planter's house, and he informed me he had shot them on a garden about 4,000 feet.

*Felis bengalensis*, Ker. The leopard Cat.

A friend of mine had a pair of these handsome little cats in a large cage, with hopes of taming them. He was not successful, however, as they resisted all his efforts, and a pair of more nasty tempered little beasts I have never seen, always snarling and growling. I believe after a time they were given their liberty.

*Felis chaus*, Güld. The jungle Cat.

This cat was common at moderate elevations.

*Viverra zibetha*, Linn. The large Indian Civet.

I saw a beautiful specimen of this animal shot by my friend, Mr. Radford, on Ring-Tong Tea Estate, and have several skins offered me for sale by natives.

*Paradoxurus grayi*, Bennet. The Himalayan Palm-Civet.

The only specimen I saw of this was a hermaphrodite shot by a planter on a garden at 4,000 feet elevation, who was puzzled to know what he had got until I identified it for him.

*Herpestes mungo*, Gmel. The common Indian Mungoose.

Plentiful at low elevations.

*Canis aureus*, Linn. The Jackal.

Found from the Terai up to Darjeeling, but not in any numbers.

*Cyon dukhunensis*, Sykes. The Indian wild Dog.

Very common. One took up its quarters in some jungle near my bungalow, and used to howl every evening in answer to the bell calling the coolies in from work.

It once came right up on to the verandah in the evening, and on seeing me ran off. I tried several times to shoot it, but on these occasions it could not be found.

*Mustela flavigula*, Bodd. The Indian Martin.

I shot several of these in the forests at moderate elevations, and saw several others on the tea gardens. The native name for this animal is Mālsāmpra.

*Putorius subhemachalanus*, Hodgs. The Himalayan Weasel.

I had a skin of this species which I bought off a native in Darjeeling. This and the next species is also known to the Nepalese as Mālsāmpra.

*Putorius cathia*, Hodgs. The yellow-bellied Weasel.

I found this species common at elevations of 5,000 feet, and several were brought to me by my native collectors.

*Lutra sp.* ?

The natives told me of an animal which from their description must have been an Otter which they said was to be found in the Balasun River. I never got one, however.

*Ælurus fulgens*, Cuv. The red Cat-bear or Himalayan Racoon.

I once shot one of these curious animals in a forest at 5,000 feet elevation. To the natives it was well known.

*Ursus torquatus*, Wagner. The Himalayan black Bear.

Common from the Serai to Darjeeling.

The finest specimen I ever saw was shot by my friend, Mr. Radford, at 4,000 feet elevation. It measured 8 feet in length, and was, I believe, quite a record specimen.

I once tracked one for a long distance through the forest, but never saw it, much less got a shot. They do a considerable amount of damage to native crops.

*Tupaia ferruginea*, Raffles. The Malay Tree-Shrew.

One of these was once brought in to me, having been caught in a cage rat trap. At first I took it for a species of squirrel, *Sciurus locria*, which in colouring they closely resemble. I never got another one, so cannot say if it is common or not.

*Talpa micrura*, Hodgs. The short-tailed Mole.

I found this mole very abundant round Kurseong and Darjeeling, and the forest paths were infested with their runs. I used to get plenty of dead specimens after a heavy shower of rain, they having been drowned out of their runs. A native once brought me a live one, which when placed on the ground ran about nimbly, uttering the while a curious squealing note. The Nepalese often cut off the fore-paws, and wear them round their necks as charms. The native name is Ootany musa.

*Soriculus nigrescens*, Gray. The Sikhim brown-toothed Shrew.

I got several specimens of this little shrew at 5,000 feet. All of them were picked up dead.

*Crocidura murina*, Linn. The brown musk Shrew.

Common in the neighbourhood of houses. This and the next species are known to Anglo-Indians as "Musk Rat."

*Crocidura cærulea*, Kerr. The grey musk Shrew.

Very common, even more so than the last.

*Chimarrogale himalayica*, Gray. The Himalayan Water-Shrew.

This shrew I did not find common, and had a few specimens brought to me caught in mountain streams at 5,000 feet.

*Pteropus medius*, Temm. The Indian Fruit-Bat or Flying-Fox.

The "Flying Fox" is common in the warmer valleys at low elevations.

*Cynopterus marginatus*, Geoff. The short-nosed Fruit-Bat.

I had a few specimens taken for me at low elevations.

*Rhinolophus affinis*, Horsf. The allied Horse-shoe Bat.

I caught one specimen of this in a house in Kurseong.

*Megaderma lyra*, Geoff. The Indian Vampire Bat.

A native brought me one of these from the Terai.

*Pteromys magnificus*, Hodgs. Hodgson's Flying-Squirrel.

A native one day brought me a skin of this beautiful squirrel, taken in the forest at 5,000 feet, and I was told by some charcoal burners that when at work they frequently came across it; but I never got another, though I looked specially for it.

*Sciuropterus pearsoni*, Gray. The hairy-footed Flying-Squirrel.

The natives brought me a living specimen of this pretty little animal. It was found in the hole of a tree at 6,000 feet. I kept it for a few days, but it did not thrive, so I killed it. During the day it remained asleep, curled up in a ball, but became restless towards evening. An old native servant in my employ assured me that these squirrels often used to come after his peas when they were ripe. I think this species must be rare, as I never got a second one, though my men made a special search for it.

*Sciurus bicolor*, Sparrman. The large Malay Squirrel.

I shot several specimens of this handsome squirrel which I found common at 5,000 feet. A friend of mine once invited me to come and see a "Polecat" he had shot, and I was much disappointed to find it was one of these squirrels.

*Sciurus locria*, Hodgs. The orange-bellied Himalayan Squirrel.

Very common in the forests at 5,000 feet, and I shot a number of specimens.

*Sciurus macclellandi*, Horsf. The striped Himalayan Squirrel.

This species was common from quite low elevations to 5,000 feet.

*Gerbillus indicus*, Hardw. The Indian Gerbille or Antelope Rat.

Common at the base of the mountains, and I once caught a specimen among the tea at 5,000 feet.

*Mus rattus*, Linn. The common Indian Rat.

This was the common house rat of Darjeeling, and I never remember seeing *M. decumanus*. Nearly all the specimens I got of this were the variety *alexandrinus*.

*Mus musculus*, Linn. The common House-Mouse.

Common everywhere.

*Lepus ruficaudatus*, Geoff. The common Indian Hare.

I used to get several of these on some grassy hills near the forest house in Kurseong, and had some young ones brought to me, but I did not manage to rear them.

*Elephas maximus*, Linn. The Indian Elephant.

Common in parts of the Terai. An old female with her calf once ascended the forests to 5,000 feet, and I remember seeing her tracks along the forest paths.

*Bos gaurus*, Trail. The Gaur.

Common in the forests of the Terai. I saw some magnificent heads which had been brought from there in the Forest Officer's house in Kurseong.

*Cemas goral*, Hardw. The Goral.

The goral is common throughout the Darjeeling district. I think one must be very keen on sport to go out after goral often, as they inhabit the rockiest and most inaccessible places, and many a weary and long climb I had after them before I shot one. In the early mornings and evenings they leave the lower jungle, and come out to feed on the grassy plateaus. I found them very good to eat; their flesh tasted like mutton.

*Nemorhædus bubalinus*, Sclater. The Himalayan Serow or Goat-antelope.

I once surprised one of these animals as it was feeding one morning on a grassy plateau at 5,000 feet. To the natives it is well known, and they often shoot it. To sportsmen in Darjeeling it is known as "Tehr"—a name which really belongs to quite a different animal.

*Cervulus muntjac*, Zimm. The Barking Deer.

I found this little deer very common from low elevations up to 6,000 feet. Its curious barking cry is uttered frequently throughout the night, and the natives say it does this if there is a leopard about. The Nepalese shoot this deer with bows and arrows, and use dogs specially trained to drive them out of the jungle. It runs with its head very low down, and is very quick in its movements, reminding one of a gigantic weasel. The native name for this is Mirgah.

*Cervus unicolor*, Bech. The Sámbar or Rusa Deer.

The sámbar is common in parts of the Terai, and I have seen some splendid heads procured there.

*Cervus axis*, Erxl. The Spotted Deer.

Common in parts of the Terai.

*Sus cristatus*, Wag. The Indian wild Boar.

Common in the Terai and ascending the forests to moderate elevations.

*Manis aurita*, Hodgs. Chinese Pangolin.

I once bought a skin of one of these curious animals off a native, killed on Margaret's Hope Tea Estate at 5,000 feet. This was the only one I saw.

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# WHAT IS A SPECIES?

By

L. C. H. Young, B.A., F.E.S., &c.

There is no question, I suppose, more often asked the well-informed naturalist by an amateur than "What is a species?" Nor is there any probably which so often meets with an unsatisfactory reply.

Of course "the short answer which turneth away wrath" is that it is the unit of classification, but this as a rule hardly satisfies the needs of the inquirer, and moreover in these days of "subspecies," named varieties and "races" is in danger of being no longer true.

So confused has the problem become that a distinguished entomologist in a recent work has declined to use the word at all and calls all his units "forms."

The question really should be put in another way, "Is a species a natural division or is it a convention of systematists?"

Previous to the publication of the "Origin of Species," the existence in nature of the species was not seriously called in question, the belief in the separate creation of each form being general.

Darwin himself had a very clear notion of what he meant by a species, though like every one else he found it difficult to frame a definition in anything but Gladstonian language,—that is to say, in a form which was not capable of varied interpretation according to the predilections of the individual systematist.

Since Darwin's time however many naturalists have affected to ignore the problem on the ground that since it had been proved that all nature was in a state of constant flux there was obviously no such thing as finality in forms or terminal developments, and that a "species" as a unit in the natural kingdom was a superstition of the ancients. As a corollary to this, species being merely convenient conventions it was open to every man to multiply or divide them according to his own notions of convenience.

This kind of convenience has generally proved a great inconvenience to practical collectors and economic and field naturalists.

This is specially the case with tropical creatures. For instance no one with any knowledge of the Lepidoptera would have any hesitation in identifying a specimen of *Arctia caja* (the Common Tiger Moth), although it is a most variable insect, and it would be possible in one

season in England alone I suppose to collect at least 50 well-marked varieties. Tropical insects however although naturally more variable than temperate ones owing to many of them breeding continuously all the year round, have hitherto been far more rigorously defined, and the same entomologists who would have no difficulty with the 50 forms of *A. caja* would insist that a haphazard collection of, let us say, *Terias hecabe* made in one season in India alone contained 5 or 6 species at least. The truth is that most exotic insects have been described and named by eminent systematists in Europe who had no first-hand knowledge of the creatures themselves and were consequently obliged to rely on arbitrary distinctions and who have by no means always been willing to accept correction from the man on the spot.

Naturally it seems to collectors abroad that these gentlemen have taken their responsibilities too lightly, and acting on the belief that in nature there was no such thing as a species they have gone on multiplying names with the object of defining forms as rigorously as possible on a purely artificial basis.

It is remarkable that those who have been most ready to adopt or misinterpret the Darwinian theory in this direction have, as a rule, been by no means willing to apply it to the higher divisions of classification, or to attempt any historical or evolutionary treatment of nature as a whole.

The consequence of all this is that the nomenclature of practically the whole animal kingdom is now admittedly in a state of almost inextricable confusion.

Yet in spite of all this, probably every practical naturalist still has a deep-seated belief that there is really such a thing as a species, though he is often in difficulties as to individuals.

He argues that though it may be the case that if we had before us not merely every form that is now extant, but every form that ever did exist from palæozoic times there might be such a perfect gradation that every one would admit there was no such thing as a species—or genus, family, order or class either—yet as a fact the extant forms are not $\frac{1}{1000}$th part of the extinct in number, and that in consequence by far the majority are now so isolated from the disappearance of intermediates that really no one will dispute their existence either in nature or convenient arrangement.

When we come to analyse the remainder we find they practically fall into three classes:—

(1) "Species" which have been described from single specimens which exhibit no structural peculiarity and which should in most cases be treated as sports of the nearest known form until other specimens and both sexes have been captured.

(2) Nearly allied forms which appear to be complementary to each other through a series of geographical regions or subregions and whose distribution does not overlap (ignoring casuals of a single season) though it may be discontinuous.

(3) Forms or groups of forms of very wide distribution, all or most of which can often be obtained in one locality.

The problem of how to deal with these can only be solved by a careful study of the Laws of Variation. These of course cannot be dealt with in detail in the limits of a single article, but the writer has attempted to express his own views on the subject as bearing on our problem in an aphoristic form for the sake of brevity.

(1) *Most variable* types are those not confined to one particular region of distribution but continuously distributed through the neighbouring regions.

(2) The *next most variable* are those found practically throughout a particular geographical region.

(3) Those restricted to a subregion are much more constant.

(4) Those confined to a minor division or to two or more small discontinuous areas are generally very constant and often impervious even to seasonable changes.

(5) The variability of (1) and (2) differs in kind as well as degree, whereas that of (1) is so great that it is difficult to define, except in the broadest lines, a type to which all the specimens captured even in a single locality will conform; in (2) the types are fairly constant in particular areas but vary geographically in the various subregions and for minor subdivisions of its area of distribution, such variations often proving on investigation to be as much climatic, or dependent on the rainfall, as geographical.

So long as (1) types maintain their wide distribution the irregularity is at least partly maintained by migrations and counter-migrations keeping the blood in fusion.

(6) Geographical variations are dependent on climate, soil, geological history and superficial characteristics, and,

(7) possibly other unknown causes, *e.g.*, it is difficult in the present state of our knowledge to account for the prevalence of a blue sheen in the dominant Papilionina of the Assam subregion.

(8) Those belonging to (1) are the newest and most dominant types. Those belonging to (2) and (3) are older, while class (4) are very ancient, often not merely as specific forms but belonging to generically ancient types of structure.

(9) There exists among all creatures a progressive or rather a conservative tendency towards fixity of type.

(10) Almost all creatures around us now are admirably adapted to their place in nature—observations of so-called evolution in the making being extremely rare.

(11) By consequence any tendency to vary would, *ceteris paribus*, be contrary to nature's great object—the preservation of the type.

(12) Therefore unless the environment is changed, there is no *à priori* likelihood that any variation will occur.

(13) A change of environment occurs either by the type itself migrating to a new locality or by a new environment coming to the type through geological upheaval causing either a complete change of climate or by uniting the region with another not previously connected letting in a crowd of forms whose presence entirely alters the aspect of the struggle for existence, or both.

(14) Species which seek a change of environment themselves will belong mainly to (1). Although the laws of migrations are imperfectly known, it may be said generally that they probably arise originally from pressure of numbers and, that their direction is determined in the first instance, at least among winged creatures, by the winds and that types once moved in this way usually acquire for a time a regular migratory habit. (This ignores all forms spread artificially by man and seasonable migrations of birds.)

(15) In the event of the second alternative the older species will many of them have become so fixed that they will not be able to adapt themselves to the new conditions and will disappear or become rare. Others will have to change and change with considerable rapidity until they acquire a form and constitution suited to survive, and most of the intermediate forms will have little chance of perpetuating themselves.

(16) In practice "a species" is a very real unit of classification presenting a very concrete shape to a naturalist's mind but is difficult of definition.

(17) The difficulty arises entirely from the exceptions which would occur in classes (1) and (2) to almost any form of wording.

(18) Nevertheless even in these the "species" is a very real entity, and in class (1) can practically always be discovered by selective breeding.

(19) Some cases of geographical races (2) can also be shown to be purely climatic by breeding also; for when once the essential difference between dry and wet season forms is known, the extremes of each and intermediate of each can be inferred and reconciled. Geographical differences of this kind should be ignored systematically and the types treated as one species.

(20) Other cases of geographical differences cannot be dealt with by breeding, and each case must be judged on its own merits, bearing in mind (*a*) magnitude of the difference, (*b*) its constancy, (*c*) the relative constancy of other specific characteristics, (*d*) the relative sharpness of the boundary of the distributive areas of the several forms, and the presence or absence of intermediates near the frontier.

(21) For simplicity sake it is desirable to unite rather than divide.

(22) A description of a "new species" from a single capture—unless it shows pronounced and not purely superficial peculiarities—is of doubtful value and most dangerous in practice.

If these conclusions are just, then there is certainly such a thing in nature as a species, and conversely a "subspecies" is an absurdity.

There is no harm of course in describing, and defining where possible, geographical races, but to give them separate names is only to add an element of confusion where all should be clear and simple.

The writer claims no finality for his views, but the subject is one of such importance and general interest that it is well worth a discussion in our journal.

# DESCRIPTIONS OF INDIAN MICRO-LEPIDOPTERA.

By

E. Meyrick, B.A., F.R.S., F.Z.S.

## II.

Thanks to the energy of the Micro-Lepidopterists of Ceylon, I have now received a considerable quantity of material from that island, and the present paper is mainly devoted to a selection from it. I am indebted for these valuable contributions to Messrs. J. Pole, of Maskeliya; E. E. Green, of Peradeniya; G. B. de Mowbray, of Maskeliya; G. C. Alston, of Maskeliya; and W. Vaughan, of Madulsima.

I have had some instructions for collectors printed, and shall be pleased to send a copy to any collector in the Indian region who will send me his address.

Seventeen genera and seventy-six species are here described as new, and some other species are recorded from the region for the first time.

### Orneodidæ.

*Orneodes toxophila*, n. sp.

♂. 15—16 mm. Head and thorax white. Palpi with appressed scales, white, towards base sprinkled with fuscous. Antennæ ochreous-whitish, basal joint white. Abdomen whitish-ochreous. Forewings ochreous-whitish, crossed by ill-defined light yellow-ochreous bands before and beyond middle, and a narrow curved darker central fascia, sometimes partially speckled with dark fuscous, not reaching sixth segment, separated from them by fine lines of ground colour; sometimes a few fine blackish specks on segments; sometimes a faint yellowish subterminal line. Hindwings as forewings, but central fascia fuscous, sprinkled with blackish, entire, dark specks on segments rather more numerous, subterminal line sometimes greyish towards dorsum.

Four specimens, Maskeliya, Ceylon, in April and June (de Mowbray).

*Orneodes sycophanta*, n. sp.

♂ ♀. 15—18 mm. Head and thorax white. Palpi smooth-scaled, white, apex of basal and second joints and subapical ring of terminal joint dark fuscous. Antennæ stout, serrate, whitish-ochreous, basal joint white. Abdomen white, segments 2—4 partially or wholly dark fuscous above (number of dark segments variable). Forewings white; first segment fuscous, with four blackish white-edged spots, fourth apical; second segment fuscous, with three dark fuscous bands, limited by white spots edged with blackish-fuscous; segments 3—6 crossed by two anterior series of undefined dark fuscous dots, and four posterior pale greyish-ochreous fasciæ, edged with dark fuscous, but these vary much in distinctness and are often partially obsolete; usually a distinct blackish-fuscous spot on middle of sixth segment. Hindwings white, with six transverse series of pale ochreous spots, speckled with black.

Eight specimens, Maskeliya, Ceylon, in January, May, and July (Pole).

*Orneodes trachyptera*, n. sp.

♂ ♀. 10—13 mm. Head palpi, antennæ, thorax, and abdomen dark fuscous, mixed with whitish ; palpi with second joint dilated with rough scales towards apex above and beneath, terminal joint thickened with loose scales towards apex anteriorly. Forewings with costa roughened with projecting dark fuscous scales, except on the white markings ; whitish, densely irrorated with dark fuscous, so as to appear dark grey ; costa with six or seven small semioval ochreous-white spots, not reaching more than half across first segment ; other segments crossed by about six series of ochreous-white dots, united by outwardly oblique whitish dashes in the cilia to form zigzag lines. Hindwings with ground colour and zigzag lines as in forewings.

Six specimens, Puttalam and Maskeliya, Ceylon, in March, May, November and December (Pole, de Mowbray).

PTEROPHORIDÆ.

*Cosmoclostis pesseuta*, n. sp.

♂ ♀. 12—13 mm. Head brownish-ochreous, front of crown white. Palpi short, whitish, sprinkled with fuscous. Thorax white, anterior and posterior margins ochreous. Abdomen in ♂ white, irregularly marked with ferruginous ; in ♀ pale yellow, last three segments marked with ferruginous. Forewings cleft from before ⅓, segments linear ; white, costal half irrorated with fuscous from base of wing to middle of first segment ; first segment with a small dark fuscous mark on its lower margin near base, dark fuscous bands about middle and ¾, and some irregularly strewn dark fuscous scales posteriorly ; second segment with dark fuscous bands towards base, beyond middle, and before apex, variable in development and first two sometimes very wide ; cilia light ochreous-grey, somewhat suffused with whitish opposite white areas. Hindwings grey ; cilia light grey.

Two specimens, Puttalam, Ceylon, in February and April (Pole).

*Cosmoclostis aglaodesma*, Meyr.

Puttalam, Ceylon, from October to January (Pole). Occurs also in Eastern Australia, and some of the South Pacific and Malayan Islands.

*Trichoptilus xerodes*, Meyr.

Peradeniya, Ceylon, in October (Green, Pole). Widely distributed in Australia.

*Trichoptilus Wahlbergi*, Zell.

(*Pterophorus Wahlbergi*, Zell. Linn. Ent. VI, 346, Mic. Caff. 117 ; *P. rutilalis*, Walk. Cat. 943 ; *Trichoptilus pyrrhodes*, Meyr. Proc. Linn. Soc. N. S. Wales 1889, 1113.)

Maskeliya, Ceylon, in March and May (Pole). Occurs from S. Africa to E. Australia.

*Deuterocopus Tengstroemi*, Zell.

Puttalam, Ceylon, in October (Pole) ; Surat, Bombay, in August (Maxwel Lefroy). Occurs also from S. Africa to New Guinea.

*Oxyptilus regulus*, n. sp.

♂. 16 mm. Head and thorax fuscous, irrorated with blackish. Palpi white, mixed with blackish, second joint reaching middle of face, terminal joint rather shorter than second. Abdomen fuscous, with dorsal series of undefined blackish marks. Forewings cleft from before $\frac{2}{3}$, first segment parallel-sided, subfalcate, second narrow, posteriorly dilated, apex abruptly and moderately produced; fuscous, irrorated with dark fuscous and blackish; an undefined spot of dark suffusion above base of cleft; a broad dark fuscous band on first segment beyond its middle, preceded on costa by a small pale suffusion, and edged posteriorly by a rather outwardly oblique incurved white line; some dark suffusion on second segment before apex; cilia light fuscous, on termen with black basal line, on lower margin of first segment mixed at base with white and elsewhere with black scales, on upper margin of second segment with scattered black scales, on dorsum with three small black scale-teeth near base, some scattered black scales towards middle, a black scale-tooth before cleft, another at $\frac{1}{3}$ of second segment, preceded and followed by ochreous-whitish spaces, beyond these mixed with black scales. Hindwings cleft firstly from $\frac{1}{3}$, secondly from near base, segments linear; rather dark fuscous; cilia fuscous, on upper margin of third segment with a few black scales towards apex, on lower margin with a very large black triangular scale-projection occupying apical third, five small black scale-teeth between this and base, and two very minute, almost basal.

Two specimens, Maskeliya, Ceylon, in March and July (Pole).

*Platyptilia brachymorpha*, Meyr.

Puttalam, Ceylon, in February, April, August, November and December (Pole). Occurs also in the Hawaiian Islands.

*Platyptilia hemimetra*, Meyr.

Puttalam, Maturatta, Kandy and Maskeliya, Ceylon, in February, March, September, November and December. Described from the Island of Réunion.

*Platyptilia molopias*, n. sp.

♂ ♀. 16—19 mm. Head, thorax, and abdomen whitish, irrorated with light brown, frontal tuft moderately long. Palpi 2, rather dark fuscous, sprinkled with whitish. Forewings cleft from $\frac{2}{3}$, segments moderately broad, somewhat dilated posteriorly, termen of first sinuate, of second slightly prominent in middle; whitish, irrorated with reddish-fuscous and dark fuscous; costal edge dark fuscous, dotted with whitish anteriorly; a roundish spot of dark fuscous suffusion on fold at $\frac{1}{3}$, and another beneath costa before middle; a dark fuscous suffusion along middle third of dorsum; a triangular blackish-fuscous costal blotch before cleft, followed by a whitish suffusion on costal edge; a rather reddish-brown band crossing both segments, obscurely whitish-edged posteriorly; remaining narrow terminal fascia sometimes dark fuscous; cilia whitish-ochreous, slightly reddish-tinged, on termen with black basal line, at both angles of each segment with bars of dark grey suffusion, on dorsum with a blackish scale-tooth beyond middle, a smaller one beneath cleft, and some

scattered blackish scales anteriorly. Hindwings cleft firstly from before middle, secondly from ⅓, first segment dilated, apex rounded, second subacute, termen very obliquely subsinuate, third linear; dark fuscous; cilia fuscous, on lower margin of third segment with a moderate black scale-tooth in middle, and scattered black scales between this and base.

Six specimens, Maskeliya, Ceylon, in October, December, January, and March (Pole).

*Marasmarcha liophanes*, Meyr.

Puttalam, Ceylon, in February, April, August, and November (Pole). Occurs also in Reunion.

*Agdistis nanodes*, n. sp.

♂ ♀. 15—16 mm. Head, thorax, and abdomen pale brownish-grey, sometimes whitish-mixed; frontal prominence moderate, acute-conical. Palpi grey, mixed with dark grey and white. Forewings very narrow, posteriorly dilated, costa posteriorly moderately arched, apex pointed, termen rather strongly oblique, almost straight; pale brownish-grey, costal and dorsal areas sprinkled with whitish and dark fuscous, confluent towards base; a cloudy dark fuscous dot in disc at ⅓, two below disc before and beyond middle, and one towards costa at ¾: cilia pale fuscous mixed with whitish. Hindwings light fuscous, veins darker; a subdorsal groove; cilia as in forewings. Undersurface of hindwings beneath with flap of scales from lower margin of cell towards angle, covering some black scales, and rows of minute raised black scales along basal portions of veins 2 and 3; dorsal area clothed with dark fuscous scales.

Four specimens, Puttalam, Ceylon, in August, October, and November. The species of this genus (usually attached to sea-coast plants) are extremely similar superficially, and the accessory structural characters must be carefully noticed; the present species is the smallest known to me.

EPIBLEMIDÆ.

*Platypeplus mormopa*, n. sp.

♂. 19 mm. Head and thorax light greyish-ochreous, mixed with dark grey and white. Palpi ochreous-fuscous, mixed with darker. Abdomen grey. Posterior tibiæ with hairs ochreous-white. Forewings elongate-triangular, costa moderately arched, apex obtuse, termen slightly rounded, hardly oblique; whitish, mostly suffused with pale brownish, and strigulated throughout with blackish; a large roundish black blotch resting on middle of costa, and reaching ⅔ across wing, with a small irregular projection in disc posteriorly: cilia grey. Hindwings grey, rather darker posteriorly; a short subdorsal groove and marginal thickening from base, clothed with hairs, with a projecting marginal hairpencil from near base; cilia grey.

Two specimens, Maskeliya, Ceylon, in February (de Mowbray, Alston).

*Eucosma leucaspis*, Meyr.

Maskeliya, Madulsima, Matale, and Puttalam, Ceylon, in May, October, and November (Pole, Vaughan).

*Epiblema ocladias*, n. sp.

♂ ♀. 18—26 mm. Head white, sides of crown and a frontal bar black. Palpi black, white above and at apex. Antennæ blackish-grey. Thorax white, shoulders and a posterior bar black. Abdomen grey. Forewings elongate, rather dilated posteriorly, costa gently arched, apex obtuse, termen almost straight, hardly oblique, rounded beneath; white; markings dark leaden-fuscous, irregularly suffused or marked with black, sharply defined; a zigzag streak from base of costa through disc, angulated thrice downwards and twice upwards, terminating on costa before apex; in ♂ costal area as far as this streak from base to beyond middle wholly blackish, in ♀ with a small wedge-shaped black costal spot at $\frac{1}{4}$, and a larger subquadrate one beyond middle, each preceded by a black strigula; two posterior black costal strigulæ: four irregular dorsal spots, second sometimes connected with middle angle of median streak; an irregular spot near termen below middle, often confluent with median streak near its extremity: cilia white, beneath tornus blackish. Hindwings dark grey, lighter towards base; cilia grey-whitish, with grey basal line.

Seven specimens, Maskeliya, Ceylon, in March, May, July, August, October and November (de Mowbray, Pole, Green).

PHALONIADÆ.

*Meridarchis*, Zell.

This genus, founded by Zeller on the Indian *trapeziella*, and attributed by him to the *Gelechiadæ*, is, I find, so close to *Tribonica*, Meyr., that it will be better at present to treat them as identical and sink the latter name, although it is possible that the small structural differences existing may ultimately involve their separation. The types of *Meridarchis* and *Tribonica*, and the two additional species now described, agree together, and are distinguished from all nearly allied forms by the stalking of veins 8 and 9 of forewings.

*Meridarchis episacta*, n. sp.

♂. 18—21 mm. Head and thorax white, more or less tinged with ochreous. Palpi porrected, dark fuscous, second joint mixed with white above. Abdomen ochreous-whitish. Forewings elongate, rather narrow, not dilated, costa arched towards base, thence nearly straight, apex round-pointed, termen sinuate, oblique; 3 and 4 separate; white; a black basal patch, edge parallel to termen; a black subdorsal scaletuft at $\frac{1}{3}$; a trapezoidal black patch extending along costa from $\frac{1}{3}$ to beyond $\frac{2}{3}$, rapidly narrowed downwards, reaching more than half across wing, edged beneath with a few ochreous scales; a black strigula on dorsum at $\frac{2}{3}$, almost connected with costal patch; a small blackish costal spot at $\frac{5}{6}$, whence proceeds an undefined line of black and grey scales to tornus; a row of black dots round apex and termen: cilia whitish-grey-ochreous. Hindwings pale grey; beneath cell towards base a group of raised black hair scales, partially covered by an expansible pencil of long ochreous-whitish hairs from base; cilia whitish-grey-ochreous.

Three specimens, Maskeliya, Ceylon, in October, December, and January (de Mowbray).

*Meridarchis pheodelta*, n. sp.

♂ ♀. 13—17 mm. Head and thorax whitish-ochreous, tinged with brownish ochreous. Palpi in ♂ moderate, curved, subascending, in ♀ very long, straight, porrected; ochreous-whitish, second joint irrorated with fuscous, terminal joint with dark fuscous band. Abdomen in ♂ grey, in ♀ light greyish-ochreous. Forewings elongate, narrow, hardly dilated, costa slightly arched, apex round-pointed, termen sinuate, rather strongly oblique; 3 and 4 separate; pale greyish-ochreous, partially mixed and suffused with brownish ochreous, sometimes partially sprinkled with dark fuscous; a dark fuscous or blackish triangular patch extending along costa from about $\frac{1}{3}$ to $\frac{2}{3}$, and reaching $\frac{3}{4}$ across wing, somewhat mixed with pale scales, and on costa with alternate usually obscure pale and blackish spots; a terminal series of connected blackish marks: cilia whitish-ochreous, mixed with dark grey on termen. Hindwings light grey, darker towards apex, veins dark grey; cilia whitish-ochreous, suffused with grey.

Six specimens, Maskeliya and Haputale, Ceylon, in February, June, and November (Alston, Pole).

*Paramorpha laxeuta*, n. sp.

♀. 15—17 mm. Head and thorax white, partially tinged with fuscous. Palpi whitish, mixed with dark fuscous. Abdomen ochreous-whitish. Forewings elongate, narrow, hardly dilated, costa gently arched, apex round-pointed, termen slightly sinuate, rather strongly oblique; white; a narrow basal patch of ochreous-grey suffusion, edge inwardly oblique; a wide median band extending from $\frac{1}{3}$ to somewhat beyond $\frac{2}{3}$ irrorated with ochreous and grey, with four black marks on costa, and discal scaletufts mixed with black, edges inwardly oblique; a subterminal cloudy fascia of grey irroration; some grey spots with a few black scales round apex and termen: cilia whitish-ochreous, round apex fuscous-tinged. Hindwings whitish-grey: cilia ochreous-grey-whitish.

Three specimens, Matale and Maskeliya, Ceylon, in January and April (Pole, de Mowbray).

GELECHIADÆ.

*Aristotelia peltosema*, Low.

Puttalam, Ceylon, from September to December (Pole). Described from Australia.

*Thiotricha saulotis*, n. sp.

♀. 11 mm. Head, palpi, and thorax shining white. Abdomen ochreous-whitish. Forewings almost linear, costa almost straight, apex pointed, termen rather strongly oblique, slightly rounded; 9 out of 6; shining white; an orange-ochreous spot towards apex, connected by two indistinct oblique grey strigulæ with costa, beneath with two longer similar strigulæ, first reaching fold and angulated on it to margin, second limited below by a yellowish mark; a blackish apical dot, more strongly marked on under surface: cilia ochreous-whitish, round apex and termen with a grey median shade, on termen with a fine yellowish basal line and some black basal scales at tornus. Hindwings very

narrow, cilia 5 ; pale grey ; a minute blackish apical dot ; cilia ochreous-grey-whitish, with some blackish median scales opposite apex.

One specimen, Maskeliya, Ceylon, in March (Pole). To this genus is also referable *animosella*, Walk., described under *Gelechia*.

*Idiophantis soreuta*, n. sp.

♂. 13–14 mm. Head pale ochreous, face and palpi whitish-ochreous, terminal joint of palpi with dark fuscous line each side of anterior edge. Antennæ whitish, lined with dark fuscous. Thorax pale ochreous, shoulders narrowly fuscous. Abdomen light grey. Forewings elongate, narrow, costa gently arched, termen very deeply concave, so that apex becomes a narrow twisted strip, tornus a somewhat shorter, strong, rounded prominence ; 6 absent ; pale brownish-ochreous, towards apex yellowish-tinged ; a dark fuscous patch extending along costa from base to $\frac{1}{3}$, not reaching half across wing, lower edge with two short darker rounded prominences before middle, posterior edge straight, oblique ; a few variable scattered dark fuscous dots or dashes between this and dorsum ; a fine whitish fuscous-edged line from $\frac{2}{3}$ of costa to dorsum before tornus, right-angled above middle, arms subsinuate ; a whitish streak along costa towards apex, edged with fuscous beneath ; a small dark metallic-bronze spot on termen beneath middle : cilia whitish-ochreous, round apex with a dark fuscous basal line, opposite terminal spot with a metallic-bronze patch. Hindwings fuscous ; cilia whitish-fuscous, with darker subbasal shade.

Three specimens, Puttalam, Ceylon, in November and December (Pole). The absence of vein 6 of the forewings is an extension of the generic characters, but the species is in all respects so clearly allied to the Australian insect which forms the type of *Idiophantis* that I do not hesitate to include them together.

*Anacampsis verteria*, n. sp.

♂ ♀. 10—11 mm. Head, antennæ, and thorax dark bronzy-fuscous; face whitish-ochreous. Palpi ochreous-whitish, terminal joint with anterior and interior blackish lines. Abdomen grey. Forewings elongate, narrow, long-pointed, acute ; 6 out of 7 ; bronzy-fuscous, irrorated with dark fuscous, sometimes paler-sprinkled ; stigmata dark fuscous, very obscure, plical obliquely before first discal, edged posteriorly by an ochreous-whitish dot ; a small ochreous-whitish costal spot before $\frac{2}{3}$ : cilia fuscous, towards base mixed with brown and black points, with a median black line. Hindwings and cilia grey.

Thirty-four specimens, Maskeliya, Ceylon, in February and April (Green). Bred in plenty by Mr. Green who gives the following particulars :—"Larva dull greenish ; head and plate of 2 dark brown ; spots black : feeds between two leaves spun together on the ground-nut (*Arachis hypogæa*), and is destructive to foliage ; egg pale green, irregularly elongate-oval, surface coarsely pitted in irregular longitudinal series, under the microscope remarkably similar both in form and sculpture to seed of *Arachis*." This species is very closely allied to the common European *anthyllidella*, differing only by the ochreous-whitish face and second joint of palpi, which in *anthyllidella* are pale fuscous ; also very

close to the Australian *clarisignella*, but differing by the absence of the pale dorsal spot. These three species appear to be representative geographical forms.

*Stegasta variana*, Meyr.

Ceylon (without further locality, but probably Puttalam) (Pole). Hitherto only known from Eastern Australia.

*Zalithia amethystias*, n. sp.

♂. 10 mm. Head and thorax dark bronzy-fuscous, shoulders with a prismatic violet-blue spot. Palpi pale yellowish-fuscous, terminal joint longer than second, ochreous-whitish, with black anterior edge. Antennæ ochreous-whitish ringed with dark fuscous, simple. Abdomen dark grey. Legs dark fuscous ringed with white, middle tibiæ with a violet-blue streak towards base. Forewings elongate, narrow, posteriorly dilated, costa gently arched towards extremities, apex obtuse, termen slightly sinuate, little oblique; 6 to apex, 8 absent; dull ochreous-orange sprinkled with fuscous; markings prismatic violet-blue, partially edged with dark fuscous; narrow costal and median streaks from base to $\frac{1}{3}$; an oblique mark from costa before middle, not reaching half across wing; a short longitudinal mark beneath disc before middle; a straight narrow fascia at $\frac{2}{3}$, interrupted above middle; apical fourth blackish except a terminal line, anterior edge straight, near and parallel to preceding fascia, including a small round violet-silvery-metallic spot on costa and four others before termen: cilia bluish-silvery-metallic, beneath tornus dark fuscous. Hindwings dark fuscous, bronzy-tinged; cilia fuscous, with dark fuscous basal line.

Two specimens, Peradeniya, Ceylon, in January and April (Green). The generic characters are extended in the particulars indicated, but the species is in all essentials closely allied to the type-form of the genus.

*Epicænia*, n. g.

Head with appressed scales; tongue developed. Antennæ $\frac{1}{2}$, in ♂ serrulate, minutely ciliated. Labial palpi long, recurved, second joint with appressed scales, somewhat roughened beneath towards apex, terminal joint almost or quite as long as second, smooth, acute. Posterior tibiæ somewhat roughened with scales above. Forewings with 2 and 3 stalked from angle, 7 to costa, 8 absent, 11 from middle. Hindwings 1, trapezoidal, termen sinuate beneath apex, cilia $\frac{1}{2}$—1; 3 and 4 connate, 5 somewhat approximated, 6 and 7 stalked.

Type *E. chernetis*. Belongs to the *Protolechia* group; nearest to *Pancænia*, from which it differs essentially by the stalking of 6 and 7 of hindwings.

*Epicænia chlorodelta*, n. sp.

♂ ♀. 14—15 mm. Head, palpi, and thorax ochreous-orange, second joint of palpi with lower half irrorated with fuscous and a dark fuscous subapical ring, terminal joint somewhat shorter than second, with traces of a dark fuscous median ring. Antennæ pale ochreous-yellowish ringed with dark fuscous. Abdomen rather dark fuscous. Forewings elongate, costa moderately arched, apex round-pointed, termen slightly rounded, oblique; dark fuscous; a small

basal ochreous-orange spot; stigmata and a small prætornal spot very obscurely darker, plical obliquely before first discal; a triangular ochreous-orange blotch extending on costa from $\frac{2}{3}$ to ratner near apex, and reaching more than half across wing: cilia pale ochreous, at apex and tornus with patches of dark fuscous suffusion. Hindwings dark grey; cilia grey.

Four specimens, Maskeliya, Ceylon, in February and October (Pole, de Mowbray).

*Epicœnia authœma*, n. sp.

♂ ♀. 12—13 mm. Head and thorax whitish-ochreous, mixed with dark fuscous. Palpi whitish-ochreous, second joint irrorated or suffused with dark fuscous except at apex, terminal joint somewhat shorter than second, with dark fuscous median band sometimes extended nearly to base. Antennæ whitish-fuscous or whitish-ochreous tinged with fuscous, obscurely ringed with dark fuscous. Abdomen grey, apex whitish-ochreous. Forewings elongate, narrow, costa gently arched, apex round-pointed, termen very obliquely rounded; pale ochreous, irrorated with fuscous and dark fuscous; stigmata rather large, dark fuscous, plical nearly beneath first discal; a small dark fuscous prætornal spot; an almost marginal series of dark fuscous dots along posterior half of costa and termen: cilia whitish-ochreous, basal half yellowish, with a median line of dark fuscous points, apical half with faint whitish-fuscous irroration, on costa sometimes barred with dark fuscous irroration. Hindwings grey, darker in ♀; cilia pale grey, sometimes suffused with whitish-ochreous towards base.

Four specimens, Peradeniya, Ceylon, in February (three bred) (Green). Larva constructs heliciform cases on surface of moss-covered rocks (Green); cases sent seem to consist of a gradually dilated gallery coiled in a flat rounded spiral, and are composed of silk closely covered with grains of sand and fragments of lichens. This species is extremely close to *E. chernetis*, and both appear to vary in small details; *authœma* is smaller, with the forewings obviously narrower and with more strongly oblique termen, and the terminal joint of palpi relatively shorter; the larval habits are distinct.

*Epicœnia chernetis*, n. sp.

♂ ♀. 13—17 mm. Head and thorax whitish-ochreous, irrorated with fuscous and dark fuscous. Palpi whitish-ochreous, second joint irrorated with dark fuscous except at apex, terminal joint as long as second, with dark fuscous median band. Antennæ whitish-ochreous ringed with dark fuscous. Abdomen fuscous, anal tuft whitish-ochreous. Forewings elongate, costa gently arched, apex obtuse, termen almost straight, rather oblique; whitish-ochreous, tinged with fuscous and irrorated with dark fuscous; a dark fuscous dot on base of costa, followed by an undefined whitish-ochreous dot; stigmata dark fuscous, sometimes rather large, plical somewhat before first discal; a small prætornal spot of dark fuscous suffusion; an almost marginal row of dark fuscous or blackish dots along posterior portion of costa and termen: cilia whitish-ochreous, more yellowish towards base, with basal dots and a median line of dark fuscous

irroration, on apical half with faint whitish-fuscous irroration. Hindwings grey ; cilia whitish-ochreous, tinged with fuscous.

Fifteen specimens, Peradeniya and Madulsima, Ceylon, from February to April (Green, Vaughan). Larva feeding in galleries several inches long on surface of moss-covered rocks, and pupating in an enlarged chamber (Green); specimens of these galleries sent by Mr. Green are composed of silk covered with grains of sand and fragments of lichen, moss, and incidental refuse ; from similar undistinguished galleries two other species of different genera were also bred. Not only is this species very close to *E. authæma* as noted above, but also by its obscure and ordinary colouring exceedingly similar superficially to species of other genera, from which it must be carefully distinguished by verifying the neuration.

*Tipha diacma*, n. sp.

♂ ♀. 17—22 mm. Head and thorax ochreous-yellow, face paler, apex of patagia and a posterior spot on thorax metallic-grey. Palpi light ochreous-yellowish, in ♂ with second joint dilated with long projecting scales towards apex and excavated internally (spoon-shaped), interior of excavation metallic-grey, terminal joint short, in ♀ very long, normal. Antennæ light ochreous-yellowish, towards apex suffused with grey. Abdomen whitish-ochreous. Legs pale ochreous-yellowish, anterior and middle tibiæ with indistinct grey subapical ring, posterior tibiæ and tarsi clothed with rough hairs above. Forewings elongate, very narrow, costa gently arched, apex round-pointed, termen extremely obliquely rounded ; 2 remote, 3 from near angle, 4 and 5 stalked, 8 and 9 out of 7, 7 to costa ; dull orange-yellow ; a minute metallic-grey black-edged basal mark ; a small dark metallic-grey black-mixed spot in disc near base ; three indistinct cloudy rather broad pale fuscous fasciæ, first at $\frac{1}{4}$, angulated in middle, second oblique, from towards middle of costa to before tornus, third oblique, about $\frac{3}{4}$, little marked ; five linear longitudinal dark metallic-grey streaks mixed with black, two on first fascia in middle and on fold, one on second fascia in middle, and two stronger starting on anterior edge of third fascia and continued along costa and termen respectively almost meeting at apex : cilia ochreous-yellow, at apex with a cloudy dark fuscous spot. Hindwings with 2 remote, in ♂ 3 and 5 absent, in ♀ 3 and 4 short-stalked, 5 approximated, 6 and 7 long-stalked, 6 in ♂ to costa, in ♀ to termen ; grey ; in ♂ a longitudinal median furrow throughout, suffused with whitish-ochreous, suffusion extending round apex, and a long ochreous-yellow hair-pencil from base, lying in a groove beneath cell, tornal area clothed with modified dark grey hair-scales ; cilia whitish-yellowish, becoming greyish-tinged towards tornus.

Four specimens, Maskeliya, Ceylon, from December to February (de Mowbray).

*Tipha trichroa*, n. sp.

♂ ♀. 14 mm. Head and palpi glossy whitish-ochreous ; palpi in ♂ with second joint broadly dilated beneath with projecting scales towards apex and excavated internally (spoon-shaped), mixed with dark grey towards apex and

interior of excavation wholly dark grey, terminal joint concealed. Antennæ whitish-ochreous, more yellow towards base. Thorax dark coppery-bronze. Abdomen whitish-ochreous. Legs whitish, tibiæ yellowish-tinged, anterior tibiæ with dark grey band, posterior tibiæ and basal joint of tarsi roughened with hairs, partially suffused with yellow and irregularly banded with dark grey at middle and apex of tibiæ, and apex of two basal joints of tarsi. Forewings elongate, very narrow, costa moderately arched towards base, thence nearly straight, apex round-pointed, termen extremely obliquely rounded; 2 tolerably remote, 3 and 5 stalked, 4 absent, 7 and 9 short-stalked, 7 to costa, 8 absent; dark brown, basal third dark purple-fuscous; a triangular white blotch on dorsum beyond $\frac{1}{4}$, reaching more than half across wing; a cloudy ochreous-yellow dot on costa before middle; a triangular ochreous-yellow patch extending along costa from middle to $\frac{2}{3}$, and reaching more than half across wing: cilia light fuscous, at base tinged with ochreous-yellowish. Hindwings with termen sinuate; 2 remote, in ♂ 3 and 5 absent, in ♀ 3 and 4 stalked, 5 approximated, 6 and 7 long-stalked; rather dark fuscous; in ♂ a subdorsal furrow throughout, filled with very long expansible pale fuscous hairs; cilia pale fuscous.

Two specimens, Madulsima, Ceylon, in April (Vaughan).

*Timyra tetraclina*, n. sp.

♂ ♀. 16—18 mm. Head and thorax ochreous-yellow. Palpi whitish-ochreous, lower half of second joint infuscated, in ♂ with second joint dilated with long projecting scales beneath towards apex and excavated internally (spoon-shaped), interior of excavation mixed with dark grey, terminal joint concealed, in ♀ second joint with tuft of rough projecting ochreous-yellow hairs towards apex beneath, terminal joint longer than second. Antennæ pale ochreous-yellowish, indistinctly ringed with fuscous, basal joint in ♂ with anterior scale-projection. Abdomen pale greyish-ochreous. Legs ochreous-whitish, anterior femora and tibiæ suffusedly banded with dark fuscous, middle tibiæ banded with dark fuscous and with tuft of yellow scales above towards base, posterior tibiæ roughened with ochreous-yellow scales, with dense expanded median tuft of long ochreous-whitish hairs suffusedly banded with grey, and smaller apical similar tuft marked with black, tarsi with interrupted dark fuscous line above. Forewings elongate, narrow, costa anteriorly moderately, posteriorly slightly arched, apex round-pointed, termen extremely obliquely rounded; 4 and 5 stalked, 7 to costa, 9 connate with 7; yellowish-orange, markings fuscous-purple; a small spot on base of costa; five narrow transverse fasciæ, first at $\frac{1}{6}$, rather inwardly oblique, second at $\frac{1}{3}$, rather outwardly oblique, third median, oblique, irregularly angulated or dilated, fourth at $\frac{2}{3}$, irregular, fifth terminal, meeting fourth at tornus; a small discal spot beyond third, sometimes connected with it: cilia pale ochreous-yellowish, on costa yellowish-orange. Hindwings with 2 in ♂ near 3, in ♀ remote; in ♂ whitish-ochreous, posterior third suffused with dark fuscous, with a deep groove along fold containing a very long expansible whitish-ochreous hair-pencil; in ♀ grey; cilia whitish-ochreous.

Six specimens, Maturatta and Maskeliya, Ceylon, in September (Pole, Alston).

*Timyra palathodes*, n. sp.

♂ ♀. 14—16 mm. Head, palpi, thorax and abdomen whitish-ochreous; palpi in ♂ with second joint infuscated towards base, dilated with rough projecting scales towards apex beneath and internally excavated (spoon-shaped), excavation partly dark fuscous internally, terminal joint concealed, in ♀ with second joint smooth-scaled, slender, terminal joint as long as second. Antennæ whitish, basal joint in ♂ with anterior scale-projection. Legs ochreous-whitish, anterior and middle tibiæ with dark fuscous subapical bands, posterior tibiæ clothed with rough yellowish-whitish hairs, with dense long median and shorter apical tufts partly suffused with grey and somewhat mixed with blackish. Forewings elongate, narrow, costa gently arched, apex round pointed, termen extremely obliquely rounded; 4 and 5 stalked, 7 to costa, 9 connate or short stalked with 7; ochreous-yellow; small dark fuscous spots on costa at and near base, and near base of dorsum; three irregular obscure brownish-ochreous fasciæ at $\frac{1}{4}$, middle, and $\frac{3}{4}$, dilated in disc, and a similar transverse line before second, sometimes mostly confluent with it, third sometimes suffused with fuscous: cilia light brownish-ochreous. Hindwings in ♂ dark grey, apex whitish-ochreous, with subdorsal groove enclosing long ochreous-yellowish hair-pencil; in ♀ grey, apex and upper part of termen suffused with whitish-ochreous; cilia whitish-ochreous.

Five specimens, Madulsima and Maturatta, Ceylon, in April, July, and September (Vaughan, Pole).

*Timyra marmaritis*, n. sp.

♂. 21—23 mm. Head light ochreous-yellowish, face paler and greyish-tinged. Palpi long, basal joint dark grey, second joint clothed with long dense ochreous whitish hairs above and beneath, terminal joint moderately long, much thickened with dense dark grey hairs, obtuse. Antennæ dark grey, basal joint with strong anterior scale-tuft. Thorax dark purplish-fuscous. Abdomen pale ochreous, marked laterally with dark fuscous. Legs dark purplish-fuscous, obscurely ringed with ochreous-whitish, posterior tibiæ wholly clothed above with very long projecting curled whitish hairs slightly mixed with dark fuscous and towards apex suffused with ochreous-yellow. Forewings elongate, narrow, costa gently arched, apex obtuse, termen obliquely rounded; 3, 4, 5 approximated, 7 to apex; whitish-ochreous tinged with yellowish and irrorated with dark fuscous a narrow dark fuscous basal fascia, followed by a clear pale ochreous-yellow subbasal fascia, edged posteriorly with dark fuscous suffusion; a slender cloudy dark fuscous slightly oblique median fascia, slightly bent in middle; a dark fuscous streak along termen: cilia pale whitish-ochreous, becoming ochreous-yellow at base and on costa, with a dark fuscous subbasal line round apex and on termen, beyond this tinged and somewhat mixed with fuscous. Hindwings posteriorly clothed with hair-scales, rather dark fuscous, disc more or less broadly suffused with light ochreous-yellowish; a subdorsal groove

enclosing an ochreous-yellowish hair-pencil from base; a dark fuscous terminal line; cilia whitish-ochreous, becoming ochreous-yellowish towards base, with fuscous subbasal line.

Five specimens, Maskeliya and Maturatta, Ceylon, in March, May, June, and October (Pole, de Mowbray).

*Timyra orthadia*, n. sp.

♂ ♀. 16-18 mm. Head whitish-ochreous mixed with fuscous. Palpi very long, whitish, in ♂ second joint much elongated, flatly compressed, clothed with very long whitish hairs above and beneath, terminal joint short, greyish, thickened with dense scales, hardly pointed, in ♀ second joint smooth-scaled, slender. Antennæ grey, in ♂ darker, with large dense concave anterior tuft on basal joint. Thorax rather dark fuscous, posterior extremity ochreous-whitish. Abdomen pale ochreous. Legs dark fuscous ringed with whitish, posterior tibiæ clothed above with very long projecting curled whitish hairs mixed with dark fuscous in middle. Forewings elongate, rather narrow, costa moderately arched towards extremities, apex obtuse, termen obliquely rounded; 3, 4, 5 approximated, 7 to apex; whitish-ochreous; a narrow dark fuscous basal fascia; two broad rather dark fuscous fasciæ about $\frac{1}{3}$ and $\frac{2}{3}$, first somewhat narrowed towards costa, second rather oblique, more or less constricted in disc, beneath dilated and confluent posteriorly with a broad dark fuscous suffusion or irroration in disc; between these fasciæ a very undefined oblique median line of dark fuscous irroration; a dark fuscous terminal streak, thickened at apex: cilia whitish-ochreous becoming ochreous-yellowish towards base, with a dark fuscous antemedian shade. Hindwings fuscous; in ♂ a broad median longitudinal ochreous-yellow band, including a deep central groove, and a subdorsal groove enclosing an ochreous-yellow hairpencil from base; cilia whitish-ochreous.

Eight specimens, Madulsima, Matale, and Maskeliya, Ceylon, in January, April, and October (Vaughan, Alston, Pole). Allied to the following.

*Timyra irrorella*, Wals.

(*Tipha irrorella*, Wals., Moore Lep. Ceyl. iii, 517, pl. 209, 9.)

Peradeniya, Maturatta, Diyatalawa, Puttalam, Ceylon; a common species.

*Timyra crassella*, Feld.

(*Harpella crassella*, Feld. Reis. Nov. pl. cxxxix, 22; *Timyra sphenias*, Meyr.)

Felder's figure is very poor and not characteristic, and the locality is said to be Ternate, hence I failed to recognise his species; but I have since seen his type, which is certainly this insect; the alleged locality is doubtless erroneous, as is frequently the case with Felder's species.

*Timyra peronetris*, n. sp.

♂. 29-30 mm. Head, palpi, and thorax rather dark fuscous; palpi very long, basal joint elongate, so that it forms a sharp elbow with second, second joint reaching much above vertex, broadly compressed, internally with large dense expansible tuft of very long whitish hairs, terminal joint about half second, dilated with dense scales, tolerably obtuse. Antennæ fuscous-ochreous, basal

joint with large, dense anterior dark fuscous scale-tuft. Abdomen fuscous, sides suffused with pale ochreous-yellowish. Legs dark fuscous, ringed with pale yellowish, anterior tibiæ rough-haired beneath, middle tibiæ rough-scaled, posterior tibiæ hairy beneath and with very large curled median tuft of light fuscous scales above, posterior tarsi rough-scaled above throughout. Forewings elongate, narrow, posteriorly somewhat dilated, costa gently arched, apex obtuse, termen rather obliquely rounded; 3, 4, 5 approximated, 7 to termen; dark fuscous, with a few whitish-ochreous scales; a tuft of scales in disc near base; a transverse light ochreous-yellow mark at ⅓, somewhat dilated upwards, reaching from near costa to below middle: cilia whitish-fuscous, darker towards tips, base pale ochreous-yellow, with a dark fuscous subbasal shade. Hindwings oblong, termen beneath apex hardly oblique; ochreous-yellow; a moderate suffused dark fuscous streak along costa, dilated at apex; a suffused dark fuscous streak proceeding from a basal tuft of scales along dorsum and termen to above middle, widest at tornus and gradually attenuated; a groove along fold, enclosing an exceedingly long expansible pale ochreous-yellowish hair-pencil; cilia whitish-ochreous, becoming ochreous-yellow towards base on upper part of termen, with fuscous subbasal shade obsolete on yellow area.

Three specimens, Maskeliya, Ceylon, in January and February (Pole, Alston). Very similar to *crassella*, but structurally distinct in the palpi, especially by the elongate basal joint and resulting elbow, the large whitish interior hairtuft, and the dark fuscous costal streak of hindwings, of which the termen is less oblique on upper portion and therefore more prominently bowed; the reduced yellow mark of forewings is found also sometimes in *crassella*, but is there exceptional.

*Timyra parochra*, n. sp.

♂. 23-27 mm. Head ochreous. Palpi dark purplish-fuscous, internally deep ochreous-yellow, second joint thickened with scales, above rough-scaled, terminal joint shorter than second, thickened with scales, tolerably pointed. Antennæ ochreous faintly ringed with fuscous, basal joint without tuft. Thorax purplish-fuscous, more or less mixed with pale ochreous. Abdomen pale ochreous. Legs dark fuscous, ringed with ochreous-yellowish, posterior tibiæ orange-suffused on basal half, partially rough-scaled, with large curled median purplish-fuscous tuft above, posterior tarsi somewhat rough-scaled above. Forewings elongate, rather narrowed towards base, costa moderately arched, apex obtuse, termen rather obliquely rounded; 3, 4, 5 approximated, 7 to termen; deep yellow-ochreous or brownish-ochreous, irrorated with purplish fuscous and dark fuscous; a curved postmedian fascia more or less obscurely indicated by margins of purplish-fuscous and dark fuscous suffusion, narrowed dorsally, enclosed portion sometimes ferruginous-tinged: cilia whitish-ochreous tinged with fuscous, more yellow-ochreous basally, with subbasal fuscous line, on costa deep yellow-ochreous. Hindwings pale whitish-ochreous, towards termen slightly infuscated; a slight groove on lower margin of cell; cilia whitish-ochreous, base yellowish-tinged, sometimes with indistinct fuscous subbasal line.

Five specimens, Maturatta, Ceylon, in July (Pole).

*Macrernis rostrata*, n. sp.

♂. 18-21 mm. Head and thorax light brownish-ochreous, faintly lilac-tinged, hairs of crown projecting between antennæ. Palpi pale ochreous, mixed with deeper ochreous and dark fuscous. Antennæ whitish-ochreous, faintly fuscous-ringed. Abdomen pale ochreous. Forewings elongate, narrow, posteriorly slightly dilated, costa gently arched, apex round-pointed, termen sinuate, oblique; brownish-ochreous, with a few scattered dark fuscous scales; a dark fuscous mark along base of costa; a dark fuscous streak of somewhat raised scales along dorsum from base to tornus, enclosing a groove along vein 1 b, with a flap of hairscales curved over it from above towards base, upper edge of streak with two strong projections at $\frac{1}{3}$ and $\frac{2}{3}$, first triangular, reaching half across wing, second fascia-like, parallel to termen, reaching above middle of wing; a suffused dark fuscous streak along termen: cilia light brownish-ochreous, with one or two indistinct fuscous lines. Hindwings whitish-ochreous-grey; cilia whitish-ochreous.

Six specimens, Maskeliya, Ceylon, in January, February, and July (Pole, Alston, de Mowbray). It seems probable that *Frisilia nesciatella*, Walk., though described as a male, is the female of a species of this genus, in which case the generic name *Frisilia* would have to be adopted; but I am not yet able to identify with certainty Walker's species.

*Heliangara*, n. g.

Head with appressed scales, face retreating; tongue developed. Antennæ over 1, thick, compressed, in ♂ simple, basal joint moderate, without pecten. Labial palpi moderately long, curved, ascending, smooth-scaled, terminal joint shorter than second, acute. Posterior tibiæ rough-scaled above. Forewings with 2 from angle, 3 absent, 7 and 8 stalked, 7 to costa, 9 and 10 from near 7, 11 from before middle. Hindwings 1, elongate-ovate, cilia $1\frac{1}{2}$; 3 and 4 stalked, 5 parallel, 6 and 7 long-stalked.

A genus of very peculiar facies, but apparently bearing much the same relationship to *Narthecoceros* that *Tipha* does to *Macrernis*.

*Heliangara lampetis*, n. sp.

♂ ♀. 11-13 mm. Head shining ochreous-bronze, face paler. Antennæ ochreous-yellowish, tip infuscated. Palpi ochreous-yellow. Thorax shining purple-bronze. Abdomen rather dark bronzy-fuscous. Forewings elongate, narrow, costa slightly arched, somewhat sinuate beyond middle, apex round-pointed, termen extremely obliquely rounded; bright shining purple-coppery-bronze; a suffused orange-yellow patch extending along dorsum from $\frac{1}{4}$ to $\frac{3}{4}$, narrowed to extremities, not reaching half across wing; two parallel thick transverse ridges of raised scales about $\frac{2}{3}$: cilia light shining yellowish, more or less mixed with bronzy and pale purplish towards base. Hindwings dark fuscous, thinly scaled in disc; cilia rather dark fuscous.

Twelve specimens, Puttalam, Ceylon, from September to November (Pole).

*Narthecoceros*, n.g.

Head with appressed scales; tongue developed. Antennæ 1, thick, flatly compressed throughout, basal joint moderate, without pecten. Labial palpi long, curved, ascending, second joint thickened with scales, roughly expanded towards apex above and beneath, terminal joint shorter than second, acute. Posterior tibiæ rough-haired above. Forewings with 2 and 3 stalked, 7 and 8 stalked, 7 to termen. Hindwings 1, trapezoidal, apex round-pointed, termen faintly sinuate, cilia 1; 3 and 4 connate, 5 parallel, 6 and 7 long-stalked.

Type *N. platyconta*, Meyr. Having now obtained a second allied species, I consider the characters warrant generic separation from *Macrotona*, from which the genus is distinguished by the flatly-compressed antennæ, second joint of palpi roughened above towards apex, and terminal joint shorter than second.

*Narthecoceros xylodes*, n. sp.

♂. 20-21 mm. Head and thorax pale greyish-ochreous sprinkled with fuscous. Palpi pale brownish-ochreous irrorated with dark fuscous. Antennæ whitish-ochreous tinged with fuscous, with two narrow dark fuscous subapical bands. Abdomen light ochreous. Forewings elongate, narrow, costa gently arched, apex round-pointed, termen slightly sinuate, rather strongly oblique; whitish-ochreous, irrorated with fuscous; a moderate dark fuscous suffusion along costa from before middle to apex, and dorsal half posteriorly more or less suffused with dark fuscous irroration, space between these sometimes forming an undefined pale streak; stigmata undefined, dark fuscous, plical very obliquely before first discal; undefined cloudy dark fuscous dots along posterior part of costa and termen: cilia fuscous with rows of ochreous-whitish points, on termen with whitish-ochreous basal shade. Hindwings rather dark fuscous; cilia as in forewings, but lighter and more yellowish-tinged towards tornus.

Three specimens, Maskeliya, Ceylon, in February and March (Pole).

*Macrotona parœna*, n. sp.

♂. 23-25 mm. Head, antennæ, thorax, and abdomen light brownish-ochreous. Palpi ochreous-whitish, second joint dark fuscous except apex, terminal joint tinged with fuscous externally. Forewings elongate, narrowed towards base, costa gently arched, apex obtuse, termen sinuate, rather oblique; 7 to apex, 9 separate; light brownish-ochreous, somewhat sprinkled with pale brownish and a few black scales; a minute black subcostal dot near base; discal stigmata small, cloudy, dark brown, first resting on a transverse cloudy purple-fuscous mark beneath it, between first and second a cloudy fuscous dot in disc rather above them; a transverse purple-brownish fascia about ⅔, somewhat angulated in middle, faint towards costa, stronger and much darker on dorsal half: cilia light yellow-ochreous, with subbasal series of undefined fuscous spots. Hindwings with 3 and 4 connate; light fuscous, ochreous-tinged; cilia as in forewings but paler.

Three specimens, Maskeliya and Maturatta, Ceylon, in March, May, and October (Pole, de Mowbray).

*Lecithocera cholopis*, n. sp.

♂. 16-17 mm. Head and thorax rather dark fuscous, face and antennæ ochreous-white. Palpi ochreous-white, towards base fuscous. Abdomen greyish-ochreous. Forewings elongate, narrow, costa gently arched; apex obtuse, termen almost straight, oblique ; 9 out of 7 ; rather dark fuscous : cilia fuscous. Hindwings whitish-grey, greyer posteriorly ; cilia whitish-grey, becoming greyer round apex.

Two specimens, Kôni, Burma, in September (Manders). Erroneously recorded by me formerly as *luticornella*, Zell., from which it differs by the neuration and white face.

*Psammoris*, n. g.

Head smooth ; tongue developed. Antennæ 1, in ♂ rather thick, simple, basal joint moderately elongate, without pecten. Labial palpi long, recurved, second joint thickened with scales, shortly projecting beneath towards apex-terminal joint as long as second, slender, acute. Posterior tibiæ with hairs appressed above, projecting beneath. Forewings with 2 and 3 stalked from angle, 7 and 8 stalked, 7 to costa, 9 absent, 11 from beyond middle. Hindwings 1, trapezoidal, termen sinuate, cilia 1 ; 4 absent, 3 and 5 connate or short-stalked, 6 and 7 stalked.

Belongs to the *Macrotona* group.

*Psammoris carpæa*, n. sp.

♂. 13-14 mm. Head, thorax, and abdomen whitish-ochreous tinged with yellow. Palpi ochreous-yellowish, second joint externally dark fuscous except extreme base and apex. Antennæ yellowish, apex suffused with dark fuscous. Forewings elongate, narrow, costa gently arched, apex obtuse, termen very obliquely rounded ; ochreous-yellow, with some fine scattered black scales ; a very small blackish spot on base of costa ; a rather curved outwardly oblique thick black mark in disc about $\frac{2}{3}$, and a small round black discal spot before $\frac{3}{4}$ : cilia pale ochreous-yellowish, with a fine grey postmedian line. Hindwings light grey, paler and whitish-tinged towards base ; cilia whitish-yellowish.

Two specimens, Maskeliya, Ceylon, in January and July (Pole).

*Antiochtha stellulata*, n. sp.

♂. 22 mm. Head pale ochreous-yellowish, slightly fuscous-tinged. Palpi with second joint rather dark fuscous, suffused with pale ochreous-yellowish towards apex, terminal joint longer than second, blackish, anterior and posterior edges pale yellowish. Antennæ pale ochreous-yellowish. Thorax rather dark purplish-fuscous, somewhat mixed with pale ochreous. Abdomen light ochreous-yellowish. Posterior tarsi with basal joint rough-scaled above. Forewings elongate, narrow, somewhat dilated posteriorly, costa gently arched, apex round-pointed, termen concave, oblique ; 2 and 4 connate or short-stalked, 5 closely approximated, 7 to apex ; pale fuscous irrorated with dark fuscous, with strong purplish reflections ; markings pale whitish-ochreous, yellower on costal edge ; transverse marks from costa beyond $\frac{1}{3}$ and $\frac{2}{3}$, first narrow, irregular, second rather broader ; a dot on fold before middle ; two minute dots

transversely placed in disc beyond middle; four dots forming a curved transverse subterminal series on dorsal half: cilia rather dark fuscous with darker shades and some ochreous-whitish points, a basal line and some narrow bars on basal third ochreous-yellowish. Hindwings with 3 and 4 connate; fuscous; cilia whitish-ochreous, base more yellowish, with two rather dark fuscous shades.

One specimen, Maskeliya, Ceylon, in February (Pole).

*Antiochtha achnastis*, n. sp.

♂ ♀. 18-20 mm. Head whitish-ochreous, somewhat mixed with grey. Palpi whitish-ochreous, second joint irrorated with dark fuscous, terminal joint somewhat longer than second, with incomplete blackish lateral lines. Antennæ whitish-ochreous, in ♀ more or less mixed with dark fuscous. Abdomen whitish-ochreous. Posterior tibiæ with basal joint rough-scaled above, remaining joints ochreous-white. Forewings elongate, narrow, slightly dilated posteriorly, costa slightly arched, apex obtuse, termen sinuate, oblique; 2 and 4 short-stalked, 5 connate, 7 to just below apex; fuscous irrorated with dark fuscous or blackish; stigmata dark fuscous or black, ringed with whitish, sometimes large, plical slightly beyond first discal, these two placed in an indistinct irregular rather oblique narrow fascia of whitish suffusion which forms a more distinct whitish spot on costa, sometimes preceded by a dark fuscous spot; a cloudy subterminal line of ochreous-whitish suffusion, angulated in middle, forming a conspicuous triangular ochreous-white spot on costa: cilia dark fuscous with rows of fuscous-whitish points, basal line and narrow bars on basal third more or less distinctly whitish-ochreous. Hindwings with 3 and 4 connate; grey, darker posteriorly; cilia varying from whitish-ochreous to pale greyish, with two cloudy dark grey shades.

Five specimens, Maskeliya, Ceylon, in March, May, and December (Pole, de Mowbray).

*Antiochtha tetradelta*, n. sp.

♂. 20 mm. Head, palpi, and antennæ ochreous-whitish, palpi with lower ⅔ of second joint and anterior edge of terminal joint dark bronzy-fuscous, terminal joint longer than second. Thorax bronzy-fuscous, shoulders suffused with ochreous-whitish. Abdomen light ochreous-yellowish. Posterior tarsi with basal joint smooth. Forewings elongate, narrow posteriorly slightly dilated, costa slightly arched, apex round-pointed, termen concave, somewhat oblique; 2 separate, 4 and 5 connate, 7 to apex; pale greyish-ochreous suffused with ochreous-whitish; base of costa, and an oblique costal strigula before middle dark fuscous; a triangular dark fuscous blotch, edged with ochreous-whitish, extending on dorsum from ⅓ to beyond middle, and reaching ¾ across wing; a similar blotch extending along costa from middle to ⅘, and nearly reaching to dorsum; a fine dark fuscous terminal line, shortly continued and stronger above apex: cilia ochreous-whitish, towards base yellowish-tinged with median fuscous shade. Hindwings with 3 and 4 stalked; light fuscous; cilia whitish-fuscous, at base and towards tornus pale yellowish.

One specimen, Maskeliya, Ceylon, in October (de Mowbray).

*Organitis*, n. g.

Head with appressed scales; tongue developed. Antennæ $\frac{4}{5}$, in ♂ shortly ciliated, basal joint moderate, without pecten. Labial palpi long, curved, ascending, second joint thickened with scales, slightly rough beneath, terminal joint as long as second, slender, acute. Posterior tibiæ rough-scaled above. Forewings with 2 and 4 stalked, 3 absent, 8 and 9 out of 7, 7 to apex, 11 from beyond middle. Hindwings 1, trapezoidal, apex rounded, termen hardly sinuate, cilia $\frac{3}{4}$; 3 and 4 connate or stalked, 5 absent, 6 and 7 stalked.

Allied to *Brachmia*; in neuration resembling *Antiochtha*, but distinguished by the shorter antennæ.

*Organitis characopa*, n. sp.

♂ ♀. 15-17 mm. Head and thorax pale bronzy-ochreous, sometimes fuscous-tinged. Palpi ochreous-whitish, second joint fuscous except apex. Antennæ whitish-ochreous, sometimes fuscous-tinged, basal joint fuscous. Abdomen pale ochreous. Forewings elongate, rather narrow, costa moderately arched, apex obtuse, termen almost straight, rather oblique; pale brassy-ochreous suffused with light fuscous; stigmata rather large, dark fuscous, often elongate, plical very obliquely before first discal, sometimes nearly obsolete, discal stigmata sometimes connected by an obscure paler streak: cilia whitish-ochreous. Hindwings pale fuscous; cilia whitish-ochreous.

Five specimens, Maskeliya, Ceylon, in March, June, and July (Pole).

*Brachmia*, Hb.

I find it necessary to merge *Torodora*, Meyr. in this genus; the differences of neuration and palpi would, if pressed, separate closely allied species; the combined genus is natural and easily recognised, and appears to be specially characteristic of the Indo-Malayan region, where it is very extensively developed. The two following species extend the neural characters somewhat.

*Brachmia cherandra*, n. sp.

♂. 20 mm. Head light ochreous-yellow, crown suffused with light grey except at sides. Palpi pale ochreous-yellowish, second joint suffused externally with dark fuscous on lower $\frac{2}{3}$, terminal joint as long as second. Antennæ pale ochreous yellowish. Thorax dark purple-fuscous. Abdomen grey, anal tuft whitish-ochreous. Legs dark grey, middle tibiæ and all tarsi whitish-ochreous, basal joint of posterior tarsi somewht rough-scaled above. Forewings elongate, rather narrow, somewht dilated posteriorly, costa moderately arched, apex obtuse, termen nearly straight, somewhat oblique; 7 absent, 8 and 9 stalked; dark fuscous, purplish-tinged; stigmata small, faintly darker, plical beneath first discal, edged posteriorly by a minute grey-whitish dot; ochreous-yellowish subtriangular dots on costa at $\frac{2}{3}$ and $\frac{4}{5}$, and on dorsum near tornus: cilia light fuscous mixed with slaty-grey. Hindwings with 3 and 4 stalked; grey; cilia grey, with basal ochreous-whitish line.

One specimen, Maskeliya, Ceylon, in May (Pole). The absence of vein 7 in the forewings is an abnormal character, but as in all other respects the species is normal, I do not at present separate it generically.

*Brachmia syrphetodes*, n. sp.

♂ ♀. 25-27 mm. Head brownish-ochreous. Palpi whitish-ochreous, second joint externally dark fuscous except at apex, terminal joint as long as second, anterior edge dark fuscous. Antennæ pale ochreous, obscurely fuscous-ringed. Thorax brownish-ochreous partially suffused with dark fuscous. Abdomen light ochreous. Posterior tarsi with basal joint smooth-scaled. Forewings elongate, rather narrowed anteriorly, costa gently arched, apex obtuse, termen nearly straight, little oblique; 3 and 4 out of 2, 8 and 9 out of 7, 7 to apex; fuscous, partially suffused with dark fuscous, irregularly strewn with pale ochreous; a small dark fuscous subbasal spot towards costa; discal stigmata rather large, suffused, dark fuscous, connected by an irregular elongate pale ochreous patch, an additional dark fuscous dot before and above second; a cloudy whitish-ochreous subterminal line, somewhat curved and indented beneath costa: cilia whitish-ochreous, in ♀ fuscous-tinged, above apex with a dark fuscous patch. Hindwings with 3 and 4 connate or short-stalked, 5 approximated; light fuscous; cilia whitish-ochreous, in ♀ fuscous-tinged.

Two specimens, Maskeliya, Ceylon, in April and June (Pole).

*Demiophila*, n. g.

Head with appressed scales; tongue developed. Antennæ $\frac{4}{5}$, in ♂ serrulate, minutely ciliated, basal joint moderately elongate, without pecten. Labial palpi long, recurved, second joint thickened with appressed scales, somewhat rough beneath towards apex, terminal joint as long as second, moderate, acute. Posterior tibiæ clothed with long rough hairs above. Forewings with 2 from near angle, 3 and 4 stalked, 5 approximated, 7 to apex, 8 absent, 9 approximated, 11 from beyond middle. Hindwings over 1, oblong-ovate, cilia $\frac{1}{2}$, 3 and 4 connate or short-stalked, 5 tolerably parallel, 6 and 7 connate.

A genus of ordinary appearance but somewhat uncertain affinity; the stalking of veins 3 and 4 of forewings is a notable peculiarity.

*Demiophila psaphara*, n. sp.

♂ ♀. 17-21 mm. Head and thorax whitish-ochreous sprinkled with fuscous. Palpi whitish-ochreous, second joint dark fuscous except apex, terminal joint with anterior edge usually suffused with dark fuscous. Antennæ whitish-ochreous, basal joint dark fuscous. Abdomen whitish-ochreous, more or less fuscous-sprinkled. Forewings elongate, slightly narrowed anteriorly, costa gently arched, apex obtuse, termen rather obliquely rounded; whitish-ochreous, more or less sprinkled with fuscous; a dark fuscous dot on base of costa, and another beneath it; stigmata moderate, dark fuscous, plical elongate and often small, obliquely beyond first discal; an almost marginal series of dark fuscous dots round termen and apical portion of costa: cilia whitish-ochreous, faintly sprinkled with whitish-fuscous, with a faint whitish-fuscous antemedian shade. Hindwings pale whitish-ochreous-grey or whitish-ochreous; cilia whitish-ochreous.

Eight specimens, Puttalam, Ceylon, in February and from July to September (Pole).

*Dactylethra*, n.g.

Head with appressed scales, sidetufts loosely spreading; tongue developed. Antennæ $\frac{4}{5}$, in ♂ serrulate, simple, basal joint moderate, without pecten. Labial palpi long, curved, ascending, second joint with long dense rough projecting tuft beneath, terminal joint as long as second, loosely scaled, acute. Posterior tibiæ rough-haired above. Forewings with 2 from near angle, 2, 3 4 parallel, 7 and 8 stalked, 7 to apex, 11 from middle. Hindwings 1, trapezoidal, apex obtuse, termen faintly sinuate, cilia $\frac{4}{5}$; 2 remote, 3 and 4 connate, somewhat approximated, 6 and 7 stalked.

Apparently related to the *Ypsolophus* group.

*Dactylethra tetroctas*, n. sp.

♂♀. 14-15 mm. Head, palpi, antennæ, thorax, and abdomen ochreous-white; second and terminal joints of palpi with blackish supramedian and usually less marked subbasal rings, tuft suffused with brownish, seldom mixed with dark fuscous. Forewings elongate, costa gently arched, apex obtuse, termen obliquely rounded; ochreous-white; a dark fuscous dot towards costa near base, and two transversely placed in disc at $\frac{1}{3}$; about eight short oblique brown strigulæ on costa; transverse undefined patches of ochreous-brown suffusion in disc at $\frac{1}{3}$, beyond middle, and towards termen, first narrow, second broader, reaching costa, third largest, somewhat mixed with black scales and bounded by a grey terminal streak; between these are two lilac-grey sometimes whitish-centred irregularly 8-shaped spots in disc before middle and at $\frac{2}{3}$, first rather oblique, second shorter: cilia brownish, with rows of whitish points. Hindwings fuscous-whitish; cilia whitish-ochreous.

Ten specimens, Puttalam, Ceylon, in August, October, and November (Pole).

(*To be continued.*)

# NOTES ON SMALL MAMMALS IN KASHMIR AND ADJACENT DISTRICTS.

By

A. E. Ward.

In continuation of my rough notes on the Small Mammals in Kashmir and the adjacent districts, read before the Bombay Natural History Society on 16th March 1905 (Vol. XVI., page 358), I would again refer to the Mouse-hares.

In the Proceedings, Zoological Society of London, Vol. II., Part II., 1904, Mr. Bonhote wrote on the subject of the *Ochotona* genus. Dealing with *O. macrotis*, the Large-eared Mouse-hare of Blanford's "Fauna of India," Mr. Bonhote refers to two species—*aurita* and *grisea*—and says these may probably be assigned to this species (*macrotis*).

One of my collectors brought down from the Paugong Lake shores a couple of Mouse-hares which have now been identified as *aurita*, and Mr. Bonhote writes:—"It is practically a topotype of Blanford's *aurita*, and proves *aurita* to be a good species, nearly allied to *roylei* and not to *macrotis* . . . . ." The measurements are:—

| | | | | |
|---|---|---|---|---|
| ♂ | b. and h. | 6·90 | hf. 1·20 | ear 0·90 |
| ♀ | ,, | 7·30 | ,, 1·20 | ,, 0·80 |

Amongst other specimens brought back from Ladak are four Mouse-hares, two of which came from the Khardong Pass from an altitude of 16,000′, and two were obtained high up the Indus Valley. All these are *macrotis*.

Up to date we have the following from Kashmir and Ladak, &c.:—

*Ladacensis* group. *Ochotona ladacensis* from the Chaugcheumo Valley and W. Tibet at altitudes 16,500′ and 15,500′.

Blanford mentions *ladacensis* Stoliczka's Mouse-hare on page 458. (Mammals).

*Rufescens* group. *O. wardi* from Kashmir.

*Curzoniæ* group. *O. curzoniæ* from Haule, Ladak.
*O. macrotis* from Indus Valley and Kharony.
*O. aurita* from Paugong Lake.

If reference is made to Blanford, page 457 (Mammals), it will be seen that the *macrotis* type came from the Yarkand road, so that evidently this animal is found on both sides of the high range north of Leh,

whilst *aurita* was apparently based on Dr. Stoliczka's specimens from Lukong on the Paugong, which place is not far from where the two specimens I have referred to were found.

Slowly, but, I hope, surely, we are getting on with all the tiresome rodents, and I hope very shortly to present to the Bombay Natural History Society a specimen of *Microtus Blythi* (Blythe's Vole), the distribution of which appears to be extensive. I am awaiting a letter from the British Museum before despatching this specimen.

Regarding the mice found during 1905, I must wait until I am in a position to write definitely.

Also p. 240

# NOTES ON ANDAMAN BIRDS WITH ACCOUNTS OF THE NIDIFICATION OF SEVERAL SPECIES WHOSE NESTS AND EGGS HAVE NOT BEEN HITHERTO DESCRIBED.

By

B. B. Osmaston, I.F.S.

4. *Corvus macrorhynchus.*—The Jungle-Crow.

Common throughout the islands, but especially near Port Blair. Breeds in March, frequently on Cocoanut Palms.

20. *Dendrocitta bayleyi.*—The Andamanese Tree-Pie.

Occurs throughout the Andamans, but is not very numerous. They go about in small parties of half a dozen or so and frequent the densest forest. I failed to find the nest.

296. *Zosterops palpebrosa.*—The Indian White-Eye.

Fairly common, especially in Port Blair. They are late breeders, laying in June and July. The nests and eggs resemble those taken in India. The mean of the measurements of 5 eggs gave 0·63″ × 0·49′.

254. *Irena puella.*—The Fairy Blue-bird.

Fairly numerous around Port Blair, especially from September to March. I did not find the nest, and in fact I rarely saw a bird between April and August. I do not think they breed in the vicinity of Port Blair.

288. *Otocompsa emeria.*—The Bengal Red-whiskered Bulbul.

Common everywhere and especially in Port Blair where it frequently enters the houses taking the place of the common sparrow. Breeds from March to May laying 2 or 3 eggs only.

312. *Micropus fusciflavescens.*—The Andaman Black-headed Bulbul.

This species is decidedly rare. I have only come across it about half a dozen times in 15 months. It frequents the outskirts of forest. It has no song but a characteristic call.

336. *Dissemuroides andamanensis.*—The Small Andamanese Drongo.

Common, but restricted to well wooded and forest areas. Has a variety of notes. Breeds from the middle of April to the middle of May. The nest consists of a shallow cup or cradle suspended from the forked twig of some usually dry or leafless tree, generally at a considerable height from the ground. It is composed of fine twigs firmly woven together and attached to the support by cobwebs and is scantily lined with black hair-like rhizomorph. The eggs, 2 or 3 in number, differ strikingly in colour, at least half a dozen, distinct types being found. The commonest variety is perhaps one in which the ground colour is pale salmon-pink spotted all over with pale brownish markings and with some underlying spots of pale grey. In another type the ground is white and the markings consist of bold dashes and streaks of pinkish brown. Others again are spotted and blotched with dark purplish brown in a zone at the large end, or again they may be finely specked with black in a cap at the large end. The eggs vary in length from 0·88 to 1·05 and in breadth from 0·65 to 0·76 the mean of 31 eggs being 1·00″ × 0·72″.

340. *Dissemurus paradiseus.*—The Larger Racket-tailed Drongo.

Common in high forest. Has a fine series of melodius calls. The Andaman variety of this species shows no trace of the conspicuous frontal crest which forms so marked a feature in the Sub-Himalayan race. It breeds in May building its nest generally high up on the more or less inaccessible branches of big trees. The eggs are similar to those found in India and the mean of 3 eggs gave as measurements 1·13″ × 0·82.″

393. *Arundinax aëdon.*—The Thick-billed Warbler.

Fairly common in and around Port Blair throughout the cold weather. Frequents low scrub where it carefully avoids exposing itself. Its note is a sharp "click, click."

410. *Phylloscopus fuscatus.*—The Dusky Willow-Warbler.

Common in and around Port Blair in the winter, the majority, if not all, leaving by the end of April. It has a sharp "clicking" note.

451. *Horornis pallidipes.*—Blanford's Bush-Warbler.

Common in the dense undergrowth both in high and secondary forest, and never met with in the open. It frequents the thickest cover whence it gives vent at intervals to its characteristic and peculiar call consisting of 3 or 4 rapidly repeated notes. It is an artful skulker and extremely difficult to observe. It is a permanent resident.

482. *Lanius lucionensis.*—The Philippine Shrike.

A seasonal visitor only, arriving in September and leaving in April.

492. *Pericrocotus andamanensis.*—The Andamanese Scarlet Minivet.

Fairly common, frequenting the crowns of trees in small parties.

500. *Pericrocotus peregrinus.*—The Small Minivet.

More numerous than the last. Found several nests in May and June, placed on fairly thick branches of trees, at a height of from 12′ to 30′ from the ground. They were neat cup-shaped structures made of little bits of papery bark held together with spider's web and sparsely lined with bits of dead leaves and fine fibres. The eggs are pale blue spotted, speckled or blotched, chiefly in a zone at the large end, with purplish brown with, in some eggs, underlying grey markings. The mean of 5 eggs gave 0·69″ × 0·55.″

510. *Graucalus macii.*—The Large Cuckoo-Shrike.

Common in and around the Settlement. Found two nests on May 14th and June 4th, respectively, containing 2 fresh eggs each, of the usual type.

513. *Artamus leucogaster.*—The White-rumped Swallow-Shrike.

Common in open places and clearings around Port Blair. They appear to be very affectionate, the male and female sitting for long periods side by side on the same perch. They are fearless of men and follow any one about, who may be walking through long grass, snapping up the grasshoppers and other insects which are disturbed into flight. They breed in April and May, the nests being almost invariably placed on the broken off stump of some stout branch of a tree from 10 to 20 feet from the ground. Jack fruit trees are frequently selected as a building site. The nest is an untidy shallow saucer of twigs little better

than a dove's nest. It is usually quite exposed to view from above and more or less also from below. The parent birds are very bold and defend their property with much spirit. The full complement of eggs is 3. They are white spotted with light brown or fawn, chiefly in a zone, with numerous underlying grey markings. The mean of 5 eggs gave 0·93″ × 0·67″.

517. *Oriolus andamanensis*.—The Andaman Black-naped Oriole.

Very common and conspicuous, being found both in forest and open country. They breed from April to June, laying 2 or 3 eggs only. The nest is the usual cradle suspended from the leafy branch of some tree, and is usually decorated outside with sprays of a small climbing Asclepiad with orbicular leaves. The eggs are fairly glossy. The ground is white generally more or less tinged with claret with dark purplish brown spots which appear to have "run" from the edges, and with a few underlying grey spots. The mean of the measurements of 7 eggs gave 1·10″ × 0·82.″

521. *Oriolus melanocephalus*.—The Indian Black-headed Oriole.

This species is not uncommon in the hot weather; I saw none, however, in the winter.

524. *Eulabes intermedia*.—The Indian Grackle.

Common throughout the Andamans. Large numbers were snared and exported to Calcutta until quite recently but the trade has now been forbidden.

527. *Calornis chalybeius*.—The Glossy Calornis.

These birds appear in Port Blair about February and remain till June, feeding chiefly upon small figs and honey out of flowers. They are exceedingly numerous during these months. Where they go to for the rest of the year I could not ascertain.

528. *Pastor roseus*.—The Rose-coloured Starling.

This species was recorded from the Andamans many years ago by Col. Tytler, but as no one had subsequently seen the bird here, Mr. A. O. Hume and others were doubtful whether it should be included in the Andaman avifauna or not. This year, however, I saw flocks of this bird on two occasions in March and April, and shot three specimens, two males and a female. It is possible that they only visit the Andamans in very severe winters such as was experienced in India this cold weather.

540. *Sturnia andamanensis*.—The Andaman Myna.

Very common both in forest and in the open. Gregarious. They breed towards the end of April and in May. The nest is placed in a hole in a tree at any height from 6 to 30 feet or more. The nest is composed of small, pliant twigs with an occasional stiff feather, and is lined with small green leaves. The eggs, four in number, are of a uniform blue, about the same shade, as or slightly darker than, those of *Acridotheres tristis*. They vary in length from 1·14″ to 0·97″ and in breadth from 0·78″ to 0·72″, but the mean of 22 eggs gives 1·02″ × 0·76″.

549. *Acridotheres tristis*.—The Common Myna.

This objectionable bird which was introduced some years ago by an officer of the Settlement has now become firmly established, and is doing its best to oust

its weaker, though handsomer relative, *Sturnia andamanensis*. Breeds in March and April in holes in trees and in houses.

582. *Muscitrea grisola*.—The Grey Flycatcher.

This bird occurs throughout the islands but is not common, though fairly numerous in open jungle and clearings near Port Blair, especially between Haddo and Navy Bay. It has a fine loud and clear whistle, repeated 3 or 4 times or prolonged and drawn out, followed suddenly by a higher (or lower) note in a different key, reminding one somewhat of the call of *Ægithina tiphia*, and unlike that of any flycatcher. It is a quiet, unobtrusive bird usually seen alone or in pairs. It frequents mangroves and other small trees and catches insects sometimes on the wing and at other times on the branches or trunks of trees. It breeds in May and June, and 2 eggs only are laid. I found five nests between May 17 and June 10. The nest is rather a thin flimsy, cup-shaped structure made of roots, which are attached by means of cobwebs to the twigs supporting it. The eggs could be seen from below through the nest, which was unlined and somewhat resembled that of a Bulbul. The nests were all in small trees from 6 to 12 feet from the ground. The eggs are slightly glossy, dark cream or pale cafe-au-lait spotted with dark yellowish brown and sepia. The spots are rather small and not numerous and they tend to form a zone towards the big end. The eggs remind one a little of those of *Rhipidura albicollis*. They vary very little in size, the mean of 8 eggs being 0·85″ × 0·62″. I brought up a nestling of this species but it died just as it was about to fly. It never showed any vestige of spotted plumage at any stage. Even when in the nest the breast was pure spotless white and the back and wings a warm reddish brown. This looks as if it had been wrongly placed in the *Muscicapidæ* and I would suggest that it may have more affinity for the *Sylviidæ*.

588. *Alseonax latirostris*.—The Brown Flycatcher.

A common winter visitor, of dull plumage and quiet unobtrusive habits.

602. *Hypothymis tytleri*.—The Andaman Black-naped Flycatcher.

Common both in the forest and in and about Port Blair. It is wonderfully active as well as fearless. I found many nests between April 8 and June 1. They were all similar in structure and position to those of *H. azurea*. They were invariably decorated outside with white spider egg-cases. The eggs, 3 in number, are white or faintly pinkish, speckled with rufous brown chiefly in a zone towards the large end.

They vary in length from 0·64″ to 0·75″ and in breadth from 0·53″ to 0·57″, the mean of 16 eggs being 0·72″ × 0·54″.

610. *Pratincola maura*.—The Indian Bush-Chat.

A rare winter visitor. Saw one only near Stewartganj in March.

663. *Copsychus saularis*.—The Magpie-Robin.

Common, especially in and around Port Blair. Breeds from March to June chiefly in holes in trees about 6 feet from the ground, laying 4 eggs of the usual colour.

665. *Cittocincla albiventris.*—The Andaman Shama.

Common throughout the islands, keeping to the densest jungle. It has many fine clear notes, but its song, if it can be so called, is disappointingly unmusical owing to a number of low discordant sounds which are introduced at frequent intervals. They are late breeders, waiting for the burst of the monsoon before commencing to build.

I found seven nests between May 21 and June 27. Four of these were in boxes or hollowed out cocoanut husks placed in thick forest for the purpose of affording building sites, and three were in holes in stumps or clefts in the trunks of trees, all at a height of from 5 to 8 feet from the ground. The nests were composed of dry bamboo leaves lined with fine roots or twigs and lastly with black hair-like rhizomorph. Three was the maximum number of eggs in any nest and two nests contained 2 only.

The eggs appear to be rather small for the bird. They are glossy, with a pale-green ground densely marked, chiefly at the large end with purplish-brown or chocolate, with underlying grey markings visible here and there.

In length the eggs vary from 0·89″ to 0·80″ and in breadth from 0·68″ to 0·65″, but the mean of 9 eggs gives 0·85″ × 0·66″.

680. *Merula obscura.*—The Dark Ouzel.

Saw a solitary specimen of this species on April 4, near the Salt Works.

689. *Geocichla andamanensis.*—The Andaman Ground-Thrush.

Common, especially in Port Blair. It has a pretty, characteristic song. Found many nests in May and June, generally in small trees just outside the forest.

The nests are composed of roots and dead leaves, lined with the former. They contain either two or three (never more) eggs, which vary a good deal in colour. They are fairly glossy and often somewhat pyriform in shape, pale green spotted or blotched with chestnut chiefly in a zone or cap at the large end; also a few underlying pale grey markings may usually be observed. Some eggs are spotted thickly all over with reddish brown, showing no ground at all.

In size the eggs vary from 1·07″ to 0·89″ in length and from 0·76″ to 0·69″ in breadth, the mean of 55 eggs being 0·98″ × 0·73″.

730. *Uroloncha fumigata.*—The Andaman White-backed Munia.

Common in the vicinity of Port Blair, generally in parties of from 6 to a dozen, feeding on bamboo or grass seeds. They breed in June and July, constructing the usual domed nest of fine flowering grasses and laying up to 7 pure white glossless eggs which are often very elongate and pyriform.

They vary in length from 0·67″ to 0·56″ and in breadth from 0·42″ to 0·39″. The mean of 34 eggs gave 0·60″ × 0·41″.

725. *Munia malacca.*—The Black-headed Munia.

Saw three of these birds in some long grass between Haddo and Navy Bay on 17th May. They were building a nest and allowed me to approach and watch them within a few feet. They subsequently, however, deserted the

nest and I have not seen them recently. This species has not been previously recorded from the Andamans.

776. *Passer domesticus.*—The House-Sparrow.

A small colony of these birds still exists at Aberdeen, Phœnix Bay, and Haddo, but they do not fortunately seem to spread much. They were introduced more than ten years ago.

813. *Hirundo rustica.*—The Swallow.

These birds arrive in numbers about the third week in September and remain throughout the cold weather, retiring north in April to breed.

817. *Hirundo javanica.*—The Nilgiri House-Swallow.

Not common. Found 3 nests with hard set eggs in caves on the shore of North Button Island on May 5. The nests were similar in construction to those of *H. rustica*, the eggs being also similar, only smaller.

832. *Motacilla melanope.*—The Gray-Wagtail.

A cold-weather visitor; not common.

839. *Limonidromus indicus.*—The Forest-Wagtail.

Another cold-weather visitor, arriving early in October and leaving in April. Frequents glades and paths in the forest. Has a curious habit of wagging its tail laterally, *i.e.*, from side to side and not up and down as in the case of other wagtails.

899. *Arachnechthra andamanica.*—The Andaman Sun-bird.

Common everywhere and very tame and fearless. Breeds twice in the year, first in February and again in May. The nests are oval in shape, the entrance hole being situated near the top and overhung by a portico of fine grasses. The nest is composed of a variety of materials, chiefly fine grasses, bits of dead leaves, and vegetable fibres. It is lined with down or fine grass stems. It hangs suspended from some twig or grass stem, usually under an overhanging bank often close to the ground, less frequently at some considerable height up in a shrub or tree.

Two eggs are laid which vary a good deal both in shape and colour. They are usually elongated ovals with a tendency to be pyriform, with little or no gloss. The ground colour of the eggs is, where visible, a very pale greenish or bluish white, the whole surface being usually more or less completely mottled over with pale greenish or purplish brown, with occasional dark spots or streaks of the same colour. One type not very common has no brown mottlings, but a few greyish brown spots or blotches on a pale blue ground.

In length they vary from 0·61″ to 0·72″ and in breadth from 0·43″ to 0·47″, and the mean of 26 eggs is 0·65″ × 0·45″.

918. *Dicæum virescens.*—The Andamanese Flower-pecker.

Not common. Frequents trees infested with Loranthus, the fruits of which it feeds on. Note—a sharp "click."

971. *Dendrocopus andamanensis.*—The Andaman Pied Woodpecker.

Common in and around Port Blair. Affects chiefly fairly open jungle. Found many nest holes on the underside of branches of avenue trees (chiefly

the Rain tree--*Pithecolobium saman*). Watched a bird excavating such a hole in January, but it was subsequently deserted.

1000. *Thriponax hodgii*.—The Andaman Black Woodpecker.

Fairly common in high forest throughout the main Islands. Frequents lofty forest trees, whence the sound of its resonant tapping on some dead branch may be heard half a mile away.

Found a nest in a hole in a dead tree 20 feet from the ground containing two fresh eggs, pure glossy white, measuring 1·13″×0·82″ and 1·03″×0·81″ respectively.

1025. *Eurystomus orientalis*.—The Broad-billed Roller.

Rather rare but widely distributed. Frequents clearings in high forest.

1027. *Merops philippinus*.—The Blue-tailed Bee-eater.

Not common. I saw a few individuals near Port Blair in March and also on Narcondam in October. They were probably only in migration at the time and do not seem to stop in the Andamans.

1030. *Melittophagus swinhoii*.—The Chestnut-headed Bee-eater.

Very common in and around Port Blair. They are chiefly seen in pairs. Breed in holes in banks, which often penetrate to a depth of 4 feet. The eggs are of the usual bee-eater type, 3 to 5 in number, pure white, round and glossy.

They vary from 0·83″ to 0·95″ in length and from 0·72″ to 0·79″ in breadth, the mean of 20 eggs being 0·89″×0·76″.

1035. *Alcedo lepida*.—The Common Kingfisher.

Not nearly so common as the next species. Have seen a few around Port Blair.

1036. *Alcedo beavani*.—Beavan's Kingfisher.

Common both on salt and fresh water creeks and streams. They are late breeders, all the nests seen by me being taken between June 25 and July 15.

The eggs, usually 5 in number, are glossy broad ovals. In length they vary from 0·82″ to 0·76″ and in breadth from 0·62″ to 0·71″, the mean of 20 eggs being 0·78″×0·68″.

1040. *Ceyx tridactyla*.—The Indian Three-toed Kingfisher.

This lovely little King-fisher is certainly very rare in the Andamans. I have only once come across it when following up a small rocky stream in dense forest below Mount Harriet. This was on May 27th, and the bird was disturbed excavating a nest hole in the bank, which, however, was afterwards abandoned.

1043. *Pelargopsis gurial*.—The Brown-headed Stork-billed Kingfisher.

Fairly common, especially on brackish creeks. I did not come across its nest.

1044. *Halcyon smyrnensis*.—The White-breasted Kingfisher.

One of the commonest birds in the Islands, especially near Port Blair. Breeds in April and May, the nest holes being in banks 2 to 3 feet deep.

The eggs vary from 1·16″ to 1·27″ in length and from 1·00″ to 1·09″ in breadth, the mean of 10 eggs being 1·22″×1·05″.

1045. *Halcyon pileata*.—The Black-capped Kingfisher.

Rare but widely distributed. I have seen three individuals only in 15 months—one near Port Blair, one in the Cinqué Islands and one on Narcondam.

1046. *Calialcyon lilacina*.—The Ruddy Kingfisher.

Not uncommon in the North Andaman, but very scarce elsewhere. I have seen none near Port Blair.

1047. *Sauropatis chloris*.—The White-collared Kingfisher.

Very common everywhere along the coast or up brackish creeks. Feeds largely in grasshoppers as well as fish. Found several nests in April and May. They are usually in holes in banks, only about a foot deep, occasionally also in holes in white ants' mounts or in the up turned roots of a tree, and one nest I observed was in a hole in a mango tree about 15 feet from the ground.

Three or four eggs are laid broadly pyriform and exhibiting very little or no gloss.

Length, 1·07″ to 1·19″. Breadth, 0·91″ to 0·97″. Mean of 12 eggs, 1·11″ × 0·95″.

(*To be continued.*)

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# THE MOTHS OF INDIA.

## SUPPLEMENTARY PAPER TO THE VOLUMES IN "THE FAUNA OF BRITISH INDIA."

### SERIES III. PART III.

By

Sir George Hampson, Bart., F.Z.S., F.E.S.

(*Continued from page 719 of Vol. XVI.*)

### Sub-family Hadeninæ.

### Key to the Genera.

A. Fore tibia with terminal claw.
  *a.* Abdomen with dorsal series of crests..... *Barathra.*
  *b.* Abdomen with dorsal crest on 1st segment only ... *Hypobarathra.*

B. Fore tibia without terminal claw.
  *a.* Fore tarsus with long curved claw-like spines on outer side of 1st joint ... ..... ..... *Trichoclea.*
  *b.* Fore tarsus without claw-like spines on outer side of 1st joint.
    $a^1$. Eyes overhung by long cilia.
      $a^2$. Thorax clothed chiefly with scales ..... *Thyrestra.*
      $b^2$. Thorax clothed with hair only ..... ..... *Lasiestra.*
    $b^1$. Eyes not overhung by long cilia.
      $a^2$. Proboscis aborted, minute.
        $a^3$. Abdomen with dorsal crest on 1st segment.
          $a^4$. Frons with disk-shaped prominence with central truncate process ..... *Aspidifrontia.*
          $b^4$. Frons without prominence .. ..... *Brithys.*
        $b^3$. Abdomen without dorsal crest ..... *Polytela.*
      $b^2$. Proboscis fully developed.
        $a^3$. Frons with truncate conical prominence.
          $a^4$. Abdomen with dorsal series of crests.
            $a^5$. Frons with semilunar corneous prominence ..... *Discestra.*
            $b^5$. Frons with circular prominence ..... *Craterestra.*
          $b^4$. Abdomen with dorsal crest on 1st segment only ..... *Palpanima.*
        $b^3$. Frons with slight rounded prominence with corneous plate below it.
          $a^4$. Abdomen with dorsal series of crests.
            $a^5$. Head and thorax clothed chiefly with scales ..... *Scotogramma.*
            $b^5$. Head and thorax clothed with hair-like scales ..... *Dasygaster.*

$b^4$. Abdomen with dorsal crest on 1st segment only ..... *Odontestra.*
$c^4$. Abdomen without dorsal crest ..... *Meliana.*
$c^3$. Frons without prominence.
$a^4$. Tegulæ dorsally produced into a ridge.
$a^5$. Abdomen with dorsal crest on 1st segment ..... *Xylomania.*
$b^5$. Abdomen without dorsal crest ..... *Monima.*
$b^4$. Tegulæ not produced into a ridge.
$a^5$. Thorax clothed chiefly with scales.
$a^6$. Abdomen with dorsal series of crests ..... *Miselia.*
$b^6$. Abdomen with dorsal crest on 1st segment only ..... *Hadena*
$b^5$. Thorax clothed with hair and hair-like scales, sometimes with a few scales on upper edge of patagia.
$a^6$. Abdomen with dorsal series of crests..... *Tiracola*
$b^6$. Abdomen with dorsal crest on 1st segment only.
$a^7$. Prothorax with dorsal ridge-like crest ..... *Chalwata.*
$b^7$. Prothorax with spreading crest ... *Cirphis.*
$c^6$. Abdomen without dorsal crest ... *Borolia.*
$c^5$. Thorax clothed with hair only.
$a^6$. Prothorax with spreading crest..... *Sideridis.*
$b^6$. Thorax without distinct crests ..... *Ceraphyra.*

Genus THYRESTRA.

*Type.*

*Thyrestra*, Hmpsn. Cat. Lep. Phal. B.M. V., p. 6 (1905) ... *hyalophora.*

Proboscis fully developed; palpi upturned, fringed with hair in front, the 3rd joint porrect; frons smooth; eyes large, rounded, overhung by long cilia; antennæ of male almost simple, head and thorax clothed with rough scales, the prothorax with ridge-like dorsal crest, the metathorax with crest; abdomen with dorsal series of crests, paired lateral tufts of very long white hair protrusible from the lateral stigmata of male. Forewing rather long and narrow, the apex produced and the termen oblique; veins 3 and 5 from near angle of cell; 6 from upper angle; 9 from 10

*Thyrestra hyalophora.* ♂ ½.

anastomosing with 8 to form the areole ; 11 from cell. Hindwing with veins 3-4 from angle of cell ; 5 obsolescent from middle of discocellulars ; 6-7 stalked ; 8 anastomosing with the cell near base only ; male with a patch of hyaline membrane in, below, and beyond cell.

1756 *a*. THERESTRA HYALOPHORA.

Genus BARATHRA.

*Type.*

*Barathra Hübn. Verz.*, p. 218 (1827) ..... *brassicæ.*

*Copimamestra*, Grote, A. M. N. H. (5) XI., p. 54 (1883). *brassicæ.*

Proboscis fully developed ; palpi obliquely upturned, the 2nd joint fringed with hair, the 3rd short ; frons smooth ; eyes large, rounded, not ciliated ; antennæ of male minutely ciliated ; tibiæ fringed with hair, the fore tibia with long curved claw on outer side ; head and thorax clothed with hair and scales, the pro- and metathorax with spreading crests, abdomen with dorsal series of crests, the one on basal segment large. Forewing with the termen crenulate ; veins 3 and 5 from close to angle of cell ; 6 from upper angle ; 9 from 10 anastomosing with 8 to form the areole ; 11 from cell. Hindwing with veins 3-4 from angle of cell ; 5 obsolescent from just below middle of discocellulars ; 6-7 from upper angle ; 8 anastomosing with the cell near base.

*Barathra brassicæ.* ♂ ♀

1691. BARATHRA BRASSICÆ insert (syns.).

*Mamestra andalusica*, Staud. Cat., p. 99 (1871).

" *scotochroma*, Röber. Iris. 1, p. 240, pl. xii., f. 13 (1884).

" *decolorata*, Staud. Stett Ent. Zeit 1889, p. 34.

" *straminea*, Failla. Nat. Sic. X., p. 30, pl. 1, f. 5 (1890).

Genus DISCESTRA.

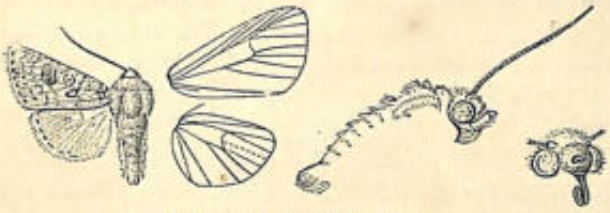
*Type.*

*Discestra*, Hmpsn. Cat. Lep. Phal B. M. V. p. 14 (1905) ..... *chartaria.*

Proboscis fully developed ; palpi upturned, the 2nd joint fringed with hair in front ; frons with semilunar corneous prominence with raised edges, a corneous plate below frons ; eyes large, rounded ; antennæ of male ciliated ; head and thorax clothed chiefly with scales, the pro- and metathorax with divided crests ; abdomen with dorsal series of crests. Forewing with veins 3-5 from near angle of cell ; 6 from upper angle ; 9 from 10 anastomosing with 8 to form the areole ; 11 from cell. Hindwing with veins 3-4 from angle of cell ; 5 obsolescent from middle of discocellulars ; 6-7 from upper angle ; 8 anastomosing with the cell near base only.

1679*c*. DISCESTRA ARENARIA, Hmpsn. Cat. Lep. B. M. V., p. 16, pl. 78, f. 25 (1905).

Head whitish; thorax and abdomen whitish tinged with pale ochreous brown; tarsi tinged with fuscous. Forewing whitish, tinged with pale ochreous brown and irrorated with fuscous: subbasal line double waved, from costa to vein 1; antemedial line indistinct, double, waved; claviform moderate, defined by black; orbicular and reniform moderate, with fuscous centres defined by black, the former round; traces of a medial line; postmedial line dentate, bent outwards below costa, excurved to vein 4, then incurved, some pale points beyond it on costa; subterminal line pale, slightly defined by fuscous, minutely waved, angled outwards at vein 7, slightly dentate at veins 4·3 and bent outwards to tornus; a terminal series of small black lunules. Hindwing white, the veins and termen tinged with brown; some dark terminal points; the under side with the costa slightly irrorated with brown, a small black discoidial point



*Discestra arenaria.* ♂ ½.

*Habitat*—SIND, Karachi. *Exp.* 30-32, mill.

Genus CRATERESTRA.

*Type.*

*Craterestra* Hmpsn. Cat. Lep. Phal., B.M., V., p. 17 (1905) ... *lucina.*

Proboscis fully developed; palpi upturned, the 2nd joint fringed with hair in front, the 3rd moderate, oblique; frons with truncate conical corneous prominence with corneous plate below it; eyes large, rounded; antennæ ciliated; head and thorax clothed with scales and hair, the pro- and metathorax with spreading crests; tibiæ fringed with rather long hair; abdomen with dorsal series of crests and lateral fringes of hair. Forewing with veins 3 and 5 from near angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hindwing with veins 3·4 from angle of cell; 5 obsolescent from middle of discocellulars; 6·7 from upper angle; 8 anastomosing with the cell near base only.

*A.* Forewing with the medial area darker than ground colour ..... *media.*

*B.* Forewing with the medial area not darker than ground colour.

*a.* Forewing with the costal area whitish.

*a*¹. Forewing with the inner area whitish ..... *bifascia.*

*b*¹. Forewing with the inner area not whitish ..... *albicosta.*

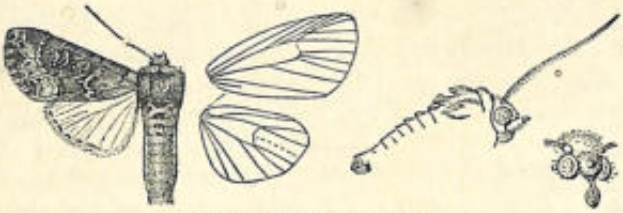
*b.* Forewing with the costal area not whitish..... *subterminata.*

1679*d*. CRATERESTRA MEDIA. Wlk., XI. 756 (1857); Hmpsn. Cat. Lep. Phal., B. M., V., p. 19, pl. 78, f. 28.

*Apamea latifasciata*, Moore, P. Z. S. 1881, p. 345.

*Apamea viriata*, Swinh., P. Z. S. 1885, p. 450.

Head and thorax red-brown mixed with black or fuscous brown; tegulæ with medial black line; tarsi with ochreous rings; abdomen ochreous brown. Forewing fuscous brown, the area below the cell



*Craterestra media.* ♂ ½.

before the antemedial line and the postmedial area except towards costa ochreous more or less tinged with brown; a waved subbasal line from costa to submedian fold; antemedial line defined by ochreous on inner side, waved, strongly angled outwards above inner margin; claviform moderate, defined by black and with some blackish between it and postmedial line; orbicular and reniform defined by black, the former round; an indistinct waved medial line; postmedial line dentate, indistinctly double, bent outwards below costa, excurved to vein 4, then oblique; subterminal line pale, defined on inner side by a series of slight dentate rufous marks, angled outwards at vein 7 and dentate at veins 4-3, the area beyond it dark except at apex; a terminal series of black points; cilia intersected with rufous. Hindwing white or ochreous white, the veins and terminal area more or less tinged with fuscous; the under side with the costal and terminal areas irrorated with fuscous, a postmedial series of slight dark streaks on the veins.

*Habitat.*—Mashonaland, Salisbury; Punjab, Kulu, Sultanpore, Dharmsála, Jubbulpore, Manpuri; Bombay, Poona; Canara; Nilgiris; Burma, Mandalay, Thayetmyo. *Exp.* 34-36, mill.

1935. Craterestra bifascia.

1936. Craterestra albicosta.

1679. Craterestra subterminata. Hmpsn. Cat. Lep. Phal., B. M., V., p. 22, pl. 78, f. 31 (1905).

♀. Head and thorax bronwish grey; tegulæ with black medial line; tarsi fuscous with pale rings; abdomen grey-brown. Forewing grey tinged with reddish-brown; the postmedial area except towards costa, the area below the cell from before middle, and the inner margin from base suffused with fuscous; an ill-defined black streak below base of cell; subbasal line represented by a blackish mark below costa; antemedial line indistinct, dentate, oblique; claviform absent; orbicular very indistinct, rather elongate; reniform with brown and fuscous centre and greyish annulus, somewhat angled inwards on median nervure; postmedial line indistinct, double, filled in with greyish, bent outwards below costa excurved to vein 4, then incurved, some pale points on costa beyond it; subterminal line pale, diffused, angled outwards at vein 7 and excurved at middle; a terminal series of points; cilia whitish intersected with brown. Hindwing whitish tinged with brown; the veins and

termen brown ; the underside white irrorated with brown, a discoidal spot, indistinct sinuous postmedial line with dark streaks on the veins, and some terminal lunules.

*Habitat.*—SIKHIM. *Exp.* 34, mill.

Genus SCOTOGRAMMA.

*Type.*

*Scotogramma*, Smith, Pr. U. S. Nat. Mus. X., p. 469 (1887)... *submarina.*

Proboscis fully developed ; palpi oblique, the 2nd joint fringed with hair in front, the 3rd moderate, porrect ; frons with rounded prominence with slight vertical edge and corneous plate below it ; eyes large, rounded ; antennæ of male ciliated ; head and thorax clothed with hair and scales, the pro- and meta thorax with spreading crests ; tibiæ fringed with hair ; abdomen with dorsal series of crests and lateral fringes of hair. Forewing with veins 3 and 5 from near angle of cell ; 6 from upper angle ; 9 from 10 anastomosing with 8 to form the areole ; 11 from cell. Hindwing with veins 3·4 from angle of cell ; 5 obsolescent from middle of discocellulars ; 6·7 from upper angle ; 8 anastomosing with the cell near base only.

A. Forewing with the subterminal line angled outwards at veins 4 3 and forming a distinct W-mark ... ... ..... *trifolii.*

B. Forewing with the subterminal line not forming a W-mark at veins 4·3 ..... *agrotiformis.*

*Scotograma trifolii.* ♂ ½.

1677. SCOTOGRAMMA TRIFOLII, insert (syns.).

*Noctua verna*, Esp. Schmett., IV., pl. 117. A ff. 5·6 (1786).

„ *saucia*, Esp. Schmett., IV., pl. 152, f. 5. (1786).

„ *treitschkei*, Hübn., Eur. Schmett. Noct., f. 850 (1827) ; Boisd., Mem. Soc. Linn., Paris 1827, p. iii., pl. 6, f. 2 ; Dup. Lep. Fr. VIII. p. 40, pl. 103, f. 1 ; Herr-Schaff. Schmett., Eur. Noct. ff. 68·69 ; Staud. Cat. Lep. Pal, p. 159.

„ *pugnax*, Hübn. Eur. Schmett. Noct. ff. 726-7 (1827).

„ *farkasii*, Treit. Schmett. Eur., X. 2, p. 74. (1835).

*Hadena intermissa*, Wlk., XI., 587 (1857).

*Apamia inquieta*, Wlk., XI., 730 (1857).

*Hadena albifusa*, Wlk., XII., 752 (1857).

*Apamea glaucovaria*, Wlk., Can. Nat. and Geol., V., p. 255 (1860).

*Mamestra canescens*, Moore, A. M. N. H. 1878, p. 233 ; id. 2nd Yarkand Mission, p. 9, pl. 1, f. 13.

„ *oregonica*, Grote, Can. Ent., XIII., p. 230 (1881).

*Habitat.*—N. America; Europe; Sokotra; W. and C. Asia; Punjab; Sikhim; Tibet.

1679*a*. Scotogramma agrotiformis.

Genus Lasiestra.

*Type.*

*Lasiestra*, Hmpsn. Cat. Lep. Phal. B. M. V., p. 47 (1905)... *phoca.*

Proboscis fully developed; palpi upturned, the 2nd joint clothed with long hair in front, the 3rd moderate; frons smooth; eyes large, rounded, overhung by long cilia; antennæ of male serrate or ciliated; head and thorax clothed with rough hair and without crests; tibiæ fringed with rough hair; abdomen with dorsal crests on basal segments. Forewing with the termen obliquely curved; veins 3 and 5 from close to angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hindwing with vein 3 from close to angle of cell; 5 obsolescent from just below middle of discocellulars; 6-7 shortly stalked; 8 anastomosing with the cell near base only.

Sect. II. Antennæ of male ciliated.

A. Forewing not tinged with olive..... *elvesi.*

B. Forewing tinged with olive ..... *deliciosa.*

1683. Lasiestra elvesi.

1683*a*. Lasiestra deliciosa, Alph. Hor. Ent. Soc. Ross. XXVI., p. 446 (1892); id. Rom. Mem. IX., p. 18, pl. 3, f. 3; Staud. Cat. Lep. Pal., p. 162.

Head and thorax olive-grey mixed with some black; tegulæ whitish edged with black; tarsi with whitish rings; abdomen olive-grey. Forewing olive-grey irrorated with fuscous, the markings blackish irrorated with yellow scales; subbasal line double, waved, from costa to vein 1; antemedial line double, waved; claviform small, defined by black; orbicular and reniform defined by black, the former round, or quadrate, open above and below; a waved medial line; postmedial line double, dentate and produced to points on the veins, bent outwards below costa and oblique below vein 4; subterminal line excurved below costa and at middle, angled inwards in discal and submedian folds; a terminal series of small triangular black spots; cilia whitish, with a dark line through them. Hindwing dark fuscous, with very indistinct greyish subterminal line; cilia white with dark line through them; the underside grey irrorated with brown, a dark discoidal spot and sinuous postmedial line.

*Lasiestra elvesi.* ♂ ♮.

*Habitat.*—Tibet; Kashmir, Barra Larcha, Kokser. *Exp.* 36-38 mill.

Genus MISELIA.

| | Type. |
|---|---|
| *Miselia*, Ochs. Schmett. Eur., IV., p. 72 (1816), non. descr.; Treit. Schmett. Eur., V. (1), p. 386 (1825) | *cohspersa.* |
| *Polia*, Ochs. Schmett. Eur., IV., p. 73 (1816), non. descr.; Treit. Schmett. Eur., V. (2), p. 5 (1825) | *cappa.* |
| *Mamestra*, Ochs. Schmett. Eur., IV., p. 75 (1816), non. descr.; Treit. Schmett. Eur., V. (2), p. 127 (1825) | *pisi.* |
| *Xanthia*, Ochs. Schmett. Eur., IV., p. 82 (1816), non. descr. | *luteago.* |
| *Polymixis*, Hübn. Verz., p. 205 (1827) | *filigramma.* |
| *Harmodia*, Hübn. Verz., p. 207 (1827) | *compta.* |
| *Melanchra*, Hübn. Verz., p. 207 (1827) | *persicariæ.* |
| *Ethria*, Hübn. Verz., p. 218 (1827) | *serena.* |
| *Astrapetis*, Hübn. Verz., p. 219 (1827) | *dentina.* |
| *Diataraxia*, Hübn. Verz., p. 219 (1827) | *splendens.* |
| *Dianthœcia*, Boisd. Silberm. Rev. Ent., II., p. 246 (1834) | *cucubali.* |
| *Hecatera*, Guen. Noct., II., p. 27 (1852) | *dysodea.* |
| *Aplecta*, Guen. Noct., II., p. 74 (1852), nec Guen., 1841, non. descr. | *nebulosa.* |
| *Pastona*, Wlk., XV., 1754 (1858) | *rudis.* |
| *Maguza*, Wlk., XXXIV., 1223 (1865) | *rudis.* |
| *Meterana*, Butl. P.Z.S., 1877, p. 85 | *pictula.* |
| *Xanthalia*, Berg. Ann. Soc. Ent. Belg., XXXVIII., p. 395 (1894) | *luteago.* |
| *Haderonia*, Staud Iris., VIII., p. 322 (1895) | *subarschanica.* |

Proboscis fully developed; palpi obliquely upturned, the 2nd joint fringed with long hair in front, the 3rd short; frons smooth; eyes large, rounded; head and thorax clothed chiefly with scales, the pro- and metathorax with crests; pectus and tibiæ clothed with long hair; abdomer with dorsal series of crests. Forewing with veins 3 and 5 from near angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hindwing with veins 3·4 from angle of cell; 5 obsolescent from middle of discocellulars; 6·7 from upper angle or shortly stalked; 8 anastomosing with the cell near base only.

Sect. I. (*Haderonia*). Antennæ of male bipectinate with long branches, the apical part serrate.

1702. MISELIA CULTA, insert (syn.) *Hadena subviolacea*, Leech Trans. Ent. Soc., 1900, p. 55.

Sec. II. Antennæ of male serrate and fasciculate.

1702 *a*. MISELIA TENEBRA, Hmpsn. Cat. Lep. Phal. B.M., V., p. 87, pl. 80, f. 26 (1905).

♂. Head and thorax brown mixed with white and black scales; tarsi with pale rings; abdomen reddish-brown. Forewing fuscous brown mixed with grey and slightly tinged in parts with dull olive; subbasal line double, waved,

interrupted at middle, from costa to vein 1; antemedial line irregularly waved, oblique, defined by grey on inner side; claviform moderate, defined by black; orbicular and reniform defined by black, the former small, round with white annulus, the latter indistinct, irregular; an indistinct waved medial line; postmedial line defined by whitish on outer side, dentate, bent outwards below costa, excurved to vein 4, then incurved, some white points beyond it on costa; subterminal line whitish, defined on inner side by a series of small dentate black marks, slightly angled outwards at vein 7 and excurved at middle; a terminal series of small black lunules; cilia whitish and fuscous with a black line at base. Hindwing pale, suffused with brown, the terminal area darkest, a slight discoidal spot, sinuous postmedial line, and some terminal lunules; cilia whitish with a dark line near base; the underside whitish irrorated with brown.

*Habitat.*—KASHMIR, Deosai Plains. *Exp.* 36 mill.

*Sect.* III. Antennæ of male ciliated.

A. Prothorax with divided crest.

*a*. Forewing with the ground-colour ochreous or greyish ochreous ..... *consanguis*.

*b*. Forewing with the ground-colour blackish..... *mortua*.

*c*. Forewing with the ground-colour dark purplish grey more or less completely suffused with fuscous.

$a^1$ Forewing with the costal area concolorous.

$a^2$ Forewing with the inner area concolorous..... *mamestrina*.

$b^2$ Forewing with ochreous-brown fascia on inner margin ..... *nagaensis*.

$b^1$ Forewing with grey streak below costa ..... *ferrisparsa*.

$c^1$ Forewing with the costal area pinkish ochreous..... *castigera*.

*d*. Forewing with the ground-colour whitish grey ..... *scotochlora*.

1679. MISELIA CONSANGUIS, insert (syns.)

*Hadena languida*, Wlk., XV., 728 (1858).

*Mamestra zachii*, Bhtsch. Vesh. Zool-bot. Ges. Wien. 1879, p. 406.

*Hecatera impura*, Snell. Medden-Sumatra Lep., p. 43, pl. 51, f. 5 (1880).

*Hadena stolida*, Leech, P. Z. S. 1889, p. 509, pl. iv., f. 2.

*Mamestra abbas*, Baker. Trans. Ent. Soc. 1894, p. 40, pl. 1, f. 8.

1694. MISELIA MORTUA, Staud. Stett. Ent. Zeit. 1888, p. 249; id. Rom. Mem. VI., p. 426, pl. 8, f. 1; id. Cat. Lep. Pal., p. 156.

*Mamestra afra*, Græs. Berl. Ent. Zeit., 1888, p. 326.

" *nigerrima*, Warr. P. Z. S., 1888, p. 302.

*Hadena kala*, Swinh. Cat. Het. Mus. Oxon, II., p. 17 (1900).

1700. MISELIA MAMESTRINA.

1689. MISELIA NAGAENSIS.

1688. MISELIA FERRISPARSA.

1685. MISELIA COSTIGERA.

1695. MISELIA SCOTOCHLORA.

B Prothorax with spreading crest.

*a*. Abdomen of female with the extremity blunt, the ovipositor not exserted.

$a^1$. Forewing with the subterminal line dentate on veins 4·3 and forming a distinct W-mark.

$a^2$. Forewing with black streak below base of cell. *pradita.*

$b^2$. Forewing without black streak below base of cell.

$a^3$. Forewing with the postmedial line incurved between veins 5 and 2.

$a^4$. Forewing with the orbicular small, narrow, oblique eliptical ..... *furcula.*

$b^4$. Forewing with the orbicular well developed ..... *schneideri.*

$b^3$. Forewing with the postmedial line oblique, waved below vein 2..... ..... *perdentata.*

$b^1$. Forewing with the subterminal line not forming a distinct W-mark.

$a^2$. Forewing with the reniform large, kidney-shaped.

$a^3$. Forewing with the ground-colour purplish grey.

$a^4$. Forewing with pale dentate mark on base of vein 2 ..... ..... ..... *dentina.*

$b^4$. Forewing without pale dentate mark on base of vein 2.

$a^5$. Head and tegulæ not white..... ..... *glauca.*

$b^5$. Head and tegulæ white..... *chivetti.*

$b^3$. Forewing with the ground-colour reddish brown ..... ..... ..... ..... *pannosa.*

$c^4$. Forewing with the ground-colour grey-white ..... ..... *dysodea.*

$b^2$. Forewing with reniform small, narrow, and angled inwards to orbicular on median nervure ..... ..... ..... *mediana.*

1678*a*. MISELIA PRÆDITA, Hübn. Eur. Schmett. Noct., f. 595 (1827); Led. Ann. Soc. Ent. Belg. 1870, pl. 1, f. 11; Staud. Cat. Lep. Pal., p. 160.

Head, thorax and abdomen grey, slightly tinged with fuscous. Forewing grey, the antemedial and medial areas tinged with fuscous except towards costa and inner margin; a black streak below base of cell; subbasal line absent; antemedial line defined by white on outer side, oblique from costa to submedian fold, then nearly erect; claviform almost obsolete, a dentate whitish mark beyond it on base of vein 2; orbicular and reniform with brownish centres and white annuli defined by black, the former oblique elliptical, open above; the

median nervure and veins rising from it defined by fine white streaks; postmedial line defined by white on outer side, bent outwards below costa, excurved to vein 4, then oblique; terminal area brown except at apex, extending to inner side of the subterminal line which is white, angled outwards at vein 7 and dentate to termen at veins 4·3. Hindwing whitish, tinged with brown, the terminal area suffused with fuscous; the underside white, the costal and terminal areas irrorated with brown, a small discoidal spot and sinuous punctiform postmedial line.

*Habitat.*—S. E. Russia; Armenia; W. Turkistan; E. Turkistan; Kashmir, Nubra. *Exp.* 34 mill.

1678.*b*. Miselia furcula, Staud. Stett. Ent. Zeit. 1889, p. 36; Hmpsn. Cat. Lep. Phal. B. M. V., p. 127; pl. 81, f. 19; Staud. Cat. Lep. Pal., p. 160.

Head and thorax grey mixed with brown and fuscous; tegulæ with two more or less prominent black lines; patagia with some black scales on upper edge; abdomen grey mixed with fuscous. Forewing grey with a violaceous tinge and slight brown suffusion, the medial area brown except towards costa and inner margin; subbasal line represented by double black striæ from costa and cell filled in with white; antemedial line double filled in with white, waved from costa to vein 1, then strongly angled outwards, sometimes almost to postmedial line; claviform large, brown defined by black, acute at extremity, a bidentate white mark above it on vein 2; orbicular and reniform small defined by black, the former oblique elliptical, white with slight brown centre, the latter brown with slight white annulus; postmedial line defined by white on outer side, angled outwards below costa and sharply at vein 5, then incurved and angled on veins 2 and 1; subterminal line white, defined on inner side by dentate black marks below costa and at middle, angled outwards at vein 7 and dentate to termen at veins 4·3, the area beyond it suffused with brown; a terminal series of small lack lunules; cilia intersected with white. Hindwing white, the veins, base and inner area suffused with brown; a broad terminal fuscous-brown band; cilia white; the underside sparsely irrorated with brown, a small discoidal lunule, crenulate postmedial line, and diffused subterminal band.

*Habitat.*—W. Turkistan; E. Turkistan; Kashmir, Kardong, Digha Pass. *Exp.* 30 mill.

1678.*c*. Miselia schneideri, Staud. Iris, XII., p. 368 (1900); Hmpsn. Cat. Lep. Phal. B. M., V., p. 129, pl. 81, f. 21; Staud: Cat. Lep. Pal., p. 160.

Head, thorax and abdomen grey mixed with brown; tegulæ with black medial line; tarsi with pale rings. Forewing grey-brown; subbasal line represented by double black striæ from costa and cell; a double black streak above inner margin before the antemedial line which is double, filled in with grey, angled outwards below costa and strongly above inner margin, slightly excurved between those points; claviform brown defined by black; acute at extremity, a bidentate whitish mark above it on vein 2; orbicular oblique elliptical, with

brown centre and whitish annulus defined by black; reniform rather narrow, fuscous grey defined by black; an indistinct medial line oblique from costa to vein 2, then dentate; postmedial line double filled in with grey, bent outwards below costa, incurved to vein 4, then bisinuate, the area beyond it paler with some whitish points on costa; subterminal line whitish defined on inner side by black streaks below costa and dentate marks at middle, angled outwards at vein 7 and dentate to termen at veins 4·3, the area beyond it suffused with black; a terminal series of black lunules; cilia pale brown with darker line through them and intersected with ochreous. Hindwing whitish, the base tinged with brown, the veins, discoidal lunule and terminal half brown; cilia white; the underside whitish slightly irrorated with brown, a discoidal lunule, slight curved postmedial line and broad subterminal band.

*Habitat.*—W. TURKISTAN; E. TURKISTAN; KASHMIR; Deosai Plains. *Exp.* 40-44 mill.

1678. MISELIA PERDENTATA insert-(syn.) *Mamestra bifida*, Püng. Iris, 1902, p. 149, pl. 5, f. 3; Hmpsn. Cat. Lep. Phal., B. M., V., p. 129, pl 81, f. 22.

1690.*a*. MISELIA DENTINA, Schiff. Wien. Verz., p. 82 (1776); Esp. Schmett IV., pl. 127, f. 3 (1789); Hübn. Eur. Schmett. Noct. f. 408; Dup. Lep. Fr. VI., p. 269, pl. 89, f. 6; Staud. Cat. Lep. Pal., p. 159.

*Noctua plebeia*, Haw. Lep. Brit., p. 198 (1809); Steph. Ill. Brit. Ent. Haust., III., p. 185.

*Noctua leucostigma*, Haw. Lep. Brit., p. 198 (1809); Steph. Ill. Brit. Ent. Haust., III., p. 186.

*Hadena latenai*, Pierret, Ann. Soc. Ent Fr. 1857, p. 177, pl. 8, f. 3.

*Noctua hilaris*, Zett. Ins. Lapp, p. 938 (1840).

Head and thorax grey mixed with black; tegulæ with black medial line; tarsi ringed with white; abdomen greyish fuscous. Forewing violaceous grey irrorated with fuscous; the medial area suffused with fuscous brown; a black streak in base of submedian fold; subbasal line represented by double black striæ from costa and cell; some yellow on inner margin near base usually present; antemedial line double, waved, oblique; claviform moderate, defined by black; a bidentate whitish patch beyond it below the cell; orbicular and reniform grey defined by black and with more or less developed fuscous centres, the former round; an indistinct waved medial line; postmedial line double, dentate and produced to short streaks on the veins, bent outwards below costa and incurved below vein 4, some white spots beyond it on costa; subterminal line whitish, often tinged with yellow, defined on inner side by small dentate black marks and with some black beyond it in discal fold, angled outwards at vein 7 and somewhat dentate at veins 4·3; a terminal series of small black lunules; cilia fuscous intersected with white. Hindwing fuscous brown, rather darker on terminal area; cilia yellowish at base, with brown line through them and white tips; the underside grey irrorated with brown, a small discoidal spot, curved postmedial line, and subterminal band.

Ab *latenai* much darker, the forewing wholly suffused with fuscous.

*Habitat.*—Europe ; W. Asia : W. Turkistan ; W. Siberia ; E. Turkistan ; Kashmir, Goorais Valley. *Exp.* 32-42 mill.

*Larva*, Meyr. Brit. Lep., p. 82 ; Barrett. Lep. Brit., IV., p. 197, pl. 159, f. 1.

Pale grey-brown ; a dorsal series of conjoined blackish spots edged with white ; spiracular line darker ; lateral and subspiracular lines less distinct. Food plant, roots of *Taraxacum*. 5.

1690. Miselia glauca, Kleem. Beitr. Ins. 1, pl. 48, ff. 1-7 (1761) ; Hübn. Eur. Schmett. Noct., f. 410 ; Dup. Lep. Fr., VI., p. 322, pl. 92, f. 7 ; Steph. Ill. Brit. Ent. Haust., II., p. 185 ; Staud. Cat. Lep. pal., p. 158.

*Noctua aperta*, Geyer. Eur. Schmett. Noct., f. 800 (1827).

" *lappo*, Dup. Lep. Fr., VII, p. 255, pl. 116, f. 3 (1837).

*Hadena quadripositа*, Zett. Ins. Lapp., p. 939 (1840).

" *farkasii*, Herr. Schäff. Eur. Schmett. Noct., f. 390 (1845), nec Treit.

*Hadena poliostigma*, Hmpsn. Moths. Ind., II., p. 201 (1894).

*Mamestra tamensis*, Fucks. Jhrb. Nass. LII., p. 133 (1899).

*Habitat*—Europe ; W. Turkistan ; Amurland ; Kamschatca ; Kashmir.

1698. Miselia cnivetti.

1703. Miselia pannosa.

1682. Miselia dysodea, Schiff. Wien. Verz., p. 72 (1776) ; Hübn. Eur. Schmett. Noct., f. 47. Dup. Lep. Fr. VI., p. 404, pl. 98, f. 2 and Suppl. V., pl. 1, f. 2 ; Steph. Ill. Brit. Ent. Haust., III, p. 32.

*Noctua spinacia*, View. Tab. Viez. Brandenburg, p. 70 (1789).

" *flavocincta minor*, Esp. Schmett. IV., pl. 153, ff. 6-7 (1790).

" *chrysozona*, Borkh. Eur. Schmett., IV, p. 264. (1792) ; Staud. Cat. Lep. pal. p. 160.

" *ranunculina*, Haw. Lep. Brit., p. 183 (1809).

*Mamestra caduca*, Herr. Schäff. Eur. Schmett., II., p. 266. Noct., f. 484 (1845).

" *innocens*, Staud. Hor. Soc. Ent. Ross, VII., p. 123, pl. 1, f. 10 (1870).

" *koechlini*, Th. Mieg. Le Nat., XII., p. 181 (1889).

" *turbida*, Höfn. Jhrb. Kärnt., XXIV., p. 11 (1897).

Head and thorax grey mixed with reddish brown and black; tarsi blackish mixed with white; abdomen grey tinged with rufous and irrorated with fuscous. Forewing grey-white thickly irrorated with dark brown, the medial area rather darker ; some orange-yellow in submedian fold ; subbasal line with yellow marks on it and defined by white on outer side, waved, from costa to submedian fold ; antemedial line oblique, waved, defined by white on inner side and with yellow marks on it ; claviform moderate, defined by black ; orbicular and reniform defined by black and with some yellow at sides, the former round ; an irregularly waved medial line ; postmedial line defined by white on outer

side, dentate, bent outwards below costa, excurved to vein 4, then incurved, some white points beyond it on costa; subterminal line represented by yellow spots on inner side of irregular brown marks; a terminal series of slight dark lunules; cilia chequered ochreous and brown. Hindwing pale tinged with brown, the terminal area dark brown; slight greyish streaks on extremities of veins 2 and 1; cilia pale with a brown line near base, the underside white, the costal and terminal areas irrorated with brown, a small discoidal spot and waved postmedial line.

Ab. 1. *caduca*. Forewing whitish grey without the yellow markings.

Ab. 2. *innocens*. Forewing whitish grey with slight yellow markings, the medial area more prominently dark. . . S. Europe, W. and C. Asia.

Ab. 3. Darker, especially the medial area of forewing. Kashmir.

*Habitat*—EUROPE; W. ASIA; PERSIA; W. TURKISTAN; W. CHINA; KASHMIR, Goorais Valley. *Exp.* 32-36 mill.

*Larva*, Meyr. Brit. Lep., p. 82; Barrett. Lep. Brit. IV., p. 218, pl. 161, f. 1.

Pale dull green or yellowish irrorated with brown; dorsal line pale with dark edges; lateral line dark indistinct; spiracles black; head ochreous brown or dull greenish. Food plants: flowers of *Sonchus* and *Lactuca*, 7-8.

1682. MISELIA MEDIANA.

*b*. (*Harmodia*) Abdomen of female with the extremity produced and conical, the ovipositor exserted.

1682.*b*. MISELIA MAGNOLII, Boisd. Ind. Meth., p. 125 (1829); Dup. Lep. Fr. Suppl. VI., p. 241, pl. 22, f. 4. Herr. Schäff. Eur. Schmett. Noct., f. 71; Staud. Cat. Lep. pal. p. 162.

*Miselia nummosa*, Ev. Faun. Volg. Ur, p. 233 (1844); Frr. Beitr., IV., pl. 351, f. 3.

Head and thorax olive brown mixed with white and black; tarsi mixed with white; abdomen grey-brown. Forewing olive-brown with a reddish tinge, sparsely irrorated with white, chiefly on the veins, and slightly suffused with black; a whitish patch at base of costa traversed by the double, waved, black subbasal line, from costa to submedian fold; antemedial line double, waved, filled in with white; claviform large, defined by black; orbicular and reniform with brown centres and white annuli defined by black, the former round, the latter rather irregular and with its outer edge indented; a medial shade, oblique to median nervure, then somewhat dentate; postmedial line defined by white on outer side, strongly dentate, bent outwards below costa and strongly incurved below vein 4, some white points beyond it on costa; subterminal line white, defined on inner side by a series of small dentate black marks, angled outwards at vein 7 and somewhat dentate at veins 4-3; a terminal series of small black lunules defined by white; cilia intersected with white. Hindwing ochreous white slightly irrorated with brown, the veins and marginal areas strongly suffused with brown; cilia with a brown line near base; the underside with discoidal spot, sinuous postmedial line and diffused subterminal band.

*Habitat*—EUROPE; W. ASIA; W. TURKISTAN. *Exp.* 36-40 mill.

Subspecies. *conspurcata*, Frr. Neue. Beitr. Schmett., V., p. 82, pl., 433, f. 3 (1844); Herr. Schäff. Eur. Schmett. Noct. ff. 463-470; Staud. Cat. Lep. pal. p. 162.

Head, thorax and forewing grey-brown without the rufous tinge, the last with the claviform reduced to a small black mark, the orbicular oblique elliptical, the reniform slightly angled inwards on median nervure, but not on subcostal nervure.

*Habitat*—C. AND S. RUSSIA, Urals; W. SIBERIA, Altai; ? E. SIBERIA; PUNJAB, Hunza.

*Larva*, Wullschlegel, Stett. Ent. Zeit, XXXII, p. 466.

Pale reddish grey with a dark maculate dorsal stripe, oblique subdorsal marks and pale lateral line. Food plant: *Silene nutans*. 8-9.

Genus ODONTESTRA. *Type.*

*Odontestra*, Hmpsn. Cat. Lep. Phal. B. M., V., p. 205 (1905) *vittigera.*

Proboscis fully developed; palpi short, oblique, fringed with hair in front; frons with rounded prominence with small corneous plate below it; eyes large, rounded; antennæ of male ciliated; head and thorax clothed chiefly with scales, pro- and metathorax with spreading crests; abdomen with dorsal crest on 1st segment only. Forewing rather short and broad, the termen evenly curved; veins 3 and 5 from near angle of cell, 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hindwing with veins 3·4 from angle of cell; 5 obsolescent from middle of discocellulars; 6·7 from upper angle or shortly stalked; 8 anastomosing with the cell near base only.

A. Forewing with the terminal line narrow, whitish.

*a.* Hindwing white, the terminal area suffused with fuscous ..... *simillima.*

*b.* Hindwing uniformly suffused with fuscous ..... *potanini.*

B. Forewing with the subterminal line broader, yellowish *submarginalis.*

1687. ODONTESTRA SIMILLIMA.

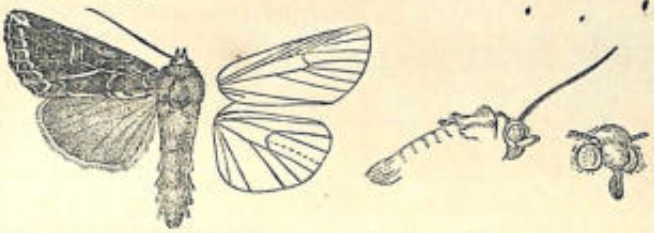
1687*a*. ODONTESTRA POTANINI, Alph. Iris., VIII, p. 192 (1895); id. Rom. Mem., IX, p. 137, pl. IX., f. 10 (1897).

Head and thorax irrorated with grey; tegulæ with black medial line; patagia edged with black above; tarsi with pale rings; abdomen fuscous brown. Forewing purple-grey; the costal area suffused with purplish red except towards base; the inner margin with ochreous white fascia from base to tornus; subbasal line represented by double striæ from costa and a black patch below the cell crossed by an oblique ochreous striga; antemedial line double, dentate towards costa, usually filled in with ochreous in submedian interspace, obsolete below vein 1; claviform very large, filled in with black; vein 2 defined by an ochreous white fascia below or on both sides to just beyond postmedial line; orbicular and reniform with ochreous annuli defined by black, the former very small, round or oblique elliptical, the latter with ochreous centre and angled inwards on median nervure; postmedial line

double, dentate and produced to points on the veins, bent outwards below costa, excurved to vein 4, then oblique, obsolete below vein 1, some pale points beyond it on costa often present ; subterminal line ochreous white, defined on inner side by prominent dentate black marks, angled outwards at vein 7 and inwards in submedian fold, some red-brown suffusion beyond it, the apex usually ochreous ; a terminal series of small black lunules ; cilia grey with black lines through them. Hindwing fuscous ; the cilia pale with a brown line near base ; the underside pale, the costal and terminal area thickly irrorated with fuscous, a discoidal lunule and curved postmedial line.

*Habitat*—W. CHINA ; PUNJAB, Simla, Dalhousie, Dharmsála. *Exp.* 4½ mill.

1686. ODONTESTRA SUBMARGINALIS, Wlk. Char. Undescr. Het., p. 32 (1862), has priority over *incisa*.



*Odontestra submarginalis.* ♂ ½.

Genus HADENA. *Type.*

*Hadena*, Schrank, Faun. Boica, II (2), p. 158 (1802)..... *reticulata.*
*Neuria*, Guen. Noct. 1, p. 166 (1852), nec Guen. 1841, non descr. ..... *reticulata.*
*Dargida*, Wlk. IX., 401 (1856) ..... *graminivora.*
*Eupsephopactes*, Grote, Bull. Buff. Soc. Nat. Sci. I, p. 138, pl. iv., f. 6 (1873) ..... *procincta.*

Proboscis fully developed ; palpi obliquely upturned, the 2nd joint fringed with hair in front, the 3rd short ; frons smooth ; eyes large, rounded ; antennæ of male ciliated ; thorax quadrately clothed with hair and scales, prothorax typically with divided crest ; pectus clothed with long hair ; abdomen with dorsal crest on basal segment, clothed with woolly hair at base and with lateral fringes of hair towards extremity. Forewing rather narrow, the apex produced and the termen obliquely curved, the cilia crenulate ; veins 3 and 5 from near angle of cell, 6 from upper angle ; 9 from 10 anastomosing with 8 to form the areole ; 11 from cell. Hindwing with veins 3·4 from angle of cell ; 5 obsolescent from middle of discocellulars ; 6·7 from upper angle ; 8 anastomosing with the cell near base.

A. Forewing with the postmedial line strongly excurved from below costa to vein 4, then oblique ..... *dissecta.*
B. Forewing with the postmedial line moderately excurved from below costa to vein 4, then incurved..... *reticulata.*

1684. HADENA DISSECTA, insert (syn.) *Mamestra crucifer*, Feld. Reis. Nov., pl. 109, f. 30 (1874).

1684.*a*. HADENA RETICULATA, Vill. Linn. Ent. II., p. 254 (1789); Staud Cat. Lep. pal., p. 159.

*Noctua calcatrippa*, View., Schmett., p. 71 (1789).

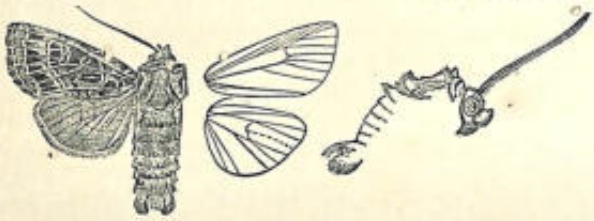
,, *saponariæ*, Esp. Schmett. IV., pl. 198., ff. 3·4 (1790); Dup. Lep. Fr. VI., p. 272, pl. 90, f. 2; Steph. Ill. Brit. Ent. Haust. II, p. 189.

,, *marginosa*, Haw. Lep. Brit., p. 101 (1803).

,, *typica*, Hübn. Eur. Schmett. Noct., f. 58 (1827).

*Mamestra unicolor*, Alph. Rom. Mem. V., p. 147 (1889).

Head and thorax reddish brown mixed with grey and black; tarsi blackish with pale bands; abdomen ochreous thickly irrorated with dark brown. Forewing dark brown suffused with violaceous before the antemedial line, beyond the claviform, and on postmedial area; the veins streaked with white except on postmedial area, where they are black; the subbasal line represented by double oblique black stripe from costa and cell filled in with white, a very oblique white striga across the cell just beyond it; the antemedial line double, black filled in with white, angled outwards below costa and above inner margin, incurved between those points; claviform large, defined by black, and with pale streak at centre; orbicular and reniform with white annuli defined by black, the former oblique elliptical, open above, the latter narrow and with white lunule at centre; a fine black medial line, oblique from costa to vein 2, then dentate; postmedial line double, black filled in with white, minutely waved, bent outwards below costa, excurved to vein 4, then incurved and angled inwards above inner margin, some white points beyond it on costa; subterminal line ochreous white, angled outwards at vein 7 and dentate at veins 4 and 3, with a series of dentate black marks on its inner side; a terminal series of small black lunules; cilia with fine pale line at base and intersected with white. Hindwing ochreous white suffused with brown, the veins and terminal area brown; cilia ochreous white with a fine brown line at base; the underside with the costal and terminal areas irrorated with brown, a dark discoidal lunule and indistinct curved postmedial line.



*Hadena reticulata*. ♂ ½.

Ab. 1 *unicolor*. Forewing without violaceous tinge.

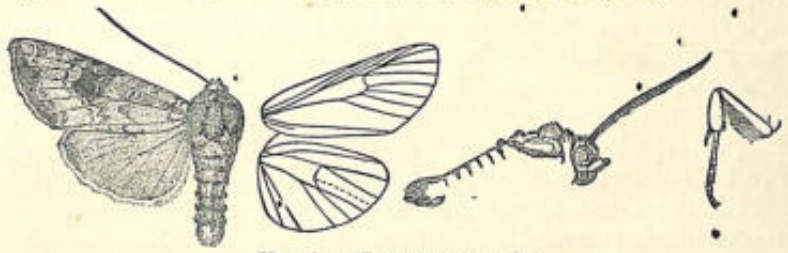
*Habitat*.—EUROPE; ARMENIA; W. SIBERIA; W. TURKISTAN; E. TURKISTAN; MONGOLIA; KASHMIR, Nubra, Goorais Valley. *Exp.* 40·44 mill.

*Larva*, Meyr. Brit. Lep., p. 81; Barrett. Lep. Brit. IV., p. 153, pl. 153, f. 2.

Pale greenish ochreous or pinkish ochreous with darker irroration; dorsal, subdorsal, lateral and spiracular lines faintly paler; head pale brownish. Food plants: *Lilene*, *Rumex*, *Primula*, etc., 8·4.

Genus HYPOBARATHRA. *Type.*

*Hypobarathra*, Hmpsn. Cat. Lep. Phal. B. M. V., p. 221 (1905) *cterias.*



*Hypobarathra repetita.* ♂ ½.

Proboscis fully developed; palpi obliquely upturned, fringed with hair in front; frons smooth; eyes large, rounded; antennæ of male ciliated; head and thorax clothed with hair and scales, the pro- and metathorax with spreading crests; fore tibiæ with long curved claw on inner side; abdomen with dorsal crest at base only. Forewing with veins 3 and 5 from near angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hindwing with veins 3·4 from angle of cell; 5 obsolescent from just below angle of discocellulars; 6·7 from upper angle or shortly stalked; 8 anastomosing with the cell near base only.

1692. HYPOBARATHRA REPETITA.

Genus TRICHOCLEA. *Type.*

*Trichoclea*, Grote, Papilio III, p. 30 (1883). ..... *decepta.*

Proboscis fully developed; palpi obliquely porrect, the 2nd joint fringed with hair, the 3rd short, porrect; frons with small rounded prominence with corneous plate below it; eyes large, round, not ciliated; antennæ of male ciliated; thorax clothed with hair and scales, the pro- and metathorax with slight spreading crests; tibiæ fringed with hair on outer side; the tarsi with the 1st or 1st two joints with long curved claw-like spines on outer side; abdomen with dorsal crest on 1st segment. Forewing with the termen slightly crenulate veins 3 and 5 from near angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hindwing with veins 3·4 from angle of cell; 5 obsolescent from just below middle of discocellulars; 6·7 from upper angle; 8 anastomosing with the cell near base only.

1692. *a.* TRICHOCLEA CHOLICA, Hmpsn. Cat. Lep. Phal. B. M., V., pl. 84, f. 25 (1905).

Head and thorax ochreous, slightly mixed with brown and grey; abdomen ochreous brown or greyish. Forewing ochreous brown irrorated with fuscous; an indistinct double, waved subbasal line from costa to submedian

*Trichoclea cholica* ♂ ½.

fold; an oblique waved antemedial line angled inwards on vein 1 and defined by greyish on inner side; claviform hardly visible, defined by a few dark scales; orbicular and reniform very indistinct, defined by a few dark scales, the former round; an indistinct curved medial band; postmedial line strongly dentate, bent outwards below costa and strongly incurved below vein 4; subterminal line indistinct, pale, defined by obscure somewhat dentate fuscous marks on inner side, angled outwards at vein 7 and excurved at middle; a terminal series of black points. Hindwing suffused with fuscous brown, the terminal area rather darker; the underside greyish irrorated with brown, a discoidal spot and curved postmedial line with short dark streaks on the veins.

*Habitat.*—KASHMIR, Nubra. *Exp.* 40 mill.

Genus TIRACOLA.

*Type.*

*Tiracola*, Moore P. Z. S. 1881, p. 351..... *plagiata.*

1940. TIRACOLA PLAGIATA, insert (syn.) *Agrotis grandirena*, Herr Schäff. Corresp-blatt. Regensb. 1868, p. 149.

*Habitat.*—W. INDIES; C. & S. AMERICA; W. CHINA; INDIA; CEYLON SINGAPORE; BORNEO; JAVA; N. GUINEA; AUSTRALIA; TAHITI; MARQUESAS.

Genus CHABUATA.

*Type.*

*Chabuata*, Wlk., XIV. 1034 (1857) ..... *ampla.*

*Tricholita*, Grote, Bull. Buff. Soc. Nat. Sci. II., p. 211 (1875). *signata.*

Proboscis fully developed; palpi obliquely upturned, the second joint fringed with hair in front, the 3rd moderate; frons smooth; eyes large, rounded; head and thorax clothed with rough hair and scales, the prothorax with triangular crest, the metathorax with spreading crest; tibiæ clothed with rough hair; abdomen with dorsal crest at base and slight lateral fringes of hair. Forewing with veins 3 and 5 from close to angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hindwing with veins 3·4 from angle of cell; 5 obsolescent from middle of discocellulars; 6·7 from upper angle; 8 anastomosing with the cell near base only.

Sec. III. Antennæ of male ciliated.

A. Abdomen of male with paired ventral tufts of long hair from base.

*a.* Forewing yellow, irrorated and striated with rufous ..... *distincta.*

*b.* Forewing reddish or grey tinged with red, irrorated and striated with brown ..... *obscura.*

1921. CHABUATA DISTINCTA.

Fig. 54. *Chabuata distincta* ♂ 1.

1922. CHABUATA OBSCURA, insert (syn.) *Leucania nepos*, Leech. Trans. Ent. Soc. 1900, p. 100.

B. Abdomen of male without ventral tufts of hair.

*a*. Forewing with the antemedial line angled outwards in submedian fold ..... *angulifera*.

*b*. Forewing with the antemedial line not angled outwards in submedian fold.

*a*. Forewing without pale striæ ..... *albicosta*.

*b*. Forewing with numerous pale striæ ..... *fraterna*.

1916. CHABUATA ANGULIFERA.

1914. CHABUATA ALBICOSTA.

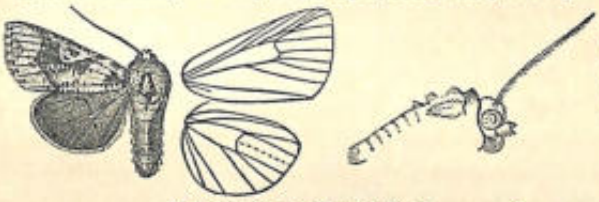
1915. CHABUATA FRATERNA.

## Genus XYLOMANIA.

*Type.*

*Xylomania*, Hmpsn. Cat. Lep. Phal. B. M. V., p. 389 (1905). *hyemalis*.

Proboscis fully developed ; palpi porrect to just beyond frons, the 2nd joint fringed with hair below, the 3rd short ; frons smooth ; eyes large, rounded ; tegulæ dorsally produced into a slight ridge ; pro and metathorax with spreading crests ; pectus clothed with woolly hair ; tibiæ fringed with hair ; abdomen with dorsal crest on basal segment. Forewing with the apex slightly produced, the termen oblique and somewhat angled at vein 3 ; veins 3 and 5 from near angle of cell ; 6 from upper angle ; 9 from 10 anastomosing with 8 to form the areole ; 11 from cell. Hindwing with veins 3-4 and 6-7 shortly stalked ; 5 obsolescent from middle of discocellulars ; 8 anastomosing with the cell near base.



*Xylomania v-album*. ♂ 1.

Sect. IV. Antennæ of male ciliated.

1907. XYLOMANIA V-ALBUM.

*(To be continued.)*

# A LIST OF BIRDS FOUND IN THE MYINGYAN DISTRICT OF BURMA.

By

K. C. Macdonald.

As the locality I write of appears to be one seldom subjected to ornithological observation, I have made out the following list of birds identified and eggs I have taken during a residence of 6 years in the Myingyan district as being of possible interest or use to members.

Myingyan town is about 60 miles as the crow flies, south of Mandalay on the Irrawaddy, and the district has a river frontage of roughly 100 miles along the left bank. It lies almost in the centre of what is styled the dry zone of Burma and contains little real forest country. This dry zone, as a look at a forest map will show, is almost entirely surrounded by some of the largest and most dense forests of the Indian Empire—a fact which I think enhances the interest in its animal like. The climate is very dry and hot, although in the cold season the temperature falls well below 60 deg. Fah. at night. The average rainfall is about 18 inches only. An extinct volcanic mountain, Popa, verging on 5,000 feet, stands within the district, and on its eastern and southern slopes and inside the huge crater is the only big tree jungle to be found. The rest of the district not cultivated, is covered with thorny bush (*Zizyphus jujuba*) or stunted tree (*Dipterocarpus*) jungle. I have given such local names as I know. The numbers in the following list refer to the "Fauna of British India"—Birds :—

## I.—Family *Corvidæ*.

4. *Corvus macrorhynchus*.—The Jungle Crow.

Local name "Taw Kyeegan." Breeds earlier than the house crow and solitary. My eggs were all taken during March and are just as variable in colouring and size as those of *C. insolens*.

8. *Corvus insolens*.—The Burmese House-Crow.

Local name "Kyeegan."

The usual pest. Breeds in March and April.

12. *Urocissa occipitalis*.—The Red-billed Blue Magpie.

Rare. I found a nest belonging to a pair of these birds on Popa on the 5th of April. It was on a sapling about 20 feet from the ground and contained three young birds and one hard-set egg. The parents were very noisy when I approached the nest and gave away its existence. There are a few pairs of birds on Popa, but I think nowhere else in the district.

16. *Dendrocitta rufa*.—The Indian Tree-pie.

Local name "Napagyi".

A common bird all over the district where there is any jungle. The two or three nests I have found have always been on saplings that would not bear much weight and from 20 to 30 feet from the ground. My eggs are all of the pale-green ground-colour type.

22. *Crypsirhina cucullata.*—The Hooded Racket-tailed Magpie.

A not uncommon bird here, and as bamboo jungle is rare it is usually seen in the sparse bush jungle all over the district. I have not yet found the nest, but have seen young birds on the wing with their parents in May. Captain Harington showed me nests and eggs taken in the Chindwin district. The eggs were of the ordinary Magpie type. The nests were peculiar. The real nests was about the size of a breakfast cup, but placed in the centre of a loose collection of twigs just like a parasitic mistletoe, kind of growth very common here.

II.—Family *Crateropodidæ.*

73. *Garrulax moniliger.*—The Necklaced Laughing-Thrush.

A sure find in the more thickly wooded parts of the district and on the lower slopes of Popa. The breeding season commences in April. The nest is usually in a bamboo clump from 5 to 15 feet from the ground. The eggs vary in the deepness of the colour considerably.

104. *Argya earlii.*—The Striated Babbler.

Local name "Zaywe" for all of this genus.

A good number to be seen round the Tanaungdaing or Talokmyo jheels, where it breeds from May to July

105. *Argya caudata.*—The Common Babbler.

Less common than *A. earlii* but met with in the same localities.

106. *Argya gularis.*—The White-throated Babbler.

This is one of the most familiar birds of the locality. It lives in all sorts of jungles, in gardens and hedgerows. It feeds on the ground. I have taken nests which are made of fibrous creepers, roots and grass from low bushes, hedges, verandah creepers and also from clefts of fairly large trees, but never more than 12 to 15 feet from the ground and usually much lower. The ordinary note is a monotonous melancholy cheep. I have found it breeding in every month of the year except January and February. The eggs, pale blue, are three or four, seldom five in number and variable in size The average measurement of 23 eggs was ·90″×·69″, the largest being ·95″×·66″. The colours of the soft parts omitted by Oates in Volume I of the Fauna—Birds, are iris bright yellow, eyelid plumbeous, bill dark greenish brown, gape pale yellow, mouth pale orange; legs dirty pale green; feet, toes and claws brownish green. I shot an albino young bird on Popa once.

116. *Pomatorhinus schisticeps.*—The Slaty-headed Scimitar Babbler.

A specimen shot on Popa had the head of the same colour as the back and the rufous collar fairly distinct. The bird is common, but of course little seen.

134. *Timelia pileata.*—The Red-capped Babbler.

Is seldom seen but occurs in most of the damper parts of the district, more especially in the creeks into which the river rises during the rains. Eggs in May and June.

139. *Pyctorhis sinensis.*—The Yellow-eyed Babbler.

Common in hedges or rank bushy jungle. The eggs taken by me were taken in June and July.

143. *Pellorneum minus.*—Sharpe's Spotted Babbler.

Not uncommon in the ravines on Popa hill. I have not come across it anywhere else. The breeding season appears to be May and June. I found three nests, in two of which were eggs. The third was empty. I was struck by the very unsafe position of the nests at this season. They were built of bamboo leaves and lined with fibres and fine grass. Two were in the bed of a ravine and would most certainly have been washed away by the first spate. The bird sat tight but went away very cunningly when moved.

176. *Mixornis rubricapillus.*—The Yellow-breasted Babbler.

Occurs on Popa. Two nests found by me there in May 1901 contained three eggs each and were built in dry thickets on the banks of dried-up torrents and close to the ground. I have once taken a nest in a bamboo clump some three feet from the ground.

188. *Myiophoneus eugenii.*—The Burmese Whistling-Thrush.

This very handsome bird may be met with very rarely on Popa but nowhere else in the district.

220. *Zosterops siamensis.*—The Siamese White-eye.

The busy little parties of this bird are common on Popa. I have not found it breeding.

243. *Ægithina tiphia.*—The Common Iora.

Common. A nest full of fledglings found on the 22nd June and eggs taken July, August and September.

247. *Chloropsis aurifrons.*—The Gold-fronted Chloropsis.

Fairly common on Popa mountain up to from 3 to 4,000 feet. I was not successful in finding the nest. The point of the tongue of this bird is disintegrated and like a brush as Oates quotes Gadow to have noticed in *Zosterops*. I watched a party of these birds one evening feeding like shrikes or bee-eaters. They shot out from their perches on the tops of the trees, seized the insect and returned.

279. *Molpastes burmanicus.*—The Burmese Red-vented Bulbul.

Local name "Bopin-ni-ta."

A very common bird. Breeds from May to September. My series of eggs measure on an average ·85″ × ·65″.

288. *Otocompsa emeria.*—The Bengal Red-whiskered Bulbul.

I have seen this bird in the district, but only in the tangled thickets near the river. It is decidedly uncommon, but breeds here, as I came across a young family in May 1901.

290. *Otocompsa flavirentris.*—The Black-crested Yellow Bulbul.

A fairly common bird on Popa but not in the plains. I found two nests with eggs in April. Two eggs in each case.

306. *Pycnonotus blanfordi.*—Blanford's Bulbul.

Local name "Bo-sa-mwe".

The most common bulbul of the Myingyan plains. I have not seen it above the lower slopes of Popa. Eggs from March to September. The nest is more

flimsy and the eggs are smaller than those of *M. burmanicus*. The latter average ·84″ × ·60″. The nest is never placed higher than a man can reach.

317. *Sitta neglecta*.—The Burmese Nuthatch.

Local name " Hnet-pya-chauk".

A small party met with on Popa slope near Shawdawtaung. Pleasantly noisy and very active little birds. In April 1903 I came across a nest with four young birds. The nest was about 30 feet from the ground. I could make no impression on the mud roof of their house with a knife.

III.—Family *Dicruridæ*.

327. *Dicrurus ater*.—The Black Drongo.

Local name " Lin-mi-swe".

Common. Eggs in April, May and June.

333. *Dicrurus cineraceus*.—The Grey Drongo.

A solitary bird met with every now and again. I have not taken the nest.

334. *Chaptia ænea*.—The Bronzed Drongo.

Fairly common throughout the district. The nest is generally placed near the tip of a bamboo curving out from a clump.

335. *Chibia hottentotta*.—The Hair-crested Drongo.

The eggs of this bird are of two very distinct types—one having the ground colour white, while in the other type it is a fine blush red.

340. *Dissemurus paradiseus*.—The Larger Racket-tailed Drongo.

A rare bird in the district.

IV.—Family *Sylviidæ*.

363. *Acrocephalus stentoreus*.—The Indian Great Reed-Warbler.

Shot among the bushes round Tanaungdaing jheel on the 2nd April 1903. They are not rare.

374. *Orthotomus sutorius*.—The Indian Tailor-bird.

Common throughout the district. Breeds in the rains.

381. *Cisticola cursitans*.—The Rufous Fantail-Warbler.

Local name " Hnan-pyi-sot".

Common in the grass and stubble of the rice plains reclaimed along the river bank. Eggs in June and July. The stone-breaking note of this little bird always seems to be uttered as he is at the lowest point of his undulating flight.

382 *Franklinia gracilis*.—Franklin's Wren-Warbler.

Quite common throughout the district. My eggs were taken in July.

393. *Arundinax æedon*.—The Thick-billed Warbler.

A skin I shot on Popa is now in the S. Kensington Museum. The same remarks apply to

404. *Herbivocula schwarzi*.—Radde's Bush-Warbler

and to

405. *Phylloscopus affinis*.—Tickell's Willow-Warbler.

458. *Suya crinigera*.—The Brown Hill-Warbler.

In the breeding season the jungle is often filled with the song of this little warbler. A sweet rattling little melody often repeated while the songster appears to be standing on tip toe on the topmost bough of a tree.

463. *Prinia flaviventris.*—The Yellow-bellied Wren-Warbler.

Common among the bushes around the Tanaungdaing and Talokmyo jheels. Nests taken in June and July always within 3 feet of the ground.

466. *Prinia inornata.*—The Indian Wren-Warbler.

Very common. Eggs during the rains.

468. *Prinia blanfordi.*—The Burmese Wren-Warbler.

I found the eggs of this species on an island in the river on the 18th of August, but from the many old nests I found should say the principal breeding time here was in June.

V.—FAMILY *Laniidæ.*

474. *Lanius collurioides.*—The Burmese Shrike.

Local name "Honget beloo."

Common in Myingyan all the year round, although it leaves gardens and compounds for quieter jungle and is not so plentiful during May and June, when I fancy it is breeding. I have not found any nests however. Captain Harington found this bird breeding in the Southern Shan States.

475. *Lanius nigriceps.*—The Black-headed Shrike.

I have seen only one bird of this species in the district so think it must be rare. I procured it in the Tanaungdaing jheel on the 24th December.

481. *Lanius cristatus.*—The Brown Shrike.

Is a cold-weather visitor to these parts. It is found all over the district then.

484. *Hemipus picatus.*—The Black-backed Pied Shrike.

Not uncommon on Popa. The breeding season appears to be April. The birds are not shy and give away their nests by sitting close. I found two nests, but the birds deserted one before laying, although I did not touch it. The other contained three eggs and was placed on the fork of a leafless branch, in forest, about 15 feet from the ground.

488. *Tephrodornis pondicerianus.*—The Common Wood-Shrike.

Common. Breeds from March to July. This bird appears to prefer the open stunted tree jungle.

491. *Pericrocotus fraterculus.*—The Burmese Scarlet Minivet.

Either this or *P. speciosus* occurs on Popa, but I did not shoot the birds I saw, as I could not have preserved them at the time.

500. *Pericrocotus peregrinus.*—The Small Minivet.

Occurs throughout the district in the more thickly wooded parts.

502. *Pericrocotus albifrons.*—Jerdon's Minivet.

This bird is common. I have not noticed it on Popa. The female is greyer than the male, but has dashes of orange on the rump like him but none on the breast. The nest, which is very difficult to detect, is a tiny cup stuck in the fork, or on the top of a horizontal branch of a low bush from 4 to 10 feet off the ground. Three is the number of eggs I found in a nest. They were pale green marked with little longitudinal dashes of brown. One nest was found on the 17th August and another at the beginning of May, both with eggs.

507. *Campophaga neglecta*.—The Small Cuckoo-Shrike.

A skin I sent to the British Museum was identified as of this species. The bird was shot on Popa

510. *Graucalus macii*.—The Large Cuckoo-Shrike.

Fairly common in the old cantonment of Myingyan and elsewhere through the district. Breeds from April to July.

512. *Artamus fuscus*.—The Ashy Swallow-Shrike.

Met with generally although not commonly throughout the district. Breeds in the larger jungle tracts away from villages. I found a nest containing 3 eggs on the 8th June 1901.

515. *Oriolus tenuirostris*.—The Burmese Black-naped Oriole.

Scattered throughout the district as well as on Popa.

521. *Oriolus melanocephalus*.—The Indian Black-headed Oriole.

Scattered over the district. I have not taken the nest, but found a bird building one on the 15th April.

VI.—FAMILY *Sturnidæ*.

547. *Graculipica burmanica*.—Jerdon's Myna.

Local name "Zayet-gaungbyu".

Very common all over the district. Breeds in holes in trees often inside villages. Eggs two to four measuring about 1·03 × ·75 and are laid from April to September. During the cold weather the colour of the head and neck of these birds is very white, in April it is dirty white or isabelline, and by August I have seen them on the hill anyway quite chestnut. When the big cotton trees (*Bombax malabaricum*) are in flower, these birds may be seen and heard in immense numbers.

549. *Acridotheres tristis*.—The Common Myna.

Local name Zayet. Very common. Breeds about May.

552. *Æthiopsar fuscus*.—The Jungle Myna.

Uncommon and generally met with near the Irrawaddy river. Breeds in holes in the cliffs of the river bank as well as in trees. Eggs in May, June and July.

556. *Sturnopastor superciliaris*.—The Burmese Pied Myna.

Rather rare and always met with in the vicinity of water. Builds in thorny trees (tanaungbin) round the Tanaungdaing and other jheel during May and June. The nests are from ten to twenty feet from the ground.

VII.—FAMILY *Muscicapidæ*.

562. *Siphia albicilla*.—The Eastern Red-breasted Flycatcher.

One specimen I shot on Popa has been identified by the British Museum as of this species.

575. *Cyornis rubeculoides*.—The Blue-throated Flycatcher.

Fairly common in the cold weather.

579. *Stoparola melanops*.—The Verditer Flycatcher.

Seen only once on the 27th January 1902.

588. *Alseonax latirostris*.—The Brown Flycatcher.

Occurs on Popa anyway and may be elsewhere but is likely to be overlooked.

592. *Culicicapa ceylonensis.*—The Grey-headed Flycatcher.

Fairly common on the hills slopes.

599. *Terpsiphone affinis.*—The Burmese Paradise Flycatcher.

This bird is rare but general.

601. *Hypothymis azurea.*—The Indian Black-naped Flycatcher.

Sparsely met with in the district.

604. *Rhipidura albifrontata.*—The White-browed Fantail Flycatcher.

Common in bush and low tree jungle. The nest is never far from the ground.

605. *Rhipidura albicollis.*—The White-throated Fantail Flycatcher.

Occurs, but is not common. A very bold little bird when breeding.

VIII.—FAMILY *Turdidæ.*

608. *Pratincola caprata.*—The Common Pied Bush-Chat.

Very common.

610. *Pratincola maura.*—The Indian Bush-Chat.

In the cold weather although not common this bird is occasionally met with in the grass round the Talokmyo and Tanaungdaing jheels.

615. *Oreicola ferrea.*—The Dark-grey Bush-Chat.

This bird might breed on Popa. I know it breeds on Mount Victoria and the Chin hills close by.

641. *Ruticilla aurorea.*—The Daurian Redstart.

More common during the cold season and always found solitary.

663. *Copsychus saularis.*—The Magpie-Robin.

Common. Eggs taken in May and June.

664. *Cittocincla macrura.*—The Shama.

Is fairly well represented in the shady ravines of Popa.

686. *Geocichla citrina.*—The Orange-headed Ground-Thrush.

To be found on Popa only. Breeds there.

693. *Petrophila cyanus.*—The Western Blue Rock-Thrush.

Stays out April commonly; probably breeds in the Chin hills.

693A. *Petrophila gularis.*—The White-throated Rock-Thrush.

As recorded in Vol. XV., page 727 of this Journal; this is a species added to the Indian fauna.

698. *Oreocincla dauma.*—The Small-billed Mountain-Thrush.

Also a rare bird on the hill, breeds there.

706. *Cochoa purpurea.*—The Purple Thrush.

A female of this species was wounded by a Burman and placed in my aviary where I found it dead on the 5th May 1902. I was not able to preserve the skin. I have seen the bird only this once.

IX. FAMILY *Ploceidæ.*

721. *Ploceus megarhynchus.*—The Eastern Baya.

Local name "Taw Sa".

It is common and becomes much in evidence in the breeding season, which is from July to October. I have taken five eggs from one nest.

723. *Ploceus manyar*.—The Striated Weaver-bird.

I found this bird breeding in the "kaing" grass in the Vezon Bog on the 11th August. It is probably to be met with on the other jheels also.

724. *Ploceëlla javanensis*.—The Golden Weaver-bird.

I have seen this species only once in Myingyan district, but secured the specimen, a beautiful male in very rich plumage, on the 3rd July. It breeds in the Pakokku district.

726. *Munia atricapilla*.—The Chestnut-bellied Munia.

Local name "Sa-Wadi".

Occurs throughout the district near water. Probably does not commence breeding until the end of June. Eggs taken from August to November. Eggs usually six in number.

735. *Uroloncha punctulata*.—The Spotted Munia.

Local name "Sa-wadi". Very common throughout the district. Breeds chiefly between July and October.

739. *Sporæginthus flavidiventris*.—The Burmese Red Munia.

Common in the jheels, and breeds during October and November.

X.—FAMILY *Fringillidæ*.

776. *Passer domesticus*.—The House-Sparrow.

Local name "Sa". As common as usual.

779. *Passer montanus*.—The Tree-Sparrow.

Is common, breeding usually in colonies and is then more of a house sparrow in habits.

781. *Passer flaveolus*.—The Pegu House Sparrow.

Local name "Sa-wa". This handsome little sparrow is as common in the district as the house or tree sparrow and is more general than either, living as much in the lonely waste parts as round our houses. On the 20th March I found five nests with full clutches of eggs (3) in the old cantonment of Myingyan.

797. *Emberiza aureola*.—The Yellow-breasted Bunting.

I found this bird in the district on the 1st May 1901. It is common in the cold-weather.

XI.—FAMILY *Hirundinidæ*.

809. *Cotile sinensis*.—The Indian Sand-Martin.

Local name "Pyanhlwa" for Martins, Swallows and Swifts. I took the eggs of *C. sinensis* during the middle of December last and yet on the 25th February found a colony only digging the holes for their nests in the river bank. Second brood I suppose.

814. *Hirundo gutturalis*.—The Eastern Swallow.

Common during the cold weather.

820. *Hirundo striolata*.—The Japanese Striated Swallow.

A bird I shot out of a large colony had the markings and streaks on rump and breast like striolata, but was only the size of typical nepalensis.

592. *Culicicapa ceylonensis.*—The Grey-headed Flycatcher.

Fairly common on the hills slopes.

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This bird is rare but general.

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XII.—Family *Motacillidæ*.

826. *Motacilla alba*.—The White Wagtail.

Arrives about the beginning of September. Usually seen in pairs during the cold weather.

827. *Motacilla leucopsis*.—The White-faced Wagtail.

A fairly common winter visitant.

828. *Motacilla ocularis*.—The Streak-eyed Wagtail.

Also fairly common in the winter and almost always seen in pairs.

832. *Motacilla melanope*.—The Gray Wagtail.

Common during the cold season.

841. *Anthus maculatus*.—Indian Tree-Pipit.

One bird shot on the bank of Kanna tank in November. Observed in no other locality in the district.

847. *Anthus rufulus*.—The Indian Pipit.

Common all over the district. Breeds during the rains.

850. *Anthus rosaceus*.—Hodgson's Pipit.

Fairly common on the sandbanks of the river in the cold weather.

There is another resident pipit which inhabits the very bare and dried-up parts of the county, but I am unable to classify it. It is larger than *A. rufulus*.

XIII.—Family *Alaudidæ*.

866. *Alaudala raytal*.—The Ganges Sand-Lark.

Common on the sand banks in the river and in the many dry nullahs of the district. I found a nest with two eggs on the 3rd March and again one with three eggs, hard set, on the 6th May.

870. *Mirafra assamica*.—The Bengal Bush-Lark.

873. *Mirafra microptera*.—The Burmese Bush-Lark.

Local name "Bilon". Both species are to be met with in the district. Their habits are alike.

The nests are domed and placed on the ground under a tuft of grass, a stone or a bush. The eggs two or three (rarely four) in number are white-speckled in 3 or 4 shades of yellow-brown, dark-brown, ashy-purple and black.

XIV.—Family *Nectariniidæ*.

895. *Arachnechthra asiatica*.—The Purple Sun-bird.

Local name "Pan-sot". Common.

898. *Arachnechthra flammaxillaris*.—The Burmese Yellow-breasted Sun-bird.

More common than the last species. I found a nest being built in April, but unfortunately broke the branch from which it was suspended, and the birds forsook it.

XV.—Family *Dicæidæ*.

912. *Dicæum cruentatum*.—The Scarlet-backed Flower-pecker.

Common on Popa. I never found the nest.

XVI.—Family *Pittidæ*.

931. *Pitta cyanoptera*.—The Lesser Blue-winged Pitta.

I came across a bird of this species at Kyawzi at dusk on the 24th May 1902

on the road and next morning organized a beat and secured it. The beaters had to crawl on hands and knees under the dense thicket.

935. *Pitta cucullata.*—The Green-breasted Pitta.

A bird was brought to me on the 12th May 1901 which had been taken alive at Sale a few days before. I have never seen the species before nor since.

XVII.—FAMILY *Picidæ.*

948. *Gecinus striolatus.*—The Little Scaly-bellied Green Woodpecker.

Local name "Thit-touk". Keeps to the better wooded parts, the slopes of Popa, or the jungle round Kanna. Two nests taken in May and June, each contained four fresh eggs and were five or six feet from the ground

970. *Dendrocopus pectoralis.*—The Spotted-breasted Pied Woodpecker.

Frequently met with but in the drier bush jungle. I have found the nest three times, but on two occasions with young birds. The breeding season is February and March and the eggs usually two in number. The nest holes are generally about twenty feet from the ground.

975. *Iyngipicus canicapillus.*—The Burmese Pigmy Woodpecker.

Very rare on Popa. Not seen elsewhere.

983. *Micropternus phæoceps.*—The Northern Rufous Woodpecker. Also very uncommon.

988. *Tiga javanensis.*—The Common Golden-backed Three-toed Woodpecker.

Fairly common. Breeds in May and June.

1003. *Iynx torquilla.*—The Common Wryneck.

I have seen this bird only twice in Myingyan, but shot it for identification. It must be a rare winter visitor.

XVIII.—FAMILY *Capitonidæ.*

1009. *Thereiceryx lineatus.*—The Lineated Barbet.

Common on Popa. Local name is "Po-Gaung."

1012. *Cyanops asiatica.*—The Blue-throated Barbet.

Occurs, but is not common in the district. Breeds in March and April.

1019. *Xantholæma hæmatocephala.*—The Coppersmith.

Met with throughout the district.

XIX.—FAMILY *Coraciadæ.*

1023. *Coracias affinis.*—The Burmese Roller.

Local name "Hnget Kah." Common all over the district. Breeds during March and April. The eggs number four, sometimes five. One day I came across a roller eating a young bulbul that it had apparently killed.

XX.—FAMILY *Meropidæ.*

1026. *Merops viridis.*—The Common Indian Bee-eater.

Local name "Yethugyi-gaung". Very common all over the district. Begins breeding about the 1st April. The eggs are apparently laid at considerable intervals, as I have noticed young birds in the same nest at all stages of maturity with an unhatched but hard-set egg.

1027. *Merops philippinus.*—The Blue-tailed Bee-eater.

This bird seems to be rare in the district except during the breeding season which is a month later than that of *M. viridis*. It is not even then common. Five eggs were taken from one nest in the river bank south of Myingyan town on the 5th May.

XXI.—FAMILY *Alcedinidæ*.

1033. *Ceryle varia.*—The Indian Pied Kingfisher.

Very common. I have not found the nest.

1035. *Alcedo ispida.*—The Common Kingfisher.

Local name "Pein-nyin". As common as the last.

1040. *Ceyx tridactyla.*—The Indian Three-toed Kingfisher.

I found a perfect specimen of this beautiful little bird at the bottom of the crater of Popa. It was dead and had been entirely cleaned out by ants. This is the only bird of the species I have seen in the district.

1043. *Pelargopsis gurial.*—The Brown-headed Stork-billed Kingfisher.

This and the next species are both rare, but both breed in the Myingyan district.

1044. *Halcyon smyrnensis.*—The White-breasted Kingfisher.

(*To be continued.*)

# THE ORIGIN OF ANONAS. *ANONA SQUAMOSA*, L.; *ANONA RETICULATA*, L.

BY

COLONEL FERNANDO LEAL.

(*Read before the Bombay Natural History Society on 25th January* 1906.)

*Anona squamosa*, L.; *Anona reticulata*, L.—These two *Anonaceae*, beside 5 kinds of *Uvariae*, the *miryo* (*Polyalthia fragrans*) and the *sajeri* (*Bocagea Dalzellii*) exist in Portuguese India, where the first two grow as indigenous. In this article I shall discuss two points: (1) determine the origin of these plants, (2) prove that they are not Indian and show who introduced them into India. The former question has been for more than 3 centuries discussed by many botanists and travellers and still remains unsettled. I shall divide the enquiry into three parts. In the first I shall place before the reader what Yule and Burnell, the erudite authors of a well-known glossary, and others quoted by them have to say on the subject; secondly, the opinion of the learned botanist A. deCandolle; finally, I shall give my own opinion and observations.

I.—The article of Yule and Burnell runs thus:—

"*Custard Apples.*—The name in India of a fruit (*Anona squamosa*, L.) originally introduced from S. America, but which spread over India during the 16th century. Its commonest name in Hindustani is *sharifa*, *i.e.*, 'noble', but it is also called *sitaphal*, *i.e.*, 'the fruit of Sita,' whilst another Anona (bullock's heart), *A. reticulata*, L., the custard apple of the W. Indies, where both names are applied to it, is called in the south by the name of her husband '*Rama*.' And the *Sitaphal* and *Ramphal* have become the subject of Hindu legends (see Forbes Or. Mem. iii, 410.). The fruit is called in Chinese *Fan-li-chi*, *i.e.*, foreign *leeches*.

"A curious controversy has arisen from time to time as to whether this fruit and its congeners were really imported from the New World, or were indigenous in India. They are not mentioned among Indian fruits by Baber (A.D. 1530), but the translation of the Ain (c. 1590) by Prof. Blochmann contains among 'the sweet fruits of Hindustan' *Custard Apple* (p. 66). On referring to the original however the word is *Saddap'hal* (*fructus perennis*), a Hind term for which Shakespear gives many applications, not one of them the *Anona*. The *bel* is one (*Aegle marmelos*) and seems as probable as any (see *Bael*). The Custard Apple is not mentioned by Garcia da Orta (1563), Linschoten (1597), or even by P. del la Valle (1624). It is not in Bontius (1631) nor in Piso's commentary on Bontius (1658), but it is described as an American product in the West Indian part of Piso's book, under the Brazilian name *Aratica*. Two species are described as common by P. Vincenzo Maria, whose book was published in 1672. Both the *Custard Apple* and the sweet-sop are fruits now generally diffused in India; but of their having been imported from the New World, the name *Anona*, which we find in Oviedo to have

been the native West Indian name of one of the species, and which in various corrupted shapes is applied to them over different parts of the East, is an indication. Crawford, it is true, in his Malay Dictionary explains *nona* or *buah* ('fruit'), *nona* in its application to the custard-apple as *fructus virginalis*, from *nona* the term applied in the Malay countries (like missy in India) to an unmarried European lady.* But in the face of the American word this becomes out of the question.

"It is, however, a fact that among the Bharhut sculptures, among the carvings dug up at Muttra by General Cunningham and among the copies from wall paintings at Ajanta (as pointed out by Sir G. Birdwood in 1874,) see *Atheneum*, 26th October, [*Bombay Gazetteer* xii, 490], there is a fruit represented, which is certainly very like a custard apple (though an abnormally big one), and not very like anything else yet pointed out. General Cunningham is convinced that it is a custard apple, and urges in corroboration of his view that the Portuguese in introducing this fruit (which he does not deny) were merely bringing coals to Newcastle; that he has found extensive tracts in various parts of India covered with the wild custard apple; and also that this fruit bears an indigenous Hindi name *ata* or *at* from the Sanskrit *atripya*.

"It seems hard to pronounce about this *atripya*. A very high authority, Professor Max Müller, to whom we once referred, doubted whether the word (meaning 'delightful') ever existed in real Sanskrit. It was probably an artificial name given to the fruit, and he compared it aptly to the factitious Latin of *aureum malum* for 'orange,' though the latter word really comes from the Sanskrit *naranga*. On the other hand, *atripya* is quoted by Raja Radhakant Deb, in his Sanskrit Dictionary, from a Medieval work, the *Dravyaguna*. And the question would have to be considered how far the MSS. of such a work are likely to have been subject to modern interpolation. Sanskrit names have certainly been invented for many objects, which were unknown till recent centuries. Thus for example Williams gives more than one word for *cactus*, or prickly pear, a class of plant which was certainly introduced from America (see *Vidara* and *Visvasaraka* in his Sanskrit Dictionary.)

"A new difficulty, moreover, arises as to the indigenous claims of *ata*, which is the name for the fruit in Malabar, as well as in Upper India. For on turning for light to the splendid works of the Dutch ancients, Rheede and Rumphius, we find in the former (*Hortus Malabaricus*, Part IV) a reference to a certain author, 'Recchus de Plantis Mexicanis,' as giving a drawing of a custard-apple tree, the name of which in Mexico was *ahate* or *ate*, '*fructu apud Mexicanos præcellenti arbor nobilis*'; (the expressions are noteworthy, for the popular Hindustani name of the fruit is *sharifa* = 'nobilis'). We also find in a Manilla vocabulary, that *até* or *atte* is the name of this fruit in the

* The word *Nona* is not originally Malay, but adopted from the old Portuguese *Nona*, a nun, from the Latin, *Nonna*; Ital., *Nona*; French, *Nonne*.—F. L.

Phillippines. And from Rheede we learn that in Malabar the *ola* was sometimes called by a native name meaning 'the Manilla jack fruit,' whilst the *Anona reticulata*, or sweet-sop, was called by the Malabars, 'the Paraṅji,' (*i.e.*, Firingi or Portuguese) jack fruit. These facts seem to indicate that probably the *ata* and its name came to India from Mexico *via* the Phillippines, whilst the *anona* and its name came to India from Hispaniola *via* the Cape. In the face of these probabilities the argument of General Cunningham from the existence of the tree in a wild state loses force. The fact is undoubted and may be corroborated by the following passage from '*Observations on the Nature of the Food of the Inhabitants of South India*,' 1864, p. 12.—'I have seen it stated in a botanical work that this plant (*Anona sq.*) is not indigenous, but introduced from America or the West Indies. If so, it has taken most kindly to the soil of the Deccan, for the jungles are full of it;' [also see *Watt, Econ. Dict.* ii. 259, *seq.*, who supports the foreign origin of the plant]. The Author adds that the wild custard-apples saved the lives of many during famine in the Hyderabad country. But on the other hand, the *Argemon Mexicana*, a plant of unquestioned American origin, is now one of the most familiar weeds all over India. The cashew (*Anarcardium occidentale*), also of American origin, and carrying its American name with it to India, not only forms tracts of jungle now (as Sir G. Birdwood has stated) in Canara and the Concan (and, as we may add from personal knowledge, in Tanjore) but was described by P. Vincenzo Maria more than two hundred and twenty years ago as then abounding in the wilder tracts of the Western coast.

"The question raised by General Cunningham is an old one, for it is alluded to by Rumphius who ends by leaving it in doubt. We cannot say that we have seen any satisfactory suggestion of another (Indian) plant as that represented in the ancient sculpture of Bharhut. [Dr. Watt says, 'They may prove to be conventional representations of the Jack-fruit tree or some other allied plant; they are not unlike the flower heads of the sacred *Kadamba* or *Anthocephalus*' (loc: cit: i 260).] But it is well to get rid of fallacious arguments on either side."

In the "*Materia Medica of the Hindus*, by Udoy Chand Dutt with a Glossary by G. King, M.B., Calc 1877," we find the following synonyms given:—

"*Anona squamosa*: Skt. *Gandagatra*; Beng. *Ata*; Hind. *Sharifa* an *Sitaphal*."

"*Anona reticulata*: Skt. *Leavali*; Beng. *Leona*."

This is all we gather from the *Glossary* of Yule and Burnell. What I note is that the heavy sword of General Cunningham, like that of Brennus, when the gold for the ransom of Rome was being weighed, has been thrown on behalf of the people who say the *ata* and the anona are indigenous to India. Let it not be forgotten that the above *Glossary*, at the beginning of the article, says "fruit originally introduced from S. America," which confirms the opinion of the enlightened authors, *malgre* that of General Cunningham.

I shall now transcribe the article of the *Savant* De Candolle.[o]

"*Pomme Canelle—Anona squamosa*, Linné, en anglais, *Sweet-sop, Sugar Apple*, (dans l'Inde Anglaise *Custard-apple*).

"La patrie de cette espèce et d'autres *Anona* cultivés a suscité des doutes qui en font un problème intéressant. Je me suis efforcé de les resoudre en 1855. L'opinion à laquelle je m'etais arrêté alors se trouve confirmé par les observations des voyageurs faites depuis, et, comme il est utile de montrer à quel point des probabilités basées sur de bonnes méthodes conduisent á des assertions vraies, je transcrirai ce que j'ai dit ; après quoi je mentionnerai ce qu'on a trouvé plus récemment.

"Robert Brown établissait en 1818 le fait que toutes les espèces du genre Anona, excepté l'*Anona senegalensis*, sont d'Amérique et aucune d'Asie. Aug. de Saint-Hilaire dit que, d'après velloso l'*A. squamosa* a été introduit au Brésil, qu'il y est connu sous le nom de Pinha, venant de la ressemblance avec les cônes de pins, et d'*Ata*, évidemment emprunte aux noms Attoa et Atis, qui sont de la même plante en Asie et qui appartiennent aux langues orientales. Donc, ajoute de Saint-Hilaire, les Portugais ont transporté l'*A. squamosa* de leurs possessions de l'Inde dans celles d' Amerique, &c." Ayant fait en 1832 une revue de la famille des Anonacées, je fis remarquer combien l'argument botanique de M. Brown devenait de plus en plus fort, car, malgré l'augmentation considerable des Anonacées décrites, on ne pouvait citer aucun Anona et meme aucune Anonacée á ovaires soudés qui fut originaire d'Asie. J'admettais

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[o] "The country of this species and of the other cultivated Anona has raised doubts, the solution of which has become an interesting problem. I endeavoured to settle them in 1855. The opinion at which I had then arrived has been confirmed by observations since made by travellers, and as it is useful to show how much probabilities based on good methods lead to some true assertions, I shall transcribe what I have said ; after which I shall mention what they have found more recently.

"Robert Brown established in 1818 the fact that all species of Anona excepting l'*Anona senegalensis* are from America and not from Asia. Aug. de Saint-Hilaire says that according to Velloz l'*A. squamosa* has been introduced in Brazil, that it is known there under the name of Pinha from its resemblance to the cones of pines, and of Ata, evidently borrowed from the names, Attoa and Atis, which are names in oriental languages for the same plant in Asia. Therefore Saint Hilaire adds the Portuguese have transported l'*A. squamosa* from their Indian possessions to those of America, &c." Having made in 1832 a review of the family Anonacæ, I remarked how much the botanical argument of Mr. Brown became stronger and stronger, because notwithstanding the considerable increase of described Anonacæ, they could not quote any Anona, nor even any Anonacæ originating from Asia. I admitted the probability that the species came from the West Indies or from the neighbouring American Continent, but by an oversight I attributed this opinion to Mr. Brown who was thus constrained to claim an American origin in general.

la probabilité que l'espèce venait des Antilles ou de la partie voisine du continent Américain ; mais par inattention j'attribuai cette opinion à M. Brown, qui s'était borné à revendiquer une origine Américaine en général. Depuis, des faits de diverse nature ont confirmé cette manière de voir.

"L'Anona Squamosa a été trouvé souvage en Asie, avec l'apparence plutôt d'une plante naturaliseé ; en Afrique, et surtout en Amérique avec les conditions d'une plante aborigène. En effet, d'apres le Dr. Boyle, cette espèce a été naturaliseé dans plusieurs localités de l'Inde ; mais il ne l'a vue avec l'apparence d'une plante sauvage, que sur les flancs de la montague ou est le fort d' Adjeegarh, dans le Bundlecund, parmi des pieds de Teck. Lorsqu ün arbre assi rémarquable ; dans un pays aussi exploré, par les botanistes, n'a été signalé que dans une seule localité hors des cultures, il est bien probable qu'il n'est pas originaire du pays. Sir Joseph Hooker l'a trouvé dáns l'île de Santhiago, du Cap Vert, formant des bois sur le sommet des collines de la vallée de Saint Dominique. Comme *l'A. squamosa* n'est qu' à létat de culture sur le Continent voisin, que même il n'est pas indiqué en Guinée par Thoning, ni au Congo, ni dans la Sénégambie, ni en Abyssinie ou en E'gypte, ce qui montre une introduction récente en Afrique ; enfin, comme les îles du Cap Vert ont perdu une grande partie de leurs forêts primitives, je crois dans ce cas à une naturalisation par des graines e'chappées de jardins. Les auteurs s'accordent a dire l'espéce sauvage à la Jamaique. On a pu autrefois négliger l'assertion de Sloane et de P. Brown, mais elle est confirmée par Mac Fadyen. De Martius a trouvé l'espéce, dans les forêts de Para, localite assurément d'une nature primitive.

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"Since then various facts have confirmed this view. *L' Anona squamosa* has been found in a wild state in Asia, with the appearance of a naturalised plant ; in Africa, and above all in America, in conditions of an indigenous plant. Indeed, according to Dr. Boyle, this plant has been naturalized in several parts of India ; but he has not seen it as growing wild except on the sides of the mountain where is the fortress of Adjeegurh in Bundelkhand, near the roots of Teak trees. When so remarkable a tree, in a country so explored by the botanists, has not been noticed except in one locality out of cultivation, it is quite probable that it is not a native of that country. Sir Joseph Hooker has found it in the island of Santiago and Cape Verd growing luxuriantly on the summits of the valley of St. Dominique. As *l'A. squamosa* is only in a cultivated state on the neighbouring continent that even it is not noticed in Guinea by Thoning, nor in the Congo, nor in Senegambia, nor in Abyssinia, nor in Egypt, this bespeaks its introduction in Africa as of recent date, in a word as the islands of Cape Verd have lost a great portion of their primitive forest, in this case I believe in a naturalization from the seeds that have escaped from the garden. The authors are unanimous in saying that the species grows wild in Jamaica. In former times they could have neglected the assertion of Sloane and P. Brown, but it is confirmed by Mac Fadeyn. De Martius has found these species in the forests of

Il dit même : ' Syvescentem in nemoribus parænsibus inveni,' d'ou l'on peut croire que les arbres formaient à eux seuls une forêt. Splitgerben l'avat trouvée dans les forêts de Surinam, mail il dit *au spontanée?* Le nombre des localités dans cette partie le l'Amerique est assez significatif. Je n'ai pas besoin de rappeler qu'aucun arbre pour ainsi dire, vivant ailleurs que sur les côtes, n' aété ' trouvé véritablement aborigène à la fois dans l'Asie, l'Afrique et l'Amérique intertropricales. L'énsemble de mes recherches rend un fait pariel infiniment peu probable, et, si un arbre 'etait assez robuste pour offrir une telle extension, il serait excessivement commun dans tous les pays intertropicaux. D'ailleurs les arguments historiques, et linguistiques ise sont aussi renforcés dans le sens de l'origine Américaine. Les détails donnés par Rumphius montrent que l' *A. squamosa*, était une plante nouvellement cultivée dans la plupart des iles de l' Archipel Indieni. Forster n'indique aucune Anonacée comme cultivées dans les petites iles de la mer Pacifique. Rheede dit *l'A. squamosa* étranger au Malabar, mais transporté dans l'Inde, d'abord par les Chinois et les Arabes, ensuite par les Portugais. Il est certain qu'il est cultive'en Chine et en Cochinchine, ainsi qu'aux Philippines ; mais depuis quelle époque ? C'est ce que nous ignorons Il est douteux qu les Arabes le cultivent. Dans l'Inde on le cultivait du temps de Roxburgh, qui n'avait pas vu l'espèce spontanée, et qui ne mentionne qu' un seul nom vulgaire de langue moderne (bengali) le nom *Ata*, qui est déja dans Rheede. Plus tard, on a cru reconaître le nom *Gunda-Gatra* comme Sanscrit ; mais le Dr. Royle ayant consulté le célébre Wilson, auteur du dictionnaire

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Para, a locality assuredly of a primitive nature. He even writes ' *Syvescentem in nemoribus parœnsibus inveni* ' from which it can be believed that these trees form by themselves a forest. Splitgerber had found it in the forests of Surinam but he says *au spontanée*. The number of localities in this part of America is quite significative. There is no need for me to remind that any tree, so to say, growing elsewhere on the hills, has not been found as indigenous at the same time in Asia, Africa, and America within tropics. All my researches make a similar fact infinitely less probable and if a tree was tolerably robust to offer a similar extension, it would be excessively common in all the inter-tropical countries. Besides historical and linguistic arguments have also upheld in a way an American origin. The details given by Rumphius show that *Anona squamosa* was a newly cultivated plant in most of the islands of the Indian Archipelago. Forster does not mention any *Anonacœ* as cultivated in the small islands of the Pacific Ocean. Rheede says *l'A. squamosa* is a stranger in Malabar, but transported into India first by the Chinese and Arabs and then by the Portuguese. It is certain that it is cultivated in China and Cochin China as well as in the Phillippines, but from what epoch ? This is what we ignore. It is doubtful if the Arabs cultivated it. In India they have cultivated it from the time of Roxburgh, who had not seen the species grow spontaneously, and who mentions it only by its common modern name (Bengali), the name *Ata* which is already in Rheede. Later on,

Sanscrit, sur l'ancienneté de ce nom, il répondit qu'il avait été tiré du *Sabda Chaurika*, compilation *moderne* comparativement. Les noms de Ata, *Ati* se trouvent dans Rheede et Rumphius. Voilà sans doute ce qui a servi de base à l'argumentation de Saint-Hilaire ; mais un nom bien voisin est donné au Mexique à l'*Anona Squamosa*. Ce nom est *Ate, Ahate de Panucho*, qui se trouve dans Hernandez avec deux figures assez semblables et assez médiocres, qu' on peut rapporter ou a l' *A. Squamosa*, avec Dunal, ou l' *A. Cherimolia*, avec de Martius. Oviedo emploie le nom de *Anon*. Il est très possible que le nom de *Ata* soit venue au Brésil du Mexique et des pays voisins. Il se peut aussi, je le reconnais, qu' il vienne des colonies Portugaises des Indes Orientales. De Martius dit cependant l' espece emportée des Antilles. Je ne sais s' il en a eu la preuve, ou si elle résulte de l' ouvrage d' Oviedo, qu' il cite et que je ne puis, consulter. L' article d' Oviedo, transcrit dans Marcgraf, decrit l' *A.' squamosa* sans parler de son origine.

" L' ensemble des faits est de plus en plus favorable à l' origine Americaine La localité ou l' espece s'est montreé le plus spontanée est celle des forêts de Para. La culture en est ancienne en Amerique, puisque Oviedo est un des premiers auteurs (1535) qui aient écrit sur ce pays. Sans doute la culture est aussi d' une date assez ancienne en Asie, et voilà ce qui rend le probleme curieux. Il ne mest pas prouve' cependant qu'elle soit antérieure à la de'couverte de l'Amérique, et il me semble qu' un arbre fruitier aussi agréable se serait répandu davantage dans l'ancien monde, s'il y avait existé de tout temps. On serait d'ailleurs fort embarassé d'expliquer sa culture en Amérique au

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they believed the name *Gunda-Gatra* as Sanskrit ; but Dr. Boyle having consulted the celebrated Wilson, Author of the Sanskrit Dictionary, as to the age of this name, he answered it was taken from *Sabda Chaurika*, a comparatively modern compilation. The names *Ata, Ati*, are found in Rheede and Rumphius. This is without doubt what has served as an argument for the dispute of Saint Hillaire ; but a nearer similarity in name is that given at Mexico to *l Annona squamosa*. This name is *Ate, Ahate* of *Panucho*, which is found in Hernandez with two figures closely similar and analogous, which may be connected either with *l'A. squamosa*, of Duval or to l' *A. Cherimolia* of Martius. Ovied uses the name of *Anon*. It is very possible that the name *Ata* may have come to Brazil from Mexico and the neighbouring countries. It can also, I acknowledge, be that it came from the Portuguese Colonies of East India. De Martius, however, says the species was imported from the W. India Islands. I do not know if he has had a proof of it, or if he deduces it from the work of Oviedo which he quotes, and which I could not consult. The article of Oviedo transcribed by Marcgraf describes *l' A. squamosa* without speaking of its origin. All these facts are more and more favourable to its American origin. The locality where this species has manifested itself in the most spontaneous form is the forests of Para. Its cultivation in America is of ancient date. Since Oviedo is one of the first authors (1535) who has written on this country, without doubt its culture is also

commencement du XVI.e siècle en supposant une origine de' l'ancien monde.

" Depuis que je méxprimais ainsi, je remarque les faits suivants publiés par divers auteurs.

" 1 ° L'argument tiré de ce qu' aucune espèce du genre Anona est asiatique est plus fort que jamais. L'*A. asiatica*, Linné, reposait sur des erreurs (voir ma note, dans *Geogr. bot*, p. 862) L'*A. obtusifolia*, Tussac, *Fl. des Antilles*, I, p. 191, pl. 28, cultivé jadis à Saint-Domingue, comme d'origine asiatique, est peut-être fondé sur une erreur. Je soupçonne qu'on a dessiné la fleur d'une espèce (*A. muricata*) et le fruit d'une autre (*A. Squamosa*). On n'a point découvert d'Anona en Asié, mais on en connait aujourd' hui quatre ou cinq en Afrique, au lieu d'une ou deux, et un nombre plus considérable qu' autrefois en Amerique.

" 2 ° Les auteurs de flores récentes d'Asie n' hésitent pas a considérer les Anona, en particulier 'l A' *Squamosa*, qu'on rencontre ça et là avec l' apparence spontanée comme naturalisés autour des cultures et des établissements européens.

" 3 ° Dans les nouvelles flores Africaines déjà citées, l' *A. Squamosa* et les autres, dont je parlerai tout à l' heure, sont indiqués tonjours comme des espéces cultivées.

" 4 ° L'horticulteur MacNab a trouvé 'l'A. *Squamosa* dans les plaines sèches de la Jamaique, ce qui confirme les anciens auteurs. Eggers dit cette espéce commune dans les taillis (thickets) des îles Saint-Croix et Vierges. Je ne voispas qu' on l'ait trouvée sauvage à Cuba.

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of sufficiently ancient date in Asia, and this is what makes the problem curious. It is not proved, however, it may be prior to the discovery of America, and it appears to me that a sweet fruit-bearing tree might have been extensively cultivated in the Old World if it was there always. They would besides be much puzzled to explain its cultivation in America at the commencement of the XVI century, supposing an origin from the Old World. Since I expressed myself thus, I have remarked the following facts published by various authors.

1. The argument drawn that the species of the genus Anona is not Asiatic, is stranger than ever. L' *A. asiatica, Linne* depended on errors (see my note, in *Geogr. bot.*, p. 862). L' *A. Obtusifolia*, Tussac, *Fl. des antilles*, I., p. 191, pl. 28, cultivated already at S. Domingo as of Asiatic origin is perhaps based on an error of a species (*A. muricata*) and the flower of another (*A. squamosa*). They have not discovered Annona in Asia but they have found four or five in Africa in place of one or two and a more considerable number than before in America.

"2. The authors of recent flora of Asia do not hesitate to consider the Annona particularly l'*A. squamosa*, which they notice here and there as apparently spontaneous, as naturalised around cultivations and European Settlements.

"3. In the new African flora already quoted l'*A. squamosa* and the others of which I shall speak presently are referred to always as cultivated species.

" 4. The horticulturist MacNab has found the l'*A. squamosa* in the dry plains of Jamaica which confirms the ancient authors. Eggers says this species is

"5° Sur le continent américain on la donne pour cultivée. Cependant M. André m' a communiqué un échantillon, d'une localité pierreuse de la vallée de la Magdalena, qui paraît appartenir á cette espece et être spontanée. Le fruit manque, cequi rend la détermination douteuse. D'aprèsune note sur l' étiquette, c'est un fruit délicieux, analogue á celui de l' *A. Squamosa*. M. Warming cite l'espéce comme cultivée a Logoa Santa, du Brésil. Elle paraît donc plutôt cultivée ou naturalisée à Para, á la Guyane et dans la Nouvelle-Grénade, par un effet des cultures.

En définitive, on ne peut guère douter, ce me semble, qu'elle ne soit d' Amerique et même specialement des Antilles."

I shall now give my own impressions, as the original home of this fruit is still a matter of doubt With the information derived from De Candolle and other *savants*, I shall endeavour to prove conclusively that the custard apple, as well as *Anona reticulata*, was introduced into India by the Portuguese. In all the principal languages of India, such as, Bengali, Hindi, Mahrati, Konkani, Tamil, Malayâlam, Singalese, etc., the *Ata* is known by the same name ; undoubtedly an American name and not Malay, as stated in the *Konkani-Portuguese* Dictionary by Dr. Dalgado, and it is the same name by which the Portuguese have known the fruit in South America. The same may be said, *mutatis mutandis*, of the Annona, a word that did not come to us from the Latin *Annona*, meaning mouth provisions (°) food, but from the American word, according to the already quoted *Oviedo*. *The Hortus Malabaricus* of the Dutch H. Van Rheede, says, that the *Ancna* is, by the Malabars, called, "*Parangi Jaca* " foreign "Jack fruit" or *Firinghi Jacca* (from the Malayalam *Chakka*) and by the Brahmans of Cochim *tjina ponnoss*, "China Jack," the plant not being native on the Malabar Coast, where it *came from afar*. To the custard apple they give, on the same Coast the name of *Manil jack* or *Manil ponnoss* (Skt. Panas) "Manil Jack." Now, a Hindu enthusiast of the great

common in the thickets of the islands of St. Croix and Virgin Islands. I do not see that they have found it in a wild state in Cuba.

"5. On the American continent they speak of it as cultivated. However, M. Andre has forwarded to me a sample of a stony locality of the valley of Magdalene which appears to belong to this species and to be spontaneous The fruit is not developed which renders the decision doubtful According to a note, it is a delicious fruit analogous to that of *l'A. squamosa*. M. Warming quotes the species as cultivated at Logoa Santa in Brazil. It then appears rather cultivated or naturalised at Parra in Guiana and in New Granada by an effect of cultivation. Definitely there is scarcely any doubt, it appears to me, that it is from America and more especially from the Antilles."

(*) In Sanscrit and Mahratta *Anna* means provisions, food ; the same word exists in Konkani. The Latin *Annona* comes perhaps from it, with the same meaning. In Sanscrit *Anaona* means mouth. In *Marathi anavam* meaning "to eat," used only in the following proverb : "*Adkim anavam magta navam*, i.e., first eat then sing.

Sanskrit poem *Ramayana*, in a fine touch of fancy christened the *Anona* and the custard apple, *Ramphal* "Rámás fruit," and *Sitáphal*, "*Sita's fruit*," respectively.

But the poetical fancy of an anonymous Hindu is no proof that these plants are originally from India. Above all it is no evidence against historical truth, against the unshaken opinion of Botanists, such as A. de Condolle in his classical work already quoted, Graham, in his *Catalogue of the Bombay Plants*, Dalzell and Gibson in their *Bombay Flora*, and so many other botanists, historians and travellers, all of whom are unanimous that the two *anonaceæ* in question came from America.

There are besides other proofs that India owes the *Anona squamosa* and *A. reticulata* to the Portuguese.

The Indian botanist Dr. J. C. Lisboa, in his work with the prudence and scruples of a scientist exposed his views in an interesting article in the *Times of India* in March 1894.

"These plants grow wild and are naturalized in various parts of India, specially near Mussalman cemeteries (Dalz. and Gibs.). Hence it is believed by many people that these fruits are natives of India. This opinion is also held by an Indian doctor, who when in Government Service had travelled much, and seen them growing wild over extensive tracts in central and other parts of India.

"Now the question is, if the opinion of M. de Condolle and other botanists and writers be true, how and when did these fruits receive the Indian names *Sita* and *Rama*.

"The Indian doctor just alluded to tells me that when the legendary Rama and Sita were expelled from the kingdom—supposed to be Oudh—they went to a jungle where anonas grew wild and lived on them—hence the names *Ramaphal* and *Sitaphal*. But nobody versed in Hindu mythology believes in this opinion. Dr. Bhandarkar tells me that the whole history of Rama and Sita is a myth.

"It is true that the delicious fruit Sitaphal on occasions of famine has literally proved to be the staff of life to the natives.

But it is to be remembered that it flowers during the early part of the hot season, and the fruit ripens in July, August, and September. On what then did Sita and Rama live during the rest of the year, when these fruits were not in season; and if they did live on other fruits why were only these called after their names?

"I shall be much obliged if some of your readers can throw light on the question of the origin of Anonas."

These doubts could be cleared by the simple statement that Sitaphal and Ramphal are not to be found in the Ramayana, that *Ata* and the Anona did neither exist in India in those mythological times, nor in subsequent historical times, and that consequently the fabulous Rama and his wife the Helen of the Hindus, had neither seen nor tasted the two fruits. No trace of these names can be found in the poem of Valmiki, or in *classical Sanscrit*.

It was therefore the fanciful Hindu, very much like the *Indian doctor* of J. C. Lisboa, who invented the two names, just like the Hindu *poet* (God knows if the same) gave the name *Sita-Keins*, "Sita's Hairs" to the climbing plant *Ipomea quamoclit*, Linnæus (*Indian forget-me-not, Red Jasamine or china Creeper* in English) indigenous to Tropical America, and probably introduced in India by the Portuguese. The natives in Guzarat do call *Sitapadri* (*Anglo Ind. Dict.* by *Whitworth*) any missionary catholic or protestant in the belief that the Virgin Mary, our Lady, is no more than their Sita. ?.....

Ramaphal and Sitaphal are indisputably neotogisms like *Sita-keins* and *Sita-padri* so much so that the *Mahrati-English Dict.* of Molesworth who always indicates the Sanskrit origin of all Mahrati words derived from that classical language, does not trace their derivations. It is true that in Sanskrit and in Mahrati there is also to be found a name little used and known, for instance the Dictionary of Talekar does not mention it. That name is *Lavani*, meaning "a sort of custard-apple," according to the Dictionary of Molesworth, wherein the word is indicated with the mark *S* to signify that it is a Sanskrit term, used in Mahrati *only by men of letters*. It is probably an inferior variety of the 400 species of 140 genera of Anonaceæ known in the New and Old World. Really it cannot be believed that that the *lavani* (and not lavali as in the Gloss. of G. King referred to by Yule and Burnell) is the delicious *ata* not even the *anona*, and if Rama has eaten *lavanis* he could only have had it for his light auxiliaries (the monkeys of Sugriva to invade Lanka) for the liberation of Sita, ravished by Ravana.

It is really curious that in Mahrati the name *Ravanaphal*, "Ravana's fruit" is given to a wild apple. Molesworth lexicon says: *So named as bearing particulars of contrast or comparison with Rámaphal.*

This is very suggestive and conclusive. A jungle fruit is given the name of Ravana on account of its similarity to the fruit of Rama. You see the ingenious process by which one and the other names have been coined. They have borrowed names from Mythology for the Ata and Anona, and it is clear that people did not know they were found in India.

At last the decisive argument, the argument of fact that altogether decides the question, is that in the times of Garcia de Orta there were no *atas* and *anonas* in India. Otherwise the author of *Colloquios* would not have omitted to describe such a delicious fruit as the *ata*. Orta was not only at Goa and Bombay, an "estate and island which the King our Lord has graciously granted me on perpetual lease," as he himself says in the Coll. XXII, about areca and banana, but he was in various parts of India, even in the interior, and describes plants which he could not see, but about which in his scientific curiosity he collected information from the natives and from the Portuguese in India.

Thence I affirm without fear of error that the *ata* and the *anona* have been like the *caju* and so many other plants, useful and palatable, introduced in India by our glorious ancestors after 1563, the year of publication at Goa, of the book of Garcia de Orta.

This conclusion is perfectly rational, for General Cunningham himself does not deny that they brought to India the two *Anonaceæ* however with this restriction, that they brought "merely coals to Newcastle." The coals were not found then in these Indian Newcastles, where actually now they abound. And General Cunningham can preserve in the museum the Barhut Sculptures with the coarse design of the *Asca*. Auguste de Saint-Hilaire had missed the mark when he said that the Portuguese had transported the Anonaceæ from India to Brazil; the fact was diametrically opposite from Brazil to India, as had already been supposed by the perspicaceous Rheede.

# A LIST OF THE MARINE MOLLUSCA IN THE BOMBAY NATURAL HISTORY SOCIETY'S COLLECTION.

By E. Comber, F.Z.S.

The subjoined list of the species of Marine Shells represented in the Society's collection is published partly with the intention of placing upon record the present extent of our collection, but to anyone with a knowledge of the molluscan fauna of India it will mainly serve to indicate the extremely scanty nature of the collection. Additions of any moment have been disappointingly rare for a number of years past, and it is to be hoped that the publication of this list will encourage contributions from some of our members that may go to fill the many large gaps in the list of even the commoner kinds of shells.

The difficulty of identifying shells without the opportunity of actual comparison with authentically named specimens and the absence of any collective book of descriptions and figures of Indian shells is a considerable drawback to the study of them, but the Society will always gladly receive unnamed contributions, and assist its members towards identifying specimens in their own collections. The essential points with regard to specimens of shells are that they should be obtained from living Molluscas and that the locality should be carefully recorded, as dead, worn shells or specimens without the locality are of little value in a collection.

In compiling this list the nomenclature of Messrs. J. C. Melvill and R. Standen's paper (Part I) on the Cephalopoda, Gastropoda and Scaphopoda of the Persian Gulf and Arabian Sea, which appeared in the P. Z. S., 1901, p. 327, &c., has been followed so far as it applied, and Mr. J. C. Melvill has very kindly corrected the list completely.

A list of the Land and Freshwater Shells in the collection is also published herewith, thanks to the assistance rendered by Mr. Edgar Smith and Capt. A. J. Peile, R.A., who have obligingly corrected the list.

## CATALOGUE OF MARINE *MOLLUSCA*

IN THE

BOMBAY NATURAL HISTORY SOCIETY'S COLLECTION.

| | | |
|---|---|---|
| | *CEPHALOPODA.* | |
| NAUTILIDÆ ... ... | *Nautilus pompilius* (L.) ... ... | |
| ARGONAUTIDÆ ... ... | *Argonauta hians* (Soland) ... ... | Persian Gulf. |
| | AMPHINEURA. | |
| CHITONIDÆ ... ... | *Chiton gigas* (Chem.) ... ... ... | Durban. |
| | " ... ... ... ... | Bombay. |

| | | |
|---|---|---|
| | *GASTROPODA* | |
| | *PROSOBRANCHIATA.* | |
| | (DIOTOCARDIA.) | |
| PATELLIDÆ ... ... | *Helcioniscus ocrem-radiatus* (Q. & G.) | Bombay. |
| FISSURELLIDÆ ... ... | *Glyphis* (*Fissurella*) *bombayana* (Sowb) | ,, |
| EMARGINULIDÆ ... ... | *Scutus unguis* (L.) ... ... ... | ,, |
| HALIOTIDÆ ... ... | *Haliotis bistriata* (Gmel.) ... ... | China. |
| | ,, *asinina* (L.) ... ... ... | |
| TROCHIDÆ ... ... | *Trochus radiatus* (Gmel.) ... ... | Bombay. |
| | ,, *tubidus* (Rve.) ... ... | Andamans. |
| | ,, *niloticus* (L.) ... ... ... | Indian Ocean. |
| | ,, ... ... ... | |
| | *Clanculus depictus* (A. Ad.) ... ... | Bombay. |
| | ,, *pharaonis* (L.) ... ... | Aden. |
| | ,, *ceylanicus* (*Nevill*)=*sulcatus* ... ... ... ... | Bombay. |
| | *Monodonta canalifera* (Lam.) ... | Aden. |
| | ,, *australis* (Lam.) ... ... | Durban. |
| | *Euchelus indicus* (A. Ad.) ... ... | Bombay. |
| | ,, *proximus* (A. Ad.) ... ... | Aden. |
| | *Delphinula laciniata* (Lam.) ... ... | Andamans. |
| | *Umbonium* (*Rotella*) *vestiarium* (L.) | Bombay. |
| TURBINIDÆ ... ... | *Turbo intercostalis* (Menke)=(*elegans*, Phil.) ... ... ... ... | Bombay. |
| | ,, *margaritaceus* ... ... ... | |
| | ,, *chrysostoma* ... ... ... | |
| | ,, ... ... ... | |
| | ,, ... ... ... | |
| | ,, ... ... ... | Mombasa and Table Ids. |
| | *Astralium stellatum* (Gmel.) ... .. | Bombay. |
| | *Phasianella australis* (Gmel) .. ... | Australia. |
| NERITIDÆ ... ... ... | *Nerita orygoram* (Reclus.) ... ... | Bombay. |
| | ,, *alricilla* (L.) ... ... ... | Aden. |
| | ,, (*Odontostoma*) *polita* (L.) ... | ,, |
| | ,, (*Pila*) *chrysostoma* (Reclus) ... | ,, |
| | ,, *plexa* (Chemn.) ... ... | ,, |
| | ,, ... ... | ,, |
| | *Neritina* (*Dostia*) *crepidularia* (Lam.) | Bombay. |
| | ,, *pulchella* (Wood) ... ... | ,, |
| | (MONOTOCARDIA.) | |
| IANTHINIDÆ ... ... | *Ianthina fragilis* (Lam.) = *communis* (Lam.) ... ... ... | Bombay. |
| | ,, *globosa* (Swains.) ... ... | ,, |
| SCALIDÆ ... ... ... | *Scala pretiosa* (Lam.) ... ... ... | ,, |
| NATICIDÆ ... ... ... | *Natica ala papilionis* (Ch.)=*tanata* (Menke.) ... ... ... | ,, |
| | ,, *lineata* (Lam.) ... ... | ,, |
| | ,, *maculosa* (Lam.) ... ... | ,, |
| | ,, *rufa* (Born.) ... ... ... | ,, |
| | ,, (*Neverita*) *didyma* (Bolten).. | ,, |
| | ,, (*Mamma*) *mamilla* (L.) ... | |
| | ,, (*Mamilla*) *melanostoma*, (Gmel.)=(*Zanzibarica*) (Reclus) ... ... ... | Bombay and Aden. |
| | ,, *maroccana* (Chem.) ... ... | Aden. |
| | *Sigaretus* ... .. ... | |
| XENOPHORIDÆ ... ... | *Xenophora* (*Onustus*) *solaris* (L.) ... | |
| | ,, ... | Japan. |
| CALYLIDÆ ... ... | *Crucibulum scutellatum* (Gray) (*var violaceum*) (Carp.) ... ... ... | Ratnagiri. |
| | *Calyptraea* (*Ergaea*) *walshi* (Herm.) | Bombay. |
| SOLARIIDÆ ... ... | *Solarium perspectivum* (L.) ... ... | Andamans. |

| | | |
|---|---|---|
| | *GASTROPODA PROSOBRANCHIATA*—contd. | |
| | (MONOTOCARDIA)—*contd.* | |
| LITTORINIDÆ ... ... | *Littorina scabra* (L.) ... ... ... | |
| | " " (*var. newcombi*) (Reeve.) ... | Bombay. |
| | " " (*var. intermedia*) (Phil.) ... | " |
| | " *ventricosa* (Phil.) ... ... | " |
| | " *malaccana* (Phil.) ... ... | " |
| | " *arboricola* (Reeve)... ... | Andamans. |
| | *Tectarius nodulosus* (Gmel.) ... ... | Bombay. |
| RISSOIDÆ... ... ... | *Rissoa* (*Alvania*) *mahimensis* (Melv.) | " |
| CERITHIIDÆ ... ... | *Cerithium morus* (Lam.) ... ... | Bombay and Aden. |
| | " *rubus* (Martyn) ... ... | Bombay. |
| | " *cæruleum* (Sowb.) ... | Aden. |
| | " (*Vertagus*) *obeliscus* (Brug.) | Ratnagiri. |
| | " " *vertagus* ... | Andamans. |
| | " *tuberosum* (Fabr.) .. ... | Aden. |
| | " (*Vertagus*) *aluco* (L.) ... | |
| | " " *asper* (L.) ... | Andamans. |
| | " " *cedo-nulli* (Sowb.) | Aden. |
| | " " *taeniatum* (Quoy.) | Somali Coast. |
| | *Potamides* (*Telescopium*) *telescopium* (L.) ... ... ... | Bombay. |
| | " (*Tympanonotus*) *fluviatilis* (Pot. and Mich.) ... | Bombay. |
| | " (*Cerithidea*) *quadrata* (Sowb.) | Andamans. |
| | *Pyrazus palustris* (L.) ... ... ... | |
| PLANAXIDÆ ... ... | *Planaxis sulcatus* (Born.) ... ... | Bombay. |
| TURRITELLIDÆ ... ... | *Turritella* (*Zaria*) *duplicata* (L.) ... | " |
| | " (*Haustator*) *vittulata* (Ad. and Rve.) ... ... | Ratnagiri. |
| | " *cerea* (Rve.) ... ... | " |
| | " ... ... ... ... ... | |
| | " ... ... ... ... ... | |
| STROMBIDÆ ... ... | *Strombus* (*Canarium*) *gibberulus* (L.)... | Andamans and Aden. |
| | " *lentiginosus* (L.) ... ... | Andamans. |
| | " *auris-diana* (L.) ... ... | " |
| | " *variabilis* (Sowb.) ... ... | " |
| | " *dentatus* (L.) ... ... ... | Aden. |
| | " *urceus* (L.) ... ... ... | " |
| | " *isabella* (Lam.) ... ... | Andamans. |
| | " *luhuanus* (L.)... ... ... | |
| | " *succinctus* (L.) ... ... | |
| | " *canarium* (L.) ... ... | |
| | " *mauritianus* (Lam.)... ... | Durban. |
| | " ... | Japan. |
| | *Pteroceras bryonia* (Chem.) | |
| | " *lambis* (L.)... ... ... | Andamans. |
| | *Rostellaria curvirostis* (Lam.) (*var. curta*) (Sowb.) ... ... ... | Bombay. |
| CYPRÆIDÆ ... ... | *Cyprea annulus* (L.) ... ... ... | Andamans. |
| | " *carneola* (L.) .. ... ... | " |
| | " *caurica* (L.) ... ... ... | " |
| | " *erosa* (L.) ... ... ... | " and Aden. |
| | " *arabica* (L.) ... ... ... | Aden and Bombay. |
| | " *felina* (Gmel)... ... ... | |
| | " *fimbriata* (Gmel) ... ... | |
| | " *lamarckii* (Gray) ... ... | Bombay. |
| | " *lentiginosa* (Gray.) ... ... | " |
| | " *mauritiana* (L.) ... .. | Perim. |
| | " *moneta* (L.) ... ... ... | Andamans. |
| | " *ocellata* (L.) ... ... ... | |

| | | |
|---|---|---|
| | MONOTOCARDIA—*contd.* | |
| CYPRÆIDÆ—*contd.* | *Cypræa onyx* (L.) | Andamans. |
| | ,, *pallida* (Gray.) | Bombay. |
| | ,, *argus* (L.) | Andamans. |
| | ,, *mappa* (L.) | ,, |
| | ,, *vitellus* (L.) | |
| | ,, *talpa* (L.) | |
| | ,, *tigris* (L.) | Aden. |
| | ,, *pantherina* (L.) | ,, |
| | ,, *lynx* (L.) | ,, |
| | ,, *turdus* (Lam.) | ,, |
| | ,, *cylindrica* (Born.) | ,, |
| | ,, *caput-serpentis* (L.) | Andamans. |
| | ,, *tabescens* (Soland) | |
| | ,, *diluculum* (Rve.) | |
| | ,, *globulus* (L.) | Straits. |
| | ,, *cribraria* (L.) | Andamans. |
| | ,, *asellus* (L.) | ,, |
| | ,, *gangrenosa* (Dillwyn.) | |
| | ,, *helvola* (L.) | |
| | ,, *miliaris* (Gmel.) | |
| | ,, *isabella* (L.) | Andamans. |
| | ,, *hirundo* (L.) | |
| | ,, *staphylæa* (L.) | |
| | ,, *pulchra* (Gray) | Aden. |
| | ,, *erythræensis* (Beck.) | ,, |
| | *Amphiperas* (*Ovula*) *ovum* (L.) | Andamans |
| | ,, (*Calpurnus*) *verrucosum* (L.) | Philippines. |
| | *Erato pellucida* (Reeve) | Bombay. |
| DOLIIDÆ | *Dolium maculatum* (Lam.) | ,, |
| | ,, *costatum* (Desh.) | Andamans. |
| | ,, *olearium* (Brug.) | ,, |
| | ,, | Nicobars. |
| | ,, | Mekran Coast. |
| | *Malea pomum* (L.) | Andamans |
| | *Pyrula bucephala* (Lam.) | Persian Gulf. |
| | ,, *pugilina* (Born.) | |
| | ,, (*Rapana*) *bulbosa* (Soland) | |
| | ,, *paradisiaca* (Mart.) | |
| | ,, (*Sycotypus*) *ficus* (Lam.) | |
| CASSIDIDÆ | *Cassis vibex* (L.) | Andamans. |
| TRITONIDÆ | *Lotorium* (*Simpulum*) *pileare* (L.) | Ratnagiri |
| | ,, (*Lagena*) *cingulatum* (Pfr.) | |
| | ,, (*Triton*) *olearium* (L.) | Ratnagiri. |
| | *Gyrineum* (*Ranella*) *tuberculatum* (Brod.) | Bombay. |
| | ,, *spinosum* (Lam.) | Bombay. |
| | ,, *elegans* (Beck) | Andamans. |
| | ,, *graniferum* (Lam.) | ,, |
| | ,, *leucostoma* (Lam.) | Durban. |
| | ,, (*Eupleura*) *perca* (Peary) =*pulchra* (Gray) | Japan. |
| | ,, | Cape. |
| EULIMIDÆ | *Eulima dens-colubri* (Melv.) | Bombay. |
| PYRAMIDELLIDÆ | *Pyramidella mitralis* (A. Ad.) | Somali Coast. |
| MURICIDÆ | *Murex tenuispina* (Lam.) | |
| | ,, *tribulus* (L.) | Ratnagiri. |
| | ,, *adustus* (Lam.) | Bombay. |
| | ,, (*Ocinebra*) *bombayanus* (Melv.) | ,, |
| | ,, *palma-rosæ* (Lam.) | Andamans. |
| | ,, *brandaris* (L.) | Mediterranean. |
| | ,, *haustellum* (L.) | |
| | ,, *scolopax* (Dillwyn) | |
| | ,, *trunculus* (L.) | |
| | ,, *ramosus* (L.) | |

| | | |
|---|---|---|
| | MONOTOCARDIA—*contd.* | |
| MURICIDÆ—*contd.* ... | *Murex brevispina* (Lam.) ... ... | Durban. |
| | ,, ... ... ... | Nicobar Ids. |
| | ,, ... ... ... | Aden. |
| | ,, ... ... ... | S. Africa. |
| | *Urosalpinx contracta* (Rve.) ... ... | Bombay. |
| | *Purpura rudolfi* (Chenn.) ... ... | |
| | ,, *bufo* (Lam.) ... ... ... | Bombay. |
| | ,, *echinulata* (Lam.) ... ... | Konkan Coast. |
| | ,, *blanfordi* (Melv.) ... ... | Bombay. |
| | ,, *sacellum* (Ch.) ... ... | ,, |
| | *Jopas situla* (Reeve) ... ... ... | Aden. |
| | *Cuma carinifera* (Lam.) ... ... | Bombay. |
| | *Sistrum subnodulosum* (Melv.) ... | ,, |
| | ,, *tuberculatum* (Blv.) ... ... | ,, |
| | ,, *guthedra* (Melv.) ... ... | ,, |
| | ,, (*Ricinula*) *chrysostoma* (Desh.) ... ... ... | Aden. |
| COLUMBELLIDÆ ... ... | *Columbella atrata* (Gould) ... ... | Bombay. |
| | ,, *misera* (Sowb.) ... ... | Aden. |
| | ,, ... ... | ,, |
| | ,, ... ... ... | ,, |
| | ,, ... ... ... | ,, |
| | ,, *terpsichore* (Lesthes) ... | Bombay. |
| NASSIDÆ ... ... ... | *Bullia* (*Pseudostrombus*) *mauritiana* (Gray) ... ... ... | Aden. |
| | ,, ... ... ... | ,, |
| | *Nassa arcularia* (L.) ... ... ... | |
| | ,, *coronata* (L.) ... ... ... | Aden. |
| | ,, *pulla* (L.) ... ... ... | ,, |
| | ,, *ravida* (A. Ad.) ... ... | ,, |
| | ,, *nodifera* (Powis) ... ... | Bombay. |
| | ,, *stolata* (Gmel.)=*ornata* (Desh.) | ,, |
| | ,, *oliwacea* (Brug.)=*tania* (Gmel.) | ,, |
| | ,, *canaliculata* (Lam.) ... ... | Ratnagiri. |
| | ,, *gemmulata* (Lam.) ... ... | Aden. |
| | ,, ... ... ... ... | |
| | ,, ... ... ... ... | |
| | ,, ... ... ... ... | |
| BUCCINIDÆ... ... ... | *Tritonidea tissoti* (Petit) ... ... | Bombay. |
| | ,, *rubiginosa* (Reeve) ... | ,, |
| | ,, *spiralis* (Gray) ... | ,, |
| | ,, *undosa* (L.) ... ... | Ratnagiri. |
| | *Latrunculus* (*Eburna*) *spiratus* (Lam.) | Bombay. |
| | ,, ,, *zeylanica* (Lam.) | Andamans. |
| | *Engina* (*Pusiostoma*) *mendicaria* (L.) (*and varieties*) ... ... ... | Aden. |
| | ,, *zea* (Melv.) ... ... ... | Bombay. |
| TURBINELLIDÆ ... ... | *Turbinella rapa* (Gmel.) ... ... | |
| | ,, *cornigera* (Lam.) ... ... | Aden. |
| | ,, *pyrum* (L.) ... ... ... | Andamans. |
| FASCIOLARIIDÆ ... ... | *Fasciolaria trapezium* (Lam.) ... | |
| | ,, *gigantea* (Kiener) ... | |
| | ,, ... ... ... | |
| | *Latirus polygonus* (L.)... ... ... | Mauritius. |
| MITRIDÆ ... ... ... | *Mitra episcopalis* (L.) ... ... ... | |
| | ,, *aurantia* (Sw.) ... ... ... | Andamans. |
| | ,, (*Scabricola*) *scabricula* (L.) ... | ,, |
| | ,, ,, *crenifera* (Lam.) | ,, |
| | ,, (*Cancilla*) *carnicolor* (Rve.) ... | ,, |
| | ,, ,, *filaris* (L.) ... ... | ,, |
| | ,, *strigillata* (Sowb.) ... ... | ,, |
| | ,, (*Chrysame*) *ambigua* (Sowb.)= *fulva* (Swain.) ... ... | ,, |
| | ,, (*Chrysame*) *procissa* (Rve.) ... | Bombay. |
| | ,, (*Strigatella*) *amphorella* (Lam.) | Andamans. |

| | | |
|---|---|---|
| | MONOTOCARDIA—*contd.* | |
| MITRIDÆ—*contd.* | *Mitra* (*Turricula*) *plicata* (Klein.) | Andamans. |
| | " " *melongena* (Lam.) | " |
| | " " *costellaris* ( " ) | " |
| | " " *tæniata* ( " ) | " |
| | " " *lyrata* ( " ) | " |
| | " (*Costellaria*) *mucronata* (Rve.) | " |
| | " " *deshayesii* ( " ) | " |
| | " " *crebrilirata* ( " ) | " |
| | " (*Callithea*) *stigmataria* (Lam.) | " |
| | " " *sanguisuga* (L.) | " |
| | " (*Cylindra*) *fenestrata* (Lam.) | " |
| | " | " |
| | " | " |
| | " | " |
| | " | Aden. |
| MARGINELLIDÆ | *Marginella mazagonica* (Melv.) | Bombay. |
| | " *monilis* (L.) | Aden. |
| VOLUTIDÆ | *Voluta scripha* (L.) | |
| | " *vespertilio* (L.) | |
| | *Melo indica* (Gmel.) | Andamans. |
| HARPIDÆ | *Harpa ventricosa* (Lam.) | Mauritius. |
| | " *minor* (Lam.) | " |
| OLIVIDÆ | *Oliva inflata* (Lam.) | Aden. |
| | " " (*var. undata* Lam.) | " |
| | " " (*var. bicincta* Lam.) | " |
| | " *maura* (L.) | Bombay. |
| | " *nebulosa* (Lam.) | " |
| | " *oliopiadina* (Duclos) = *picta* (Lam.) | |
| | " *nigrita* | Andamans. |
| | " *servicea* (Bolt) = *texulina* (Lam.) | " |
| | " *zeylanica* (Lam.) | " |
| | " *ponderosa* (Duclos) | " |
| | " *ispidula* (L.) | " |
| | " *irisans* (Lam.) | |
| | " *gibbosa* (Born.) | |
| | " *emicator* (Morch) = *guttata* (Lam.) | |
| | " | Aden. |
| | " | " |
| | " | " |
| | " | " |
| | *Ancilla ventricosa* (Lam.) | " |
| TEREBIDÆ | *Terebra cœrulescens* (Lam.) | " |
| | " *cinctella* (*Desh.*) (=*undulata* (Gray.)) | Andamans. |
| | " *duplicata* (L.) | " |
| | " *subulata* (L.) | " |
| | " *muscaria* (Lam.) | " |
| | " *myuros* (Lam.) | " |
| | " *oculata* (Lam.) | " |
| | " *affinis* (Gray). | " |
| | " *tricolor* (Sowb.) | " |
| | " *cancellata* (Quoy) | " |
| | " *maculata* (L.) | " |
| | " *crenulata* (L.) | " |
| CONIDÆ | *Conus* (*Stephanoconus*) *lividus* (Hwass.) | Bombay. |
| | " (*Coronaxis*) *betræus* (L.) | Andamans. |
| | " " *minimus* (L.) | Aden and Andamans. |
| | " " *taeniatus* (Brug.) | Aden. |
| | " (*Dendroconus*) *betulinus* (L.) | |
| | " ( " ) *quercinus* (Brug.) | Andamans. |

| | | |
|---|---|---|
| | MONOTOCARDIA—*contd.* | |
| CONIDÆ—*contd.* ... | *Conus* (*Lithoconus*) *flavidus* (Lam.)... | |
| | ,, ,, *tessellatus* (Born.) | |
| | ,, (*Leptoconus*) *insculptus* (Kien.) | Aden. |
| | ,, ,, *lentiginosus* (Rve) | Bombay. |
| | ,, (*Rhizoconus*) *capitaneus* (L.)... | Andamans. |
| | ,, ,, *maldivus* (L.) ... | |
| | ,, ,, *mutabilis* (Chemn.) | Bombay. |
| | ,, ,, *punctatus* (Chemn.) | Ratnagiri. |
| | ,, (*Chelyconus*) *achatinus* (Chemn.) | Bombay. |
| | ,, ,, *monachus* (L.) ... | ,, |
| | ,, (*Cylinder*) *pennaceus* (Born.)... | Andamans. |
| | ,, ,, *textile* (L.) ... ... | Aden. |
| | ,, *acuminatus* (Brug.) ... ... | |
| | ,, *amadis* (Chem.) ... ... | |
| | ,, *arachnoideus* (Gmel.) ... | Andamans. |
| | ,, *arenatus* (Brug.) ... ... | Aden and Andamans. |
| | ,, *canonicus* (Brug.) ... ... | Andamans. |
| | ,, *consors* (Sowb.) ... ... | |
| | ,, *eburneus* (Brug.) ... ... | ,, |
| | ,, *emaciatus* (Reeve.) ... ... | ,, |
| | ,, *episcopus* (Brug.) ... ... | ,, |
| | ,, *figulinus* (L.) ... .. ... | ,, |
| | ,, *fumigatus* (Brug.) = *coffea* (Gmel.) ... ... ... | Aden. |
| | ,, *generalis* (L.) ... ... ... | |
| | ,, *geographus* (L.) ... ... | Andamans. |
| | ,, *lineatus* (Chem.) ... ... | ,, |
| | ,, *litteratus* (L.) ... ... | ,, |
| | ,, *marmoreus* (L.) ... ... | |
| | ,, *miles* (L.) ... ... ... | Andamans. |
| | ,, *nussatella* (L.) ... ... | Aden and Andamans. |
| | ,, *nobilis* (L.) ... ... ... | Andamans. |
| | ,, *papilionaceus* (Brug.) ... | |
| | ,, *pusillus* (Chem.) ... ... | Aden. |
| | ,, *rattus* (Brug.)... ... ... | Andamans. |
| | ,, *splendidulus* (Sow.) ... ... | Aden. |
| | ,, *straturatus* (Sowb.) ... ... | Andamans. |
| | ,, *striatus* (L.) ... ... ... | ,, |
| | ,, *sumatrensis* (Brug) ... ... | Aden. |
| | ,, *sugillatus* (Rve) ... .. | |
| | ,, *tessellatus* (L.)... ... ... | Andamans. |
| | ,, *thomasi* (Sowb.) ... ... | Aden. |
| | ,, *vexillum* (Gmel.) ... ... | |
| | ,, *virgo* (L.) .. ... ... | |
| | ,, *zonatus* (Brg) ... ... ... | Andamans. |
| | *Pleurotoma tigrina* (Lam.) ... .... | ,, |
| | ,, ... ... ... | |
| | ,, ... ... ... | |
| | ,, ... ... ... | |
| | *Surcula cingulifera* (Lam.) (*var. amicta* (Sm.) ... ... | Bombay. |
| | ,, *javana* (L.) (=*nodifera*, Lam.) | ,, |
| | ,, *tornata* (Dillw.) (*var.* fulminata, Kien) ... ... | Ratnagiri. |
| | *Drillia crenularis* (Lam.) (*var. atkinsoni*, Sm.) ... ... ... | Bombay. |
| | *Clathurella tincta* (Rve.) ... ... | ,, |
| CANCELLARIIDÆ ... | *Cancellaria scalarina* (Sowb.) ... | ,, |
| | OPISTHOBRANCHIATA (TECTIBRANCHIATA). | |
| ACTEONIDÆ ... ... | *Acteon coccinatus* (Reeve) ... ... | Andamans. |
| TORNATINIDÆ ... ... | *Tornatina involuta* (G. & H. Nev.) ... | Bombay. |
| SCAPHANDRIDÆ ... ... | *Atys naucum* (L.) ... ... ... | Andamans. |
| | *Cylichna cylindracea* (Penn.)... ... | Bombay. |

| | | |
|---|---|---|
| | OPISTHOBRANCHIATA (TECTIBRANCHIATA)—*contd.* | |
| BULLIDÆ ... ... ... | *Bulla ampulla* (L.) ... ... ... | Andamans. |
| | *Hydatina physis* (L.) ... ... .. | Aden. |
| AKERIDÆ ... ... ... | *Haminea galba* (Pease) ... ... | Bombay. |
| RINGICULIDÆ .. .. | *Ringicula propinquans* (Hinds.) ... | ,, |
| SIPHONARIIDÆ ... ... | *Siphonaria basseinensis* (Melv.) . | ,, |
| | ,, ... | Aden. |
| | PULMONATA. | |
| AURICULIDÆ ... ... | *Auricula auris-judæ* (L.) ... ... | Andamans and Bombay. |
| | ,, *auris-midæ* (L.) ... ... | |
| | *Melampus siamensis* (Mart.) ... ... | Bombay. |
| | ,, *erythræus* (Morlet) ... | Aden. |
| | ,, ... ... ... | ,, |
| | ,, ... ... ... | |
| | SCAPHOPODA. | |
| DENTALIIDÆ ... ... | *Dentalium longitrorsum* (Rve.) ... | Bombay. |
| | *Cadulus gadus* (Sowb.) ... ... | ,, |
| | PELECYPODA. | |
| | FILIBRANCHIATA. | |
| ANOMIIDÆ ... . | *Placuna placenta* (L.) ... ... ... | Bombay. |
| | *Anomia achæus* (Gray) ... ... | ,, |
| ARCADÆ ... ... ... | *Arca bistrigata* (Dunker) ... ... | Ratnagiri. |
| | ,, *inæquivalvis* (Brug.) ... ... | Bombay. |
| | *Scapharca japonica* (Rve.) ... ... | Ratnagiri. |
| | ,, *rhombea* (Born.) ... | ,, |
| | *Anomalocardia granosa* (Lam.) ... | Bombay. |
| | *Anomalocardia formosa* (Sowb.) ... | |
| | *Barbatia obliquata* (Gray) ... ... | Konkan Coast. |
| | *Scapharca natalensis* (Krauss) ... | Durban. |
| | *Parallelepipedum tortuosum* (L.) ... | Aden. |
| | ,, ... ... ... | Bombay. |
| MYTILIDÆ ... .. | *Mytilus smaragdinus* (Chem.) ... | Bombay & Konkan Coast. |
| | *Modiola emarginata* (Benn.) ... ... | Bombay. |
| | PSEUDOLAMELLIBRANCHIATA. | |
| AVICULIDÆ ... ... | *Meleagrina margaritifera* (L.) ... | Indian Ocean. |
| | *Pinna nigra* (Chemn.)... ... ... | Bombay. |
| | ,, ... ... ... ... | Japan. |
| | ,, ... ... ... ... | Mekran Coast. |
| OSTREIDÆ ... ... | *Ostrea lacerata* (Hanley) ... ... | |
| | *Ostrea crenulifera* (Sowb.) ... .. | Bombay. |
| PECTINIDÆ ... ... | *Pecten senatorius* (Gmel.) ... ... | |
| | ,, *crassicostatus* (Sowb.) .. ... | |
| | ,, *pretens* (Sol.) = *glaber* (L.) ... | |
| SPONDYLIDÆ ... ... | *Spondylus rubicundus* (Rve.) ... ... | Bombay. |
| | ,, ... ... ... | Japan. |
| | EULAMELLIBRANCHIATA. | |
| CARDITIDÆ ... ... | *Cardita calyculata* (Lam.) ... ... | Konkan Coast. |
| | ,, *antiquata* (Lam.) ... ... | Bombay. |
| CYPRINIDÆ ... | *Libitina* (*Cypricarda*) *vellicata* (Rve.) | ,, |
| LUCINIDÆ ... ... | *Lucina fibula* (Rve.) ... ... ... | Ratnagiri. |
| | ,, *tigerina* (L.) ... . ... | |
| UNGULINIDÆ ... ... | *Diplodonta indica* (Desh.) ... .. | Konkan Coast. |
| CYRENIDÆ ... .. | *Velorita cyprinoides* (Gray) .. ... | ,, |
| | *Tellina capsoides* (Lam.) ... ... | Ratnagiri. |
| TELLINIDÆ ... ... | ,, (*Homala*) *ala* (Hanley) ... | ,, |
| | ,, *sinuata* (Speng.) ... ... | ,, |

| | | |
|---|---|---|
| | PELECYPODA—*contd.* | |
| | EULAMELLIBRANCHIATA—*contd.* | |
| TELLINIDÆ—*contd.* ... | *Tellina rubra* (Desh.) ... ... ... | Ratnagiri. |
| | „ *rubella* (Desh.) ... ... ... | „ |
| | „ *planata* (L.) ... ... ... | Konkan Coast. |
| | *Macoma edentula* (Bord & Sowb.) .. | Ratnagiri. |
| | „ *truncata* (Jonas) .. ... | „ |
| | *Gastrana polygona* (Chemn.) ... ... | „ |
| | *Macoma nasuta* (Conrad) ... ... | Victoria B. C. |
| SCROBICULARIIDÆ ... | *Semele cordiformis* (Sowb.) ... ... | Bombay. |
| DONACIDÆ ... ... | *Donax scortum* (L.) ... ... ... | „ |
| | „ *incarnatus* (Chemn.) ... ... | „ |
| | „ *serra* (Chem.) ... ... ... | Cape Colony. |
| VENERIDÆ ... ... | *Meretrix morphina* (Lam.) ... ... | Bombay. |
| | *Circe divaricata* (Chemn.) .. ... | „ |
| | „ *intermedia* (Reeve.) ... .. | Aden. |
| | *Cytherea* (*Meretrix*) *morphina* (Lam.) | Andamans. |
| | „ *castanea* (Lam.) ... ... | Aden. |
| | *Meroe solandri* (Gray) ... ... ... | Konkan Coast. |
| | „ *effossa* (Hanley) ... ... | Bombay. |
| | *Dosinia prostrata* (L.) ... ... ... | „ |
| | „ *rustica* (Romer) ... ... | „ |
| | „ *pubescens* (Phil.) ... ... | Konkan Coast. |
| | *Venus* (*Chione*) *pinguis* (Hinds.) ... | Bombay. |
| | „ „ *radiata* (Chemn.) ... | „ |
| | *Tapes* (*Pullastra*) *malabarica* (Chemn.) | „ |
| | „ „ *textrix* (Chemn.) ... | „ |
| | „ „ *indica* (Sowb.) ... | Konkan Coast. |
| | „ „ *turgida* (Lam.) ... | Ratnagiri. |
| | „ „ ... .. .. ... | „ |
| | „ „ *traminea* (Conrad.) | British Columbia. |
| | *Callista chinensis* (Chem.) ... ... | Indian Ocean. |
| | „ *erycina* (L.) ... ... ... | Konkan Coast. |
| MACTRIDÆ ... ... | *Mactra cornea* (Desh.) ... ... | Bombay and Konkan Coast. |
| | „ *luzonica* (Desh.) ... ... | „ |
| | „ *plicataria* (L.) ... . ... | Ratnagiri. |
| | „ (*Schizodesma*) *spengleri* (L.) . | Cape Colony. |
| | *Harvella capillacea* (Desh.) ... ... | Konkan Coast. |
| | „ ... ... .. | Bombay. |
| | *Lutraria transversalis* (Desh.) ... | Konkan Coast. |
| | *Anatinella candida* (Chem.) ... ... | Ratnagiri. |
| GLAUCOMYIDÆ ... ... | *Glaucomya cerea* (Rve.) ... ... | „ |
| CARDIIDÆ ... ... | *Cardium coronatum* (Speng.) ... .. | Bombay. |
| | „ *latum* (Born.) ... ... | „ |
| | „ *rugosum* (Lam.) ... ... | Ratnagiri. |
| | „ (*Hemicardium*) *fragum* (L.) . | |
| | „ „ *cardissa* ... | Japan. |
| | „ *pseudolima* (Lam.) ... ... | |
| TRIDACNIDÆ ... ... | *Tridacna squamosa* (Lam.) ... ... | |
| | „ *compressa* (Reeve.) ... ... | Andamans. |
| | „ *gigas* (Lam.) ... ... | |
| CHAMIDÆ ... .. | *Chama macrophylla* (Chemn.) ... | Bombay. |
| PSAMMOBIIDÆ ... ... | *Psammobia malaccana* (Rve.) ... | „ |
| | *Solentellina oblonga* (Desh.) ... ... | Ratnagiri. |
| | „ *atrata* (Desh.) ... ... | Konkan Coast. |
| | „ *diphos* (L.) ... .. | Ratnagiri. |
| | *Asaphis* (*Capsa*) *rugosa* (Lam.) ... | Konkan Coast. |
| MYIDÆ ... ... ... | *Cryptomya philippinarum* (A. Ad.) ... | Ratnagiri. |
| SOLENIDÆ ... ... ... | *Solen truncatus* (Sowb.) ... ... | Alibag. |
| | *Siliqua* (*Machæra*) *polita* (Wood.) ... | Bombay. |
| PHOLADIDÆ ... ... | *Pholas bakeri* (Desh.) ... ... ... | Ratnagiri. |
| ANATINIDÆ ... .. | *Anatina labiata* (Rve.) ... ... | Bombay. |
| | *Thracia salsettensis* (Melv.) ... ... | „ |

# CATALOGUE

OF

# FRESH WATER AND LAND *MOLLUSCA*

IN THE

## BOMBAY NATURAL HISTORY SOCIETY'S COLLECTION.

| | | |
|---|---|---|
| | **GASTEROPODA.** | |
| | **PROSOBRANCHIATA.** | |
| | **DIOTOCARDIA.** | |
| NERITIDÆ ... ... | *Neritina perotetiana* (Récluz) ... | Nilgiris. |
| HELICINIDÆ ... ... | *Helicina andamanica* (Bens.) ... | Andamans. |
| | **MONOTOCARDIA.** | |
| CYCLOPHORIDÆ ... ... | *Cyclophorus himalayanus* (Pf.) ... | Bhutan and Sikhim. |
| | " *indicus* (Desh.) ... ... | Bombay. |
| | " *nilghericus* (Bens.) ... | Mysore. |
| | " *pearsoni* (Bens.) ... | Khasi Hills. |
| | " *siamensis* (Sowb.) ... | " |
| | " *polynema* (Pf.) ... ... | Matheran. |
| | " (*Cyclohelix*) *leaii* (Tryon.) | |
| | " (*Theobaldia*) *bairdi* (Pf.) | Kandy. |
| | " " *annulatus* (Tros.)... | Watawala, Ceylon. |
| | " " *stenostoma* (Sowb.).. | |
| | " *tavidus* ... ... ... | Shevaroy Hills. |
| | *Cyathopoma peilei* (Preston.) ... | " |
| | *Pterocyclus bilabeatus* (Bens.) ... | " |
| | " *nanus* (Bens.) ... .. | Mysore and Nilgiris. |
| | *Leptopoma immaculata* (Chem.) ... | Andamans. |
| | " *raapstorffi* (Nevill.) ... | " |
| | *Alycæus plectocheilus* (Bens.) ... | Darjeeling. |
| | " *constrictus* ( " ) ... | " |
| | " *expatriatus* ( " ) ... | Shevaroy Hills. |
| | " *prosectus* ( " ) ... | Khasi Hills. |
| CYCLOSTOMATIDÆ ... | *Cyclostoma barclayanus* (Pf.) ... | Mauritius. |
| | *Cyclotopsis semistriatus* (Sow.) ... | Nasik. |
| | *Omphalotropis destermina* (Bens.) ... | Andamans. |
| HYDROBIIDÆ ... ... | *Bithynia pulchella* (Bens.) ... ... | Delhi. |
| | " *stenothyroides* (Dohrn.) ... | Madras. |
| VIVIPARIDÆ ... ... | *Vivipara bengalensis* (Link.)... ... | Bombay. |
| | " *dissimilis* (Müll) ... ... | Madras. |
| AMPULLARIIDÆ ... ... | *Ampullaria dolioides* (Reeve) ... | Bombay and Kalyan. |
| | " *globosa* (Swain.) ... | Bhutan, Douars and Jubbulpore. |
| | " *carinata* (Swain.) ... | Madras. |
| | " *nux* (Reeve) ... ... | Matheran. |
| MELANIIDÆ ... ... | *Melania elegans* ... ... ... | Madras. |
| | " *lyrata* (Menke.) ... ... | Dinapore, C. P. |
| | " *tuberculata* (Müll.) ... ... | Bombay, Malegaum, Satpuras and Rajputana. |
| | " *variabilis* (Bens.) ... ... | Jalpaiguri, Sikhim. |
| | *Paludomus* (*Philopotamus*) *globulosa* (Gray.) ... ... | Chindwin R., Burma. |
| | " *obesa* (Phil.) ... ... | Kalyan. |
| | " *tanjoriensis* (Gmel.) ... | Madras. |

GASTEROPODA—*contd.*

PULMONATA.

| | | |
|---|---|---|
| LIMNÆIDÆ | *Limnæa amygdalus* (Tros.) | Jamnagar. |
| | ,, *rufescens* (Gray) | Cachar. |
| | ,, *pinguis* (Dohrn.) | Bombay and Bangalore. |
| | ,, *stagnilis* (Linn.) | Kashmir. |
| | *Planorbis compressus* (Hutt.) | Madras. |
| | ,, *exustus* (Desh.) | Dinapore, C. P., Bangalore and Ratnagiri. |
| LIMACIDÆ | *Ariophanta lævipes* (Müll.) | Bombay. |
| | ,, *bajadera* (Pf.) | Mahableshwar, Matheran, Karjat, Lanowli and Bassein. |
| | ,, *intumescens* (Blf.) | Mahableshwar. |
| | ,, *cysis* (Bens.) var. *dalyi* (Blf.) | Nilgiris and Ceylon. |
| | ,, *thyreus* (Bens.) | ,, |
| | *Hemiplecta chenui* (Pf.) | Watawala, Ceylon. |
| | ,, *juliana* (Gray.)=*ganoma* (Pf.) | Udagama, Ceylon. |
| | ,, *solata* (Bens.) | Nilgiris. |
| | ,, *semidecussata* (Pf.) | Watawala, Ceylon. |
| | *Euplecta indica* (Pf.)= *Shiplayi* (Pf.) | Mysore. |
| | ,, *gardneri* (Pf.) | Uva, Ceylon. |
| | ,, *prestoni* (G. Aus.) | ,, |
| | *Xesta semirugata* (Beck.) | Nasik and Ceylon. |
| | ,, *belangeri* (Desh.) = *vitellina* (Pf.) | Madras. |
| | ,, *bistrialis* (Beck) | Madras and Shevaroy Hills. |
| | ,, *taprobanensis* (Dohrn.) | Jaffna, Ceylon. |
| | *Oxytes blanfordi* (Theo.) | Jaintia Hill, Assam. |
| | ,, *oxytes* (Bens.) | Khasi Hills. |
| | *Macrochlamys choinx* (Bens.) | Andamans. |
| | ,, *pedina* (Bens.) | Bombay and Matheran. |
| | ,, *tenuicula* (Adams) | Kalyan. |
| | *Eurychlamys platychlamys* (Blf.) | Bhewindi. |
| | *Sitala barrackpurensis* (Pf.) | Mysore. |
| | *Indrella ampulla* (Bens.) | Nilgiris. |
| | *Rotula retifera* (Pf.) | Shevaroy Hills. |
| | *Nessara daghoba* (W. & H. Blf.) | ,, |
| HELICIDÆ | *Plectotropis tapacina* (Bens.) | Khasi Hills |
| | *Plectopylis fultoni* (Cursten) | ,, |
| | ,, *plecostoma* (Bens.) | ,, |
| | *Planispira delibrata* (Bens.) var. *fasciata* (G. Aus.) | ,, |
| | ,, ,, (Bens.) var. *tenella* | ,, |
| | *Ganesella hemiopta* (Bens.) | Andamans. |
| | *Geotrochus physalis* | Nilgiris. |
| | *Eulota propinqua* (Pf.) | Bhewindi. |
| | *Corilla beddomew* | Gampala, Ceylon. |
| | ,, *beddomii* | Pundnyola, ,, |
| | ,, *gudei* (Sykes) | Kegalle. ,, |
| | ,, *erronea* | Watawala, ,, |
| | ,, *humberti* | Newara Eliya, ,, |
| | ,, *odontophora* | Uva, ,, |
| | *Acavus skinneri* (Pfr.) | Newara Eliya, ,, |
| | ,, *waltoni* (Reeve.) | Watawala, ,, |
| | ,, *phœnix* (Pf.) | Colombo and Kandy, Ceylon. |
| | ,, *superba*, var. *roscolata* (Pf.) | Watawala, Ceylon. |
| | ,, *hormastoma* (Linn.) | Colombo. |
| | ,, *melanotragus* (Born.) | Galle. |
| BULIMULIDÆ | *Amphidromus andamanicus* (?) | Andamans. |
| | ,, *sylheticus* (Reeve.) | Khasi Hills. |
| | ,, *sinensis* | Bhutan, Doors. |

| | | |
|---|---|---|
| | GASTEROPODA—*contd.* | |
| | PULMONATA—*contd.* | |
| PUPIDÆ ... ... ... | *Pupa evezardi* (Blf.) ... ... ... | Lanauli. |
| | „ (*Leucochila*) *cænopicta* (Hutt.) | Bombay. |
| | *Bulimus* (*Mastus*) *insularis* (Shrenl.) | Aden. |
| | „ (*Rachis*) *bengalensis* (Lmk.) .. | Bombay. |
| | „ „ *punctatus* (Anton.) | „ |
| | „ (*Cerastus*) *monssonianus* (Petit) ... ... ... | „ |
| | (*Petræus*) *labiosus* ... ... | Aden. |
| STENOGYRIDÆ ... ... | *Subulina shiplayi* (Pf.) ... ... | Assam. |
| | „ *orthoceras* (G. Ans.) ... | Naga Hills |
| | *Prosopeas haughtoni* (Bens.) ... ... | Andamans. |
| | *Opeas gracilis* (Hutt.) ... ... | Bombay. |
| | *Spiraxis octona* (Chem.) ... ... | „ |
| | „ *huttoni*... ... ... ... | Andamans. |
| | *Glessula chenzoni* (Bens.) ... ... | Matheran. |
| | „ *inconspicua* (Nev.) ... ... | Shevaroy Hills. |
| | „ *facula* (Blf.) ... .. | „ |
| | „ *filosa* (Blf.) ... ... | „ |
| | *Achatina fulva* (eggs brought in plante from Mauritius.) ... ... | Rajkot. |
| | PELECYPODA. | |
| | EULAMELLIBRANCHIATA. | |
| ÆTHERIIDÆ ... ... | *Praxis dalyi* (Smith) ... ... ... | Mysore. |
| UNIONIDÆ ... ... | *Unio cæruleus* (Lea,) ... ... | Cachar. |
| | „ *corrugatus* (Smith) ... ... | Madras. |
| | „ *crispatus* ... ... ... | Bara R. Cachar. |
| | „ *marginalis* ... ... ... | |
| | *Corbicula benzoni* ... | Ratnagiri. |

# A NOTE ON THE PRESERVATION OF BAMBOOS FROM THE ATTACKS OF THE BAMBOO BEETLE OR "SHOT-BORER."

BY

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## General Remarks.

The work of the bamboo beetle or "shot-borer," the *ghoong* of the natives in many parts of the country, is wellknown in India. All who have anything to do with bamboos, either with their cutting and export, their use in buildings, or their manufacture into the thousand and one articles to which this most useful commodity is put in the country, have to count upon and allow for the ravages of this pest, and in many parts a year to a year and a half may be given as the estimated and probable life of a bamboo after cutting.

## Description and Life-History of the 'Shot-Borer.'

But although the results of its work are well-known, the real author of the depredations is far from being a well recognised enemy owing both to its small size and to its secretive habits. The damage is committed by a tiny beetle and its grubs, which are just of slightly smaller diameter than the holes with which the bamboos are seen to be riddled. The beetle, which has a black head and thorax and reddish-coloured shining wing covers, bores its way into the bamboo, and lays its eggs in the interior, each beetle laying about 30. From these eggs small, white, roundish dots of grubs issue within a few days of their being deposited. These tiny larvæ burrow up and down in the interior of the bamboo, and reduce its structure to powder. About four weeks are spent in this stage, and the grubs then enlarge the ends of their burrows and change to pupæ which after some eight days or so turn into the beetles. On becoming mature the beetles bore their way out of the bamboos and thus add further to the tunnels already made in them. On emergence the insects fly off to attack fresh bamboos or they may bore into the one in which they have matured themselves. There are thus three separate forms of attack:—

(*a*) The female beetle bores into the interior of the bamboo and lays its eggs there. This is the first attack on the bamboo.

(*b*) From the eggs hatch out little grubs which feed upon the wood of interior of the bamboo and thus undermine its strength.

(*c*) The beetles on maturing from the grubs bore their way out of the bamboo.

It used to be thought that each of the shot-borers made their way out by a separate tunnel, driven direct from the place where the grub had pupated to the outside. This is not however the case, as the matured beetles appear to issue either all from the same exit hole or from one or two only, these being often the former entrance holes of the mother beetles which are considerably enlarged. Beetles of the new generation appear to also make use of these old holes to enter the bamboo to egg-lay, boring away from the old gallery when

they have got inside. When bamboos are in lengths it will be found that the beetles tunnel in them parallel to the long axis and form galleries which open at one of the ends. The bamboo is thus often completely hollow in parts without there being much outward evidence of its having been badly attacked. This is more especially the case when the beetles have entered and left by the same holes, made at one of the ends of the bamboo. A feature which greatly adds to the insect's power of doing serious damage is to be found in the fact that in the warmer parts of the country it passes through at least five, and perhaps more, generations or life cycles in the year. I have said that the insect lays about 20 eggs, and therefore one female beetle may produce 200,000 insects in the year on the supposition that only five generations are passed through.

RECOMMENDATIONS.

(*a*) I am inclined to recommend soaking the bamboos for five days in water, since a thick shiny gelatinous substance exudes from the bamboos during this process, and this exudation probably enables the bamboo to absorb a larger quantity of oil than would be otherwise the case.

(*b*) That the bamboos be allowed to dry in a covered shed for several days after the water process.

(*c*) That, after drying, the bamboos be soaked for 48 hours in common Rangoon oil.

## A FURTHER NOTE ON THE PRESERVATION OF BAMBOOS FROM THE ATTACKS OF THE BAMBOO BEETLES OR SHOT-BORERS.

In the Appendix Series of the *Indian Forester* [xxix—12, (1903)]* some notes were given upon the life-history of one of the minute bamboo beetles, or "shot-borers" as they have been popularly called, and the question of the preservation of the bamboo from their attacks was discussed. The effects of the latter are well known. The insects tunnel into the stem and reduce its wood-structure to powder. It is some years now since Mons. P. Lesne, of the Paris Museum, at the request of the authorities of the Indian Museum in Calcutta, examined sets of specimens of these beetles sent home to him. Mons. Lesne reported that the smaller of the two beetles received was a widespread insect known as *Dinoderus minutus*, the second of the two a species unknown to science, which he named *D. pilifrons*. Up to the year 1903 it was generally supposed that these two beetles worked in company and that they were to be found distributed throughout India.†

Although the researches which are being instituted into the life-histories, habits and distribution of the two species are by no means complete, it has been shown in the note to which allusion has been made above, that the beetle (almost

* A note on the preservation of bamboos from the attacks of the bamboo beetle or "shot-borer."

† Indian Museum Notes. I, 43; III, 123; IV, 125; V, 166. Inj. Ins. Ind. For p 42.

invariably if not invariably), responsible for the riddling of bamboo in Calcutta (and possibly to the south throughout the Madras Presidency) is *D. minutus*, whilst its confrére *D. pilifrons* would appear to confine itself to Upper India. ‡

A series of experiments and observations were conducted at the Indian Museum throughout the greater part of the year 1903 (as fully detailed in the note in the Appendix Series) with a view to ascertaining whether it was possible by impregnating or soaking the bamboo with some preservative material to protect it from the shot-borer's attacks. It may be mentioned that incidentally, in the course of these experiments, a large amount of information was obtained on the life-history of *D. minutus* and of the reasons which lead to its being such a pest within the area of its depredations.

The bamboos experimented with were some from a lot received at the Government Telegraph Workshops in Calcutta from Northern India. They had been cut in the cold weather of 1902-03. As already explained in the previous note, these bamboos were to be converted into field telegraph posts, and in the hope of giving them some protection against the shot-borer pest, they were subjected to a series of soakings in water, copper sulphate and Rangoon oil. For over eight months untreated bamboos and those treated with one or more of the above solutions were kept under close observation, all the lengths experimented with having been received direct from the Workshops, chosen at haphazard by the Superintendent. As a result of the carefully recorded observations throughout this period, it was proved that the untreated bamboos were invariably attacked by the shot-borer, *D. minutus*, within a couple of months, *i.e.*, between March and May ; that soakings in water alone or water followed by immersion in the copper sulphate solution were equally innoxious to the beetles ; but that those bamboos which had proceeded the stage further and had been soaked in the Rangoon oil were immune from subsequent attack by the pest. It was shown that the insect passes through no less than five generations in the year, different swarms of adult individuals appearing in April, June, July, September and October, and that the attacks of one or more of these generations with those of their resultant grubs would ordinarily have reduced the bamboos, if untreated, to powder ; it was therefore held to have been proved as a result of the experiments that the life of the bamboo had been lengthened by at least a year as a direct result of the impregnation.

It has since been possible to trace the history of these treated bamboos, all of which were converted into field telegraph posts, a stage further in their career, and the evidence that has been obtained both by the use of the posts in the field and, equally important, by their storage in an open shed without any special protection being afforded to them in the Workshop yard, points to the wonderful efficacy of the oil treatment. It is the purpose of this supplementary note to give publicity to this fact, firstly, owing to numerous enquiries as to the necessary treatment to be given to the bamboos having been received from the Public Works Department, and, secondly, because the

‡ *Vide* Depart. Not. Ins. wh. aff. For No. 2, 168.

oil treatment for the preservation of bamboos may be said to have now passed the rubicon of the "Experimental Stage" and to have reached the arena of practical utility.

To go back to the bamboos converted in 1903. Some of them were sent up that year for service with the Tibet Mission. They were returned to store in Calcutta about the beginning of the present year, and Mr. L. Truniger, C.I.E., who was in charge of the Field Telegraph with the Mission, has stated that they had fully answered expectations. Some of these returned posts were inspected by the writer in the yard at Calcutta towards the end of March last. Although it was two and-a-half years since they were cut in the forests of Upper India and close upon two years since they were treated with the oil, they showed no trace of attacks by the *Dinoderus* beetle. It may be contended, and justly, that throughout 1904 these posts had been at an altitude, greatly above that at which either of the shot-borer beetles could, or do, live, and that they were thus safe from their attacks. This was so, but the same argument does not hold good when we come to consider those converted bamboos which remained throughout the year in store in Calcutta. An inspection of these has shown that they have remained equally immune from the pest. Most are aware how short is the life, economically, of the bamboo after it has been cut, and many know the difficulties which stand in the path of the lance, the tent-pegging and hog-spear purveyor. The results that have attended the treatment of the 9,000 bamboos in 1903 are well worthy of the consideration of these latter, for on present observations it has been shown that the impregnation with the oil leaves the bamboo strong and serviceable two-and-a-half years after it has been cut. Arrangements have been made to keep some of these posts under continuous observation with the object of ascertaining the longevity to which the treatment enables them to attain. That the Telegraph Department has the fullest confidence in a discovery the full credit of which chiefly belongs to it, is borne out by the fact that an additional 50,000 bamboos are at the time of writing being put through the treatment and converted into field telegraph posts. It may be stated that the recommendations of the previous note are being followed, the bamboos being first soaked in water for five days (this is very necessary for reasons previously given), allowed to dry for several days, and then re-soaked in the Rangoon oil (crude petroleum), this latter, as used in the Workshops, having the consistency of treacle.

That the use of the bamboo as a field telegraph and telephone post has a great future before it has been proved by the Japanese in the present campaign. The following note upon the subject appeared recently in the *Pioneer**: "Every general of brigade in the field is 'at the end of a wire' which his divisional commander controls and the generals of divisions are in touch by telegraph or telephone with the corps commander. The engineers run wires after the columns with marvellous rapidity. Firing is heard somewhere at the front. A detachment of engineers emerges from head-quarters, pack ponies carrying bundles of

* Allahabad, *Pioneer*, October 24th, 1904.

light bamboo poles, while coolies and carts follow them with coils of slender copper wire. The poles, which have pointed ends, are quickly planted, the wire spreads out as fast as men can uncoil it, and a field telephone is at work."

As having a bearing upon the experiments and results attained in India, Mr. Y. Hara, Chief of the Japanese Forest Bureau, was addressed with the object of ascertaining whether the bamboo field posts used by his countrymen were subjected to any treatment. His reply would seem to show that in this matter Japan is in the position occupied by India before the discovery of the oil treatment. He wrote: "In answer to your enquiries with regard to a protection of our bamboos, I would state that although the method in preserving bamboos in the field is not well known, there are three processes of treatment generally adopted by our people—

(1) The season of cutting—September and October.

(2) The fumigation in sulphur.

(3) Application of both of these processes."

(*From "The Annals and Magazine of Natural History," Seventh Series, Vol. 15, No. 86; Feb.* 1905.)

# ON A NEW VOLE FROM KASHMIR.

BY

J. LEWIS BONHOTE, M.A.

The collection of voles sent home from Kashmir by Colonel A. E. Ward contains three specimens of a most interesting new species allied to *Microtus nivalis*, for which I propose the name

*Microtus imitator*, sp. n.

Differs externally from *M. nivalis* only in its smaller size and slightly browner coloration.

General colour above grizzled greyish brown, each hair being dark at its base, with a light subterminal portion and a black tip; interspersed among these are longer pure black hairs. The colour is deepest across the back and paler on the flanks and cheeks. Underparts whitish, tinged with yellow; hair with dark bases. Feet greyish. Tail long and bicolor, brown above, white below. Ears moderate, rounded, and clothed with short hairs similar in colour to the upper parts.

The skull is slightly smaller and flatter than in true *nivalis*, but the brain-case is rather more rounded at the sides. The auditory bullæ smaller, less elongate, and well rounded, thus slightly compressing the basioccipital.

Teeth generally resembling those of *M. nivalis*, with two important exceptions. In the species under consideration the spaces are rather narrower and smaller than in *nivalis*, the third molar of the upper jaw has four external angles instead of three, and the posterior lobe of the same tooth has a slight constriction on its inner edge, tending to form a fourth interior angle. In the lower jaw the anterior narrow-shaped head of the first molar is not symmetrical, but is elongated on its external side to form an oblong rounded space; a tendency towards this shape is found, so Dr. Forsyth Major tells me, in a specimen of *nivalis* from Mount Hermon, but is never found among the western forms. The anterior external space of the third lower molar is similarly modified.

*Dimensions.*—Head and body 105 mm.; tail 45; hind foot 15; ear 12.

*Skull.*—Length of palate 12 mm.; length of nasals 8; length of molar series 6; width of brain-case above posterior roots of zygomata 13.

*Habitat.*—Tullian, Kashmir. Alt. 11,000 feet.

*Type.*—B. M. 5. 1. 5. 12. ♂ ad. Tullian, Kashmir. Collected by Colonel A. E. Ward, 14th July, 1903.

In outward appearance, as well as in skull-characters, this vole is undoubtedly allied to *M. nivalis* of Europe, which, however, has not hitherto been found east of the Caucasus; so that its discovery in Kashmir forms a considerable eastward extension of this group. Its smaller size, slightly browner coloration, and dental characters enable it to be distinguished easily from the typical *nivalis*.

## REVIEW.

### THE INAUGURAL ADDRESS OF THE PRESIDENT OF THE MINING AND GEOLOGICAL INSTITUTE OF INDIA.

Somehow the Bombay Natural History Society has always had very few geologists among its members or, at any rate, among its literary contributors, and very few references to Indian geology can be found in the pages of our Journal except as concerns its indirect relation to extant organisms. This is to be regretted, as a great deal of our space—some members, we fear, think a disproportionate amount of our space—is devoted to the accumulation of data for the study of distribution, and the full value of the facts ascertained can only be properly appreciated when they are studied in connection with the geology of the localities concerned.

For this reason we welcome the foundation of the Mining and Geological Institute, as though at present principally a Bengal Association where we have not many members, it will doubtless become more representative in time, and by linking up science with commerce should have the effect of inducing many people who have no particular scientific bent to take an interest in a fascinating study which is badly in need of amateur assistance in this country.

Mr. Holland, the first President, is always worth hearing or reading, and we call special attention to his address here because in it he proposes for general acceptance a new nomenclature of the principal epochs in Indian geological history.

As regards the names themselves they all possess the merit of carrying with them no reference to any particular theory, and therefore contain one of the most essential elements of permanence. We think it rather a pity that the name "Dravidian" should be applied to purely extra-Peninsular series. This, however, is a minor point.

With all that Mr. Holland says as to the impossibility of classifying Indian rocks on the European system, of course we cordially agree, but as regards the task of discovering the approximate equivalents in the two systems we would have liked a little more emphasis laid on the fact that the existence of the same fossils in different parts of the world is no sort of evidence by itself that the rocks in which they occur are even approximately contemporaneous, any more than the remains of a kangaroo in an Australian kutchra heap are contemporaneous with early tertiary marsupial fossils in Europe. Indeed, it is doubtful whether we can speak at all positively of the relative age of any fresh water beds without a complete knowledge of the marine beds which may lie between them and a rough idea of the distribution of land and water throughout the globe at any particular epoch, and this, of course, we are a very long way from possessing at present.

Also we cannot help expressing our regret that Mr. Holland appears to have fallen into a habit rather common among geologists of speaking of theoretical hypotheses as if they were proven facts.

For instance, he speaks of that " peculiar tropical weather product known as laterite." We do not know on what evidence this theory is given—the preference among the many which have been advanced to account for laterite—indeed, it seems to us to be in the nature of things a theory for which there can be no evidence. And, moreover, it should be borne in mind with regard to the bauxite occurring in the laterite that all the other known deposits of bauxite lie in the temperate regions. Many people with an equal show of reason maintain that laterite is not a rock altered in sike at all, but a volcanic deposit only differing in chemical composition from the basalt on which so much of it lies.

But where we must join issue with Mr. Holland most strenuously is with regard to his statement.

" ..... the old Gondwana Continent of which India, Australia and South Africa are relics ....."

This is one of the many references to allusions which have occurred in recent years in the publications of the Geological Department to a vast Southern continent sometimes, we believe, extended to include Patagonia also, and which is little more than old " Lemuria " writ large.

In this as in several other references this continent is written of as though its existence had been proved and was undisputed, and yet, so far as we know, the only attempt at a detailed statement of the theory yet made is an article called " The Carboniferous Glacial Period " by Professor Dr. Waagen, a translation of which was published in Vol. XXI of the Records of the Geological Survey.

We cannot enter into a detailed discussion of it here, but to those who have not read it we can confidently recommend it as containing some of the most illogical and preposterous reasoning that has ever appeared in a scientific Journal.

The Professor starts with the fact that bolder beds occur in South Africa, India and Australia and that all these contain a number of fossils of common species or at least common genera.

The number of these fossils is altogether less than a hundred. Yet from this evidence he concludes that these deposits must have been contemporary and that these at present isolated land areas must have been connected by land now submerged—apparently because if they were not connected by land it is unlikely that the same fossils could have occurred contemporaneously in the three areas. Yet he does not see that he is arguing in a circle, and he does not see that the chance survival of an odd hundred forms as fossils out of a probable Mesozoic fauna and flora of several hundred thousand species cannot prove anything at all. The very utmost we can expect of them is a suggestion.

The Professor concludes absolutely inconsequently, " The chief point is always the proof of a glacial period which appeared on the Southern continent during the coal-measure epoch, for all the other conclusions are based on this one fundamental fact. "

It does not appear to us after reading the article that any of his conclusions are based on this fact—or fancy—or, indeed, that the majority have any basis at all. But since he has chosen to take his stand on this point, let us say at once that nobody but a professional geologist now believes that there ever was a secondary glacial epoch or a quaternary one either, and that no plain-thinking people ever will until it has been shown both that a glacial epoch is astronomically, meteorologically and physically possible and that, if one did occur, it could possibly do the things they are postulated to have done, bearing in mind what the potentialities of a glacier are really known to be.

Hitherto all attempts to account for the occurrence of such periods have absolutely failed, and no really honest attempt even has been made to prove that glaciers could do what they are said to have done even if they had existed and had been superior to the Laws of Gravity.

We have wasted a good deal more powder and shot on the Professor than he deserves, because, so far as we know, his is the only detailed statement of this Gondwana Continent theory yet made, although it has already become a kind of fetish with some people.

But in the interests of plain-thinking, clear reasoning and true science, we would appeal to Indian geologists to confine their attention to humbler matters for the present and not to attempt to build up transcendental theories to account for nothing and for which no evidence is forthcoming.

If Mr. Holland can make a better case for his continent than Professor Waagen, we should be very interested to read it; but at the same time we would very much rather that all theorising of this kind with no facts or next to none behind it were left alone altogether.

It is just possible that two hundred years hence there may be sufficient material collected to discuss the possibility of the former existence of a land area in the Indian Ocean, south of Ceylon. At present there is no geological or geographical evidence of such, and there are absolutely no phenomena in the animal or vegetable kingdoms at present known which require such a transcendental explanation.

L. C. H. Y.

# MISCELLANEOUS NOTES.

## No. I.—PEARLS IN THE THANA CREEK (W. INDIA).

I see that Mr. Comber refers in his paper on "The Economic Uses of Shells," printed in a recent number of the Society's Journal (No. 3, Vol. XVI.), to the existence of pearls in the Thana Creek. When I was Assistant Collector in charge of Salsette Taluka in 1903, the right to collect oyster shells at the mouth of the creek near the village of Trombhe or Trombay was still a subject of considerable competition. So far as I recollect, the price realized was three or four times the amounts quoted by Mr. Comber. Presumably then either the pearl oysters are now more plentiful in the creek or the value of the small pearls has increased. The heaps of oyster shells lying about in all the villages in the strip of country running down the Thana Creek between it and the range of hills to the east are quite a noticeable feature.

E. L. SALE, I.C.S.

LARKANA, SIND, 1*st October* 1905.

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## No. II.—NESTING OF THE MALAYAN BANDED CRAKE (*RALLINA FASCIATA*).

On the 29th June I found a nest of the Malayan Banded Crake with 5 eggs, a note on which may be of interest, as the eggs were unspotted, and in this respect unlike the remainder of the family except *R. superciliaris*. The eggs were white, rather glossy, nest-stained, although only very slightly incubated, and measure on the average 1·18″ × ·94″. The nest was a pad of dead bamboo leaves with a few dry twigs placed on the ground under the thin cover of a small bush. I had many attempts to secure the old bird—one including three drives, one cast with a fishing net in the day time, twice shot at (once on the nest) and the setting of noozes; in spite of all these failures, I was lucky enough to get the old male caught on the nest at night with a cast net; probably the bird I missed on the nest was the female. The power of the old bird in concealing itself was extraordinary; it seldom, as far as I know, ever ran more than 10 yards from the nest when disturbed; the undergrowth was not thick, and although once or twice I had 6 or 8 men hunting for it, we could never find it; it ran away very fast and seemed to disappear into the earth; probably squatting half hidden in leaves, etc.; it took wing only once, the first time I fired at it, and then it was some way from the nest and had not been actually driven from it. The locality is roughly longitude 21°·35′ north, latitude 94°·22′ east, and the nest was in a small patch of bamboo tree jungle, rather dark, not very thick undergrowth, in the bend of a stream which dries up in the hot weather, leaving perhaps a pool or two, but was at this time a flowing stream. The nest was within 15′ of the edge of the water, and was probably only just above high flood level. The surrounding country is hilly and the place is a small valley at the junction of 3 streams, where a few Burmans have squatted and cultivate a few acres of paddy land when possible; the particular patch of jungle was bordering the

paddy fields. I send the skin to confirm my identification, but it has been unfortunately eaten by ants round the bill, the soft parts round the base of which were bright red as described by Blanford.

P. F. WICKHAM (P. W. D.)

PAKOKKU DISTRICT, UPPER BURMA,
*13th August* 1905.

[The above most interesting note has been sent to me by Mr. Wickham together with the skin of the male bird, which is undoubtedly that of a specimen of *R. fasciata*, and the nest is probably the first authentic one of this species. Herr von Nehrkorn has eggs which he states are of this bird (Cat. der Eiersammlung, p. 201), and which he describes as being like those of *Rallus aquaticus*. These were taken in Java. I also have two eggs from Borneo, said to be of this species, and which are just like very large eggs of *Porzana fusca*. I have no doubt that both Nehrkorn and my own eggs are not those of *R. fasciata*. Mr. Wickham's discovery shews that two species of *Rallina*, at least this and *superciliaris*, lay white eggs.

E. L. STUART BAKER, F. Z. S., etc.

DIBRUGARH, *22nd August* 1905.]

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## No. III.—FOOD OF THE HIMALAYAN NUTCRACKER (*NUCIFRAGA HEMISPILA*).

I am sending one of fourteen nuts, all similar, taken out of the crop of a Himalayan Nutcracker, which I shot about a month ago in Kashmir. I do not think this bird's crop would have held a single nut more! All the nuts were whole like this one. The question is—was the bird going to digest them, shells and all, or was it going to disgorge them, break the shells at leisure, eat the kernels and discard the former?

I can hardly think the first, but then if it were able to break the shells of the nuts, why stuff up its crop in such an uncomfortable manner when nuts are so abundant, and it could have eaten them on the spot?

The native name of the tree to which the nut belongs is "poh," a kind of bastard hazel, and I am sorry I do not know the scientific name. The nut grows in clusters on the tree which is very common on the lower slopes of the hills. It may be worth recording that I afterwards shot some nutcrackers with their crops full of *walnuts*. In the latter case not only was there no shell, but the nut had been carefully cleaned of all "skin," which, as every one knows, is very bitter. The nuts were off wild trees growing in the jungle, the shells of which are very hard, and how the birds cracked them I cannot say. I watched them very carefully, but never saw a bird on the ground where it might have picked up bits of nut discarded by rats, flying-squirrels, mice, &c.

L. L. FENTON, LT.-COL.

WADHWAN CAMP, KATHIAWAR,
*23rd Nov.* 1905.

## No. IV.—OCCURRENCE OF THE BUTTERFLY *TALICADA NYSEUS*, GUERIN, AT KHANDALA—WESTERN GHATS.

As Mr. Aitken, in a previous number of this Journal (Vol. I, p. 218), has remarked on the absence of this insect from Khandala and Matheran, it may interest members to know that I took several in Khandala at the end of October. I am not aware whether the species has been recorded from Khandala since Mr. Aitken wrote his note, but from what I saw of the species, I can well understand its having escaped notice. The insects are apparently never seen abroad during the day; and I only came across them quite accidentally towards dusk, one evening when out for a walk, when I saw a small swarm of them fluttering round and settling on a patch of a scented weed which grows commonly near the bazaar. Being without my net, I could not capture any at the time; so next day I made a point of visiting the spot again. There were none about either in the morning or during the day; but at sunset there were a few there again. I saw none anywhere except at this one particular corner, but I daresay further search at about the same time of day would bring to light other resorts of this very curiously distributed insect.

G. W. V. DE RHE-PHILIPE.

*October 31st*, 1905.

[There is no doubt that *Everes* (or *Talicada*) *nyseus* is to be found generally in the Konkan, and Mr. Comber recorded it from both Khandala and Matheran in his List of Konkan Butterflies in Vol. XV of our Journal.

It is well under the circumstances, as Mr. Aitken has been quoted by others, that the supposed limitation to its distribution should be proved to be unreal. Mr. P. M. D. Sanderson has shown me specimens captured at Matheran also.

L. C. H. YOUNG,
*Hon. Sec., Entom. Secn.,*
*Bombay Natural History Society.*]

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## No. V.—MEASUREMENTS OF BUFFALO (*BOS BUBALUS*) HORNS.

While at home in Scotland I saw in a house I was staying in (Taymouth Castle, Perthshire) an Indian buffalo (*Bos bubalus*) head. It appeared to me to be a very large bull, and, so far as I could ascertain from my host, it had been shot in India 80 or 100 years ago by one of his ancestors.

| | |
|---|---|
| Length of right horn ... ... ... ... ... ... | 59″ |
| ,, ,, left ,, ... ... ... ... ... ... | 58″ |
| Outside sweep of horns across forehead ... ... ... | 131¼″ |
| Circumference of base... ... ... ... ... ... | 20″ |
| Between tips ... ... ... ... ... ... ... | 57½″ |
| Breadth between horns 1 ft. from tip, inside measurement (? widest inside) ... ... ... ... ... ... | 59″ |

According to Rowland Ward's "Horn Measurements," the above is not a record head, but it apparently comes third, both the others being in the British Museum.

A. F. MACKENZIE, MAJOR,
93rd Highlanders.

POONA, *26th October* 1905.

[The above measurements are very good, but Burke in his "Indian Field Shikar Book" (published in 1904, but now withdrawn from publication) mentions eleven with longer horns. The best head which we have in our Museum measures: length of right-horn 54½", length of left-horn 54", outside sweep of horns across forehead 125", circumference of base 19", between tips 46", widest inside 56". This head was presented to us by Mr. T. J. Campbell, I.F.S., of Assam.

W. S. MILLARD,
*Hon. Sec.*
*Bombay Natural History Society.*]

## No. VI.—THE PROTECTION OF WILD BIRDS IN THE BOMBAY PRESIDENCY.

List of the Municipalities in the Bombay Presidency to which rules under the Wild Birds Protection Act. XX of 1887, have been applied :—

### BOMBAY CITY.

BOMBAY MUNICIPALITY.

*Northern Division.*

Ahmedabad District.—Ahmedabad, Viramgam, Dholka, Mandal, Dhandhuka, Dholera, Rampur, Sanand, Gogha.

Kaira District.—Kaira, Umreth, Mahuda, Dakor.

Broach District.—Broach, Anklesvar, Amod, Jambusar, Hansot.

Surat District.—Mandvi, Bulsar.

Thana District.—Thana, Bassein, Bandra, Bhiwndi, Kelva-Mahim, Kurla.

*Central Division.*

Ahmednagar District.—Ahmednagar, Bhingar.

Poona District.—Poona City, Poona Suburban.

Satara District.—Malcolmpeth.

*Southern Division.*

Belgaum District.—Gokak, Saundatti-Yellama.

Dharwar District.—Dharwar, Hubli, Ranebennur, Byadgi, Gadag-Bettigeri.

Ratnagiri District.—Dapoli.

SIND.

Karachi District.—Karachi, Tatta, Keti-Bandar, Kotri, Manjhand.

Hyderabad District.—Hyderabad, Matiari, Tando-Allahyar, Tando-Adam, Nasarpur, Hala, Tando Muhammadkhan.

Sukkur District.—Sukkur, Shikarpur, Ghotki, Garhi-Yasin, Rohri.

Larkhana District.—Larkhana, Kambar, Ratodero, Sehwan, Bubuk.

Thar and Parkar District.—Umarkot.

Upper Sind Frontier District.—Jacobabad.

## No. VII.—THE NEST OF THE BROWN-BACKED INDIAN ROBIN (*THAMNOBIA CAMBAIENSIS*).

With reference to the note in the Society's last Journal (No. 3, Vol. XVI., page 513), by Major Arundel Begbie on the nest of the Brown-backed Indian Robin (*Thamnobia cambaiensis*), the following may prove interesting :—

I found several nests of this species in Bareilly, N. W. P., during the months of June and July 1902. On each occasion the nest contained portions of cast-

off snake-skins worked into the lining, which invariably consisted of horse hair. I do not remember noticing any defined pattern such as the cross mentioned by him.

On referring to my rough notes on Indian Birds' Eggs, which I obtained during the two years I was stationed at Bareilly, I find the following :—

"June 4th, 1902. Nest of Brown-backed Indian Robin (*T. cambaiensis*) containing 3 addled eggs. The nest, usual type, lined with horse hair, with five pieces of cast snake-skin interwoven, was placed between the stems of the leaves of a low palm-tree about 2 feet from the ground."

"June 25th, 1902. Nest of *T. cambaiensis*, containing 3 eggs, slightly incubated. The nest, usual type, lined with horse hair, contained two small pieces of cast snake-skin interwoven, and was placed in a hole in a tree 4 feet from the ground. On this occasion the bird sat so closely that it allowed me to remove it from its nest."

The habit of working cast snake-skins into the lining of nests is mentioned in the 2nd Volume of Hume's "Nests and Eggs of Indian Birds," 2nd Edition, with regard to this species, and also *T. fulicata*.

STANLEY PERSHOUSE, *2nd Border Regt.*
Attchd. 5th Mounted Infantry.

MIDDELBURG, TRANSVAAL, S. AFRICA, 1*st October* 1905.

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## No. VIII.—LATE BREEDING OF THE BLACK PARTRIDGE (*FRANCOLINUS VULGARIS*).

It may be of interest to some of your readers to hear that we found this morning, near Naini Tal, at an elevation of five thousand feet, a black Partridge sitting on four eggs that appeared to be pretty hard-set. The nest was placed in some low grass adjoining cultivation, and was rather a substantial looking pad of dry grass. I have occasionally seen chicks lately hatched in September, and imagine they have two broods, but this date (October 21) seems most unusually late for eggs.

NAINI TAL, 21*st October* 1905. S. L. WHYMPER.

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## No. IX.—REPORT ON THE DESTRUCTION OF RATS IN RANGOON DURING AUGUST 1905.

The destruction of rats was continued with vigour during the month, and it is to be hoped that the Municipality will not allow this most important work to stop. The figures are—

| | |
|---|---|
| Pazundaung ... ... ... ... | 714 |
| Theinbyu ... ... ... ... | 1,452 |
| Eastern Division ... ... ... | 2,297 |
| Central Division ... ... ... | 4,175 |
| Municipal Office ... ... ... | 83 |
| Western Division ... ... ... | 2,627 |
| Kemmendine ... ... ... ... | 854 |
| Dalla ... ... ... ... ... | 926 |
| | 13,128 |

The totals to date are—

| | |
|---|---|
| February ... ... ... ... | 4,337 |
| March ... ... ... ... ... | 42,662 |
| April ... ... ... ... ... | 39,469 |
| May ... ... ... ... ... | 18,524 |
| June ... ... ... ... ... | 12,523 |
| July ... ... ... ... ... | 12,342 |
| August ... ... ... ... | 13,128 |
| Total ... | 142,985 |

The increase during the present month is due to the young families which are now being caught.

In five divisions the catches since the 18th have been classified, and show 1,952 young rats against 1,554 rats over six weeks in age. In one division, where the catches of other rodents were distinguished, it was found that there were 57 young bandicoots to 81 old and 173 young mice to 126 old.

In another there were, of both classes combined, 113 young to 150 old.

Also during house cleaning many nests of rats have been discovered; one rat was found in the Laboratory to be pregnant. From the other rats brought in, too, it may be inferred that one season of producing the young is during July and August. This is so much evidence to decide the much-contested question of the breeding time of rats.

If the Municipality will continue the classifying process, it will be discovered if there is another breeding time in February and March.

Of the rats examined in the Laboratory, plague bacillus was found in 43 out of 211, as follows :—

| | | |
|---|---|---|
| Pazundaung and Theinbyu ... | 52— 6 | infected. |
| Eastern ... ... ... ... | 33— 4 | ,, |
| Central ... ... ... ... | 32— 6 | ,, |
| Western ... .. ... | 33— 5 | ,, |
| Kemmendine .. ... ... | 30—12 | ,, |
| Kanaungto ... ... ... | 16— 3 | ,, |
| Dalla ... ... ... ... | 15— 7 | ,, |
| | 211—43 | ,, |

This shows a much smaller proportion of rats infected than last month. I think testing a rat a day from each station is quite enough for our purposes.

In Dalla, where the percentage is highest, plague is still persistent, but in Kemmendine, where the proportion is high, plague is abating somewhat.

(Sd.) HARRY L. TILLY,
Officer in Charge of Plague Operations.

RANGOON, *4th September* 1905.

## No. X.—NOTE ON TWO BLACK LEOPARDS IN THE KOLHAPUR COLLECTION.

The leopards are male and female and are no longer young.

Their measurements are, as near as I can judge by measuring the bars of the cage against which they leant,

Male, length 6 feet, height at shoulder 2ft. 2 inches.
Female, „ 5 „ „ „ „ 1 „ 8 „

Their colour is an uniform black, *but in the sunlight* a faint trace of spots is visible on the sides, and lower down on the belly the hair appears of a deep brown and the spots are more apparent; they are not, however, five-finger-tipped or circular broken rosettes but entirely black blotches without annulation. The tongues are of that brilliant pink that one associates with the mouth of a nigger minstrel, the palate of the male is also quite pink, but on that of the female there are two small black spots, one 1½ in × 1 in. and the other ½ in. × ½ in. Under the tongue both are blackish, the female more so than the male; the gums above and below the *front* teeth and in which they are set, are black. The eyes are the same as those of the ordinary leopard.

This pair has been 3½ years in captivity in Kolhapur and have bred together thrice, two cubs resulting on each of the first two occasions and one on the third. All these 5 cubs were entirely black like the parents. The female is now again in cub to the male.

The male was 2½ years ago put to a female of the ordinary red spotted species (*Felis pardus* typica), one cub was the issue, and he is now a full grown well developed male nigh on 7 feet long; he is neither ordinary coloured nor black but a mixture, the markings on him being much larger and of a more vivid black than that of its mother; there are no five-finger spots though there are rosettes but the greater number of the spots are very large and solid black. It is an extremely handsome animal and noticeable. Its tongue, palate, &c., are pink.

I am inclined, for the above reasons, to think that these black leopards are a distinct species; the man who sold them to H. H. the Maharaja said they came from Northern China, where all were of this kind. Those shot in Kanara appear to be "sports," for I am told that in the case of one shot at Supa by Captain Brewis it was noticed to have a black tongue. This male was evidently the father of the black cub shot a few days later by Mr. Marjoribanks at the same place and was found to be at the foot of an ordinary coloured female leopard. There is no trace of the female's colour in the cross now at Kolhapur. The Kanara black leopards would, therefore, appear to be true cases of melanism. Mr. Rowland Ward observes that black leopards are not entitled to be regarded as a distinct race, being only specially coloured individuals, but as the pair in Kolhapur have on every occasion bred purely black cubs with no throw back to the original yellow, and as, moreover, the progeny of the black male with a yellow female bore special markings bearing indications of its mixed parentage, it seems worthy of consideration whether after all they are not a distinct race.

Since writing the above I have seen the skin of the black leopard shot by Mr. Monteath and set up by Mr. Rowland Ward, and I am more than ever inclined to think that the Kolhapur pair are a distinct species.

Mr. Monteath's skin, even without a strong light on it, is of a dark brown colour and the spots on it appear to stand out in relief.

The Kolhapur pair, on the other hand, are of the same coal black (except on the sides of the belly) as the ordinary domestic black cat.

W. B. FERRIS, LIEUT.-COL.

KOLHAPUR, *23rd November* 1905.

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## No. XI.—THE STRAIGHT-HORNED ASSAM BUFFALO.

In response to a request from me, the Maharaja of Cooch-Behar has presented to the British (Natural History) Museum the skull and horns of a cow of the straight-horned Assam buffalo (*Bos bubalis macroceros*). The generosity of the donor is specially notable, as this was the only fine specimen of the skull of a cow of this rare and, I believe, now extinct buffalo in his Highness's collection. Mr. Ward has been commissioned to prepare a wooden model of the specimen for the Maharaja, so that the animal may still be represented among the Cooch-Behar trophies. The specimen is the only one of its kind I have ever seen in this country, and when mounted will form an important addition to the museum, which already possesses two examples of the bull of the same race, namely, the huge pair of horns from the Sloane collection and a complete skull and horns. The peculiar characteristics of the horns of the cow of the straight-horned race may best be realised by comparing the dimensions of the new specimen with those of the skull and horns of a female of the typical circular-horned race. These dimensions are as follow, those of the new specimen being in the first column:—

| | | | |
|---|---|---|---|
| Maximum span ..... | 8ft. 1½in. | ..... | 4ft. 3in. |
| Tip to tip interval ..... | 8ft. | ..... | 1ft. 11½in. |
| Length of left horn on outer curve ..... | 4ft. 10in. | ..... | 4ft. 7¾in. |

R. L.

*(From "The Field," 5th August* 1905.)

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## No. XII.—THE CEYLON CHITAL.

Although it is a well-known fact that the chital, or spotted deer of Ceylon, carries much lighter antlers than the typical Indian *Cervus axis* found in the Central Provinces, it does not appear that a detailed comparison has ever been made between the two animals. Indeed, hitherto the Natural History Museum has not contained a single example of the Ceylon representative of the species, so that such a comparison has been impossible. Recently, however, I have had the opportunity of seeing a fine series of heads and body skins of Ceylon chital shot by Major F. W. Begbie, of the Royal Army Medical Corps, and these specimens render it certain that this deer represents a well marked local race. I should add that, at my request, Major Begbie has generously presented

one of the body skins to the museum, while Mr. Walter Reynolds, of Hawks-Wick, near St. Albans (to whom they had been given by Major Begbie), has, with equal generosity, presented one of the mounted heads.

Compared with the typical chital of India, the Ceylon specimens, all of which are perfectly similar in general character, differ not only by the very much more slender and lighter antlers, but likewise in several details of coloration. The ground colour of the whole skin is, for instance, a yellower and purer fawn, while the white spots on the body are smaller, and may be described as flecks rather than spots. On the head the brown markings present a less decided contrast with the fawn area, while the forehead is almost wholly brown instead of showing chiefly a more or less well defined dark chevron between the eyes, as is usually the case in the large chital of the mainland. The chevron, it is true, is present in the Ceylon animal, but its distinctness is largely obscured by the dark patch in the middle of the forehead. Ceylon chital, I am told, rarely have antlers exceeding 27in. in length.

Hodgson recognised two forms of chital in India, *Axis major* and *Axis minor* or *medius* (for he uses both these names), the latter distinguished by its inferior size and being a native of the southern provinces of the peninsula. The smaller form, which has never been properly defined, has been assumed to be common to Ceylon ; but there is no evidence that such is really the case, and consequently (especially in view of the fact that the smaller mainland form is still undefined) I regard the Ceylon animal as a distinct race, to which the name *Cervus* (*Rusa*) *axis zeylanicus* might be applied, taking the mounted head and the skin in the Museum as the types.

Of the small amount of interest attaching to such local variations I am fully aware, but as it is the fashion to recognise and name them, I cannot but follow the lead. In Ceylon, I am told, sportsmen attribute the small size of the antlers of the chital to the lack of lime in the soil. This, however, can scarcely be regarded as a *vera causa*, since there are, I believe, many sandstone districts in India where these deer grow good antlers. Rather must we attribute the diminution in the size of the antlers in the Ceylon chital to that general dwarfing which is very common in island forms. If every possessor of a fine series of heads and skins from a single locality were to follow the example of Mr. Reynolds and Major Begbie, and present a specimen of each to the Museum, not only would the national collection be largely increased, but we should discover much more about the large animals of the British Empire than is at present possible.

R. LYDEKKER.

(*From "The Field," 3rd June* 1905.)

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## No. XIII.—SITES OF BIRDS' NESTS.

It may be news to some of your readers, as it certainly was to me, that *Rhyacornis fuliginosus* (The Plumbeous Redstart) sometimes builds in trees. Up the Liddar Valley in Kashmir this summer on two occasions I saw them building

and afterwards secured the eggs ten or twelve feet up, the nest being placed like a fly-catcher's against the trunk of some fairly large tree near the water's edge. At one camp there was a bird sitting on a nest placed on a ledge of rock as they ordinarily are, and within twenty yards there was another pair building fully fifteen feet up the trunk of a large tree.

*Chimarrhornis leucocephalus* (The White-capped Redstart) occasionally builds in cavities in fallen trees. I saw two nests with young in such positions. They are early breeders, the young were ready to leave, and in some cases had left the nest by June 15th. I got some clutches later which were probably second broods, as I saw one pair repairing an old nest on July 30. The nest is usually in a rocky bank and is very thickly lined with hair and wool.

*Cinclus kashmiriensis* (The White-breasted Asiatic Dipper) appears to build two fairly distinct types of nests: one kind is placed on the ground among short grass by the water's edge, an oven-shaped nest thatched with grass and with the entrance very low down, looking like a tiny Kaffir hut; the other kind is a round ball (much rounder than any of *Cinclus asiaticus*' nests that I have seen) as big as a football and placed on a boulder in midstream without any attempt at concealment although sometimes the boulder can be easily got at; it is made of grass and leaves and has the entrance in the middle. I saw several of both kinds, but only got eggs from one nest.

*Calliope pectoralis* (The Himalayan Ruby-throat) occasionally builds a domed nest; the first clutch of eggs I got was from such a nest after seeing many ordinary undomed nests with young. It was a ball of dry grass placed among short grass and quite in the open, *i.e.*, without any rocks or bushes about it, and although the bird flew out at my feet I was so puzzled with the nest that I had to shoot the bird to make quite certain. Afterwards I saw two nests with a sort of half-dome. They use nothing but grass for their nests.

*Fringillauda sordida* (Stoliczka's Mountain Finch) seems to build indifferently in a crevice of rock, a hole in the ground like a rat-hole and fully two feet inside, on a sheltered ledge of rock or under the shelter of a bank. The nest is of dry grass lined with hair and wool, the full clutch appears to be four eggs.

S. L. WHYMPER.

NAINI TAL, *4th November* 1905.

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## No. XIV.—NOTE OF THE BURMESE BUTTON QUAIL.

Sitting in the P. W. D. bungalow here, on August 12, I was watching three Button Quail, a male and two females, feeding under some trees within about twelve yards of the bungalow. The male commenced "booming" (the only word I can express it by); it stopped feeding, placed its head near the ground, inflated itself, or appeared to do so to a certain extent, and "boomed" eight or nine times at intervals of about five or six minutes. The sound was very much like that made by a bittern on a small scale, and very deep for so small a bird. I continued watching them for nearly half an hour, and also heard others during the afternoon, a short distance away, making a similar noise. I do not

know whether they utter this sound when kept in captivity by the natives of India, who keep them for fighting.—D. L. Keddie (Myawaddy, Lower Burma) [There are several species of Button Quail distributed over India, Burma, and Nicobars. We presume from our correspondent's address that the bird to which he refers is the Burmese Button Quail (*Turnix blanfordi*), found not only in Burma but also in Assam and China. It is very like the large Button Quai which is common throughout India, from the Himalayas to Travancore and which is known to science as *Turnix tanki*. The Burmese bird, however, is somewhat larger.—ED.]

(*From "The Field" of 23rd September* 1905.)

## No. XV.—THE "BOOMING" OF THE BUTTON QUAIL.

The note which appeared in your last issue on the "booming" note emitted by *Turnix blanfordi* interested me greatly, for it is seldom one hears anything about hemipodes in a wild state. I have kept several species of *Turnix* in captivity, and succeeded in inducing two forms—the Indian *T. tanki* and the Australian *T. varia*—to breed successfully; I may, therefore, claim some knowledge of these interesting quail-like birds. Your correspondent states that he watched a male and two females feeding, and that the male commenced to utter the "booming" note which is characteristic of this group. I may say however, from careful observation, that it is invariably the female, the larger and more brilliantly coloured bird, that "booms." She is the one that does all the courting, while the male undertakes the entire duties of incubation and the rearing of the young. It is evident, therefore, that the trio seen by your correspondent consisted of one female and two males. I have published full accounts of the habits, under more or less natural conditions, of both *Turnix tanki* and *T. varia* in the *Avicultural Magazine* (New Series, Vol. I., p. 317, and Vol. III., p: 295). The way in which the female, after laying a clutch of eggs upon which the male sits, goes off and recommences "booming," apparently with the object of calling another male, suggests that these birds, like the tinamous, are polyandrous, and the fact of your correspondent seeing a female with two males would seem to support this view.

D. SETH-SMITH.

(*From "The Field" of 30th September* 1905.)

## No. XVI.—PLUMAGE OF YOUNG MALE PINTAIL DUCK (*DAFILA ACUTA*).

I notice very little mention is made in most of our books on the nestling plumage of some of our Indian ducks, from which I gather notes on such may be of interest. A duck shot at Fyzabad, United Provinces, on the 16th November 1905 which I identify as a young male Pintail (*Dafila acuta*), presents the following characters.

The bird is evidently this year's nestling, and exhibits a good deal of down, especially on the abdomen.

The head and neck feathers are blackish-brown, finely margined rufous, creating a fine mottling of these two colours. The lores present some chestnut mottling. Hind neck, back, and upper tail coverts blackish-brown finely barred and margined white. Many feathers have two or three distinct bars, but a few on the sides are fine and densely vermiculated as in the adult male. Lower neck, sides of neck, abdomen, and under tail coverts are white, mottled rufous yellow, and some feathers at the side are finely vermiculated blackish-brown as in adult males. Upper wing coverts uniform darkish grey, the greater secondary coverts tipped cinnamon. Primary quills with outer webs blackish, inner drab with blackish tip; shafts white; secondary quills, except innermost two, with outer webs washed bronze-green, and broadly tipped white. The three outermost with a cinnamon bar above the white, and fulvous white fine mottling on outer webs. Inner webs blackish grey, mottled white towards tips. The two innermost quills are much longer than the rest. The outer web of the outer is black on the outer side, and silvery grey on the inner side. The outer web of the inner silvery grey. The inner webs of both blackish brown. Underwings coverts greyish with very fine white profuse mottling. Axillaries white moderately mottled blackish-brown. No long tail feathers. The rectrices, which are just appearing, are black edged white.

Bill bluish-grey at sides of base, otherwise blackish-brown. Legs and feet plumbeous-grey with blackish webs and nails. Hind toe narrowly lobed.

Length 21″; wing 10½″; tail 1½″: Stuart Baker (Bom. Nat. Hist. Journ. Vol. XII, p. 439) says the young male "has the wing like that of the adult," but is otherwise coloured like the female, which observation appears to be substantially correct.

F. WALL, CAPTAIN, I.M.S., C.M.Z.S.

FYZABAD, 17*th November* 1905.

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## No. XVII.—ALBINISM IN THE KAKAR OR MUNTJAC (*CERVULUS MUNTJAC*).

The Prime Minister of Nepal has sent me a pure white fawn of the Barking Deer said to have been caught on the 5th instant on the Sheogouri, a hill in the Nepal Valley, where the other white deer about which I wrote in April or May last (*vide* page 742, No. 4, Vol. XVI of the Journal) was found. This latter deer—still in the Nepal State menagerie—is now turning colour and becoming pie-bald.

The new fawn is being brought up by hand and is doing well.

J. MANNERS SMITH, MAJOR.

THE RESIDENCY, NEPAL,
14*th November* 1905.

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## No. XVIII.—FOOD OF PREDACEOUS FLIES.

With regard to Captain K. E. Nangle's note about the food of predaceous flies on page 747 of the last Journal (No. 4, Vol. XVI), I have twice seen this

occur, both times in the same locality and at about 8 p.m. It was, however, after the heavy showers of the hot weather. The flies were slightly smaller than the common blue bottle fly and had dull red heads.

H. R. G. HASTED.

NARSIPATAM, VIZAGAPATAM,
*4th December* 1905.

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## No. XIX.—MANGROVES AND PAROQUETS.

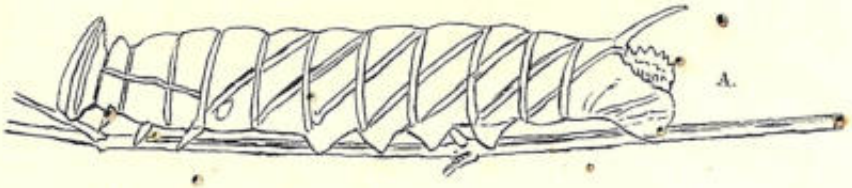
In the common mangrove *(Rhizophora mucronata)* of the sheltered shores and tidal creeks in the Andamans, one may sometimes notice a patch of an acre or so in extent, in which all the mangroves are apparently dead at the top, or in other words "stag-headed." Such patches are usually more or less isolated from the main shore by shallow water. Various reasons, all more or less unsatisfactory, have been adduced to attempt to explain what appeared to denote an unhealthy condition, and it has been quoted in support of the theory that the Andaman Islands are slowly undergoing subsidence. The true explanation is, however, far simpler.

Coming home late one evening I noticed that thousands of paroquets were settling down for the night in one of the above patches and it struck me as rather a peculiar coincidence that they should have selected this peculiar patch of mangrove in preference to others apparently equally suitable for roosting purposes.

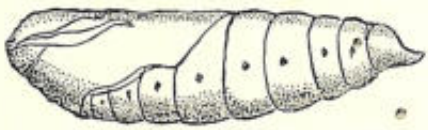
I visited the place again a few days later just after sun-down and found, as before, myriads of paroquets coming in from all points of the compass to what was evidently their regular roosting place. I slid my canoe quietly in among the mangroves and having climbed up one of them to near the top, where I was fairly well screened by leaves, awaited developments. The birds had been alarmed at my approach and had risen into the air in a vast cloud with a roar of wings resembling the breaking of a huge wave on the shore. They soon returned however, and in less than a minute were dropping into the trees all round me, and some in the tree in which I stood concealed, within a couple of feet of my face. I remained motionless and they did not seem to notice my presence. I had suspected that possibly the birds were responsible for this leafless and apparently stag-headed condition and it was therefore with considerable satisfaction that I noticed some of the paroquets busy stripping off the leaves with their beaks. On a close examination, moreover, it was evident that the upper branches were not dead but merely leafless. The paroquets roosting in this patch were *Palaornis magnirostris* and *P. fasciatus*, the former more predominating.

B. B. OSMASTON, I.F.S.

PORT BLAIR,
ANDAMAN ISLANDS, *12th December* 1905.



A.



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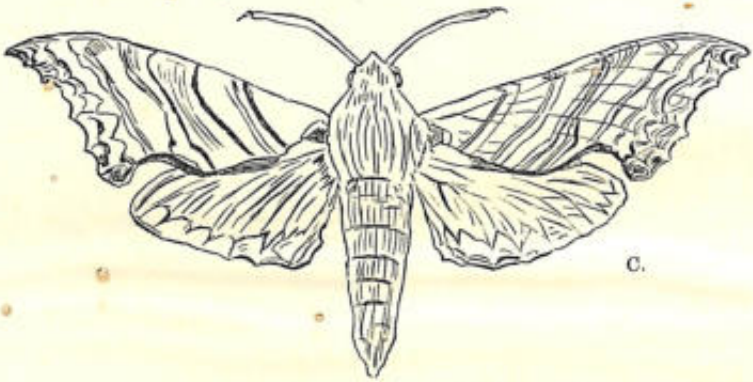

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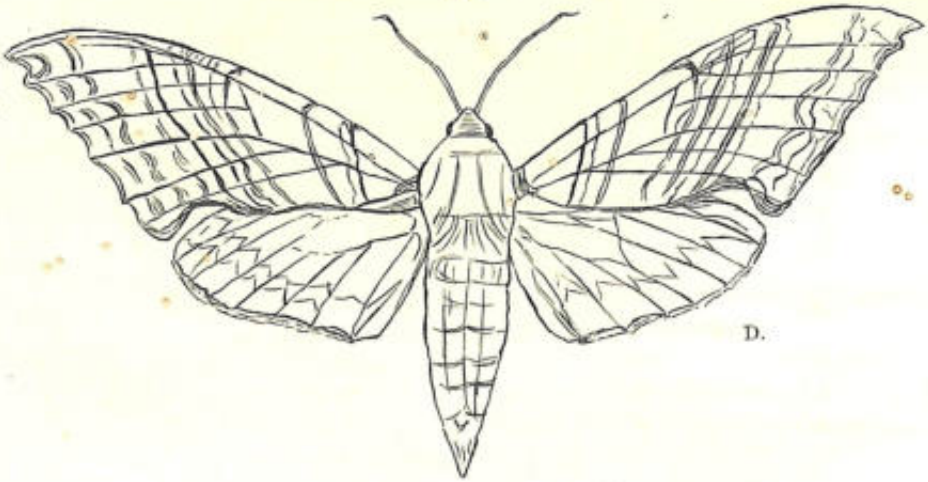

D.

RHODOPRASINA FLORALIS.

C. E. F. MANSON DEL.

A. larva.
B. pupa (lateral surface)
C ♂ imago (upperside)
D ♀ imago (upperside)

A. P. CORTEZ & CO. LITH.

## No. XX.—THE EARLY STAGES OF THE MOTH *RHODOPRASINA FLORALIS*.

*(With a Plate.)*

*Ambulyx floralis*, Butler, Trans. Zool. Soc., Lond., IX, p. 639, (1877).

*Cypa floralis*, Hampson, l.c., p. 72, n. 96. (1892), Dudgeon, Journ., Bombay N. H. Soc., XI, p. 407, n. 96. (1898).

*Rhodoprasina floralis*, Rothschild, l. c., p. 293, (1903).

Habitat.—Sikhim.

Elevation (vertical range.)—7,000 to 10,000 feet.

Time of appearance.—April and May.

Occurrence.—Very rare.

Larva green, covered with whitish coloured granules, a darker green stripe on the dorsal surface together with a series of short orange coloured spines from the head to the horn, on segments 1-4 is a sub-dorsal yellowish streak, a small white spot on 4th segment edged with black and with a disc of yellow near it, oblique lateral violet stripes edged with pale greenish-yellow below on segments 4 to 11; anal flap covered with orange coloured spines, a white streak on each side of head which is green, triangular and produced upwards, horn long, nearly straight, rough, green with the tip black, legs and claspers pale yellow.

Length.—80 mm.

Time of appearance.—July and August.

Food Plants.—*Acer campbellii* (Maple).

Pupa cylindrical, deep reddish-brown with a purplish suffusion, the antennæ, tongue, legs and wings being tightly compressed into the anterior part of the case. The surface is slightly granulated. Cremaster stout, with a lump on the dorsal surface.

Length.—♂ 54 mm. ♀ 60 mm.

Time of pupation.—August to April.

Situation.—Subterranean at roots of Maple.

C. E. F. MANSON.

RANGOON.

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## No. XXI.—OCCURRENCE OF THE MOTH *DUDGEONA LEUCOSTICTA* IN CEYLON.

I am unaware if you keep a record of specimens from new localities. In case you do, I am writing to let you know I caught a specimen of *Dudgeona leucosticta* (656A) figured in Vol. XIII, No. 2, page 227.

My capture was in April this year at this place, about 4,000 feet.

W. VAUGHAN, F.E.S.

COCOGALLA, MADULSIMA,
CEYLON, 12*th December* 1905.

## No. XXII.—NOTE ON THE MALAY TAPIR (*TAPIRUS INDICUS*) IN CAPTIVITY.

*(With an Illustration.)*

Local native name, "Pan dukkar" (Anglicé, Leaf-eating Hog).

The Tapir is perissodactyle and has relationship with the rhinoceros. The only parts of the world in which it is to be found are South and Central America and the Malay Peninsula. The Malay is differentiated from the American species by its colour, size and habits.

There are two Malay tapirs (male and female), in the Kolhapur collection, where they have been for the last 2½ years thriving successfully. The female is larger than the male, as the following measurements will show.

Male, height 3 ft. 1 in. at withers, 3 ft. 3 in. at back, length 7 ft. 5 in.

Female, „ 3 „ 3 „ „ „ 3 „ 5 „ „ „ „ 7 „ 9 „

Unlike the American species, which is of a monochrome of dark brown or black, the Malay tapir is particoloured. The head and up to the withers, front legs to back of shoulders and under chest, hind legs and as far as and including rump and arms, black; the saddle from back of withers to end of spine and round and under the belly, grey. A sharp line defines the particolouring and there is a thin grey line round the top of the ovate erect ears. The eye is small and of a greyish green colour, the tail a mere rudimentary stump about one inch long.

The feet have typically perissodactyl arrangement of toes, the fore have five case of which one is rudimentary, and the third is considerably longer than the others, the hind have but three toes of which the middle is the longest.

Both jaws of both sexes are furnished with a full set of incisors, tusks and molars. The canine teeth, which are very marked, are separated by a considerable interval from the molar series which are all in contact, with quadrate crowns.

The nose and upper lip are elongated into a flexible mobile snout with nostrils situated at the end. The skin is thick and scantily covered with hair.

The period of gestation for the female is 9 months, at the end of which period she seeks an isolated spot, makes a shallow excavation with her feet, and brings forth her young. The Kolhapur pair have only bred once, and on that occasion the female produced but one. The little one, at birth, weighs about 6 lbs., it is covered with longish hair of a dark red brown colour with white oblong spots in longitudinal rows on the body, and round shaped and promiscuously scattered on the legs and face.

The Malay tapir, unlike its American cousin which is stated to be nocturnal, shy and fond of shady places, sleeps through the night and wanders about all day, passing much of its time in the water in which it sports and dives and seems happiest.

The female is always rather aggressive towards the male, but not towards other animals or man, both are of a heavy bovine nature and allow themselves to be handled and driven about. They have the habit of very carefully and

ADULT MALE.

YOUNG, 2 DAYS OLD.

THE MALAY TAPIR (TAPIRUS INDICUS).

slowly covering up their dung by kicking leaves and earth over it with the hind feet; if disturbed in this and driven away, they will return and finish the operation. The only vocal sound they make is a very shrill squeak which would sound appropriate in a small sucking pig but in nothing larger.

When in the act of copulation, which takes place in the daytime in the water, the female gives off a series of these squeaks, while the male blows through the snout, making staccato puffs like the noise of the escape of an oil engine.

The tapir is herbiverous, but in captivity is remarkably fond of boiled rice. The ages of those in the Kolhapur collection are not known, but they show no signs of decay.

Photographs of the male tapir, and of the young at the age of two days accompany this.

W. B. FERRIS, COLONEL.

KOLHAPUR, 27*th December* 1905.

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## No. XXIII.—NOTES ON THE OCCURRENCE OF CERTAIN BIRDS IN THE PLAINS OF N.-W. INDIA.

The following notes made this autumn on certain birds which, according to Oates and Blanford in the "*Fauna of India, Birds*," are rare or unknown in these parts, may be of interest :—

1. *Round Rawal Pindi.*—In the park I came across a Crested Serpent-Eagle (1217. *Spilornis cheela*) in full plumage. It was perched in a tree overhanging a small reedy pond.

The Dusky Horned Owl (1169. *Bubo coromandus*) too, occurs there, and several pairs of them apparently. One can hear its curious call most evenings.

I saw a Caspian Tern (1498. *Hydroprogne caspia*) in immature plumage by the Sohan river.

2. *Salt Range.*—During a few days' leave (December 11th to 15th) in and about the Salt Range I came across the Black-crowned Finch-Lark (880. *Pyrrhulauda melanauchen*) four miles north of Lilla (Pind Dadan Khan Tahsil, Jhelum District). Oates says of this bird, "has been obtained at Muttra, just within the limits of the Punjab." There were a good many about feeding in the fields, &c.

Next day on the top of the plateau north of Sardi, I noticed a flock of strange finches and shot one; it turned out to be an Eastern Linnet (769. *Acanthis fringillirostris*). The Black-throated Accentor (716. *Tharrhaleus atrigularis*) is a common bird up there just like the hedge sparrow in habits, except that it appears to be gregarious. On the way back below Sardi, I shot a ♀ Red-mantled Rose-Finch (757. *Propasser grandis*). I again saw the Black-crowned Finch Larks, and shot a male to make certain.

On the march from Kohat to Rawal Pindi manœuvres Lieut. Keen shot a strange bird on a tank five miles east of Khushalgarh on the Indus; he showed it to me, and asked me to identify it. It was an Eared Grebe (1616. *Podicipes nigricollis*), an unmistakable bird. Blanford says of this species: "This

Grebe had been met with in India until lately, only at Karachi, and thence westward along the Mekran Coast."

I have just heard from Mr. Finn that he obtained a specimen alive in the Calcutta bazar, so *P. nigricollis* may occur in winter *throughout Northern India.*

C. H. WHITEHEAD.

KOHAT, *30th December* 1905.

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## No. XXIV.—OCCURRENCE OF *ÆGITHALISCUS CORONATUS*, SEVERTZ, IN SIND.

I found this pretty little tit in the dense, well-watered Tamarix-Acacia jungles of Andaldal in the Sukkur District, close to the Ruk Junction on the North-Western Railway, in the month of February 1904. I saw several lots of them. They go about in small parties, uttering a low, short "tweet" after the manner of tits while hunting for insects amongst the leaves of the tamarisks, hanging and clinging to which they seemed as much at home as an ordinary bird does on twigs and branches. I shot two of the birds. They were 4 inches in length, with a wing of 2 inches, and a tail of 1, 6 inches. They were evidently in somewhat immature plumage, with brown-grey upper parts and a broad black forehead, the black passing broadly through the eyes and meeting narrowly on the nape. The black was sprinkled with white; the cheeks and throat were white; the back strongly isabelline on the upper portion, fading into very light isabelline on the rump; upper tail coverts dark brown, broadly edged with hoary; primaries and rectrices black-brown, broadly edged hoary, somewhat narrower on the outer web than on the inner; the edging on the middle pair of rectrices and on the secondaries broadest; lesser wing coverts the same colour as upper back; the greater wing coverts dark brown, edged very broadly with dark isabelline; under wing coverts, axillaries, breast and under parts white, tinged strongly isabelline on the middle breast. Legs and feet dark slate; bill dark horny except edges which were nearly white, and the base of the lower mandible which was light slate coloured. The forehead in both specimens was pure white immediately behind the black band, and in one specimen merged into the grey of the occiput which itself became sullied with black on the nape (all the head feathers, except those of the chin, had black bases) where there was no distinct black band, the hind neck being brownish-grey; in the other specimen the nape was nearly pure black, followed by a broad white collar, just tinged with grey in the centre of the hind neck, this collar being continued from the white cheeks and breast. In the first specimen even the forehead and ear covers showed some white edging to the feathers. Neither of the specimens could be sexed as they were both damaged. The food consisted of small moth larvæ and small insects.

Both the specimens were sent home to the British Museum, where one was kept, while the other is at present in the possession of Mr. J. Davidson of Edinburgh, formerly a member of the Civil Service of the Bombay Presidency and a well-known ornithologist.

The bird is, I believe, well known in other parts from Eastern Europe to Japan.

T. R. BELL.

KARACHI, 10*th January* 1906.

## No. XXV.—A LARGE DHÁMAN (*ZAMENIS MUCOSUS*).

I have found here, at Amalchuni, Mandvi Taluka of Surat, the complete cast skin of a dhâman or rat snake, *Zamenis (Ptyas) mucosus*, which probably takes the record. It is in two pieces, and in its wrinkled state without stretching reaches to 9 feet 9 inches, *i.e.*, snout to anus 7-2, tail 2-7.

F. GLEADOW, I.F.S.

CAMP BANDRA, 8*th February* 1906.

[In our copy of Boulenger's Reptiles (*Fauna of British India* Series) I find entered against *Zamenis mucosus* in Mr. J. Mason's handwriting, "I killed a *Zamenis mucosus* in the rice fields alongside Mahim Station, which measured 11 feet 9 inches." Mr. Mason was for several years custodian of our Museum.

W. S. MILLARD,

*Hony. Secretary, Bombay Nat. Hist. Socy.*]

## No. XXVI.—HOW TIGERS KILL THEIR PREY.

SIR,—I have noticed a good deal of correspondence about the method in which tigers kill their prey. I have taken considerable trouble to find out how they kill large game. Some time ago I was asked to come and see a full-grown bullock that had been killed by a tiger. On examining it I found the animal had its neck broken, and there were claw marks on the nose and shoulder, but nowhere else. There was no doubt that the tiger had jumped at the bull and landed on the shoulder, and when the bull turned his head to gore the tiger, he must have put his claw out and with a sudden jerk broken the neck. On another occasion I went to see a young buffalo which had been killed by a tiger, and found the same thing had happened. There were similar marks on the nose and also on the near shoulder, which clearly indicated that this animal had been killed in the same way. Malays who have actually seen a tiger killing a buffalo told me they saw the same thing happen, also that in dragging off a heavy carcase, such as buffalo or bull, that he gets most of the weight across his shoulder. This must be fairly correct, as I have often followed a kill, and the marks left indicated that only a portion of the animal was trailing along the ground. I have known a full grown bull which ten men could not move dragged for two miles by a tiger in heavy jungle, where roots of trees and swamp had to be gone through. In no case have I seen the pug marks facing the wrong way except when stopping to feed, which proves he must carry a portion of the animal over his shoulder. The old idea of a tiger killing large game by a blow from his paw is nonsense; besides, in this country a tiger never faces his prey, but attacks him on the flank, unless charged. Another curious fact that may seem very like a fairy tale is that a tiger does not seem to mind

a small lamp being tied over a kill about 10 ft. high, but will come and feed. I have known three occasions when this has been tried, and each time a tiger has come to feed upon the carcase.

F. O. B. DENNYS,
Assistant Controller of Forests.

SUNGKAI, PERAK.

SIR,—I was much interested to read in your last issue the communication from your correspondent, Mr. F. O. B. Dennys, as to the manner in which tiger kill their prey, since what he says concerning the method adopted by a tiger to kill a heavy horned animal is precisely the same as that I have myself recorded from personal observation in the case of a lion. Besides the specific case referred to, of which I wrote a full description in the course of an article on the lion, published in the Badminton volume on *Big Game Shooting*, I have examined a good many other oxen, as well as buffaloes, which had been killed by a single large male lion, and I always found that they had been seized in the same way by the muzzle with one fore paw, and high up on the shoulder by the other. Their necks were then dislocated, either by a sudden violent wrench, or by their own weight in falling forward with their heads pulled in under their chests.

When, however, an ox or a buffalo is killed by a family of lions, the unfortunate animal is usually mauled and bitten all over, and in such a case its piteous and long-continued bellowings prove conclusively that its sufferings are very great, and that the idea, therefore, that carnivorous animals always kill their prey painlessly is quite a mistaken one. It has always puzzled me to account for the fact that a party of four or five lions usually kill an ox or a buffalo slowly and very inartistically when there is a big male amongst them, which, if he had been by himself, would have despatched his victim in a few seconds of time by a wonderful combination of strength and skill.

Possibly when a party of lions, consisting of an old male, two or three females, and some well-grown cubs, are hunting together, the eagerness of the younger animals prevents the old lion from carrying out his best method of attack, or else, perhaps, he stands aside at first to give the less powerful members of his family a little practice in killing.

In the course of his interesting communication, Mr. Dennys says, "The old idea of a tiger killing large game by a blow from his paw is nonsense," and this remark again accords exactly with my experience with lions, which, I believe, never attempt to kill a heavy animal with "a crushing blow of the paw," as has so often been asserted. They use their claws to hold, and in so doing, and especially when trying to hold heavy animals in motion, often inflict terrible lacerations; but, to the best of my belief, they never strike heavy blows with their paws, and, except when they break an animal's neck by a sudden wrench, always kill by biting.

When a lion moves the carcase of an ox or a horse, he holds it by the back of the neck, and, lifting the weight of the head, and to a certain extent, of course, of the fore quarters as well, drags it alongside of him. He holds small

animals in the same way by the back of the neck, and, walking along with head half turned, trails their hind quarters on the ground beside him.

As I have pointed out, there is a very great difference in the way in which an animal is killed by a single full-grown lion and by a party of these animals; but after reading Mr. Dennys's letter I feel convinced that a tiger kills its prey in precisely the same way as a solitary lion.

—F. C. SELOUS.

(*The above appeared in the "Field" of 23rd and 30th December* 1905.)

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## No. XXVII.—NOTE ON THE MAGPIE ROBIN (*COPSYCHUS SAULARIS*).

It may interest some of the readers of the Journal to hear of the conduct of a *Copsychus saularis*, or Indian Magpie Robin. It found its way one morning into our drawing-room, and in the course of its wanderings alighted on the writing table which has at the back a small mirror let into the frame-work. When the bird—a male—saw its own reflection, the first impulse was evidently anger, for he dashed his beak against the glass, and scolded in an unmistakeable voice. Then he moved away, but presently returned, and now was all sweetness: he posed before the glass, and courted his reflection with a little ripple of soft song. At intervals he peeped round the back, and seeing nothing, took a flight round the room, only to return and re-commence courting.

Almost every day for a week the bird has come: he flies direct to the table, and walking up to the mirror pays court to himself with undulations of the body and the same little ripple of song. I have known a peacock that admired itself in the glass. Is this admiration or is it courtship? If the latter, does it point to the conclusion that the bird, which evidently at first knew its reflection to be that of a male, now supposes it to be one of the opposite sex? The courtship, as I say, has been going on for a week.

E. C. CHOLMONDELEY.

INDORE, C. I., 18*th January* 1906.

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## No. XXVIII.—OCCURRENCE OF THE BITTERN IN SOUTH INDIA (*BOTAURUS STELLARIS*).

I am sending you the legs and wings of what I take to be the Bittern (*Botaurus stellaris*). I should be much obliged by your kindly letting me know whether I am right about this. The bird was shot near Cuddalore, about 120 miles south of Madras; but Oates says that the bird is not found in South India, so perhaps I am wrong in my identification.

C. E. RHENIUS.

CUDDALORE, 20*th February* 1906.

[The wings and legs are, undoubtedly, those of *Botaurus stellaris*, and thus establishes the occurrence of this bird in South India for the first time.

E. COMBER,
*Hony. Secretary,*
*Ornithological Section, Nat. Hist. Soc.*]

## No. XXIX.—SIZE OF BILL OF COMMON TEAL (*NETTIUM CRECCA*).

On going through a series of skins of the Common Teal (*Nettium crecca*) from India, I was surprised at the remarkable difference in size of the bill of the Indian bird to that of its English representative. The bills of the English birds are longer and narrower than those from India, the latter having the bill shorter and stouter in form. I must say, however, I have examined more skins from India than those from England, but the difference appears to be very constant in those I *have* examined. The Indian bird, moreover, appears altogether slightly smaller than the English one. The bills of the birds on an average measure (in millimeters) :—

Adult ♂ (Bengal)—length 37″, breadth at tip 14″.
Adult ♂ (England)—length 42″, breadth at tip 13″.
Adult ♀ (Bengal)—length 32·5″, breadth at tip 13·5″.
Adult ♀ (England)—length 41″, breadth at tip 12″.

Though I myself am not an advocate for the making of sub-species, yet I believe that if these differences are constant, then the Indian bird would, according to many ornithologists, be entitled to at least sub-specific rank. I have examined far too few skins to be able to form a decided opinion, but points like this, I think, are worth recording, and the information I have given must stand for what it is worth.

GORDON DALGLIESH.

EASHING, SURREY, 1*st February* 1906.

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## No. XXX.—NESTING OF THE WHITE-BELLIED DRONGO (*DICRURUS CÆRULESCENS*).

Oates in describing the habits of this bird says very little as to its nesting and states that the eggs have not yet been described. I have found nests at Ramondrug in Bellary District, and Horsleyhada in Cuddapah District. The bird builds in much the same situations as *Dicrurus ater* (the Black Drongo) choosing as a rule the fork of a branch some 20 or 30 feet from the ground. The nest is much more substantial than that of the other Drongos, and is well lined with fine grass. The eggs which are three or four in number average 1″ by 7″. They are pale salmon coloured, heavily marked at the wider end with pale red and pale purple spots and blotches, which in some cases tend to coalesce in a circle round the top.

W. HOWARD CAMPBELL.

GOOTY, *February* 1906.

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## No. XXXI.—THE STORK-BILLED KINGFISHER (*PELARGOPSIS GURIAL*) AT CAWNPORE.

It may be of interest to record that I shot a *Pelargopsis gurial* (the Brown-headed Stork-billed Kingfisher) over an open borrow-pit by the side of a railway here on the 8th December last and that I saw another over the same borrow-

pit on the 4th January. The abnormal failure of the rains in these provinces explains the visit of birds which, as far as I can learn, have never been observed in this neighbourhood before.

ARUNDEL BEGBIE, MAJOR.

CAWNPORE, *6th January* 1906.

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## No. XXXII.—THE GREEN THRUSH (*COCHOA VIRIDIS*) BREEDING IN BURMA.

At the beginning of June 1905 (I have not the exact date with me) I found a nest, and obtained the old bird of *Cochoa viridis* (the Green Thrush). The nest was a large cup of moss, and contained three fresh eggs. It was obtained in evergreen jungle on Thandaung, in the Toungoo District, Lower Burma, at an elevation of about 4,000 feet.

J. C. HOPWOOD.

KINDAT, UPPER BURMA,
*March* 1906.

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## No. XXXIII.—THE FALCATED TEAL (*EUNETTA FALCATA*) IN UPPER BURMA.

I recently saw a male of *Eunetta falcata*, shot by Mr. C. Elliot, Military Police, on the Upper Chindwin. The falcate tertiaries were very apparent, but the crest was inconspicuous. As far as I remember, it was one of the two ducks which flew over Mr. Elliot whilst we were shooting on a small marsh. The other one was not bagged.

J. C. HOPWOOD.

KINDAT, UPPER BURMA,
*March* 1906.

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## No. XXXIV.—ALBINISM IN THE MALAY SPOTTED DOVE (*TURTUR TIGRINUS*) NEAR KINDAT, UPPER CHINDWIN.

I recently saw a specimen of a dove which I have no doubt was *Turtur tigrinus*, showing a very strong tendency towards albinism. When flying with other ordinary coloured doves, it looked quite white; but when examined through a glass, it was of a sort of pale whitish dun, rather darker on the wings. The villagers said they had seen it several times and that it was a wild bird.

J. C. HOPWOOD.

KINDAT, UPPER BURMA,
*March* 1906.

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## No. XXXV.—THE VARIATION IN THE COLOUR OF THE EGGS OF THE DARK GREY BUSH CHAT (*OREICOLA FERREA*).

I lately received an interesting letter from Mr. S. L. Whymper, asking whether I had not made a mistake in the identification of some eggs which I had sent him as belonging to the above species, as they were totally unlike the eggs he had taken himself in India, and were very like those of *O. Jerdoni* he

had received in exchange, and asking whether the eggs might not belong to those of the latter. In 1902 I took two nests of *O. ferrea* in the Shan States and was given another clutch of the same, the birds being identified beyond doubt. These nests were taken over 5,000 ft., and, as far as I am aware *O. Jerdoni* is only found in the plains of Upper Burma and not in the hills, and has totally different nesting habits. At the time I noticed that my eggs did not agree with the description in either the "Fauna of British India" or "Oates and Hume's Nests and Eggs," and drew attention to the fact in the Journal of that year, in which I compared them to the eggs of the English Redstart. The other day I had the opportunity of looking through the Catalogue of Eggs in the British Museum, in which I saw that the eggs of *O. ferrea* were described as being of two varieties, those from China being a pale blue, and likened to those (I think) of the English Hedge-sparrow, whilst those from India were spotted and of the usual Chat type. Besides the above, I have seen and taken other eggs of *O. ferrea* in Burma, and they are all of the same type, being either a pale spotless *blue* (not green) or the same colour, with a few minute rusty-coloured specks. I think that there is no doubt that the Chinese, Indian and Burmese birds are identical; therefore the variation in the colour of their eggs can only be due to different local surroundings, and thus give rise to an interesting problem in the colouration of eggs.

In June 1905, I found a nest of the above, containing four eggs—two on the point of hatching and two quite fresh. Since writing the above, I have received a clutch of *O. ferrea* from Mr. Whymper, which are absolutely different to my eggs, and one would say belonged to a different species.

H. H. HARINGTON,
CAPTAIN.

RANGOON,
*4th March* 1906.

# PROCEEDINGS

## OF THE MEETING HELD ON 23RD NOVEMBER 1905.

A meeting of the members of the Bombay Natural History Society took place at the Society's rooms on the 23rd November 1905, H. E. Lord Lamington presiding. His Excellency was accompanied by H. H. the Maharajah of Kashmir. A large number of members were present.

### NEW MEMBERS.

The election of the following 14 new members, since the last meeting, was duly announced :—Mr. J. B. Leslie-Rogers (Bombay) ; Mr. D. Marshall (Pamaru, Nellore District) ; Mr. E. B. Cooke (Manmad) ; Lieut. L. G. Baker (Sabathu) ; Lieut. Rupert Simson (Umballa) ; Mr. H. F. Bush (Bombay) ; Mr. A. D. McDonough (Murree) ; Lieut. R. C. Burke (Sangli, S. M. C.) ; The Mess President, 44th Merwara Infantry (Ajmer) ; Mr. H. Gronvold (London, S. W.) ; Lieut. R. D. McGeorge, I. M. S. (Bellary) ; Capt. W. R. J. Scroggie, I. M. S. (Fort Lockhart, Samana, N.-W. F. P.) ; Lieut. D. Steel, I. M. S. (Manipur, Assam) ; Mr. S. S. Story (Bombay) ; and Mr. R. H. Burnett (Sholapur).

Mr. W. S. Millard, the Honorary Secretary, said it was to be regretted that there were not more new members joining the Society at the present time, but this was probably due to its being so close to the end of the year. He hoped, however, that the appeal in the new Journal, which was just being issued, would bring in a large number of recruits, and the Journal itself—which has twenty illustrations, and has cost some Rs. 3,500 to produce—would surely convince members, if such was necessary, that they were obtaining the value of the small subscription in that alone.

### CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary acknowledged receipt of the following contributions since the last meeting :—

| Contribution. | Description. | Contributor. |
|---|---|---|
| 1 Snake juv..... | *Zamenis fasciolatus* ..... | Col. F. J. Jenken, R.A.M.C. |
| 1 Lizard, alive, juv. ..... | *Eublepharis hardwickii* ... | Lieut. R. Rutherford, R.A.M.C |
| 1 Lizard ..... | *Hemidactylus triedrus*..... | Mr. W. S. Millard. |
| 5 Palm Squirrels..... | *Sciurus palmarum*..... | Capt. W. B. Walker, R.A. |
| A collection of Moths from Darjeeling. | ..... | St. Joseph's College. |
| 1 Krait from Jesulmir ..... | *Bungarus sindanus* ..... | Col. D. ff. Mullen, I.M.S. |
| 1 Bean Goose ..... | *Anser sp.*..... | Lieut. T. G. Sheppard, R.G.A. |
| 1 Skin of a Python from Udaipur. | *Python molurus* ..... | Major Goodenough. |
| 1 Ant-Eater or Indian Pangolin*, alive. | *Manis pentadactyla* ..... | Mr. W. F. Jardine. |
| 1 Snake, alive ..... | *Typhlops acutus*..... | Mr. F. O. Annesley. |
| 2 Green Tree-Snakes, alive. | *Dryophis mycterizans* ..... | Rev. F. Dreckmann, S.J. |
| 1 Snake from Matheran ... | *Lycodon travancoricus.* ... | Mr. A. J. Broad. |
| 2 Hoary-bellied Himalayan Squirrels. | *Sciurus locroides*..... | Major J. Manners-Smith. |

* Forwarded to the Victoria Gardens.

| Contribution. | Description. | Contributor. |
|---|---|---|
| 1 Snake from Matheran ... | *Lycodon travancoricus* ..... | Major L. Childe, I.M.S. |
| 1 Dhaman..... | *Zamenis mucosus*..... | Major F. Lee. |
| 1 Palm Civet, juv., alive ... | *Paradoxurus niger* ..... | Mr. D. J. de Souza. |
| 2 Snakes ..... | *Distira ornata and Platurus laticaudatus.* ..... | Capt. F. Wall, I.M.S., C.M.Z.S. |
| A number of interesting Butterflies from Assam. | | Mrs. Jackson. |
| 1 Great Crested Grebe ..... | *Podiceps cristatus* ..... | Hon'ble A. E. Hill-Trevor. |
| Some marine shells from Zanzibar. | ..... | Lieut.-Col. C. T. Peters, I.M.S. |
| 1 Gadwall, juv ..... | *Chaulelasmus streperus*..... | Major H. H. the Maharajah of Bikanir. |
| 1 Great Indian Bustard..... | *Eupodotis edwardsii* ..... | |
| Some specimens of clays from the Mysore laterite | ..... | Mr. L. C. H. Young. |
| 1 Field Rat from Nepal .. | *Mus sp*..... ... | Major J. Manners-Smith. |
| 1 Black-capped Kingfisher. | *Halcyon pileata*..... | Mr. W. F. Jardine. |

Minor contributions from Mr. J. W. Hawes, Colonel W. B. Ferris, Captain L. T. H. Hutchinson, I.M.S., and Mr. F. G. Hutchinson.

## CONTRIBUTIONS TO THE LIBRARY.

Spolia Zeylanica, Vol. III., Part X, presented by the Colombo Museum; Journal and Proceedings of the Asiatic Society of Bengal, Vol. I, Nos. 3, 4, 5 6, and 7, 1905, in exchange; The Indian Forester, for August, September and October; Annual Report of the Smithsonian Institution, 1903, in exchange; Bulletin de la Societe Royal de Botanique a Bruxelles, 1904-05; Bulletin de la Societe Royal de Botanique de Belgique, 1904-05; Annals of the Royal Botanic Gardens, Calcutta, Vol. X, Part II.

## PAPERS READ.

The following papers were read :—Pearls in the Thana Creek, by E. L. Sale, I.C.S; Note on two Black Leopards in the Kolhapur Collection, by Lt.-Col. W. B. Ferris, with photographs; Report on the Destruction of Rats in Rangoon during August 1905, by H. Tilly.

Mr. Comber in reading this paper said that it contained some valuable information on that unknown subject the breeding time of rats—a most important matter in these days—when rats were supposed to be one of the principal mediums in carrying plague. It was hoped that the Bombay efforts at the Parel Laboratory in the same direction would also contribute valuable information on this subject.

Capt. G. Lamb, I.M.S., read a paper on snake venoms and their antidotes, an account of recent research, and in the course of his remarks demonstrated with live specimens, the methods of extracting the venom from the Cobra and the Daboia, and of working with it. He pointed out the differences which have been shown to exist between the poisons of the different species, and gave a short account of the recent researches which have been made as regards the physiological actions of the different poisons.

He also mentioned that various sera have now been prepared for some of the poisons, amongst these the Cobra and Russells Viper (daboia) in India. He emphasised the specificity of these sera, and pointed out how these observations affect the serum treatment of snakebite.

His Excellency the Governor proposed a vote of thanks to Captain Lamb and the other authors of the papers, and congratulated the Society on its prosperity. The meeting terminated with a vote of thanks to His Excellency Lord Lamington for presiding.

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## PROCEEDINGS

### OF THE MEETING HELD ON THE 25TH OF JANUARY 1906.

A meeting of the members of the Bombay Natural History Society took place at the Society's rooms on the 25th January 1906, Rev. F. Dreckmann, S.J., presiding :—

### NEW MEMBERS.

The election of the following 52 new members, since last meeting, was duly announced :—Life Member—Mr. H. F. E. Bell, I.C.S. (Mundla, C. P.). Members—Mr. A. W. W. Mackie, I.C.S. (Belgaum); Mr. A. Williams, I.C.S. (Quetta); Lieut. H. S. May, R.E. (Bannu, N.-W. Frontier); Capt. J. H. Gloster, I.M.S. (Amritsar); Capt. G. Irvine Davys, I.M.S. (Amritsar); Mr. G. Wiles, I.C.S. (Godhra); Mr. H. D. Rendall, I.C.S. (Rajkote); Prof. F. F. Fyson (Madras); Mr. J. L. Reeve (Cawnpore); Capt. A. G. McKendrick, I.M.S. (Kasauli); Mr. W. A. Wilkinson (Madras); Lieut. H. W. Kettelwell (Fyzabad); Mr. W. L. Weldon (Bombay); Mr. H. R. Blanford, I.F.S. (Pyinmana, U. Burma); Mr. T. W. Forster, I.F.S. (Pyinmana, U. Burma); Rev. A. G. G. Cowie (Cawnpore); Major H. A. L. Tagart, D.S.O. (Meerut, U. P.); Lieut. D. H. Vanrenen (Lyallpur, Punjab); Lieut. G. R. S. Logan Home (Deesa); Major C. H. James, I.M.S. (Patiala, Punjab); The Principal, Rajkumar College (Rajkote); Capt. F. P. Connor, I.M.S., F.R.C.S. (Manipur, Assam); Mr. M. C. C. Bonig (Port Blair); Mr. D. M. Porteous (Poona); The Director, Pasteur Institute of India (Kasauli, Punjab); Mr. R. A. Alexander (Papan, Burma); Mr. D. L. Keddie (Papan, Burma); Mr. J. R. Drummond, B.A., F.L.S. (London); Lieut. J. E. Home (Rawal Pindi); Mr. C. J. Balding (Calcutta); Mr. E. V. Ellis (Toungoo, L. Burma); Mr. J. Pile (Secunderabad); Major O. A. Smith (Multan); Capt. C. McI. Ritchie, R.H.A. (Rawal Pindi); Mr. H. F. Dawson (Madnapalli); Dr. C. C. Caleb (Lahore); The Director, Central Research Institute (Kasauli); Dr. Gopal Ramchandra Tambe, M.A., B.Sc., L.M. & S. (Indore, C. I.); Mr. J. S. E. Walker (Chumparun, Bengal); Mr. C. E. R. Graham, I.C.S. (Mandla, C. P.); Mr. F. W. Collings (Pakokku, U. Burma); Mrs. B. M. Moberly (Hyderabad, Deccan); Lieut. S. L. Pallant, R.A.M.C. (Jubbulpore, C. P.); Capt. J. W. Skipwith, R.E. (Kirkee); Mr. R. H. Campbell, I.C.S. (Waltair, Vizagapatam Dist.); Lieut.-Col. H. Hendley, M.D., I.M.S. (Amritsar); The President, Committee of Management, Lahore Zoo (Lahore);

Mr. E. N. Bell, I.C.S. (Pagan, U. Burma); Capt. G. B. Scott (Multan); Lieut. R. E. Bate (Multan); and Lieut.-Col. H. Carruthers (Madras).

## CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary, Mr. W. S. Millard, acknowledged receipt of the following contributions since the last meeting:—

| Contribution. | Description. | Contributor. |
|---|---|---|
| 1 Snake | *Simotes arnensis* | Mr. H. F. Wagstaff. |
| 2 Slow Loris (alive) from Siam | *Nycticebus tardigradus* | Mr. E. W. Trotter. |
| Some Cocoons of the Atlas Silk moth. | *Attacus atlas* | Col. G. Hyde Cates. |
| Some estuary fish from Alibagh. | ..... | Mr. W. A. Wallinger. |
| 1 Hammer-headed shark | *Zygæna blochii* | Mr. W. L. Weldon. |
| 1 Mungoose | *Herpestes mungo* | Mr. T. R. D. Bell, I.F.S. |
| A few marine shells from the Red Sea. | ..... | Dr. T. P. Thomson. |
| 2 Squirrels | *Sciurus palmarum* | Mr. E. Comber. |
| Sardines | ..... | Do. |
| 25 Bird skins from Kumaon District. | ..... | Mr. S. L. Whymper. |
| 20 Bird skins from Bengal | ..... | Mr. M. Mackenzie. |
| A few snails | *Pupa overdi* | Capt. A. J. Peile, R.A. |
| Some fossils from Quetta District. | ..... | Mr. W. C. Clements. |
| 9 Snakes from Shan States. | ..... | Mr. S. St. C. Lightfoot. |
| 1 Indian Monitor (alive) | *Varanus bengalensis* | Mr. G. E. Bright. |
| 1 Squirrel skin from Vizagapatam. | *Sciurus indicus* "var." | Mr. H. R. G. Hasted. |
| 1 Indian Monitor (alive) juv. | *Varanus bengalensis* | Mr. C. F. Spencer. |
| 4 Smews | *Mergus albellus* | Hon'ble A. E. Hill-Trevor. |
| 1 Rock Horned Owl | *Bubo bengalensis* | Col. W. Ferris. |
| 1 Verditer Flycatcher | *Stoparola melanops* | Major A. Begbie. |
| 11 Snakes and 4 skins of Squirrels from Siam. | ..... | Mr. E. W. Trotter. |
| 1 Palm Squirrel | *Sciurus palmarum* | Col. K. R. Kirtikar, I.M.S. |
| 1 Palm Squirrel | *Sciurus palmarum* | Capt. W. B. Walker, R.A. |

## CONTRIBUTIONS TO THE LIBRARY.

The Flora of the Presidency of Bombay, Vol. II, Parts I and II, by Theodore Cook, C.I.E., presented by the author; Records of the Geological Survey of India, Vol. XXXII, Parts 3 and 4, 1905; The Agricultural Ledger, 1905, Nos. 4 and 5; Extract des Annales de la Societe Entomologique de Belgique, Tome XLIX, 1905; Canadian Entomologist, Vol. XXXVII; Lepidoptera-indica, Part LXXIII, by F. Moore, D. Sc., presented by H. H. the Maharajah of Mysore; The Palms of British East India, by Griffith (1850), presented by I. H. Burkhill, M.A.; On the occurrence of Elephas antiquus (Namadicus) in the Godavari Alluvium, by Guy E. Pilgrim, B. Sc.; The Indian Forester, Vol. XXXI., Nos. 11 and 12; The use of wood pulp for paper-making, by S. Chas. Phillipps, M.S.C.I.; Notes on Snakes collected at Hakgala, Ceylon, by Capt. F. Wall, I.M.S.; Plague Rats and Fleas, by Capt. W. G. Liston, I.M.S.; Department of Land Records and Agriculture, Bombay, Bulletin No. 35, 1905,

Sugarcane ; Memoirs of the Asiatic Society of Bengal, Vol. I, No. 5 ; Report of the Department of Agriculture, Bombay Presidency, for 1904-1905 ; Season and Crop Report of the Bombay Presidency for 1904-1905 ; Annual Report on the Experimental Farms in the Bombay Presidency for the Year ending 31st March 1905 ; The Agricultural Journal of India, Vol. I, Part 1.

PAPERS READ.

The following papers were then read :—

1. The Oology of Indian Parasitic Cuckoos, by E. C. Stuart Baker, F.Z.S. 2. The Origin of Anonas, "Anona squamosa L, Anona reticulata L.," by Col. Fernando Leal. 3. On some new species of Silver Pheasants from Burma, by Eugene W. Oates. 4. Sambur Horns, by J. D. Inverarity. 5. On the Tenthredinidæ and Parasitic Hymenoptera collected in Baluchistan by Major C. G. Nurse, by P. Cameron. 6. What is a Species? by L. C. H. Young, B.A., F.Z.S., &c. 7. Notes and observations on Mammals collected and observed in the Darjeeling District, India, by Gordon Dalgliesh. 8. The "Pectinate Organs" of Trapa bispinosa, Roxb. (Water-chestnut), by Rev. E. Blatter, S.J. 9. Mangroves and Paroquets, by B. B. Osmaston, I.F.S. 10. Note on the Malay Tapir (Tapirus indicus) in captivity, by Col. W. B. Ferris. 11. Poisonous Snakes of India and how to recognise them, by Capt. F. Wall, I.M.S., C.M.Z.S.

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## PROCEEDINGS

### OF THE MEETING HELD ON 15TH MARCH 1906.

A meeting of the members of the Bombay Natural History Society took place at the Society's Rooms on the 15th March 1906, the Rev. F. Dreckmann, S.J., presiding.

The election of the following 32 new members since last meeting was duly announced :—Captain H. Innes, I.M.S. (Barisal, E. Bengal) ; Mr. G. T. Raikes (Karachi) ; Major J. W. Jennings, R.A.M.C. (Lucknow) ; Captain C. E. Luard (Indore, C. I.) ; Mr. W. I. Palmer (Raheng, Siam) ; Major-General F. A. Buckley (Landour, Mussoorie) ; Mr. B. Egerton (Hyderabad, Deccan) ; Mr. F. C. Purkis (Rangoon) ; Mr. M. D. Parsons (Myitkyina, U. Burma) ; Lieutenant W. P. C. Tenison, R.F.A. (Mian Mir) ; Mr. J. N. Fraser (Bombay) ; Mr. J. M. Haymann (Cawnpore) ; Dr. Adolf Lehmann (Bangalore) ; Captain O. FitzGerald (Fort William, Calcutta) ; Mr. C. C. A. Prideaux (P. O. Lingsugur, Deccan) ; Mr. A. P. Doll (Khairatabad, Hyderabad, Deccan) ; Captain E. C. Doughty (Bellary) ; Mr. R. Parnell, I.F.S. (Lahore) ; Mr. H. G. Wyatt (Lahore) ; Mr. W. F. Dew, J.P. (Ceylon) ; Mr. C. O. Lowsley (Jacobabad, Sind) ; Mr. W. Swain (Bhagalpore, E. I. Railway) ; Captain J. R. Tyrrell, I.M.S (Ajmer) ; Lieutenant-Colonel B. W. Marlow (Poona) ; Mr. P. M. Lushington (Mannantoddy, North Malabar) ; Mr. H. H. Marshall, L.R.C.S. (Mandalay) ; Major J. L. Macrae, I.M.S. (Meiktila, Burma) ; Mrs. C. S. Stack (Poona) ; Mr. P. G. Tipping (Sidnapur, Coorg) ; The Mess President, 85th Regiment

Mr. E. N. Bell, I.C.S. (Pagan, U. Burma); Capt. G. B. Scott (Multan); Lieut. R. E. Bate (Multan); and Lieut.-Col. H. Carruthers (Madras).

## CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary, Mr. W. S. Millard, acknowledged receipt of the following contributions since the last meeting:—

| Contribution. | Description. | Contributor. |
|---|---|---|
| 1 Snake ..... | *Simotes arnensis* ..... | Mr. H. F. Wagstaff. |
| 2 Slow Loris (alive) from Siam | *Nycticebus tardigradus* ... | Mr. E. W. Trotter. |
| Some Cocoons of the Atlas Silk moth. | *Attacus atlas* ..... | Col. G. Hyde Cates. |
| Some estuary fish from Alibagh. | ..... | Mr. W. A. Wallinger. |
| 1 Hammer-headed shark ... | *Zygæna blochii* ..... | Mr. W. L. Weldon. |
| 1 Mungoose ..... ..... | *Herpestes mungo* ..... | Mr. T. R. D. Bell, I.F.S. |
| A few marine shells from the Red Sea. | ..... | Dr. T. P. Thomson. |
| 2 Squirrels ..... | *Sciurus palmarum*..... | Mr. E. Comber. |
| Sardines ..... ..... | .. ..... | Do. |
| 25 Bird skins from Kumaon District. | ..... | Mr. S. L. Whymper. |
| 30 Bird skins from Bengal... | ..... | Mr. M. Mackenzie. |
| A few snails ..... | *Pupa everardi* ..... | Capt. A. J. Peile, R.A. |
| Some fossils from Quetta District. | ..... | Mr. W. C. Clements. |
| 9 Snakes from Shan States. | ..... | Mr. S. St. C. Lightfoot. |
| 1 Indian Monitor (alive).. | *Varanus bengalensis*..... | Mr. G. E. Bright. |
| 1 Squirrel skin from Vizagapatam. | *Sciurus indicus* "*var.*"..... | Mr. H. R. G. Hasted. |
| 1 Indian Monitor (alive) juv. | *Varanus bengalensis*..... | Mr. C. F. Spencer. |
| 4 Smews ..... | *Mergus albellus* ..... | Hon'ble A. E. Hill-Trevor. |
| 1 Rock Horned Owl ... ..... | *Bubo bengalensis* ..... | Col. W. Ferris. |
| 1 Verditer Flycatcher ..... | *Stoparola melanops* ..... | Major A. Begbie. |
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| 1 Palm Squirrel ..... | *Sciurus palmarum*..... | Col. K. R. Kirtikar, I.M.S. |
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The following papers were then read :—

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## PROCEEDINGS

### OF THE MEETING HELD ON 15TH MARCH 1906.

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The election of the following 32 new members since last meeting was duly announced :—Captain H. Innes, I.M.S. (Barisal, E. Bengal) ; Mr. G. T. Raikes (Karachi) ; Major J. W. Jennings, R.A.M.C. (Lucknow) ; Captain C. E. Luard (Indore, C. I.) ; Mr. W. I. Palmer (Raheng, Siam) ; Major-General F. A. Buckley (Landour, Mussoorie) ; Mr. B. Egerton (Hyderabad, Deccan) ; Mr. F. C. Purkis (Rangoon) ; Mr. M. D. Parsons (Myitkyina, U. Burma) ; Lieutenant W. P. C. Tenison, R.F.A. (Mian Mir) ; Mr. J. N. Fraser (Bombay) ; Mr. J. M. Haymann (Cawnpore) ; Dr. Adolf Lehmann (Bangalore) ; Captain O. FitzGerald (Fort William, Calcutta) ; Mr. C. C. A. Prideaux (P. O. Lingsugur, Deccan) ; Mr. A. P. Doll (Khairatabad, Hyderabad, Deccan) ; Captain E. C. Doughty (Bellary) ; Mr. R. Parnell, I.F.S. (Lahore) ; Mr. H. G. Wyatt (Lahore) ; Mr. W. F. Dew, J.P. (Ceylon) ; Mr. C. O. Lowsley (Jacobabad, Sind) ; Mr. W. Swain (Bhagalpore, E. I. Railway) ; Captain J. R. Tyrrell, I.M.S (Ajmer) ; Lieutenant-Colonel B. W. Marlow (Poona) ; Mr. P. M. Lushington (Mannantoddy, North Malabar) ; Mr. H. H. Marshall, L.R.C.S. (Mandalay) ; Major J. L. Macrae, I.M.S. (Meiktila, Burma) ; Mrs. C. S. Stack (Poona) ; Mr. P. G. Tipping (Sidnapur, Coorg) ; The Mess President, 85th Regiment

(K. S. L. I.), (Fyzabad); Miss F. E. Thomas, C.M.S. (Megnanaparam, Tinnevelly District); and Mr. Balkrishna Vinayak Wasudevji Agaskar, B. A.

## CONTRIBUTIONS TO MUSEUM.

The Honorary Secretay, Mr. W. S. Millard, acknowledged receipt of the following contributions since the last meeting :—

| Contribution. | Description | Contributor. |
|---|---|---|
| 1 Malformed head of Indian gazelle. | *Gazella bennettii* ..... | Capt. E. Pratt. |
| 1 Snake (juv.) from Singapore. | *Chrysopelea ornata*..... | Do. |
| 1 Eastern Wood-pigeon..... | *Palumbus casiotis* ..... | Mr. E. M. Rennell. |
| 1 Head and feet of Grey lag Goose. | *Anser ferus*..... | Mr. E. L. Sale, I.C.S. |
| 8 White-winged Mynas.... | *Sturnia nemoricola* ..... | Mr. C. W. Allan. |
| 1 Red-headed Trogon ..... | *Harpactes erythrocephalus*... | |
| 1 Green Imperial pigeon... | *Carpophaga aenea*..... | |
| 1 Bengal green pigeon..... | *Crocopus phoenicopterus*..... | |
| 1 Ashy-headed green pigeon | *Osmotreron phayrei* ..... | |
| 1 Smew ..... | *Mergus albellus* ..... | Capt. Henderson. |
| A specimen of Manganese ore from Ramnadroog, Bellary District. | ..... | Mr. E. A. Hay. |
| 2 Bronzed drongos ..... | *Chaptia aenea* ..... | Mr. R. Foulkes. |
| 1 Viper (juv.)..... | *Echis carinata*..... ..... | Mr. W. Coen. |
| 1 Snake (juv.) ..... | *Lycodon aulicus* ..... | |
| 1 Snake (juv.)..... | *Coluber helena*..... | |
| 1 Snake (juv.)..... | *Dendrophis conicus*..... | Major Winter, R.A.M.C. |
| 3 Eggs of the Common sand grouse. | *Pterocles exustus*..... | Mr. A. H. A.Simcox, I.C.S. |
| 2 Eggs of the Crimson breasted barbet. | *Xantholaema haematocephala.* | Do. |
| 3 Skins of squirrels from Singapore. | ..... | Capt. H. R. Baker. |
| 1 Skin of the Malay tree-shrew. | *Tupaia ferruginea* ..... | |
| Some Butterflies, beetles from Singapore. | ..... | |
| 1 Flying lizard (juv.) ..... | *Draco maculatus*..... | Capt. F. Powell Connor, I.M.S. |
| 1 Great crested grebe ..... | *Podiceps cristatus*..... | |
| 3 Blue-breasted quail ..... | *Excalfactoria chinensis*..... | |
| 1 Spider from Manipur..... | ..... | |
| 1 Bustard..... | *Eupodotis edwardsi*..... | Mr. R. H. Heath, C.E. |
| 1 Large brown flying Squirrel. | *Pteromys oral* ..... | Capt. Tancred. |
| 1 Blue-bearded bee eater ... | *Nyctiornis athertoni* ..... | Mr. E. G. Oliver. |
| 2 Phoorsa (juv.) ..... ..... | *Echis carinata*..... | Mr. Sunderao D. Navalkar. |
| 1 Skin of Hamadryad (12½ feet). | *Naia bungarus* ..... | Mr. Geo. Knight. |
| 1 Nicobar megapode..... | *Megapodius nicobariensis*..... | Mr. S. H. Stevenson R.I.M. |
| Some 24 varieties of Sugarcane tops from Mauritius (Forwarded to the Director of Agriculture, Poona). | ..... | Mr. A. J. Broad. |

Minor contributions from Mr. S. E. F. Jenkins, Dr. J. F. Goldsmith and Mr. M. R. Jardine.

## CONTRIBUTIONS TO LIBRARY.

The Indian Forester, Vol. XXXII, Nos. 1 and 2. 1906; Le Bambou son etude sa culture, son Emploi; Annalen des K. K. Naturhistorischen Hofmuseums, Band XIX, No. 4; Records of the Geological Survey of India, Vol. XXXIII, Part I; Annual Report of the Imperial Department of Agriculture for the year 1904-05; The Insect Pests of Cotton in India, by H. Maxwell Lefroy, M.A., F.Z.S., F.E.S.; The Canadian Entomologist, Vol. XXXVIII, Nos. 1 and 2; Etat Independant du Congo, Annales du Musee du Congo; Recensio Critica automatica of the Doctrine of Bird Migration; Spolia Zeylanica, Vol. III., Part XI.

The following gentlemen were elected as office bearers for the present year:—

President—H. E. Lord Lamington, G.C.M.G., G.C.I.E.

Vice-Presidents—Mr. J. D. Inverarity, P.A., LL.B.; Rev. F. Dreckmann, S.J.; Mr. E. H. Aitken.

Managing Committee.—Vet.-Major G. H. Evans; Mr. E. C. Stuart Baker, F.Z.S.; Mr. E. Ernest Green, F.E.S.; Lt.-Col. K. R. Kirtikar, I.M.S.; Lt.-Col. H. D. Olivier, R.E., F.Z.S.; Capt. F. Wall, I.M.S., C.M.Z.S.; Mr. H. P. Macnaghten; Mr. G. M. Ryan, I.F.S.; Col. W. B. Bannerman, I.M.S.; Mr. E. Comber, F.Z.S.; Mr. T. R. D. Bell, I.F.S.; Major A. Newnham, F.Z.S.; Major C. G. Nurse, F.E.S.; Mr. L. C. H. Young, B.A., F.E.S.; Mr. J. McNeill, I.C.S.; Mr. John Wallace, C.E.; Mr. F. Gleadow, I.F.S.; Capt. W. G. Liston, I.M.S.; Capt. G. Lamb, I.M.S.; Prof. G. A. Gammie.

Honorary Treasurer—Mr. N. C. Macleod (*ex-officio*).

Honorary Secretary—Mr. W. S. Millard, F.Z.S. (*ex-officio*).

## ACCOUNTS FOR 1905.

Mr. N. C. Macleod, the Honorary Treasurer, placed before the meeting the accounts for the year ending 31st December 1905, showing an income of Rs. 18,166-9-8 and an expenditure of Rs. 15,362-0-9, and a cash balance carried forward of Rs. 6,188-1-4. This balance was rather larger than usual but since then Rs. 2,000 had been invested as representing the proportion of subscriptions received from those who had commuted their annual subscriptions by becoming life members. No such investment had been made in 1905. The accounts were accepted subject to the usual audit, and a vote of thanks was passed to the Honorary Treasurer.

The Committee gave notice that they propose to alter Rule V. (Life Membership) making the sum payable for commuting the annual subscription Rs. 200 instead of Rs. 150.

The Superintendent of the Victoria Gardens exhibited a quantity of stones weighing about 2 lbs. 2 oz., which had been found on *post-mortem* examination inside the stomach of a young cassowary. One of the stones was about 2 inches across and was found to be obstructing the intestine and this was probably the cause of death.

Major A. F. Mackenzie exhibited the four feet of a black-buck shot by Mr. A. Hanckel near Sholapur. The feet were all malformed and in the opinion of Mr. Sowerby (C.V.D.), the Acting Principal of the Parel Veterinary College, the buck must have been ill or injured for some considerable time, possibly by a former shot causing injury to the spinal cord and partial paralysis of the hind extremities.

## PAPERS READ.

Mr. E Comber read a paper contributed by Mr. E. W. Oates on "The Species of Bean-geese," which will be accompanied with a coloured plate of the bills of the eight species that are supposed, or may possibly be found, to occur in British India. He pointed out that the importance of the subject from a naturalist's and a sportsman's point of view was evident from the fact that of all our Indian birds the Bean-geese are in the most unsatisfactory state. No specimens of Bean-geese are included in the enormous Hume collection of Indian birds, and no recent writers have been satisfied with the material at their command to say definitely what species of Bean-geese do occur in India. The Pink-footed Goose (*Anser brachyrhynchus*), which has always been included in Indian lists, is really the most unlikely of all the species to occur, and Mr. Oates supports his doubts on its correct identification with forcible arguments. Mr. Oates is only satisfied that one species of Bean-goose, *Anser middendorffi*, has actually been proved to have occurred in India, though further investigation will no doubt result in others being found.

Mr. Comber regretted that the appeal that was included in the Society's Journal of December, 1904, for the heads of Bean-geese for the purpose of their correct identification had, after two cold weather shooting seasons, not resulted in one single specimen of a Bean-goose's head being received by the Society, and he again appealed to members for as many specimens as possible next season, so that this important question may be cleared up.

The following notes were also read :—"On the Magpie Robin," by Mr. E.C. Cholmondely; and "A large Dhaman" (*Zamenis mucosus*), by Mr. F. Gleadow, I.F.S.

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H. Gronvold del. J. Green. Chromo lith.

THE COMMON TEAL.

Nettion crecca.

JOURNAL
OF THE
BOMBAY
Natural History Society.

Vol. XVII. BOMBAY. No. 2.

# A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

ILLUSTRATED BY COLOURED PLATES AND DIAGRAMS.

BY CAPTAIN F. WALL, I.M.S., C.M.Z.S.

*Part III—With Plate III and Diagram VII.*

(*Continued from page 9 of this Volume.*)

## THE DHAMAN OR COMMON RATSNAKE (*Zamenis mucosus*).

*Nomenclature.* (*a*) *Scientific.*—The generic name is from the Greek ζα "great" and μεινος "strength," and the specific from the Latin *mucosus*, "slimy," which I need hardly remark this snake no more deserves than any other of the suborder *Ophidia*. It appears to be a popular notion that a snake is slimy, and even in these enlightened days writers of travels, etc., frequently expose their ignorance by using this inappropriate adjective to them. Some of our readers may be more familiar with its older generic title *Ptyas*, also a calumnious epithet derived from the Greek, πτυας a "spitter."

(*b*) *English.*—The name by which it is generally known is the "common ratsnake," but "dhaman," a name borrowed from the vernacular, is almost as frequently in use.

(*c*) *Vernacular.*—In Bengali, Hindi, and Marathi, all languages derived from Sanskrit, it is called "dhaman," the Sanskrit word being "dhamana." It is also called sometimes "dameen." Russell makes mention of this latter name*, and I have heard it often. Woodrow in his

* Ind. Serp., Vol. I, plate XXV.

book on botany mentions both these names "dhaman" and "dameen" as being applied to a tree, the *Grewia tiliæfolia*, which is commonly grown by the natives in Southern India about their habitations. Mr. A. M. Jackson tells me "dharmani" is the Sanskrit name for this tree and the Cyclopædia of India (Vol. II, page 14) gives "damoni" as the Ooriah name for it. From its wood, hafts are derived for various tools, and the inner bark furnishes bast which Birdwood says is used in Bombay for making ropes. The connection between the tree and the snake has been suggested to me by Father Dreckman, who says in Sanskrit "dharma" means a "binding", either in the sense of duty or of wrapping one thing round another. Those of us who have handled living specimens, must frequently have experienced the force with which this snake wreathes itself round one's legs, or arms. On the Malabar Coast it is called "chayra." The Tamils in S. India call it "Sarey pamboo," but a Tamil of the Tigala caste in Mysore told me locally (Bangalore) they called it "Jair potoo," which I am informed signifies "centipede animal." This appears to be the same as the "Jeri potoo" of Russell.* Rice† says the Canarese name for it is "Kere." The Burmese call it "Mywé' let pât," which is literally "hand-coiling snake," and according to Theobald‡ "Lim-bwi."

*Dimensions.*—The great majority of adults vary from 5½ to 6½ feet, but much larger specimens are to be met with. Evans and I obtained two in Burmah measuring 7 feet 4½ inches, and 7 feet 8½ inches respectively. One specimen brought to me in Trichinopoly was the largest I ever saw in the flesh, *viz.*, 8 feet 2 inches. I measured the slough of one just cast in the Bangalore Museum which was 9 feet 1½ inches. Mr. Millard tells me of one killed near Mahim Station which was 11 feet 9 inches. This was a veritable Goliath of its kind. I have measurements in my notes of 54 specimens, and only 3 of these exceed 7 feet. I have notes of a host of others where the measurement is not recorded, but it is certain that had they been large this would not have been omitted.§

*Physiognomy, and bodily configuration.*—The head is rather elongate. The eye, large and lustrous, exhibits an iris speckled with gold, especially densely at the pupillary margin and a pupil which is slightly ovate hori-

* Ind. Serp., Vol. I, plate XXXIV. † Mysore, Vol. I, p. 188.
‡ Jour. As. Soc., Bengal, 1868, p. 46.
§ Mr. Pearless has in a recent letter reported that he has on four occasions killed this snake in Ceylon exceeding 10 feet in length.

zontally. The nostril is large, and placed laterally. The neck is slightly constricted. The body of somewhat robust proportions is flattened in a lateral direction (*i.e.* compressed), and is from 3½ to 4 times the length of the slowly tapering, and cylindrical tail.

*Colour.*—The prevailing hue on the head and body, including the tail, is dorsally an olivaceous-green or olivaceous-brown. In the anterior half or three-fifths of the body length this is uniform or nearly so, but in the posterior part many scales are irregularly margined with black, so as to form a reticulate pattern with a tendency to form crossbars. Individuals differ in colour: I have seen some as yellow as a batter pudding, and others of a hue as dark as sepia. The shields bordering the lips, the scales at the side of the throat, and the scales beneath the body, and tail are more or less margined posteriorly with black; in fact, these marks form a very characteristic trait in the physiognomy. On the belly the regularity of these marks forcibly reminds one of a tape measure, but in individuals, they may be absent in whole or in part. The belly is greyish-white, dirty-white or yellowish, the latter hue often more pronounced about the throat. The skin is blackish, mottled with fawn or whitish in irregularly transverse streaks, but is usually not seen owing to the overlapping of the scales. The overlapped margins of the scales, however, partake of this cutaneous coloration, and in young specimens light bluish-grey irregular crossbars are usually conspicuous, especially anteriorly. In young the prevailing colour is often more greyish or bluish than one sees in the adult, but the markings and general appearance are very closely similar.

*Identification.*—Here I must digress, to emphasise a very interesting and important peculiarity in this snake. The scales of snakes counted across the back will be found, with very few exceptions, to be arranged in odd rows varying from 13 in the *Callophids*, etc., to as many as 75 in *Python reticulatus*. The exceptions to this rule which concern us are *Zaocys dhumnades* and *Z. nigromarginatus* in which they number 16 in the middle of the body, and *Stoliczkaia khasiensis* where they are 30.* Further, in some snakes the same number of rows is maintained in the whole length of the body, but in others they

* In the two families *Typhlopidæ* and *Glauconiidæ* where the scales appear to be in even numbers, if the median row on the belly (which in these snakes is not specialised, but is exactly like the rows of scales on the back and sides) is considered in its true light, *viz.*, as the analogue of the belly scutes, then the scales are in reality odd in number.

reduce by 2, 4, 6 or even more rows from before backwards, but the odd number is preserved on the body—(Caution—I do not include the tail),—with one notable exception, *viz.*, the species under discussion, *Zamenis mucosus*. In this the scales number 17 in the front of the body, but reduce to 14 or 12 posteriorly. This point in itself is sufficient to distinguish this from all other snakes in our region.* Another feature characteristic of this snake is the triple loreal. (See l, fig. 1 B). In almost all snakes possessing a loreal, this is a single shield interposed between the præocular, and the nasals. In a few species there are two, but in this there are three normally, one anterior, and two superposed behind. Occasional aberrant specimens may be seen with only 2 loreals, or even with 4 or 5.

In colour, and markings which I have already represented as faulty guides in the identification of all snakes, both the species of *Zaocys* already referred to, as well as *Xenelaphis hexagonotus* and *Zamenis korros*, closely resemble it, and all are of very similar proportions.

*Haunts.*—There is scarcely a situation, whether in hill or dale, forest or maidan, arid, swampy or cultivated tract, tree, bush, or habitation in which it may not take up its abode. It is quite at home in the proximity of man, and is to be met with in the gardens of populated areas within our largest cities almost as plentifully as in the more tranquil quarters of the Cantonment. In such localities, in deference to man's hostile inclinations, it is forced to retire during the day into some secure retreat, commonly taking up its abode in an ant-hill, drain or other convenient hole in the compound, or even in the out-houses, or bungalow itself. Like other snakes it loves old masonry, and is often flushed from or seen retiring into the crevices and crypts furnished by old walls or brick wells. In Rangoon with the aid of a bicycle lamp to illuminate the gloom of the little galleries left for drainage purposes in the faces of the fort walls I frequently found one coiled up, and provoked it to a speedy exit. In the bungalow it may tenant the basement, but not infrequently finds its way up into the roof where it may reside above the ceiling cloth, and though few may deem it as such it is certainly entitled to the consideration of a welcome friend. The late Chaplain of Cannanore, the Reverend R. B. Redding, told me that once when in conversation with a lady, upon whom he was calling, a scampering was heard overhead on the ceiling cloth, and a rat fell

* In Zaocys the scales reduce, but they are maintained in even rows.

through a hole on to the floor. It was closely followed by the head and much of the body of a large snake, which, however, managed to withdraw itself. It is more than probable that this was a rat-snake.

Removed from man's immediate environment I believe it realises there is no occasion for such prison accommodation as populous localities thrust upon it, and here it has free scope to indulge its diurnal inclinations. In Cannanore snipe-shooting I very frequently encountered it in broad daylight leisurely pursuing its quest for luncheon, and when not actually on the move I often found it coiled asleep in the paludal vegetation, or beneath a bush. Again, on two or three occasions when stepping into paddy fields at dawn I have seen it coiled on the heaps of decaying vegetable matter which represent the remnants of last year's crop, and weeds, suggesting that it had taken up these quarters over-night.

It shows a decided partiality for the vicinity of water for reasons very obvious when we come to consider its diet. It will take readily to water should occasion demand, and swims vigorously, and well, carrying its head above the surface for choice, but diving when the necessity is urgent.

I have seen it at some height in a tree (ten or fifteen feet), also on the roofs of houses, so that its scansorial abilities are not inferior to those of most of its kind.*

It appears to be very fleet in its movements, but its speed is deceptive, for on one occasion, when I chased one using its full endeavours to escape, I found I had traversed 38 yards while the reptile covered 18. It measured 5 feet 9¼ inches.

Here I may remark that this snake enters into the dietary of several natives of India, who hold it in great esteem. A Tamil of the Tigala caste in Bangalore told me his caste while despising all other snakes as food, or medicine, relished the flesh of the dhaman which when cooked was white, and fish-like. The taste he compared to that of chicken. It appears to enjoy a reputation in wasting diseases. In Fyzabad recently a cooly came, and begged the body of one that had been sent in to me dead to eat. The Burmese and Karens eat it with avidity, but are by no means bigoted with regard to the species of snake they eat. The Chinese use it in medicine among other ophidian brethren, and I doubt not eat it too. I saw many preserved on the shelves of the local medicine men in Hongkong.

* See addenda (1).

*Sloughing.*—Miss Hopley* mentions one casting its skin about once a month on an average. This specimen was caged in Regent's Park, London, I believe.

*Disposition.*—It is undoubtedly when provoked a very fierce snake, and if brought to bay will assume the offensive with great courage and determination ; but this side of its nature is rarely exhibited, as, like other snakes, it prefers to acknowledge man's supremacy by seeking swift escape when this offers. I have many times jumped into the middle of its coils when I have seen it enjoying a siesta, but have never been menaced, or struck at once, the reptile's acknowledgment of the rude awakening being manifested by speedy disappearance. On occasion, however, and especially if reasonable chances of escape are denied it, it will attack with great malice. Father Dreckman once chased a specimen nearly eight feet long, and managed to place his foot over the hole it was making for. Baulked in its attempt to escape, it coiled itself up and jumped straight at his face. Luckily Father Dreckman drew back his head in time to evade a blow in the face, but the reptile fastened itself on to his shoulder with such purpose that its teeth penetrated not only his clothes, but actually lacerated the skin beneath. On another occasion when the same observer was rendering assistance to a hatchling which was trying to emerge from its egg, the vicious little creature resenting interference bit him in the finger, and actually drew blood. Mr. Hampton tells me that once when attempting to capture one he found in a drain it struck viciously at him, and inflicted a wound beneath one of his eyes. In Bangalore I saw one belonging to a sampwallah, strike most vehemently at, and bite a mongoose, also one of the stock-in-trade. Mr. Millard tells me it is a difficult snake to tame when fairly grown, and will attack freely when cornered.† Nicholson‡ remarks how it will fight for its freedom, and says it is always a little uncertain to handle in captivity. Gunther§ says: "It is of fierce habits, always ready to bite, and old examples brought to Europe never become tame."

In Rangoon I had one brought to me which, it was reported, was attacking a full-grown fowl. The few specimens I have had caged,

* "Snakes," p. 332.
† See addenda (2).
‡ Ind. Snakes, p. 153.
§ Rept., Brit. Ind., p. 249.

exhibited a very nasty temper, and struck out most maliciously at me whenever I approached the glass of the cage: often two or three strokes were delivered in rapid succession, and with such force that the creature must have hurt itself considerably. The stroke is delivered upwards, as though to wound the face, a peculiarity also noticed by Mr. Millard. When infuriated, prior to delivering its stroke, it retracts the head and forebody into an S, slightly erects itself and gives vent to a peculiar sound which I have heard no other snake produce, and which reminds me of a cat at bay. Cantor likens it to the sound of a vibrating tuning-fork. During the production of this warning note the snake compresses itself anteriorly (*i.e.*, flattens itself in a direction contrary to that manifested by the cobra), the spine being arched about the neck, and the throat markedly pouched.

*Food.*—The dhaman is very catholic in its tastes, devouring almost anything that chance brings within its reach, but it displays a very marked partiality to a batrachian diet, doubtless because toads, and more especially frogs, are extremely plentiful, easily captured, and too defenceless to offer much resistance. The possibility of taste influencing its selection may be dismissed, since flesh, however toothsome, must fail to impart its relish when clothed in feathers, fur, or integuments. Perhaps though, the texture of these vestments may gratify the mouth or gullet as keenly as the flesh may conciliate the peptic glands. When hunger presses it is stimulated to make full use of its courage, vigour, and speed in shikaring the object of its gastric affections. The incident of the rat falling through the ceiling cloth demonstrates this. Blanford* mentions one he saw pursuing a lizard (*Calotes versicolor*) at full speed, which it caught, and then throwing its body over its victim speedily devoured. This practice of holding down its prey when troublesome to manage, or seized in a position unfavourable for swallowing, is characteristic, and it can exert a very considerable strength in this manner. Mr. Hampton tells me he has seen it hold a rat down with its body, pressing it tightly on the ground, and Mr. Millard gives me a very striking example of this behaviour. He says: "One of these which we were keeping in the same cage as our python recently caught a rat (which was put in for food) by the tail. The rat turned, and bit the dhaman severely, and the dhaman killed it by holding on to the tail, and pressing the rat against the body

* Jour. As. Soc., Bengal, Vol. XXXIX, p. 372.

of the python and the floor of the cage. Severe pressure must have been brought to bear, as the rat—a full-sized one—was dead in 3 or 4 minutes."

Here I may draw attention to the frontispiece of Lyddeker's Royal Natural History, Volume V., which shows this snake entwined in a most unnatural manner round a perpendicular bamboo stem, a large part of its body free, and holding a large rat with a serenity and facility very unreal. I doubt whether this acrobatic performance is possible for more than a few seconds apart from the manner in which it is shown bolting its meal. It is regrettable that the inaccuracies of a skilled artist should pass the censorship of so great a naturalist. The quarry once captured is swallowed at once, so that in the case of inoffensive creatures, such as frogs, it is no unusual circumstance for them to reach the stomach sufficiently alive for their suppressed cries to be distinctly audible; and moreover remarkable as it may seem, when rescued from their engulfment it is a fairly common event for them, after the lapse of some minutes, to recover sufficiently to hop away. I have witnessed this on several occasions, and Kelsall has recorded such an experience in this Journal.

Rats, though sometimes preyed upon, are not nearly so staple an article of diet as suggested by its name. Mr. Hampton tells me that in captivity in Regent's Park, London, he was familiar with this snake and saw it seizing, and devouring good-sized rats with avidity, but that his specimens in Burmah, far from liking rats, seem to be afraid of them, preferring an exclusively batrachian fare. Lizards, birds and other small vertebrates form a welcome supplement to its voracity. Recently, in Fyzabad, a three-footer was found in a shrub attacking a nest of young birds. It had already swallowed a gecko (*Hemidactylus gleadovii*), and was in the act of devouring one fledgling. That it must be considered both gourmand and gourmet may be inferred from the following bills of fare. A specimen brought to me in Cannanore had eaten a large frog (*Rana tigrina*), a large toad (*Bufo melanostictus*), and a half-grown lizard (*Calotes versicolor*); another lately acquired in Fyzabad with a very tight-fitting waistcoat was found to contain a large toad (*Bufo andersoni*), a lizard of the skink family (*Mabuia dissimilis*), and a young tortoise (*Trionyx*), and as though dissatisfied with this 3-course luncheon, had endeavoured to include a large lizard, probably of the genus *Calotes*, since some 5 inches or more of its

tail had been devoured. The specimen alluded to above which bit Mr. Hampton subsequently disgorged six frogs. Ferguson* comments upon the gluttony of this species, and says its favourite food is a medium-sized frog, of which a fair-sized snake will eat about twenty-two at a meal.

Mr. Hampton says if at all hungry it will not disdain the meal afforded by another snake, including even its own species. This I know to be true, and quite a common event in captivity, which is vouched for by Mr. Millard, Ferguson and others, but I think it is a rare exhibition of depravity in its natural state; however, Assistant Surgeon Robertson told me he once cut open a large dhaman, and found it contained another dhaman, 3 feet 11 inches in length, in its stomach. Flower† mentions one eating a snake (*Chrysopelea ornata*). Mr. Green tells me of one which disgorged several snakes of the genus *Rhinophis* in its death throes, and Lightfoot‡ has lately presented a specimen to the Bombay Natural History Society preserved in the act of swallowing a *Psammophis condanarus*. The stomach, as will be seen if distended with a meal, lies more in front of the middle point of the body, than in some other snakes, notably the Krait, and *Hemibungarus*, where it lies wholly behind this point.

*Breeding.*—It is the rule with snakes that the female exceeds the male in length. Darwin, on the authority of Gunther, makes this statement.§ Whilst fully agreeing with this remark, in this species I have no doubt that the converse obtains. An average taken from the largest males and females my notes record shows a disparity decidedly in favour of the male. Again, of specimens over 6 feet 6 inches, twelve are males and only two females. The longest female is 6 feet 7¼ inches.‖ Though usually met with singly, they are sometimes found in pairs at times other than the breeding season. On January 5th, 1900, in Rangoon, a male and female were found coiled together beneath a flooring. This date is one later than the normal hatching season. The male was 6 feet 1¼ inches and the female 5 feet 8½ inches. Again, in Fyzabad a pair was found disporting themselves in a small pool of water some three or four yards across. The female, 6 feet 7¼ inches in

* Bombay Natural History Journal, Vol. X, p. 4.

† Proc. Zool. Soc. 1899, p. 684.

‡ Bombay Natural History Journal, Vol. XVI, p. 530.

§ Descent of Man, p. 538.

‖ See addenda (3).

length, contained eggs far advanced towards maturity. The male measured 6 feet 9½ inches. This latter incident implies a conjugal attachment on a par with that of the higher animals, since sexual gratification had not dissolved the marital tie.*

The following is a list of the breeding notes I have been able to collect, arranged in tabular form :—

| Eggs. | | | Degree of maturity | Length of mother. | Locality. | Authority. | Reference. |
|---|---|---|---|---|---|---|---|
| Date. | Number. | Size. | | | | | |
| May ... | 9 | ? | In abdomina | ? | Bangalore | Nicholson .. | "Indian Snakes" p. 127. |
| May .. | 13 | ? | Do. .. | ? | Do. ... | Do. ... | Do. |
| 20th June '05 | 14 | 1⅔" long | Do. .. | 6' 3" | Fyzabad ... | Self .. | Not recorded. |
| Do. .. | 10 | 1 9/16" ,, | Do. ... | 5' 5" | Do. .. | Do. ... | Do. |
| 6th July '05 | 14 | 1 15/16" ,, | Do. ... | 5' 7¼" | Do. ... | Do. ... | Do. |
| 11th July '05 | 9 | 1 15/16" ,, | Do. .. | 5' 1¼" | Do. | Do. | Do. |
| 19th July '06 | 12 | ? | Do. ... | 6' 3½" | Rangoon .. | Evans and Self. | Do. |
| 1st Aug. '04 | 13 | 1 5/8" to 1 9/10" | Do. ... | 5' 9½" | Cannanore . | Self ... | B. N. H. S. Jourl. Vol. XV1,p. 301 |
| 14th Nov. '03 | 11 | Nearly mature. | Do. ... | ? | Do. ... | Do. .. | B. N. H. S. Jourl. Vol. XV1,p. 300 |
| September . | 12 | 2" × 1¼" | Hatched .. | ... | Bangalore ... | Nicholson ... | "Indian Snakes",p, 127. |
| Do. .. | 12 | ? | Do. ... | ... | ? | Oreckman .. | Private letter |
| 9th Dec. '99 | 13 | 1⅝" to 1¾" long. | Do. ... | ... | Rangoon .. | Evans and Self. | B. N. H. S. Jourl Vol. XIII,p.189. |

From the above it appears that the mating season is during the hot weather, and that eggs are voided in August and September, and hatch between September and December.

The periods of gestation and incubation are unknown to me.

The most juvenile mother, if one is to judge from measurement I have records of, was 5 feet 8 inches, and I believe, therefore, that the female is sexually mature at about 4½ years of age.† Both sexes appear

* See addenda (4).

† See addenda (5).

to grow about a foot a year, but as usual I have to regret gaps in my notes that prevent me speaking more positively.

The eggs are laid in adherent clusters, and deposited, I believe, in holes in the earth. They are white, glossy, and parchment-like, with the poles equally domed. In the clutch recorded by Nicholson one egg measured $2'' \times 1\frac{1}{4}''$. The eggs from which young hatched in Rangoon observed by Evans and me measured from $1\frac{5}{8}$ to $1\frac{3}{4}''$ in length.

The youngsters we witnessed hatching in Rangoon measured from $14\frac{1}{2}$ to $15\frac{1}{4}$ inches. They found exit at any convenient spot, and some, even when they had broken the shell sufficiently to admit of easy exit, appeared to quit their cradles reluctantly, as they often peeped out, or extended themselves to a considerable length, and then retired sometimes for hours before evacuating them. They were very active even at this early age, and seemed to know instinctively whom to regard as enemies, for they exhibited anger when molested; and that they can make good use of their teeth, Father Dreckman's experience related above seems to exemplify.

Those observed by Evans and me had the navel perforate, and through this I passed a bristle into the abdominal cavity. Nicholson,* however, says they emerge from the egg with the navel closed. We found two ventral shields usually perforate, and from 21 to 24 ventral shields intervened between these and the anal shield.

*Legends.*—There are various legends connected with this snake. In some parts it is addicted to sucking cows, and apropos of this it is very remarkable that a feat so manifestly impossible when the snake's mouth is examined, should have received credence in many countries in relation to several species of snakes. It would be impossible for a grasp to be maintained upon the teat without driving home many of the needle-pointed teeth, and inflicting an amount of pain no animal could passively tolerate upon so sensitive a structure. Others attribute to it the curious practice of putting its tail up the cow's nostril, and suddenly withdrawing it. What originated this strange belief, and what possible end it might fulfil, is hard even to speculate upon.

Again, it is very generally believed among natives that the ratsnake mates with the cobra, and is in fact the male cobra, and it is surprising to me that even some educated English people seriously contemplate such an absurdity, and still further so firmly believe it, as to attempt

* "Indian Snakes", p. 128.

to indicate the truth of their assertions. I have more than once engaged in a heated discussion on this subject, but after listening to many assurances, the confession has been invariably elicited that the sexes of the supposed engaging parties had never been investigated!

I think the most convincing argument in disproof of this fable lies in the fact that there are beyond dispute both male and female cobras, and both male and female dhamans. One may assume they breed true, since no hybrid, as far as I am aware, has ever been recorded. The possibility of a hybrid I am not prepared to doubt in face of the fact that hybrids have been produced in captivity, the progeny of parents of different ophidian genera, but if the outrageous attachment between Mr. Dhaman and Mrs. Cobra were true, our museums should be well stocked with evidences of their guilt. It is satisfactory to note, when reflecting upon this alleged flagrant laxity of morals, that one never hears even a whispered imputation breathed by these scandalmongers against the characters of Mr. Cobra and Mrs. Dhaman.

The Revd. Mr. John appears to have originated the idea of an attachment between the cobra and the dhaman, for Russell says, Mr. John told him, speaking of the dhaman, that it was often found in company with the cobra. The fact is these snakes are of similar habit, and seek out similar quarters, but companionship is merely a matter of accident.

Russell* says: The natives say it is not dangerous, but assert that its bite occasions blindness in persons over forty! Again he says the Revd. Mr. John tells him that the sharpness of its scales sometimes does harm to rice grounds!

*Distribution.*—Its range of distribution is very extensive. It is found throughout the whole Indian Peninsula, from Ceylon in the south to the Himalayas in the north. On the west it extends through Rajputana, and Sind to Afghanistan, and Transcaspia. In the east it ranges through Burma, and the whole Malayan Continent to Southern China and Formosa. In the Archipelago it has only been recorded from Java. In almost every locality it is to be reckoned as one of the commonest snakes, at any rate in the plains. In upland regions it becomes scarcer as one ascends. It is common at moderate elevations (5,000 ft.), and has been found up to 7,000 ft. (Sutlej Valley †) but is probably rarely met with much above this altitude.

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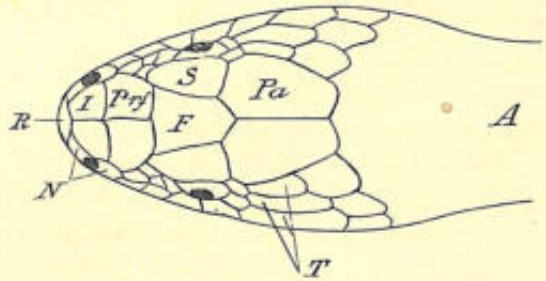
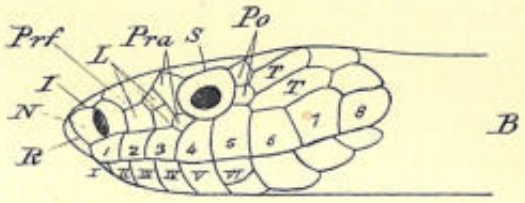
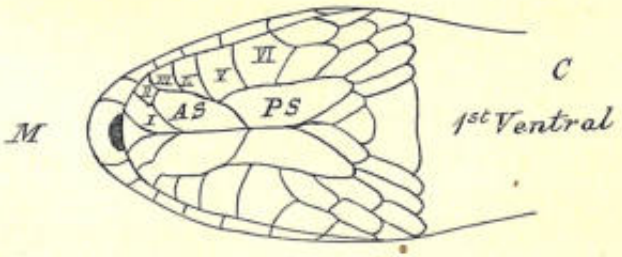
* "Ind. Serp.," Vol. II, p. 21.

† Stoliczka "Journ. As. Soc., Bengal," XXXIX, p. 185.

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|---|---|---|---|
| A. S. | Anterior sublinguals. | Prf. | Præfrontal. |
| F. | Frontal. | Po. | Postocular. |
| I. | Internasal. | P. S. | Posterior sublinguals. |
| L. | Loreals. | R. | Rostral. |
| M. | Mental. | S. | Supraocular. |
| N. | Nasal. | T. | Temporal. |
| Pa. | Parietal. | 1 to 8 | Supralabials. |
| Pra. | Præocular. | I to VI | Infralabials. |

ZAMENIS MUCOSUS. (NAT SIZE)

INDIAN SNAKES. (WALL)

Blanford* remarks that it appears much less common in the Deccan proper, west of Nagpur, than it is to the eastward.

*Description.*—*Rostral*, touches 6 shields, of which the anterior nasal sutures are largest, and about $\frac{1}{3}$ greater than the internasals.

*Internasals.*—A pair. The suture between them $\frac{1}{2}$ to $\frac{2}{3}$ that between the præfrontal fellows; $\frac{3}{4}$ the internaso-præfrontal suture.

*Præfrontals.*—The suture between them rather greater than the præfronto-frontal suture. In contact with the internasal, posterior nasal, two loreals, præocular, supraocular, and frontal. *Frontal.*—In contact with 6 shields, of which the supraocular sutures are the largest, and twice or more than twice the parietal sutures. Length subequal to supraoculars. Breadth subequal to or rather greater than the supraoculars. *Parietals* in contact with one postocular usually (rarely two). *Nasals.*—Two, lateral, completely divided. In contact with the 1st and 2nd supralabials. The nostril occupies the full depth of the suture, and is situated almost entirely in the posterior shield. *Loreals.*—Three, normally $1+\frac{1}{1}$, (rarely 2, 4, or 5). *Præoculars.*—Two normally (rarely one), the lower wedged between the 3rd and 4th supralabials. *Postoculars.*—Two. *Temporals.*—Two; the lower touching the 6th and 7th supralabials (sometimes the 5th also). *Supralabials* 8, the 4th and 5th touching the eye normally (sometimes 9 with the 5th and 6th touching the eye). *Infralabials* 5 touch the anterior sublinguals (rarely 6), the first forming a suture together about half the length of that between the anterior sublinguals. The 5th and 6th touch the posterior sublinguals. The 6th is the largest of the series, and is as broad or broader than the posterior sublinguals, and in contact with 2 scales behind. *Scales.*—Two heads lengths behind the head 17; midbody 17 or 16; two heads lengths before the vent 14 or 12. All subequal except the last row which is largest. A pair of apical facets at the apex of each scale. *Keels* anteriorly (two heads lengths behind head) none; midbody in from 0 to 6 or 7 rows; posteriorly (two heads lengths before vent) in 2 to 10 rows. *Absorption.*†—In this snake two steps occur, the first in which the scales reduce from 17 to 16, and this is brought

* Jourl. As. Soc., Bengal, Vol. XXXIX, p. 372.

† I have already referred to the fact that in some snakes the same number of rows of scales persists throughout the body length; whilst in others it decreases. Now the manner in which this reduction is effected is one of much interest from its variation in different species, and it is surprising to me that this feature should have been altogether overlooked by other herpetologists.

about by the absorption of the vertebral row into that adjacent to it on the left side. This occurs about the middle of the body, usually behind the midpoint, sometimes however in front of it. Very shortly afterwards a further reduction takes place to 14, and this is brought about by the absorption of the 3rd row above the ventrals on both sides, into one of the adjacent rows (*i.e.*, the 2nd or 4th). Should another reduction take place, as sometimes happens in the posterior part of the body, the 3rd row is again absorbed into the one above or below, and 12 rows are established. It rarely happens that the first two steps occurring closely together as they do are reversed. *Supracaudals* are in even numbers. 6 rows in the middle of the tail, and dwindling to 2 at the tip. The absorption of these rows follows the rule, and the two uppermost on each side, keep on coalescing at each step. Keels end where the rows count 6 or 8. Apical facets are present in all rows to the tail tip. *Ventrals.*—190 to 208 (Boulenger), somewhat angulate laterally. Only a part of the last row of scales visible on each side when the specimen is laid on its back. *Anal* divided. *Subcaudals* 95 to 135 (Boulenger), divided throughout.

Our plate is excellent. The only remark I have to make is that the chin is shown too receding, and is probably to be explained by some distortion from pressure against the glass in the specimen selected in the Museum.

## ADDENDA.

Since writing the above I have acquired some additional information with which I can supplement my original remarks.

(1) Mr. Millard tells me he once saw a large dhaman up a wild date palm tree on Malabar Hill, Bombay, and from the excitement shown by the small palm squirrels there was no doubt what it was after. Recently in Fyzabad a specimen 6 feet 8 inches was brought me which was discovered high up in a tree, the attention of a passer-by having been called to it, by the noisy demonstrations of several birds. I found it contained two large chicks each 3½ inches long in the stomach, and a larger one 4 inches long in the gullet. They were partially enveloped in their shells, which were of a uniform bright blue colour. They appeared to me to be much too large for crowchicks, and the colour of the eggs was not corvine.

J. Green del.

Mintern Bros. Chromo.

THE DHAMAN OR INDIAN RAT-SNAKE (Harmless)

Zamenis mucosus.

(2) Mr. Millard further tells me that in the Society's cages in Bombay large specimens are so restless when captive, and strike so frequently at the wire netting, that they do not live long.

(3) This receives abundant confirmation from this year's specimens. I find from my notes that whilst I have had 14 males measuring 6 feet 6 inches and over, my largest female was only 6 feet 3 inches. In fact only 4 females reached the limit of 6 feet.

(4) Another instance of this kind occurred this year. The baboo at the Fyzabad Club on the 2nd July sent me word there were two snakes in the garden close by. I went to investigate, but unfortunately a hue and cry had been raised among the tennis chokras, and they had taken shelter in some brushwood. The baboo told me that for many minutes he had been watching two large snakes which, as he expressed it, "were playing very nicely." He described them as facing one another, and swaying their erected bodies to and fro. I made no doubt that this was a little love passage I had unfortunately missed, and I instituted a search with the result that I observed one dhaman glide from the spot indicated, and killed the other before it could escape me in the same spot. This proved to be a male 6 feet 9 inches long. The next day at the same spot the female was killed and brought to me, and I found she contained 12 large eggs, one typical of the rest, measuring 1½ inches, and therefore nearly mature. She was 6 feet 1 inch in length. This again seems to show cohabitation long after impregnation, and if so establishes a bond of union one would hardly expect to find among reptiles. Another possible solution to this episode, however, may be that the male was pressing attentions upon the female, which her condition forbade her reciprocating and that in consequence she was really fighting, and not playing. This was suggested to me recently by a similar incident on the part of two buff-striped Keelbacks (*Tropidonotus stolatus*).

(5) I have had two gravid females this year, 5 feet 2½ inches, and 5 feet 5½ inches, respectively.

(*To be continued.*)

# ON THE TENTHREDINIDÆ & PARASITIC HYMENOPTERA COLLECTED IN BALUCHISTAN BY MAJOR C. G. NURSE.

By P. Cameron.

Part II.

(*Continued from page* 107 *of this Volume.*)

## Ichneumonidæ.

### Tryphoninæ.

#### *Bassini.*

*Bassus lætatorius*, Fab.

This, now cosmopolitan species, has been taken at Peshin in April and at Quetta in May and June. It is probably common.

#### *Banchini.*

*Exetastes nitidus*, sp. nov.

Black, the apical half of the 1st abdominal segment, the whole of the 2nd and 3rd and the basal three-fourths of the 4th, bright red; the legs red; the coxæ, basal joint of the 4 anterior trochanters, apical third of hind tibiæ and the hind tarsi, black; the hind spurs fuscous; wings hyaline, the stigma fuscous, the nervures black. ♀.

Length 11 mm.

Quetta. May.

Face and clypeus strongly, closely punctured; the front and vertex as closely, but not quite so strongly punctured; the clypeus clearly separated, obliquely projecting. Labrum rufous round the apex, distinctly, sparsely punctured. Base of mandibles strongly punctured, rufous behind the apex. Mesonotum shining, impunctate; the metanotum closely, rugosely, irregularly reticulated-striated; the pleuræ closely, not very strongly punctured. Abdomen smooth and shining; the sheaths of the ovipositor black. The transverse cubital nervures unite in front; the recurrent nervure is received in the middle of the areolet; the disco-cubital is broken by a longish stump; the transverse median is interstitial. Tibiæ and tarsi thickly spinose.

### Ophioninæ.

#### *Ophionini.*

*Ophion carinatus*, sp. nov.

Luteous, the eye orbits broadly and the face pale lemon-yellow; the pleuræ tinged with yellow; the sides of the middle lobe of mesonotum and the sides of the lateral yellow. Wings hyaline, the costa and stigma pale-testaceous, the nervures deep black; the transverse median nervure interstitial; the stump of a nervure nearly as long as the transverse cubital nervure; the recurrent

nervure is received almost, if not quite, opposite the commencement of the basal abscissa of the radius. Metanotum closely minutely punctured, depressed in the middle at the base; behind the middle is an indistinct transverse keel; in the centre of the apical third are 2 stout, parallel keels, united at the top by a transverse keel, which curves down between them and then roundly upwards at the sides; on either side is a large triangular area, the narrowed end above. Metasternal keel stout at its base; surrounding the base of the coxæ, is a stouter, more irregular keel. The scutellum is long, narrow, dilated at the base; the keels do not extend beyond the lateral slope. The recurrent nervure, in front, is bullated to near the middle; there is a much shorter bulla on the disco-cubital nervure. Temples nearly as long as the upper part of the eyes, slightly narrowed behind. Front depressed in the middle, stoutly keeled. ♀.

Length 17 mm.

Peshin. April.

This species differs from the 2 others described here in its larger size in the large size and curved form of the stump on the disco-cubital nervure; and in the 3 areæ on the apex of metanotum.

*Ophion peshinensis*, sp. nov.

Pale luteous, the head pale yellow; mesonotum with 3 obscure fuscous lines, wings hyaline, the costa and nervures black; the stigma testaceous, paler at the base and apex; metanotum closely, finely punctured, without any keels; the tarsi strongly spinose. ♂.

Length 11 mm.

Peshin. April.

The stump on the disco-cubital nervure is half the length of the basal abscissa of the cubitus; the recurrent nervure is received distinctly behind the commencement of the latter; the transverse median nervure is almost interstitial. Front furrowed in the middle. Temples broad, roundly broadly narrowed behind. Scutellum long, narrowed towards the apex. Depression at base of metanotum narrow, curved.

*Ophion quettaensis*, sp. nov.

Pallid luteous, the head yellow; the antennæ rufescent; the mesonotum with 3 pale fuscous lines; wings hyaline; the costa and stigma pale testaceous, the nervures black; behind the middle of the metanotum is a transverse keel; from its middle 2 keels run to the apex; the basal depression is short, deep and it becomes gradually narrowed from the base to the apex. There is a broad, blackish stripe down the back of the 2nd and down the basal half of the 3rd. The stump on the disco-cubital nervure is short; the transverse median is received almost behind the transverse basal; the recurrent nervure is received shortly, but distinctly behind the base of the apical abscissa of the radius. Tarsi sparsely spinose.

Length 12 mm.

Peshin. April.

This is a paler, smaller species than *peshinensis*; it is readily known from it by the transverse keel on the metanotum and by the elongated area on the apical slope.

*Nototrachini.*

*Nototrachus rufo-orbitalis*, sp. nov.

Black; the eye orbits narrowly below, more broadly above dark rufous; behind extending on to the ocelli; and on it, opposite the ocelli, is a yellowish mark. The fore legs are fuscous tinged with yellow; the 4 hinder black, their knees yellow; the hind tibiæ are fuscous on the inner side. Wings hyaline, the stigma and nervures blackish. ♀.

Length 7 mm.; terebra 2 mm.

Quetta. May.

Face and clypeus shining, sparsely punctured; the front keeled down the middle, stoutly, irregularly obliquely striated; the sides sparsely punctured; the vertex is smooth and shining. Pronotum irregularly, transversely striated. Mesonotum stoutly, irregularly reticulated; the middle lobe is broadly bordered by dark rufous. Scutellum transversely striated, almost reticulated; the apical half is dark rufous; the sides are stoutly keeled, the keels meeting in the middle. Metanotum stoutly reticulated; there is a smooth area, longer than wide, in the centre of the base. Pro- and mesopleuræ, except the upper half of the latter at the apex, closely, stoutly, longitudinally striated, the striæ running into each other; the metapleuræ stoutly longitudinally striated-reticulated. The upper part of the propleuræ is broadly rufous. Abdomen smooth, bare, and shining.

*Campoplegini.*

*Tranosema? striata*, sp. nov.

Black, shining, the mandibles, except at the apex, and tegulæ yellow; palpi pale testaceous, black at the base; legs fulvous, the coxæ and basal joint of trochanters black; the knees and anterior tibiæ yellow. Wings clear hyaline, the costa and stigma pale testaceous, the nervures black. ♀.

Length 6 mm.

Peshin. April.

The upper two-thirds of the propleuræ, the basal half of the mesopleuræ except below the middle and the middle of the petiole above are finely and closely striated; the metanotum is irregularly, more strongly striated and more or less punctured. Face aciculated, opaque, the clypeus smooth and shining. Eyes coarsely facetted, parallel, not converging above or below; the malar space short, not much longer than the antennal pedicle. Front and vertex aciculated. Ocelli prominent; the hinder separated from each other by about the same distance as they are from the eyes. Metanotum strongly aciculated or finely closely punctured; it is arcolated in the middle; the petiolar is twice longer than wide, narrowed gradually towards the apex, where it is half the length of the base; the areola is more than twice longer than wide and ob-

liquely narrowed at the base; the apical slope is smoother and shining; it is surrounded by a keel: the spiracles are small, round. Abdominal petiole long, longer than the 2nd segment; the post-petiole is dilated and clearly separated; the spiracles are placed close to its middle; the spiracles on the 2nd segment are placed shortly behind the middle. The abdomen is smooth; not compressed, the middle not much narrower than the thorax; the sheath of the ovipositor projects, but not beyond the dorsal apex; it is broad, stout; the last ventral segment projects bluntly. Pterostigma thick, rounded behind; the areolet is 5-angled, narrowed in front, receiving the recurrent nervure in the middle: the transverse median nervure is interstitial. The radial cellule is short, widened and angled at the areolet; the apical nervures in the hind wings are obsolete. Clypeus not separated from the face; a large depression at the sides; its apex broadly rounded.

In the arrangement of Dr. Ashmead (Bull. U. S. Nat. Mus., XXIII, 95) this species runs into *Tranosema*. As, however, no complete description of that genus has been given, it is possible that it may not belong to it; in that case, the species may form the type of a new genus.

*Tranosema? spilostoma*, sp. nov.

Length 6 mm. ♀.

Peshin, April.

Similar in size and colouration to *T.* (?) *striata*, except that the apical half of the clypeus is reddish-fulvous, it differs otherwise in the thorax not being striated, nor is the petiole; the petiolar area is not so wide at the base compared with the length; the areola at the base is narrowed from the middle instead of from the basal third and is not so distinctly closed at the base; the dilated part of the abdominal petiole is equal in length with the narrowed basal part, while in *T.* (?) *striata* the post-petiole is distinctly shorter than it; the transverse cubital nervures are united in front, while in *striata* they are separated; and the 2nd discoidal cellule is wider at the apex, compared with the base; in *striata* it is not much more than twice; in *spilostoma*, fully 3 times.

*Bargylpa piloselle*, sp. nov.

Black; the face, clypeus, the inner orbits to near the ocelli, the line obliquely narrowed above, the outer entirely, the basal half of the mesonotum on the sides, the line continued on the outer side to the apex of the tegulæ, scutellum, the lower half of the mesopleuræ and the others almost entirely yellow; the yellow bordered more or less with rufous; abdomen red, the basal half of the 1st, a line on the top of the 2nd, the apex of the 5th, the top and apex of the 6th and the 7th segments entirely, black. Four front legs yellow; the middle trochanters and base of femora marked above with black; hind legs yellow, the coxæ above, the femora above and below, the tibiæ above and below at the apex and the apical joints of the tarsi, black. Wings hyaline, the stigma testaceous, the nervures black; the recurrent nervure interstitial. ♂.

Length 15 mm.

Quetta, May.

Antennal scape yellow, a black line above; the basal joints of flagellum black, the rest brown. Head and thorax densely covered with long white pubescence. Front in the middle rugosely punctured, more or less obliquely striated above, the sides finely, closely, punctured; there is a keel down the middle. The top, and the bottom more broadly, of the outer orbits are rufous. Mesonotum shining, sparsely punctured; the scutellum is much more strongly punctured. Metanotum irregularly reticulated-striated; a smooth line down the centre. Pleuræ closely, somewhat strongly punctured. The apical segments of the abdomen are narrowly lined with yellow.

*Barylypa interstitialis*, sp. nov.

Black, the face, clypeus, orbits narrowly except on the top, a triangular mark on either side of the base of the mesonotum, tegulæ, scutellum, the lower part of propleuræ at the base, a large oblique mark on the lower part of the mesopleuræ at the base, a much narrower one at the apex below and a large mark, obliquely narrowed above, on the apex of the metapleuræ below, yellow. The 2nd, 3rd and 4th abdominal segments are rufo-testaceous. Legs yellow, the middle coxæ at the base, the hind coxæ, trochanters above, base and apex of femora, a line on the inner side of the tibiæ, on their outer side at the apex and the greater part of the tarsi, black, the hind femora dark red. Wings hyaline, the costa and stigma pale testaceous, the nervures black, antennæ black, brownish towards the apex. ♂.

Length 9 mm.

Quetta. August.

Head and thorax closely punctured, the mesonotum more shining and sparsely punctured; thickly covered with white pubescence. Metanotum irregularly longitudinally striated, more weakly and irregularly transversely striated, the 2 striations forming irregular reticulations. Metapleuræ more closely, rugosely punctured than the rest.

*Barylypa rufo-lineata*, sp. nov.

Head and thorax yellow, the vertex, occiput more broadly, 3 broad lines on the mesonotum, the central extending from the base to the apex; the lateral commences at the middle and reaches to the apex, the parts at the sides of scutellums, base of metanotum, the upper part of pleuræ and the breast rufous. Abdomen ferruginous, the top of the 2nd segment black. Four front legs pale yellow, the femora rufous below; the hind coxæ, trochanters and femora rufous, the trochanters marked with yellow and black, their tibiæ yellow on the outer side, blackish on the inner, the tarsi black above, dark rufous below. Wings hyaline, the stigma dark fulvous-testaceous, the nervures black. ♀.

Length 16 mm.

Antennal scape yellow; the flagellum rufous, marked with black at the base. Head and thorax thickly covered with longish white pubescence. Front strongly punctured, obliquely striated below the ocelli, the vertex is less strongly punctured. Mandibles yellow, the teeth black, rufous behind. Mesonotum

sparsely punctured at the base, more closely and strongly at the apex; its apical slope is strongly, closely transversely striated. Metanotum coarsely reticulated, the apical slope furrowed in the middle. Pro- and mesopleuræ closely, strongly punctured; the metapleuræ coarsely reticulated. Recurrent nervure interstitial, the transverse median received shortly beyond the transverse basal.

*Barylypa variornata*, sp. nov.

Rufous, the face, clypeus, mandibles, palpi, an almost interrupted line on the upper inner orbits, the outer narrowly above and below, broadly in the middle, a large mark, longer than broad, on the sides of the mesonotum at the base, scutellum, a large mark on the sides of the median segment, a large one on the base and apex of the mesopleuræ and the greater part of the metapleuræ yellow; the vertex broadly, the occiput still more broadly, a mark, of equal width throughout on the base of the mesonotum, between the yellow marks, a small mark on the sides at the apex, the space at the sides of the scutellum, the metanotum except the sides before the apex, the mesosternum, the base of the metapleuræ and a line on the top of the 2nd abdominal segment, black. Four front legs yellow; the middle femora rufous, black at the base, the hind blackish; the coxæ and the greater part of the femora rufous; the base of the tibiæ pale.

In the 2 examples I have examined the amount of black varies; in one specimen there is no black on the occiput, nor on the apex of the metanotum; and the hind legs are more largely marked with yellow. The punctuation on the head and thorax is sparse; the apex of the mesonotum is closely transversely striated; the metanotum is irregularly longitudinally striated, more or less reticulated in the larger specimen. The recurrent nervure is interstitial; it is bullated to below the middle, the wings in the smaller example are slightly tinged with fulvous. ♀.

Length 10-12 mm.

Quetta. June (the large example), August (the smaller).

*Barylypa erythroesra*, sp. nov.

Rufous, the eye orbits broadly, antennal scape, face, clypeus, mandibles palpi, the sides of mesonotum near the base, scutellum and the pleuræ largely, yellow. The apex of the hind tibiæ broadly and more narrowly on the inner side above and the greater part of the hind tarsi, black. Wings hyaline, the stigma pale testaceous, the nervures black; the recurrent nervure interstitial. ♀

Length 8 mm.

Quetta. August.

Face and clypeus closely punctured; the front and vertex are much more strongly punctured. Pro- and mesothorax closely punctured, the pleuræ more strongly than the mesonotum; the apex of the latter is transversely striated. Metanotum smooth on either side at the base, the rest transversely reticulated, depressed in the middle, the metapleuræ irregularly rugose.

The wings are slightly tinged with fulvous, and highly iridescent.

The 5 species of *Baryhypa* from Baluchistan may be separated thus :—

1 (4) The greater part of the head, thorax and apex of abdomen black.

2 (3) Large (15 mm.) the pleuræ yellow, black above, the flagellum of antennæ rufous, the basal two segments of abdomen rufous ..... *pilosella.*

3 (2) Small (9 mm.) the pleuræ black, with 3 yellow marks, the antennæ black, the basal 2 segments of abdomen for the greater part black ..... *interstitialis.*

4 (1) The greater part of the body rufous.

5 (6) The mesonotum and base of metanotum maculate with black.. *variornata.*

6 (5) The mesonotum and metanotum not maculate with black.

7 (8) Large (16 mm.) the mesonotum yellow, with 3 rufous lines, mesopleuræ yellow, rufous above and below..... *rufo-lineata.*

8 (7) (Small 8 mm.). the mesonotum rufous, yellow laterally at the base; mesopleuræ rufous, with 2 yellow marks..... *erythrocera.*

*Limnerium quettaense*, sp. nov.

Black, the legs bright red, the 4 anterior coxæ tinged with yellow, black above, the hinder black ; mandibles and tegulæ pale yellow ; palpi rufo-testaceous. Wings hyaline, the stigma and nervures dark fuscous ; the areolet has a distinct pedicle, is somewhat larger than usual, 4 angled, developed behind and receiving the recurrent nervure in the middle. ♀ and ♂.

Length 7-8 mm.

Base of metanotum closely punctured ; the areola small, square, with thick shining keels ; the posterior median area is closely, strongly, regularly transversely striated ; the lateral area is more strongly, irregularly, and more widely striated ; below it becomes narrowed to a sharp point and does not extend to the apex ; the apical slope is distinctly depressed. Face roundly dilated, opaque, minutely punctured ; it and the clypeus are thickly covered with long white pubescence ; front and vertex minutely, closely punctured. Abdomen smooth and shining.

The basal lateral area is not clearly defined, nor is the apical distinctly separated from it ; the apical slope is more depressed than usual.

*Limnerium forticarinatum*, sp. nov.

Black, the legs, except the coxæ, red, the hind tarsi, except at the base, infuscated ; the spurs pale ; the mandibles, except at the apex, and the palpi yellow ; wings hyaline, the stigma fuscous, the nervures black ; the tegulæ yellow. ♂.

Length 6 mm.

Quetta. March and August.

Head alutaceous, the face, cheeks and lower outer orbits densely covered with longish white pubescence. Pro- and mesothorax alutaceous, covered with short white pubescence, the post-scutellum with a fovea on the sides at the base. Metanotum deeply depressed at the base ; the areola large, distinct ;

the lateral keels stout, uniting at the base, becoming gradually roundly widened to the apex, which is closed by a narrow, not very distinct, transverse keel; the keels of the areola are continued round the outer edges of the apical slope; from the outer side of the base a less distinct keel runs to the central keel, uniting with it near its apex, the metanotum is finely closely rugose; the apical slope is strongly, closely, transversely striated; the striæ are somewhat twisted. On the metapleuræ the spiracular region is bounded above and below by a stout keel; beyond the spiracles this area bears somewhat stoutish, more or less broken striæ; the median segment densely covered with longish white pubescence. Areolet with a longish pedicle; the outer transverse cubital nervure is longer and more roundly curved than the inner; the areolet projects below angularly; the recurrent nervure is received distinctly beyond the middle.

The median segment at the base is broad, clearly separated from the apical slope, which is almost perpendicular. In *L. quettaense* the slope is gradually rounded from the base to the apex, the segment thus appearing shorter; *quettaense* has not a distinct areola, the apical slope is more depressed in the middle and not so strongly striated: it is a larger species and the 4 anterior coxæ and trochanters are red, not black as they are in the smaller species. The latter, too, has not a petiolar area as has the larger species, in which also the areolet is larger and the recurrent nervure is received in its middle.

*Limnerium parvicarinatum*, sp. nov.

Black; the antennal scape reddish yellow below; the legs red; all the coxæ, the 4 anterior trochanters at the base narrowly, the basal joint of the hinder, the apex of the hinder tibiæ and the hind tarsi except at the base narrowly, black; the 4 anterior tibiæ and tarsi largely tinged with yellow; the base of the hind tibiæ and of the hind tarsi pale yellow; wings hyaline, the nervures and stigma black; the areolet 4-angled; the nervures meeting in front; there is a distinct pedicle, half the length of the apical nervure, which is largely bullated below; the recurrent nervure is received in the middle; the transverse median nervure is received shortly beyond the transverse basal. ♂.

Length 7 mm.

Quetta, June.

Median segment closely rugosely punctured, thickly covered with longish white pubescence; the apical slope depressed in the middle, coarsely irregularly striated; there is a broadly curved keel in the centre of the base. Upper half of propleuræ closely rugosely punctured; the lower half stoutly striated, the striæ clearly separated; the meso- and metapleuræ closely finely rugosely punctured; the latter more strongly than the former, which, on the upper apical half, is strongly longitudinally striated; its lower part bordered by a crenulated furrow. The upper part of the metapleuræ is closely, obliquely, not very distinctly, striated. Face opaque, alutaceous, thickly covered with white pubescence; the clypeus obscurely punctured, the front and vertex closely punctured. Mandibles black. Palpi pale yellow.

The 3 species of *Limnerium* here described may be separated thus: —

*a* Metanotum not areolated, only a short, curved transverse keel at the base; the transverse median nervure not interstitial ... *parvicarinatum*.

*b* ♂. Metanotum more or less areolated, the transverse median nervure interstitial.

Pedicle of areolet half the length of the basal transverse cubital nervure; the 4 anterior coxæ and trochanters reddish-yellow: apical slope of metanotum irregularly, transversely, strongly, but not closely, striated ..... *quttaeuse*.

Pedicle of areolet longer than the basal transverse cubital nervure, the 4 anterior coxæ and trochanters for the greater part black; apical slope of metanotum closely regularly transversely striated, the striæ curved ..... *forticarinatum*.

*Paurolexis*, gen. nov.

Wings without an areolet; the recurrent nervure received shortly beyond the transverse cubital. Radial cellule short, not reaching to the middle of the apical margin of the wing; stigma wide, triangular. Cubitus and discoidal nervures obsolete; transverse median nervure interstitial; 2nd discoidal cellule at the base about one-fourth of the width of the apex. Apical nervures in hindwings obsolete. Metathoracic spiracles round. Metanotum completely areolated; the areola twice longer than wide, the base narrowed to a point, the apex transverse. Apex of clypeus rounded; it is indistinctly separated from the face in the middle; distinctly laterally by an oblique furrow. Mesopleuræ with a crenulated furrow above the middle. Abdomen not strongly compressed, stout; the petiole long, its basal third narrowed, the apical part dilated; it is smooth and has an elongated ovipositor. Eyes bare, large; malar space as long as the antennal scape. Claws simple. Basal joint of hind tarsi about as long as the following 3 united.

There are 9 areæ on the metanotum in 3 rows, besides the spiracular, which is not closed on the outer side; the petiolar is twice longer than the width at the base; it is narrowed to a point at the apex. Fore tarsi twice the length of the tibiæ. Head transverse, narrowed behind; wider than long. There is no malar furrow. The areola of metathorax is closed all round.

In the Ashmeadian-Foersterian system this genus would come near *Zaporus*, which has the claws toothed. The absence of the apical nervures in both wings, the short radial cellule, long abdominal petiole sharply narrowed at the base and transverse head, with short temples are probably characteristic points of distinction.

*Paurolexis flavus*, sp. nov.

Pallid yellow, a conical mark in the depression above each antenna, 3 large lines on the mesonotum, the larger being the central, a transverse mark on the base of the scutellum, a line round its sides and apex, a line, dilated in the middle, on the base of the metanotum, a transverse mark at the top of the mesopleural furrow, a longer at the lower part; 2 marks, above and below, on the base of the prothorax and the greater part of the meso- and metasternum

black. The base of the abdominal petiole, a large mark, commencing behind its middle and reaching close to the apex, the basal part narrow, not reaching to the sides; a line along the base of the 2nd segment continued along the sides to near the apex; from the centre of the basal stripe one, of similar size, runs down the middle to a large transverse band in the middle of the segment: there are broad black bands on the base of the 3rd and 4th segments following by broad brownish red ones; similar but much narrower bands are on the 5th and 6th. Legs coloured like the body, the hind trochanters, femora and tibiæ marked with black. Wings hyaline, iridescent, the stigma pale in front, fuscous behind; the nervures black. ♀.

Length 7-8; terebra 3-4 mm.

Except the metanotum, which is distinctly, but not closely punctured, the body is smooth, shining and almost bare; the posterior median area is transversely striated; its basal half is obliquely narrowed; the basal lateral area is wider than long; the central about 3 times longer than wide, the apical not much longer than wide.

PIMPLINÆ.

*Pimpla nursei*, sp. nov.

Black; the legs bright red, the 4 anterior coxæ black; the knees pale yellow; wings hyaline, the costa and nervures black, the stigma fuscous, white at the base; the tegulæ whitish yellow. ♀.

Length 12; terebra 10 mm.

Quetta. May.

Face shining, roundly dilated in the middle, distinctly, but not closely punctured, thickly covered with dark fuscous pubescence. Labrum pale. Palpi black. Thorax shining, closely, strongly punctured; the base of the metanotum is more strongly, but not so strongly punctured; in its centre is a shining depression, about one half longer than wide and with raised sides; the apical slope is closely, somewhat irregularly transversely striated; the upper half of the metapleuræ is strongly closely, the lower much more sparsely punctured; the two parts being separated below the spiracles by a keel. Abdomen strongly and closely punctured; the punctuation becoming gradually weaker; the apices of the segments are smooth and shining. The tibiæ and tarsi are thickly covered with white pubescence, which makes them appear paler than the femora. The areolet is almost appendiculated, the nervures uniting in front.

*Lassomota baluchistanensis*, sp. nov.

Head and thorax yellow, largely marked with black; the abdomen rufous; the base of the 1st segment broadly, its apex more narrowly and the apices of the 2nd and 3rd segments still more narrowly, yellow. Legs—the 4 anterior yellow, suffused with fulvous; the femora narrowly streaked with black; the hind legs rufous, the coxæ and trochanters yellow, the former on the inner side largely black, on the outer basal half with a large brown mark. Wings

hyaline, the apex with a smoky cloud ; the areolet shorter than the pedicle, triangular ; the recurrent nervure received at the apex. ♀.

Length 12 mm. ; terebra 10 mm.

Quetta. July.

Antennæ rufous, the scape yellow below ; the basal joints of the flagellum blackish. Head covered with a sparse, minute pale pile ; the centre of the front and a mark on the vertex wider than long, united to a wider one on the occiput, black. Face closely, the front and vertex more strongly, but not so closely punctured. Thorax somewhat strongly and closely punctured ; on it the following parts are black : on the centre of the mesonotum is a black line of equal width and about 3 times longer than wide, a slightly broader line round the sides of the apical two-thirds and round the apex, the sides of the scutellum, a large triangular mark on the sides of the metanotum, extending shortly beyond the middle, its outerside straight, the inner rounded ; the base of the mesopleura, an oblique line under the tubercles, the apex, the line dilated above the middle, a curved line on the sides of the mesosternum, the metasternum and the extreme apex of the median segment, black.

The transverse median nervure is received very shortly beyond the transverse basal. Tarsi spinose.

CRYPTINÆ.

CRYPTINI.

*Cryptus violaceotinctus*, sp. nov.

Black, a large yellow mark on the apex of clypeus ; the femora, anterior tibiæ and the abdomen, except the petiole, red ; the wings hyaline, tinged with violaceous, especially at the apex. ♂.

Length 15 mm.

Quetta. April.

Face closely, strongly punctured, thickly covered with long white pubescence. Clypeus shining, smooth, punctured in the middle ; the apex depressed. The lower inner orbits have a pale narrow border.

Front furrowed down the middle, strongly obliquely striated, except on the lower outer edge, where it is smooth and shining. Mesonotum somewhat irregularly punctured ; the apical slope striated finely and closely in the middle, the sides smooth. Metanotum closely rugosely reticulated punctured, the reticulations more distinct between the keels. Propleuræ closely rugose, striated in the middle. Mesopleuræ rugosely punctured above ; the middle closely, obliquely reticulated-striated ; the lower part shining, impunctate, irregularly aciculated. Areolet large, almost square, slightly converging in front ; the transverse median nervure is received very slightly behind the transverse basal, almost interstitial.

The middle tibiæ are rufous below ; the parapsidal furrows deep, crenulated closely, the calcaria dark testaceous ; the pubescence on the head and thorax is dense, short, pale ; the 2 transverse keels on the metanotum are stout.

Major Nurse has taken a *Cryptus* in Kashmir which is closely allied to the above. The two may be separated readily.

Abdominal petiole red; apex of abdomen blue-black; anterior tibiæ black ..... *nursei.*

Abdominal petiole black, apex of abdomen red; anterior tibiæ red..... *violaceotinctus*

I give here a description of *C. nursei*.

*Cryptus nursei*, sp. nov.

Black, the basal 3 segments of the abdomen, the base of the 4th and the femora red; the apical segments of the abdomen tinged with blue; the wings hyaline, distinctly tinged with violaceous, the nervures and stigma black. ♀.

Length 15 mm.; terebra 8 mm.

Kashmir—8—9,000 feet. June.

Face and base of mandibles thickly covered with long white pubescence: the clypeus with longer black hair; the face closely punctured; the clypeus more shining and more sparsely punctured. Front deeply excavated, strongly transversely striated and with a keel down the middle; the striæ on the upper half are stronger, more oblique and curved; the inner orbits are bordered by a pale coloured keel. Mesonotum shining, strongly but not closely punctured; the middle lobe at the base closely transversely striated, as is also the apical slope. Scutellum sparsely punctured.

Metanotum closely rugosely punctured; the space between the keels in the middle irregularly, stoutly, more or less longitudinally striated, its sides closely reticulated, strongest below at the tooth. Pleuræ closely, strongly rugosely punctured; the punctuation on the mesopleuræ runs into reticulation. Abdomen smooth and shining. Areolet large, about one-fourth longer than wide, angled below where the recurrent nervure is received shortly beyond the middle.

*Phædrophaulnus*, gen. nov.

Areolet large, not much longer than wide, the sides not converging in front; transverse median nervure received beyond the transverse basal; transverse median nervure in hind wings broken in the middle. Median segment short, obliquely depressed at the base, strongly, closely striated; there are 2 transverse keels; its spiracles longish oval, about two and a half times longer than wide. Abdominal petiole long and slender, not dilated at the apex, the post-petiole not being defined. Tarsi spinose, a number of spines at the apices of the joints, the tarsi in the ♂ have the 3rd and 4th joints marked with white. The antennæ are of uniform thickness in the ♀; in the ♂ they are slightly narrowed towards the apex. There is a distinct malar space; it is nearly as long as the antennal scape. Clypeus roundly convex, but not separated from the face by a suture.

Comes nearest to *Acroricnus-Tinocerus*, Tosch., which may be known from it by the metathorax not being striated. Also to *Bathycrisis*, Cam. from Ceylon; that genus is easily separated by the interstitial transverse basal nervure, by

the disco-cubital nervure being broken by a stump and by the transverse median nervure in hind wings being broken distinctly below the middle.

*Phædrophadnus striatus*, sp. nov.

Black, shining, the basal 4 segments of the abdomen, the 4 anterior femora, tibiæ and tarsi, the hind femora and base of hind tibiæ broadly, red ; the 10th and 11th joints of the antennæ white ; wings hyaline, the stigma and nervures black. ♀ and ♂.

Length 7 mm. ; terebra 1-5 mm.

Quetta. May and June.

Face and clypeus strongly, closely punctured : the inner half of the malar space opaque, coarsely aciculated, the outer and the temples smooth and shining ; the centre of the front strongly irregularly reticulated-striated. Temples very short, the occiput rounded. Pro- and mesothorax closely punctured, the pleuræ more strongly than the upper surface ; the lower half of the propleuræ striated ; the scutellum is more sparsely punctured, particularly in the centre. Base of metanotum obliquely depressed ; the centre is almost impunctate ; the sides closely punctured ; the space between the 2 keels is strongly longitudinally striated-reticulated ; the apical slope has the sides closely longitudinally striated-reticulated ; the centre more irregularly transversely-obliquely striated. Abdomen smooth and shining. The palpi are for the greater part testaceous.

The ♂ has a narrow elongated petiole like the ♀ ; it may be black at the base to the middle. The stump of a nerve on the disco-cubital may be distinct, indistinct, or absent.

*Mesostenini.*

*Mesostenus tricarinatus*, sp. nov.

Black, the sides of the face broadly, the clypeus except at the apex, basal half of mandibles, the inner orbits narrowly, a short narrow line on the centre of the outer, the scutellar keels ; its sides broadly, the greater part of the tegulæ and the tubercles, pale yellow ; the abdomen, except the base of the petiole, red ; the legs red, the posterior deeper in tint than the others ; the 4 anterior coxæ and trochanters whitish yellow except above ; the hind coxæ, trochanters, apical third of tibiæ, the basal joint of tarsi, base of 2nd and the apical, black ; the rest of the hind tarsi white. Antennæ black, the apical joints brownish below. Wings clear hyaline, the nervures and stigma black. ♀.

Length 8 mm.

Quetta. May.

Face and clypeus strongly punctured, thickly covered with white pubescence. Front closely rugosely punctured, the punctures intermixed with fine longitudinal striæ ; there is a distinct keel down the middle. Vertex closely punctured at, and around, the ocelli ; the sides shining, sparsely, finely punctured. Pro- and mesothorax strongly, closely punctured ; covered with a white down. Scutellum more shining and much less closely punctured. Metanotum with 2

stout transverse keels ; the apical more projecting backwards in the middle ; the base is strongly punctured, with a smooth shining space on either side of the middle ; the space between the keels is much more closely rugosely punctured and more or less reticulated ; the apical slope is stoutly transversely striated, the striæ being clearly separated. The metapleuræ are more closely, rugosely punctured than the rest. Parapsidal furrows distinct. Abdomen smooth ; the petiole long and slender. Hind coxæ closely, strongly punctured. Areolet narrow twice longer than wide ; the recurrent nervure received at the apex.

This is a *Mesostenus sensu str.*

ICHNEUMONINÆ.

*Heresiarchini.*

*Fileanta rufo-cauda*, sp. nov.

Black, face, clypeus, mandibles except at extreme apex, a narrow line on the upper inner orbits, inner side of malar space, palpi, a line on the pronotum tubercles, tegulæ, the basal two-thirds of the 2nd and 3rd abdominal segments the basal half of the 4th, the 4 front legs ; the hinder trochanters, base of tibiæ broadly and the hind tarsi, bright lemon-yellow ; the antennal flagellum, hind femora, apical two-thirds of hind tibiæ, the 4th abdominal segment behind the black, and the 5th and 6th rufous ; the apical segments lemon-yellow as is also the antennal scape. Wings hyaline, slightly tinged with fulvous ; the stigma fulvous, the nervures black. ♂.

Length 13 mm.

Quetta. May.

Face and base of clypeus closely strongly punctured, thickly covered with short white pubescence, the apex of the clypeus smooth. Front rugosely punctured, more or less striated above; the vertex and occiput closely, distinctly punctured, the latter closely striated above. Pro- and mesothorax closely, strongly punctured ; the mesopleuræ more or less striated in the middle ; the metapleuræ closely, strongly striated. Metanotum closely strongly reticulated-punctured ; the areola more distinctly reticulated , it is large, almost square, slightly obliquely narrowed laterally at the base ; it is transverse there as also at the apex ; the 2 lateral areæ and the petiolar are clearly separated. There are 3 areæ on the apical slope. Areolet 5-angled, narrowed in front ; the transverse median nervure is received shortly beyond the transverse basal ; the disco-cubital nervure has a minute stump.

This species is not unlike *F. balteata*, Cam., from Ferozepore ; the two may be known by the differences noted below.

The 5th and 6th abdominal segments black, the areola narrowed at the apex, basal half of petiole almost smooth ..... *balteata.*

The 5th and 6th abdominal segments rufous, the areola narrowed at the base, basal half of petiole strongly, closely, transversely striated ... *rufo-cauda.*

The post-petiole in *rufo-cauda* is closely, strongly, longitudinally striated in the middle ; the sides are punctured ; the punctures intermixed with striæ ; the base of the petiole closely, strongly, transversely striated. Gastrocœli

shallow, indistinct; the base has a few longitudinal keels; the apex is transversely striated.

BETHYLIDÆ.

*Epyris rugicollis*, sp. nov.

Black, shining; the antennæ, mandibles, the apex of the 3rd abdominal segment narrowly and the whole of the following, red; wings hyaline, the anterior in front slightly tinged with fulvous, the stigma and nervures pale fuscous, the parastigma white; the posterior pair ciliated. ♀.

Length 8 mm

Quetta. June to August.

Head about one-third longer than wide, shining, bearing distinct, clearly separated punctures, except between and at the sides of the ocelli; the hinder ocelli are bordered by a deep furrow; the hairs are sparse, long and pale fulvous. Temples as long as the eyes; the sides of the occiput rounded. Malar space almost obsolete. Mandibles sparsely covered with fulvous hair; on their upper half are 2 irregular rows of large punctures. Pronotum punctured like the head; it is not quite so long as the latter; the collar is distinctly separated; closely finely, rugosely, punctured. Mesonotum smooth, irregularly punctured in the middle. Scutellum transverse at the base, gradually narrowed to a bluntly rounded point; it is smooth, sparsely punctured on the sides and apex; on the sides at the base is a deep somewhat oval fovea, longer than broad, and oblique. Metanotum not quite so long as the mesonotum and scutellum united; there are 5 longitudinal keels, the central of which is prolonged to the apex of the segment; outside the 5 is a less distinct more twisted one which converges towards the central ones at the apex and runs through the striæ; between the keels are irregular transverse striæ; the sides, outside the keels, are closely, regularly transversely striated as is also, from near the top, the apical slope; on the latter the upper striæ are more irregular. Pro- and mesopleuræ sparsely punctured, the latter more strongly than the former; on the latter is a distinct curved, crenulated furrow, commencing near the top at the apex, curving back towards the base, then downwards to the middle coxæ. Metapleuræ strongly closely striated. Fore femora largely swollen, narrowed towards the apex; apex of tarsal joints strongly spinose; the femora and tibiæ are sparsely covered with white hair, the metatarsus is thickly covered with white hair below. Of the apical alar nervures only the radius is indicated. The transverse median nervure is roundly curved outwardly, the upper part being more obliquely sloped than the lower; the radius extends half way to the apex of the wing.

# ON THE TENTHREDINIDÆ AND PARASITIC HYMENOPTERA COLLECTED BY MAJOR C. G. NURSE IN KASHMIR.

BY

P. CAMERON.

## TENTHREDINIDÆ.

*Rhogogastera litubereulata*, sp. nov.

Olive green, the vertex, the front, the mark irregularly narrowed towards the apex, it extending broadly behind to the middle of the eyes, the olive coloured space behind being gradually narrowed on the innerside, the mesonotum, median segment, back of abdomen, a broad, irregular mark bordering the breast, a straight line on the upper three-fourths of the apex of mesopleuræ, upper part of metapleuræ, antennæ, their tubercles, the apex of the hind femora, and the tibiæ and tarsi, black. Wings hyaline, the nervures and stigma black. There is a short olive line above each antennæ, a longish triangular line on the apex of the pronotum, a longish triangular mark on either side of the apex of the middle lobe of the mesonotum, the scutellum, except for a curved line on the base, the sides and apex of the 2nd abdominal segment, a more irregular one on the apex of the 3rd, the sides and apex of the penultimate segment narrowly, its centre broadly, the apical segment and all the ventral surface are olive. Apex of mandibles broadly black. Face smooth; the clypeus and labrum sparsely punctured. Basal half of clypeus deeply depressed, its apex broadly, roundly incised; on either side of the top is a round deep fovea. The antennæ are bordered on the inner side by stout projecting tubercles, broadly rounded at the apex. Ocellar region raised, clearly separated from the centre of the vertex by a furrow, the latter being bounded laterally by deep furrows. Mesonotum and scutellum distinctly but not closely punctured; the middle lobe of mesonotum deeply, widely furrowed. Basal segments of abdomen closely punctured. Pleuræ and sternum closely, somewhat strongly punctured.

The 4 anterior tibiæ are only black above. Antennæ stout, as long as the head and thorax united; their 3rd joint is nearly as long as the following two united.

Taken at an elevation of 6,000 feet in May.

*Athalia leucostoma*, Cam.

Zeits. für Hymen, u. Dipter., 1904, 108.

Probably a common species.

The Indian species of *Athalia* may be separated thus:

*a*. Hind tibiæ entirely black ..... ..... ..... *proxima, Kl.*

*b*. ..... black only at the apex.

1.—Abdomen spotted with black down the sides; the apex of hind femora black... .... ..... *nigromaculata*, Cam.

2.—Abdomen and hind femora not spotted with black.

Antennæ 13-jointed, mesonotum without black .. .. *antennata*, Cam.

Antennæ 11-jointed, sides of mesonotum black... *leucostoma*, Cam.

*Dosytheus kashmirensis*, sp. nov.

Black, the pronotum, mesonotum, basal 5 segments of the abdomen and the legs, except the apex of the hind tibiæ and the hind tarsi, rufous, the red of the abdomen tinged with yellow; wings hyaline, highly iridescent, the anterior tinged with fuscous; the nervures and stigma black. ♂.

Length 6 mm.

May, at an elevation of 5-6,000 feet.

Head, except for a large triangular space on the sides of the vertex, closely rugosely punctured; the sides of the vertex sparsely, strongly punctured; its centre more closely punctured, clearly separated. Apex of clypeus broadly, distinctly, roundly bilobate. Labrum closely punctured, dark honey-yellow. Oral region fringed with long pale fulvous hair. Thorax strongly and closely punctured; the scutellum is more closely, rugosely punctured than the mesonotum.

There is a form with the thorax entirely black and with the apical half of the hind tibiæ black.

CHALCIDIDÆ.

*Chalcis ornatipes*, sp. nov.

Black, densely covered with silvery pubescence, the tegulæ and legs lemon-yellow; the following parts of the legs black: the coxæ and trochanters, the basal half of the middle femora above, the basal half of the hind femora on the inner side, their 12 teeth and an irregular roundish mark near the middle on the outerside, black. Wings hyaline, the nervures black. ♀

Length 6 mm.

5-6,000 feet, April and May.

Front and vertex closely, rugosely reticulated, as are also the cheeks. The centre of the face is irregularly reticulated; there is a smooth plate dilated below, in the middle; this central part is clearly limited and becomes gradually narrowed below. Clypeus smooth and shining; it becomes gradually roundly narrowed above; on the inner side above is a row of not very distinct foveæ. Pro-mesonotum and scutellum closely, strongly rugosely punctured, the punctures running into reticulations. Apex of scutellum broadly bilobate; the part behind the lobes thickly covered with long pale fulvous pubescence. Metanotum stoutly, deeply reticulated, without a distinctly defined areola; on the sides there is a short tooth near the base and a larger, broader, rounded one in the middle. The second and following segments of the abdomen are closely and strongly punctured and thickly covered with longish fulvous pubescence. Base of propleuræ above closely punctured—aciculated—striated, smooth below; on the base of the mesopleuræ above is an elongated fovea followed by a round one; below are 2 pairs of similar foveæ; the

part below these becomes gradually obliquely dilated and is covered with deep round foveæ; the depressed apex on the upper half is irregularly, widely striated; the lower more strongly, closely and regularly striated. Metapleuræ coarsely, rugosely reticulated.

The teeth on the upper half of the hind femora are more closely pressed together than the lower.

## ICHNEUMONIDÆ.

### Ophioninæ.

#### *Banchini.*

*Ephonites ruficornis*, Cam.

Zeits. für Hymen. ünd Dipter., 1905, 77.

May, 5-600 feet.

The ♂ has not been described; it only differs from the ♀ in the antennæ being longer, and in the usual differences in the abdomen. I am not certain as to its exact systematic position. Nor am I certain if it will fit into any of the established tribes. I believe its true position is in the *Banchini*.

#### *Paniscini.*

*Paniscus montanus*, sp. nov.

Rufous, the orbits broadly, the face, clypeus and base of mandibles yellow; the wings hyaline, the costa and stigma testaceous, the nervures black. Face broadly, distinctly projecting in the middle; the upper half with a broad longitudinal furrow; it is separated from the clypeus by a broad, shallow furrow. Apical half of mandibles black. Ocellar region black. Pro- and mesopleuræ closely finely punctured; the metapleuræ closely obliquely striated; the spiracular region, except at the base, somewhat more strongly obliquely striated. The depression on base of metanotum is narrow, curved, smooth; the rest is closely strongly, transversely striated; the apical slope is smooth, at the apex, above striated; its sides bordered by a stout keel, which curves round inwardly at the top. The transverse cubital nervures almost unite in front; the 2nd is largely bullated below; it is almost interstitial with the recurrent nervure, which is broadly, roundly curved outwardly, from shortly below the top. Basal half of metasternal keel roundly dilated, above marked with a few keels. The stump on the disco-cubital nervure is minute. ♀.

Length 17 mm.

*P. longitarsis*, Cam., from Simla is paler, more yellowish in colour, the striation on the metapleuræ and spiracular region is much weaker and may be almost obsolete, the apex of the metanotum is irregularly striated, not smooth; the face wants the longitudinal furrow.

5-6,000 feet, May.

*Paniscus kashmirensis*, sp. nov.

Length 14-15 mm. ♀

May.

Very similar to *P. montanus* but smaller; the apex of the abdomen is infuscated; the depression on the metanotum is wider and deeper; there is no curved keel bordering the smooth apex of the metanotum; there is a distinct stump of a nervure on the disco-cubital; there is no furrow on the top of the face; there is no transverse division between the face and clypeus. The upper bulla on the recurrent nervure is large, the lower slightly smaller; there is a distinct stump of a nervure on it. The head is for the greater part yellow; the centre of the face is not clearly separated; the clypeus is covered with long black hair, the mandibles rufous, black at the apex. The black ovipositor is longer than the apical 3 segments of the abdomen united. Metasternal keel wide, narrowed at the apex, margined, the top with a few obscure striæ.

CRYPTINÆ.

*Cryptus nursei*, Cam.

(Journal, Bombay Natural History Society, Vol. XVII., p. 285.)
8-9,000 feet.

EVANIIDÆ.

*Gasteruption kashmirense*, sp. nov.

Black, the base of the anterior tibiæ narrowly, the basal half of the middle, a short line on the apex behind and a short band near the base of the hind tibiæ, white; wings hyaline; the nervures and stigma black. ♂

Length 14 m.m.

Kashmir, 8-9,000 feet, June.

Occiput transverse, sharply margined. Temples rounded, not quite so long as the eyes. Ocelli large, placed in a curve, the hinder separated from each other by a slightly greater distance than they are from the eyes. The head is opaque; the face and clypeus are densely covered with silvery pubescence. The upper tooth of the mandibles piceous. Thorax opaque; the pro- and mesopleuræ irregularly and indistinctly reticulated; the metapleuræ, except above, widely reticulated. Metanotum deeply, irregularly reticulated. Basal half of hind coxæ rugosely punctured above, the apical closely transversely striated. Antennal scape twice longer than wide; the 2nd joint is not much longer than wide; the 3rd is not twice its length and not much more than half the length of the 4th. Malar space nearly as long as the 2nd and 3rd antennal joints united. The 2nd cubital cellule is divided; the lower cellule is completely closed at the apex and below; its apex is largely prolonged, almost as far as the apex of the first cubital cellule.

This species, *G. baluchistanense*, Cam., and one or two undescribed Indian species of *Gasteruption sensu str.* are to be recognized by the second discoidal cellule being not only divided above, but closed below, the lower cellule in most species projecting forwards to or even beyond the apex of the anterior cellule. The nervures closing it may be bullated.

# THE KASHMIR TERMITE,
## *TERMOPSIS WROUGHTONI.*

By J. Desneux (Brussels).

It will be remembered that in Vol. XV (1904) of the Society's Journal, page 445, I gave a brief description of a new Termite from Kashmir, *Termopsis Wroughtoni*, the first Asiatic representative of the genus *Termopsis*.

As I then said, the few specimens received from Mr. Wroughton were damaged when they reached me, and it was not possible therefore to give from them a complete and precise description.

However, through the kindness of Mr. E. Radcliffe, of the Forest Service, who has procured me fresh material of the Termite in question, I am now able to describe it thoroughly.

Although I am preparing a monographic work upon the whole family of Termitidæ, I think it necessary to give here a full description of the Himalayan *Termopsis*, as there are many details of structure which could not be mentioned in the preliminary paper, and also as the latter includes some erroneous statements owing to the bad state of preservation of the specimens first examined by me.

The genus *Termopsis* (Heer) is characterized as follows:—

*Imago* with antennæ of 27-23 segments; ocelli totally absent; epistoma not prominent; pronotum nearly flat, narrower than the head; tibiæ with lateral spines; tarsi of peculiar structure: of four completely distinct joints, but in reality of *five* joints, of which the 2nd is but partly distinct from the first (see Fig. 3); a plantula between the claws of the tarsi; cerci long, of 8-5 joints; styli present in the male, well developed; wings large, less than four times as long as broad;* subcosta present in the front wings; radius strongly developed, with several branches to the costal border; media running about the middle of the wing; † the membrana occupied by reticulated nervures.

*Soldier*, very robust, with large, rectangular, flat head. Eyes present and small, or rudimentary. Antennæ of more than 20 segments.

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* The length of the wing being that of the membranous portion (not including the stump.)

† The terminology of the wing-venation here employed is that of Comstock and Needham now quite generalized. In my preliminary description of the *Termopsis* I made use of Hagen's old names of the veins, I must thus give here their equivalents: *costal border*=Costa of. Hagen, *radius*=subcosta id., *media*=Mediana id., *cubitus*=Submediana id. The true *subcosta* was not considered by Hagen as one of the principal veins in the Termites.

Mandibles very strong, their inner margin furnished with teeth. Pronotum narrower than the head, nearly flat. Cerci and styli are long or even very long.

The *workers* appear to be larval in shape.

In all castes the tarsi are of the same structure, but a plantula is present in the Imago only.

The genus *Termopsis* was established by Heer in 1849 for the reception of several fossil species from the amber of Oeningen (Prussia). In 1856, Hagen restricted Heer's genus by showing that several of his species had to be placed in *Hodotermes*, and in 1858, in the descriptive part of his Monograph of the Termites, he described the first *living* species, *Termopsis angusticollis*, from California. At the same time Hagen also placed in this genus, although in doubt, a peculiar soldier from Central America formerly described by Walker under the name *Termes occidentis*. I am, however, convinced that this does not really belong to *Termopsis*, a question which can be ultimately confirmed by the discovery of the winged form.

It was therefore a matter of the greatest interest to me to see that there was also a living *Termopsis* in the Indian Region, and I was most astonished that such a large and peculiar "white ant" had remained so long unknown.

*Termopsis Wroughtoni*, Desneux, Journal, Bombay Nat. Hist. Soc. XV, 1904, p. 445.

= *Termopsis Radcliffei*, E. Radcliffe, Indian Forester, 1904, p. 412.

*Winged Imago.*—Length of the body about 11 millimetres, to the tip of the wings 25 mm.

Head large, rounded, the upperside nearly flat, sometimes with the centre very slightly depressed, rather dark reddish-brown, darker in front; the Y-suture distinct.

Antennæ long, longer than the head and pronotum, of 24 or 25 segments; the 1st segment large, cylindrical; the 2nd smaller than the 1st but always longer than the 3rd; the 3rd to 5th segments variable in length: in some cases the 3rd is but little shorter than the 2nd, in others it is much shorter, being broader than long; the 4th is either subequal to the 5th or longer, or shorter; the segments beyond the 5th are more or less conical, differing but little in length, becoming more slender towards the apex of the antenna.

Eyes very large but not very prominent, close to the base of the antennæ, of quite unusual form amongst the Termitidæ: the anterior border being broadly emarginated so that the eye appears to be almost *reniform* (Fig. 1).

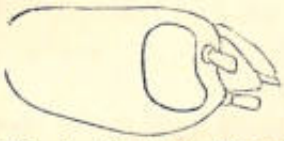

Fig. 1.—*Termopsis Wroughtoni*, side view of Imago's head.

Ocelli wholly absent.

Pronotum narrower than the head, nearly flat, the antero-lateral angles somewhat depressed with the border raised; nearly trapezoidal in form, narrowed behind; anterior margin nearly straight, very slightly emarginated in the middle, the sides slightly curved, the posterior angles obtuse, the posterior margin nearly straight, obscurely concave. The pronotum is reddish-brown, not so dark as the head.

Meso- and metanotum paler than either the pronotum or the abdomen, yellowish; broad, the posterior margins but little concave, nearly straight. Anterior wing-stumps much larger than the posterior but not overlapping them and even not reaching their base;* the border nearly straight. Wings large, less than 4 times as long as broad, the membrana almost uncoloured, slightly yellowish. The following description of the veins applies to the *anterior* wings: costal border nearly straight becoming curved towards the apex; subcosta present but short, unbranched, very close to the costal border which it reaches at some distance from the end of the stump; radius strongly developed, emitting two long branches from the stump, the first one reaching the costal border before the middle, the second beyond the middle; the radius emits further about 7 oblique branches towards the costal border in its apical half, the end ones anastomosing.

While the radial veins are strong and coloured yellow, the remaining veins are faint and uncoloured.

Media slightly concave, the greatest distance between it and the radius being about the middle; it divides generally in its second half (sometimes, however, before the middle), emitting 5 or 6 principal branches to the posterior border.

Cubitus reaching beyond the middle of the posterior border, emitting 10 or 11 oblique branches, mostly unbranched, the 5 or 6 first ones very close one to the other, the others more distant.

* In dried, shrivelled specimens, the anterior wing stumps may seem to reach the base of the posterior ones, but this is not the case in well-preserved specimens, nor consequently in the living ones.

The membrane of the wing occupied by a fine, distinct reticulation.

Length of anterior wing (without the stump) 20 millimetres, breadth of the same, 5·8 mm.

Legs of moderate size; femora broad; tibiæ with distinct lateral spines; tarsi of the typical generic structure, with a plantula between the claws.

Abdomen yellowish-brown.

Cerci very long, much longer than in any other known termite, of 7 or 8 segments, the last segment often a little longer than the two preceding ones together. The styli of the male are also the longest known, unsegmented, longer than (or at least as long as) the last segment of the cerci.

*Soldier.*—Length with mandibles 17-20 millimetres.

Head large and robust, depressed, flat, somewhat longer than broad, nearly rectangular, the sides being nearly straight and very slightly converging anteriorly; reddish brown, darker in front, this darker anterior portion of the head being limited by the diverging branches of the Y suture. The posterior border of the head is distinctly sinuate as shown in figure 2.

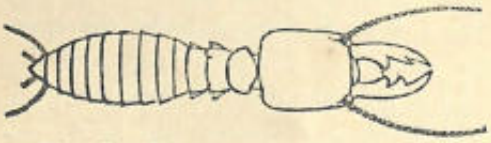

Fig. 2.—*Termopsis Wroughtoni.* Soldier (enlarged).

The eyes are present, black, small, ovate, not at all prominent and without facettæ. These eyes, though well distinct, are of course at a notably reduced stage.

Antennæ long, of 23 or 25 segments (sometimes 22); the basilar segment is large; the 2nd a little longer than the 3rd, which is shorter than the 4th; the 5 following ones about increasing a little in size towards the apex; those beyond becoming more slender towards the apex.

Labrum of moderate size, a little longer than broad.

Mandibles extremely robust, a little (in some cases very little) shorter than the head, black with the base often slightly reddish, the inner margin of both the right and the left with very strong teeth of peculiar irregular outline; the mandibles are nearly straight, with the tip incurved and acute.

Length of the head with mandibles 7-9·5 mm.; mandibles alone 3·6—4·5 mm.

Pronotum narrower than the head, nearly flat, the anterior margin irregularly convex, the postero-lateral margins converging, the posterior margin nearly straight. Meso- and metanotum as broad as the pronotum, their posterior margins subconvex; metanotum shorter than the mesonotum which is almost as long as the pronotum. The meso-thoracic and metathoracic epimera have the peculiar form of triangular appendices, externally free, prominent lobes. These I erroneously described in my former paper as wing rudiments, and, in fact, in the shrivelled specimens I had then under the eyes they quite looked like small alar lobes of the meso- and metanotum, but in well preserved specimens it is at once evident that they are lateral pieces of the thorax, peculiarly modified epimera. Legs robust, femora broad; tibiæ with distinct lateral spines, tarsi without plantulæ. Abdomen rather long, yellowish grey.

Fig. 3.—*Termopsis Wroughtoni*. Tarsus of a Soldier (much enlarged).

The cerci are slender and of very great length, nearly as long as the tibiæ of the intermediate legs (sometimes a little longer, sometimes a little shorter) consisting of 6 or 7 long segments, the last one the longest. In some cases the cerci appear to have 5 segments only, but there are then always traces of a division of the first one.

Styli very large, longer than the last segment of the cerci.

Amongst the specimens collected by Mr. Radcliffe, there are numerous nymphs 11 mm. long, with more or less developed wing buds, and also a number of specimens similar in shape to the nymphs, 10-11 mm. long, with distinct scars at the posterior borders of the meso- and metanotum, as if the wing buds had been broken there. These individuals are perhaps used as workers; their head is a little larger than that of the nymphs.

All nymphal individuals have the peculiar lobed epimera at the meso- and metathorax like the soldiers, but not the winged Imagos.

There can be no doubt that this species really belongs to the genus in which I have placed him, all the important characters are typical; bu on account of several peculiarities (form of the eyes in the Imago, wing-stumps, etc.) I have recently established for him a distinct subgenus, *Archotermopsis* (see Desneux, *Termitidæ* in "Genera Insectorum," XXV, 1904, p. 13.)

*Habitat.*—Kashmir Valley.

Mr. E. Radcliffe has recently published in the "Indian Forester" (1904, p. 412) some notes upon this Termite which, according to him is common in Kashmir in old stumps of *Pinus excelsa*.

In this paper Mr. Radcliffe said he discovered the *Termopsis* in question years ago, and this is apparently the reason why he changed the name I had given to it (*Wroughtoni*) into *Radcliffei*.

This gentleman has evidently overlooked the fact that once a name is given to an animal it cannot be altered for such a reason.

# THE POISONOUS SNAKES OF INDIA AND HOW TO RECOGNISE THEM.

By

Capt. F. Wall, I.M.S., C.M.Z.S.

Part II.

(*Continued from page 71 of this Volume.*)

*Naia tripudians*—The Cobra.

*Vernacular names.*—According to Fayrer the spectacled or binocellate cobra is called "Gokurrah" about Calcutta and the monocellate variety, which exhibits a single spot on the hood subject to much variation in size and shape, the "Keautiah". Both names appear to receive further qualification according to variations in colour. I have never heard these names in other parts of India, and it is probable that they are peculiar to Bengal. The former is the common variety in the Indian Peninsula, in which region the latter is decidedly rare according to my experience, but the converse holds good in Burmah and further East. In Bengal the distribution of the two forms seems to overlap, and both are common. In Bengal I have heard "Nag samp" and "Kala samp" as frequently in use as in other parts of India. In Madras it is called by the Tamils "Nalla pāmboo", and on the Malabar Coast is known as "Sairpoom" and "Moorookan". In Mysore it is the "Nagara havoo", and according to Russell "Nagoo" on the Coromandel Coast. It is the "Mwé howk" of the Burmese.

*Identification.*—I have no doubt that to most people living in India, the recognition of a cobra seems a very simple thing, and this is true as a rule. If the snake is seen alive at close quarters with the hood expanded, its identification will hardly admit of a doubt. Still it must be remembered that the hamadryad expands its hood to an almost equal degree, and that certain harmless snakes, especially the Keelbacks (*Tropidonoti*, and their allies), erect themselves, and flatten the neck, though to a lesser degree. The spectacle mark on the hood of the binocellate cobra, and the oval spot surrounded by an ellipse on the hood of the monocellate or Burmese variety, are both of them quite distinctive of this species, and if constant would make diagnosis invariably easy. Many cobras, however, have these marks so modified or obscured that most people unfamiliar with this subject, would fail to recognise them if reliance is placed on these alone.

After death the hood is obliterated, and if the creature is stiff cannot be readily demonstrated, and I have frequently under these conditions known people express surprise when told that the specimen is a cobra, shake their heads, and think they know better. Again, I have seen the loose skin about the neck of a harmless snake pulled out, and a hood claimed where none existed, so that one must admit that in a few cases, at least, the cobra is not recognised, and sometimes a harmless snake is mistaken for it. Nicholson's footnote on page 159 of his work on Indian snakes is a striking corroboration of my own experience. He says: "I have seen an Englishman, "considered rather an authority on snakes, declare that a *Ptyas* "*mucosus* (now *Zamenis mucosus*) just brought to me was a cobra; "he even pointed out the poison-fangs." So long as people continue to be guided by these faulty characters in diagnosis, mistakes are sure to occur.

Now there are one or two very distinctive peculiarities about the scales of a cobra which if looked for should place its identity beyond question. These are as follows:—

*The præocular shield touches the internasal* (see Pra. and Int., Fig. 16 B). In only one other snake is this relationship to be found, *viz.*, in *Xylophis perroteti*, a small harmless snake peculiar to the hills of Southern India. In this snake, though, the 3rd supralabial shield does not touch the nasal.*

*Between the 4th and 5th infralabial shields a small wedge-shaped scale occurs*, the "cuneate" (see Fig. 16 B). Sometimes a second or even a third similar scale borders the lower lip. This scale may easily be overlooked, lying partly or wholly concealed, as it may do, by the overlapping of the upper lip, so that the mouth should be opened when looking for it. It occurs in no other land snake. I have never even observed it in the hamadryad, but it is seen in a few species of sea-snakes. A head is rarely so broken that one or other of these points cannot be made out on one side. If, however, the head is mutilated beyond recognition there is one feature about the scales over the back of a cobra which is peculiar to itself. It is the concavity in the arms

* This is a very easy point to determine if it is remembered that the shields immediately behind the rostral (in land colubrines) are called internasals, and the shields touching the eye in front the præoculars. In the single instance, where the præfrontal shield touches the eye as in Fig. 19, it is obvious that this shield from its size and position has a prior claim to be considered a præfrontal, and in such a case the præocular is said to be absent.

of the bracket-shaped pattern which these form, and which I have

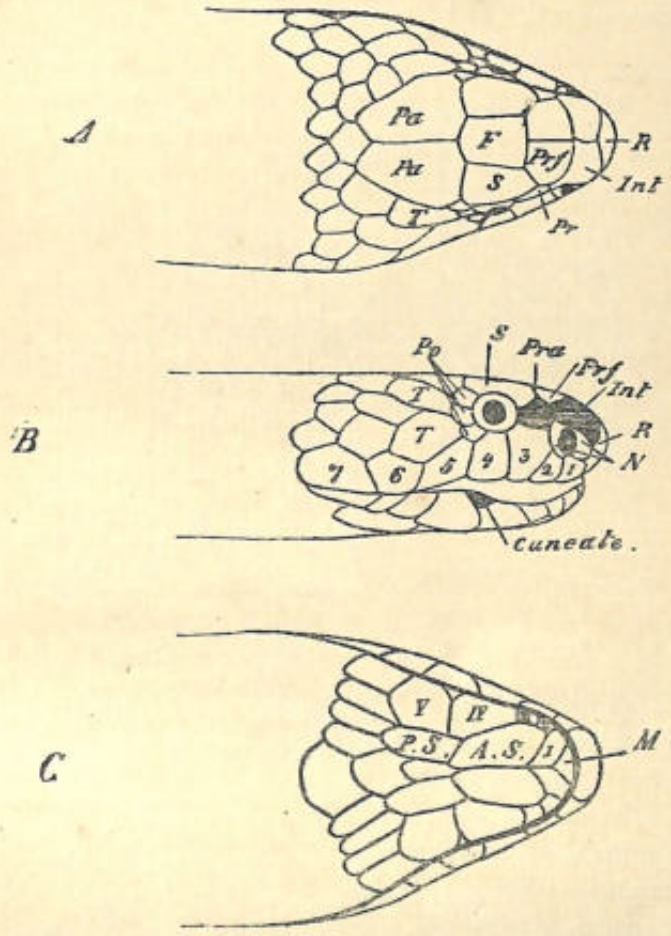


FIG. 16.—Naia tripudians (nat. size).

shown by thickened lines in Fig. 17. Besides this, I have placed another drawing to illustrate what is seen in other snakes, the pattern forming a chevron. This is perhaps rather a nice point which may require a practiced eye to determine positively, but to an observant enquirer there should be little difficulty, and with proper care the character is a very valuable one.

*Supplementary characters.*—*Præfrontals* touch the internasal, præocular, supraocular, and frontal. *Temporals* 2, the lower touching the 5th and 6th supralabials. *Supralabials* 7. *Anterior sublinguals* touch

4 infralabials. *Posterior sublinguals* touch the 4th and 5th infralabials. *Infralabials.*—The 4th and 5th are the largest of the series, and about

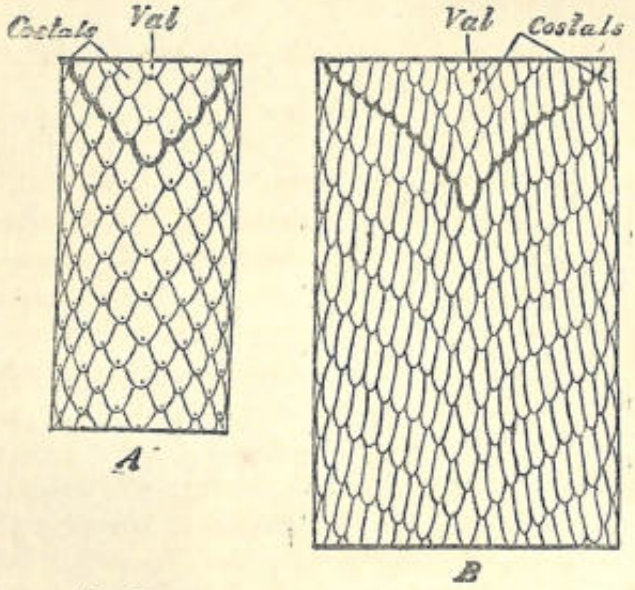


FIG. 17.—A. Scales on back of Lycodon aulicus.
B. " " Naia tripudians.

subequal. *Scales.*—2 heads lengths behind the head 19-27 ; midbody, 19 to 27 ; 2 heads lengths in front of the vent 15 usually (rarely 17). *Anal* entire. *Subcaudals* divided throughout.

*Distribution.*—It occurs in one or other of its many colour varieties throughout the whole of our Indian possessions from Burmah in the east to Sind in the west and from the Himalayas to Ceylon and is always a fairly common snake. It is an inhabitant of the plains, but it has been recorded at altitudes up to 6,000 feet.

*Poison.*—Undoubtedly fatal to man, but by no means every case of cobra bite necessarily will prove fatal ; on the contrary a percentage, hard to determine, escapes with moderate or very severe symptoms, the dose injected being less than the lethal. Fayrer records many fatal cases. In 8 of these cases stated to be due without doubt to the bite of a cobra, in all of which no treatment was tried, the victims died in from ½ to 3 hours.

*Dimensions.*—Grows to 6 feet 5½ inches, but 6 feet is a very exceptional length.

*Colour.*—Very variable. It may be any shade, from buff or wheat colour to olivaceous, brown, or tarry black. These hues are uniform,

or more or less variegated. The hood may be without marks, or adorned with a spectacle-like device, or an oval spot surrounded by an ellipse, or various modifications of these.

*Naia bungarus*—The Hamadryad or King Cobra.

*Identification.*—A pair of large shields are *in contact with one another* behind the parietals—see Oc., Fig. 18, and this alone will serve to distinguish this from every other snake.* Even if the head is badly mutilated I think this feature will be made out. In case, however, the point is dubious, the snake will be known by the existence of the following 2 characters which must co-exist. The shields under the base of the tail are entire, whilst those towards the extremity are divided, and the vertebral row of scales is similar in size and shape to the adjacent rows.

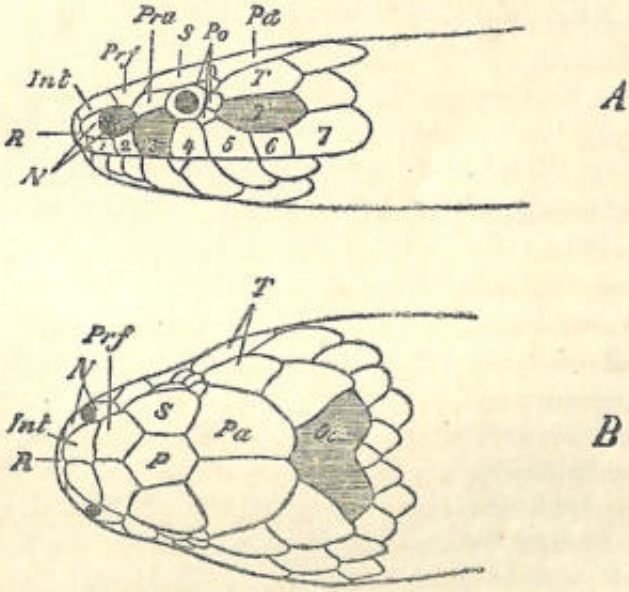


FIG. 18.—Naia bungarus (⅛ nat. size).

*Supplementary characters.*—*Præfrontals* touch the internasal, posterior nasal, præocular, supraocular, and frontal. *Temporals*—Two, the lower touching the 5th, 6th and 7th supralabials. *Supralabials* 7. *Anterior sublinguals* touch 4 infralabials. *Posterior sublinguals* touch the 4th

* In almost every other snake the parietals are succeeded by small scales and in the rare exceptions where occipitals are present, they do not touch one another (see Oc., Fig. 13).

and 5th infralabials. *Infralabials.*—The 5th is the largest of the series and touches 2 scales behind. *Scales.*—2 heads lengths from head 15 to 19, mid-body 15, 2 heads lengths in front of vent 15. *Anal* entire.

*Distribution.*—It is found throughout our Indian domains (with the exception of Ceylon, and I believe Western Rajpootana, Sind, and the Punjab) in suitable localities, that is, in jungles or their vicinity. It occurs in the plains, and in hilly regions up to an altitude of 7,000 feet at least.

*Poison.*—Undoubtedly fatal to man, but it is remarkable that a copious literature on this renowned snake, which is known to frequently show a most aggressive spirit, should furnish so few records of its bite. Theobald* saw a snake-charmer bitten by one in Burmah die within a few minutes.

Evans† mentions a case of a foolhardy Burman, believing himself snake-poison-proof, teasing one belonging to a Shan snake-charmer. He was bitten in the hand, and soon afterwards died. The same observer also records another instance of a Burman being bitten by one in the base of the index finger, with the result that he died shortly afterwards. He also furnishes another case in which this time the victim was a bullock, which was bitten by a hamadryad which the bullock cart passed over. The animal died soon afterwards.

Raby Noble‡ mentions one 10 feet 1 inch in length (identified by Mr. Phipson) making an unprovoked assault on a cooly woman in Assam, seizing her by the leg, and maintaining its hold for at least 8 minutes, when it was beaten off. She was treated by a "Doctor Babu" (treatment not specified), but succumbed in about 20 minutes. The symptoms were local pain and swelling, vomiting, laboured breathing, and prostration. Theobald§ records, on the information of a Burman, an elephant being bitten on the trunk by a hamadryad whilst browsing on some foliage, with the result that death ensued in about 3 hours. Rogers¶ estimates that the virulence of the poison is very little inferior to that of the binocellate cobra.

*Dimensions.*—The largest record I am aware of is that reported by Phipson.‖ The snake which was captured in the Konkan measured 15 feet 5 inches.

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* Cat. Rept. Brit. Burma, 1868, p. 61.
† Bombay Nat. Hist. Jourl., Vol. XIV., p. 418.
‡ Bombay Nat. Hist. Jour .. Vol. XV., p. 358.
§ Cat Rept. Brit. Burma, 1868 p. 61.
¶ The *Lancet*, Feb. 6th, 1904, p. 349.
‖ Bombay Nat. Hist. Jourl., Vol. II., p. 245.

*Colour.*—Young are jet black with white or yellow conspicuous cross bars or chevrons on the body and tail. The head is crossed by 4 similar bars, usually complete, sometimes interrupted.

Adults vary a good deal. They may be yellow, olive-green, olive-brown, blackish-brown, or black, usually with more or less distinct yellowish or whitish cross bars or chevrons on the body, which are narrower than the intervals. Light specimens are often more or less variegated with black in the hinder part of the body and tail. Often, too, the shields on the head and scales on the neck are bordered with black. The belly may be nearly uniform, mottled, or barred, but the throat is usually uniformly light-yellowish or cream-coloured.

*Callophis bibronii*—Bibron's Coral Snake.

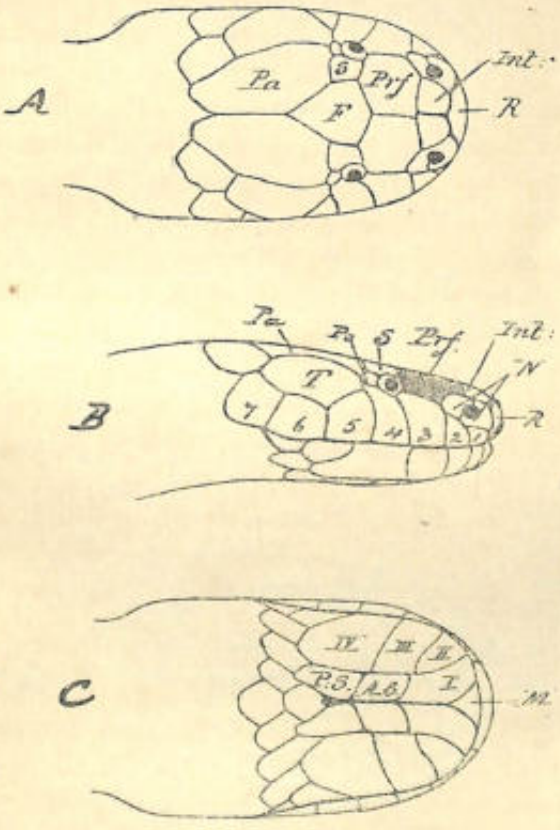



FIG. 19.—Callophis bibronii (× 3).

*Identification.*—It may be told from all others of this group by the fact that the præfrontal shield touches the 3rd supralabial (Prf. and 3, Fig. 19 B).

*Supplementary characters.*—*Præfrontals* touch the internasal, posterior nasal, 3rd supralabial, eye, supraocular and frontal. *Temporal* one; touching the 5th, 6th and 7th supralabials (and sometimes the 4th also). *Supralabials* 7. *Anterior sublinguals* touch the 1st, the 3rd and the 4th infralabials. *Posterior sublinguals* touch the 4th infralabial. *Infralabials.*—The 4th is the largest of the series, and

touches 3 scales behind. *Scales* are 13 in whole body. *Anal* entire *Subcaudals* divided throughout.

*Distribution.*—A rare species recorded only from the Western Ghats of India.

*Poison.*—Nothing known.

*Dimensions.*—Grows to 2 feet and over.

*Colour.*—Boulenger says *: "Cherry-red to dark purplish brown above, red beneath, with black transverse bands which are sometimes continuous across the belly; anterior part of head black above."

*Callophis macclellandii*—Macclelland's Coral Snake.

*Identification.*—From others of the group it can be distinguished by the following 3 characters co-existing:—The anal shield divided (as in Fig. 9 E); supralabials 7; and a single temporal touching only the 5th and 6th supralabials. (*See* Fig. 20 B.)

*Supplementary characters.*—*Præfrontals* touch the internasal, posterior nasal, præocular, supraocular, frontal. *Temporal* 1 touching the 5th and 6th supralabials. *Supralabials* 7. *Anterior sublingual* touch 4 infralabials.

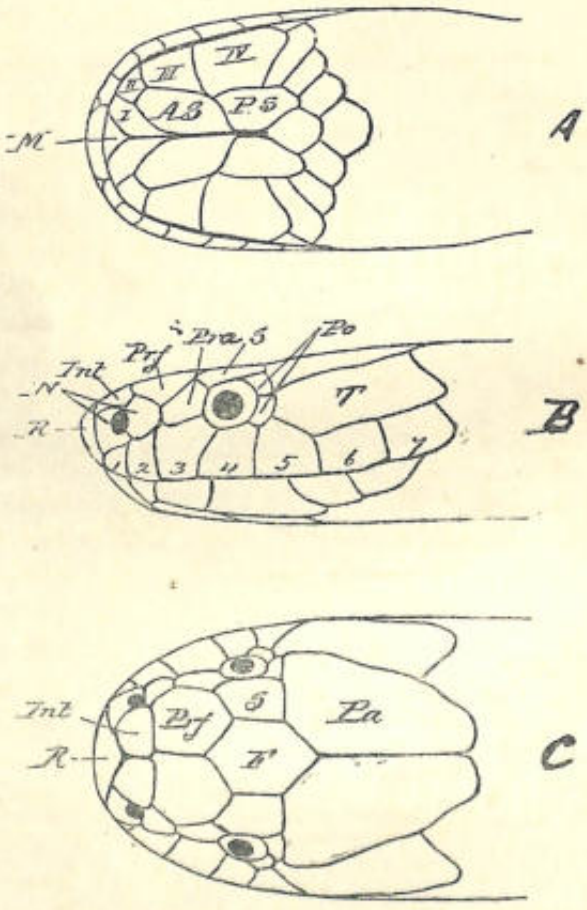



FIG. 20.—Callophis macclellandii (×3).

* Cat. Snakes, Brit. Mus., Vol. III, p. 399.

*Posterior sublinguals* touch the 4th infralabial only. *Infralabials.*—The 4th is the largest of the series, and touches 2 scales behind. *Scales* 13 in whole body. *Anal* divided. *Subcaudals* divided throughout.

*Distribution.*—An uncommon species, ranging through Burmah to Assam, Sikkim, and Nepal in the north.

*Poison.*—Nothing known.

*Dimensions.*—Grows to 2 feet and over.

*Colour.*—Reddish-brown, with or without black light-edged bars or bands. Belly whitish with black spots between the bands when present

*Callophis trimaculatus*—The Slender Coral Snake.

*Identification.*—Differs from others of this group in combining the 2 following characters. The anal shield is divided (*see* Fig. 5 E) and there are 6 supralabials.

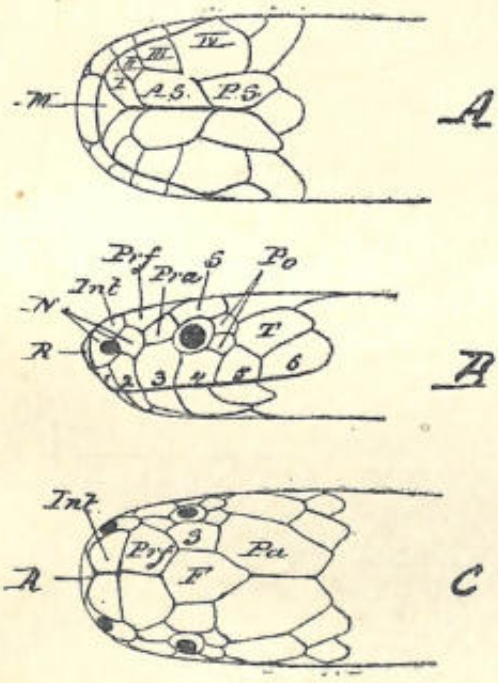



FIG. 21.—Callophis trimaculatus (×6).

*Supplementary characters.*—*Præfrontals* touch the internasal, posterior nasal, præocular, supraocular, and frontal. *Temporal*—One; touching the 5th and 6th supralabials. *Supralabials* 6. *Anterior sublinguals* touch 4 infralabials. *Posterior sublinguals* touch the 4th infralabial. *Infralabials.*—The 4th is the largest of the series, and touches 2 scales behind. *Scales* in 13 rows in whole body. *Anal* divided. *Subcaudals* divided throughout.

*Distribution.*—An uncommon snake recorded from S. India, Deccan, Kanara, Bengal, and Burmah.

*Poison.*—Nothing known.

*Dimensions.*—Of very slender form. Grows to 13 inches.

*Colour.*—Light yellowish-brown. Head and neck black. Tail with two black rings. Belly coral pink.

*Callophis maculiceps*—The Small-spotted Coral Snake.

*Identification.*—This and the next differ from others of this group in having the anal shield divided (as in Fig. 5 E) and the temporal shield touching the 5th, 6th and 7th supralabials. The habitat will separate one from the other.

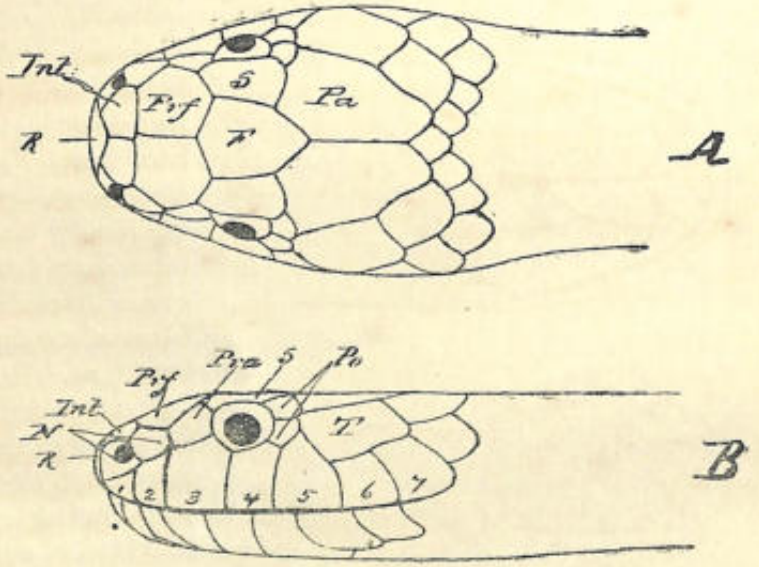



FIG. 22.—Callophis maculiceps (×6).

*Supplementary characters.*—*Præfrontals* touch the internasal, posterior nasal, præocular, supraocular, and frontal. *Temporal*—One; touching the 5th, 6th and 7th supralabials. *Supralabials* 7. *Anterior sublinguals* touch 4 infralabials. *Posterior sublinguals* touch the 4th infralabial. *Infralabials.*—The 4th is the largest of the series, and touches 2 scales behind. *Scales* 13 in whole body. *Anal* divided. *Subcaudals* divided throughout.

*Distribution.*—An uncommon snake restricted to the Burmese area of our British-Indian Territory.

*Poison.*—Nothing known.

*Dimensions.*—Grows to 1½ feet.

*Colour.*—Head and neck black. Body yellowish-brown above, with a series of small black dots on each side of the spine. Two black bands on the tail—one basal, the other subterminal. Belly coral pink. Tail dappled black, and grey beneath.

*Hemibungarus nigrescens*—The Common Indian Coral Snake.

*Identification.*—Like the last this differs from others of this group in that the anal shield is divided, and the temporal touches the 5th, 6th and 7th supralabials. Its habitat will distinguish it.

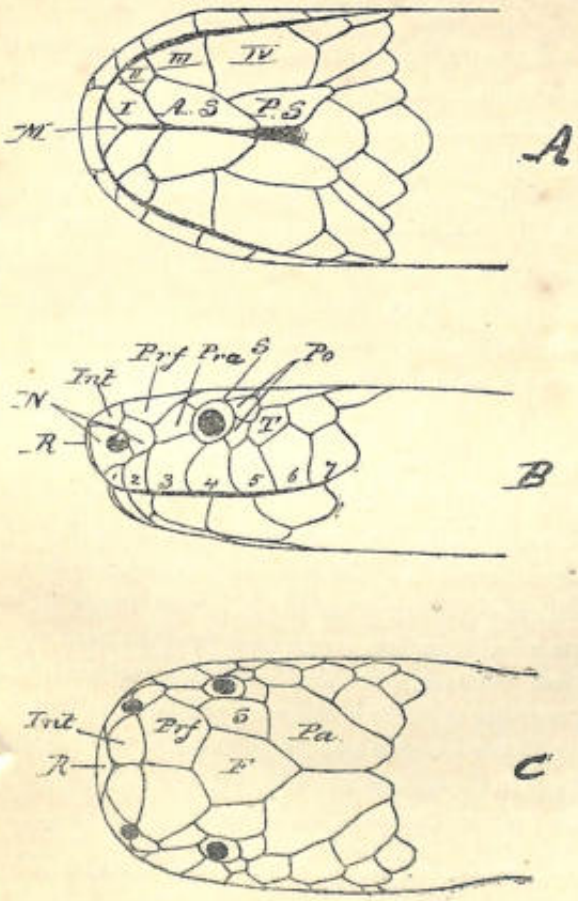



FIG. 23.—Hemibungarus nigrescens (×3).

*Supplementary characters.*—*Præfrontals* touch the internasal, posterior nasal, præocular, supraocular, and frontal. *Supralabials* 7. *Anterior sublinguals* touch 4 infralabials. *Posterior sublinguals* touch the 4th infralabial. *Infralabials.*—The 4th is the largest of the series, and touches 2 scales behind. *Scales* in 13 rows in whole of body. *Subcaudals* divided throughout.

*Distribution.*—It is a hill species confined to the Western Ghats of India including the Nilgiris and Anamallays.

*Poison.*—Nothing known.

*Dimensions.*—It grows to 4 feet.

*Colour.*—Head and neck black except for a yellowish oblique occipital streak. Dorsally purplish-brown, reddish-brown, or red, with 3 or 5 longitudinal series of spots which in some specimens are confluent, and form lines. Belly uniform red.

Group 4.—The Pit Vipers.

*Identification.*—(1) *Tail round.* (2) *A conspicuous opening in the side of the face between the eye and the nostril (the loreal pit) (see Fig. 24 B).*

This very distinctive character is peculiar to this subfamily of vipers. In spite of the fact that many members of this subfamily (Crotalinæ) attain formidable proportions, and almost all are endowed with remarkably large poison fangs, the numerous accounts of bites inflicted by them to be found in scientific and other journals, concur in showing that death is an exceedingly rare event. My own experience supported by that of many of my friends, who have favoured me with letters on this subject, entirely confirms the foregoing. A painful and swollen condition locally and a very variable degree of constitutional disturbance lasting in some instances for weeks passes on to complete recovery.

These snakes are nearly all exclusively confined to hilly regions at altitudes ranging between 1,500 to 10,000 feet. The characters of the shields, and scales upon which the classification of nearly allied ophidian forms is so largely based, are subject to very great inconstancy in the members of this group, so much so that it is with the greatest difficulty one can frame a lucid and really practical key to identify the various species. I have, however, examined and re-examined most critically all the specimens in the British Museum, and have only made allusion to those peculiarities which are most constant, and which seem to me of real practical use in identification.

Key for Identification of Pit-Vipers.

HEAD WITH LARGE SHIELDS (*see* Figs. 24 and 26).

Scales midbody in 21 or 23 rows (*see* Fig. 7) ... *Ancistrodon himalayanus.*

Scales midbody in 17 rows ..... „ *hypnale.*

Scales midbody in 15 or 14 rows ..... *Lachesis macrolepis.*

HEAD COVERED WITH SMALL SCALES (*see* Fig. 27).

SUPRAOCULARS UNDIVIDED (*see* So, Fig. 26). 2ND SUPRALABIAL DISTINCT FROM LOREAL PIT (*see* Fig. 27) ..... ..... *Lachesis strigatus.*

2ND SUPRALABIAL WITH A FURROW IN ITS UPPER PART DIRECTED INTO LOREAL PIT (*see* Fig. 28).

*MANY SMALL SUBOCULAR SCALES* (*see* Fig. 28)..... ,, *monticola.*

*AN ELONGATE SUBOCULAR SHIELD* (*see* So, Fig. 27).

*SCALES* 21 *OR* 19 *IN POSTERIOR BODY* (*see* Fig. 7).

Nasal and 1st supralabial partially or completely united (*see* Fig. 29).

*Scales in midbody* 29 *rows* (*see* Fig. 7) ..... ,, *cantoris.*

,, ,, ,, 27 *to* 23 *rows.* ,, *purpureomaculatus.*

Nasal and 1st supralabial distinct (*see* Fig. 31.) ..... ,, *mucrosquamatus.*

*SCALES* 17 *OR* 15 *IN POSTERIOR BODY* (*see* Fig. 7)

Supralabials 7 or 8 (*see* Fig. 32) ,, *jerdonii.*

,, 9 to 12 (*see* Fig. 33) ... ,, *gramineus.*

SUPRAOCULARS DIVIDED (*see* So, Fig. 34.)

Subocular touching 3rd supralabial (*see* So, Fig. 34)... ,, *trigonocephalus.*

,, not ,, ,, ,, (*see* So, Fig. 35)..... ,, *anamallensis.*

*Ancistrodon himalayanus*—The Common Himalayan Viper.

*Identification.*—The top of the head has the shields in front enlarged, and the scales in the middle of the body are arranged in 21 to 23 rows. These combined characters will distinguish this from the other pit-vipers, and even if the head is badly mutilated short of dissolution, I think the enlarged head shields will be generally clearly recognized.

*Distribution.*—It is confined to the Himalayan region, including the Khasi Hills of Assam, at altitudes between 5,000 to 10,000 feet, and is exceedingly common in some localities (Lidda Valley, Kashmir).

*Poison.*—In spite of its abundance I only know one authentic record of a bite inflicted by this species. A collector of Mr. P. W. Mackinnon's was wounded in trying to capture one recently near Mussoorie.

It struck at him, and scratched his thumb, but no ill effects, local or constitutional, supervened.

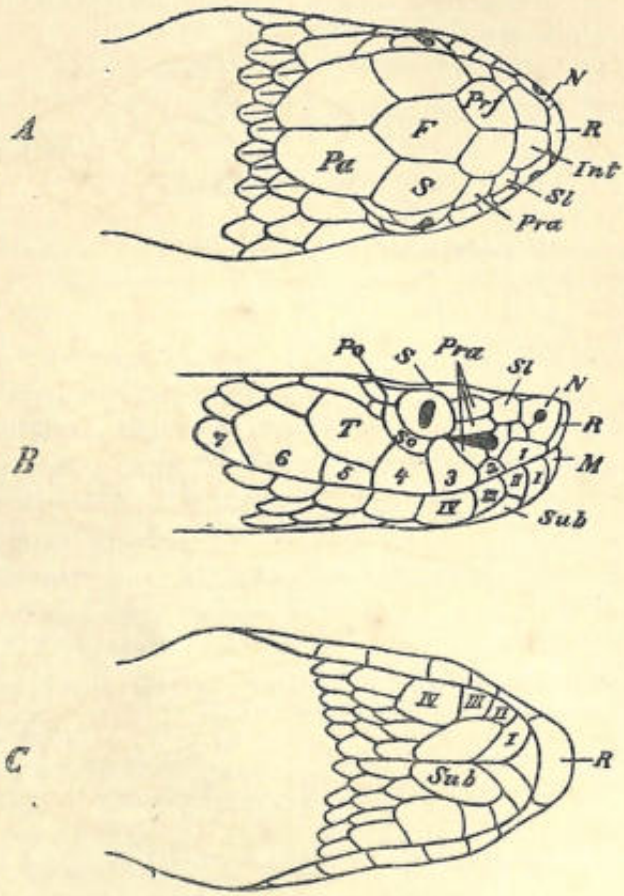



FIG. 24.—Ancistrodon himalayanus (×2).

*Dimensions.*—Boulenger gives 2 feet 10 inches. Its usual adult length is about 2 feet.

*Colour.*—Brown of various hues, sometimes nearly uniform, especially in light specimens, but more often mottled or variegated so as to form bars, or a nondescript carpet-like pattern. Belly peppered blackish and red, on a whitish ground.

*Ancistrodon hypnale.*

*Identification.*—Like the last this species has large shields on the front of the head, but differs in the scales, numbering 17, in the middle

of the body, and both these characters will usually be detected even in a badly mutilated specimen.

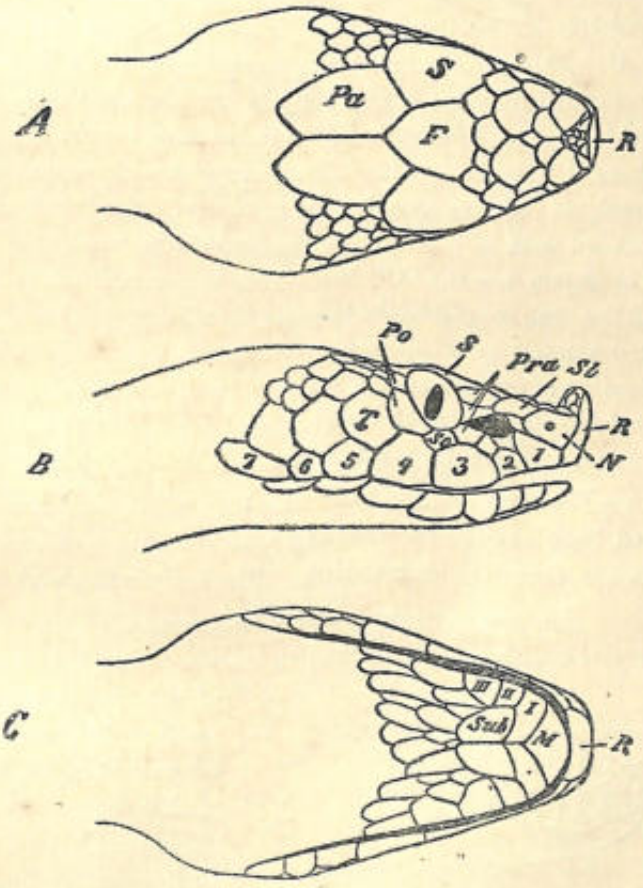



FIG. 35.—Ancistrodon hypnale (×3).

*Distribution.*—The hills of Ceylon, and the Western Ghats of India including the Anamallays. It occurs at altitudes varying from 3,000 to 6,000 feet and is not uncommon in many parts. It is a very common snake in some of the hilly districts in Ceylon (Hakgalla).

*Poison.*—Writers are not consistent upon this question. Tennent* says emphatically that a fatal issue does sometimes occur, but not invariably. Günther† says it is exceptionally fatal to man, and then not before the lapse of some days. Dr. Davy knew a dog bitten by one

* Nat. Hist. of Ceylon, p. 296. † Rept. Brit. Ind., p. 395.

recover after severe symptoms in 48 hours, but a fowl bitten by the same snake the next day succumbed after 4 days. These effects on small animals serve to show that the poison is not very virulent. Mr. Drummond Hay has written to me of two cases of bite, both in cooly women. One bitten on the ankle did not suffer in the slightest once she had recovered from her fright, but whether she was treated or not, I am unable to say. The other bitten in the hand became unconscious and he thought when he saw her the same night would die, but with the aid of stimulants had recovered by the next day. Ferguson* mentions the self-related facts of a Mr. A. F. Sanderson who was bitten by one. The seat of injury was the little toe. Pain was so acute as to prevent sleep, and the limb swelled to the knee for 2 or 3 days, but he recovered. He treated himself by ligature above the knee, cross cuts locally with the application of carbolic acid, and strong potations of brandy.

*Dimensions.*—Grows to 18 inches, but I have known females adult at 11½ inches, as shown by pregnancy.

*Colour.*—The prevailing colours are brown variously mottled or variegated, but a longitudinal series of largish oval dark spots on each side of the back is a constant characteristic. The belly is finely mottled.

*Lachesis macrolepis*—The Large-scaled Viper.

*Identification.*—One very distinctive feature makes the recognition of this snake a very simple matter. The scales of the last row along the body are smaller than in any of the other rows. In all other British Indian snakes the scales in this row are sub-equal to, or much larger than, those lying above.

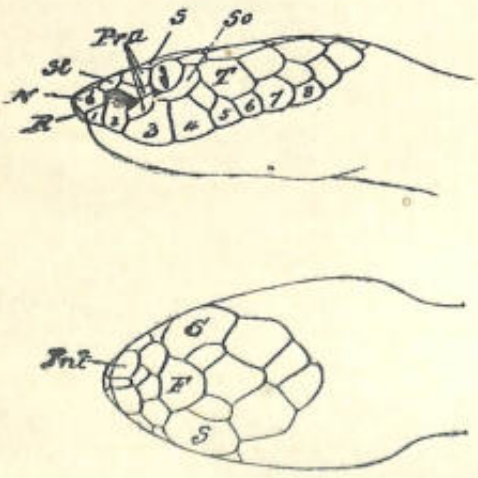



FIG. 26.—Lachesis macrolepis (nat. size).

*Distribution.*—Confined to the Pulney, Shevaroy, and Anamallay Hills of Southern India, where it is plentiful at altitudes varying from 2,000 to 7,000 feet.

* Bom. Nat. Hist. Journ., Vol. X., p. 9.

*Poison.*—Jerdon* knew several cases of bite from this species, but none proved fatal. The Rev. F. Castels has informed me that he once caused a fresh adult to bite a jackal, but the jackal did not seem to mind, and suffered no ill effects.

*Dimensions.*—Grows to 2 feet.

*Colour.*—Uniform bright foliage-green above, lighter beneath. A well-defined white or yellow line runs down the flanks, sometimes a blackish supercilium, blackish marks along the spine, and blackish rings round the tail, but these rapidly fade in spirit. Rarely specimens are met with uniform olive-brown in colour.

*Lachesis strigatus*—The Horse-shoe Viper.

*Identification.*—This is the only species in which the 2nd labial shield is entirely distinct from the loreal pit (*see* Fig. 27), and this alone will suffice to establish its identity.

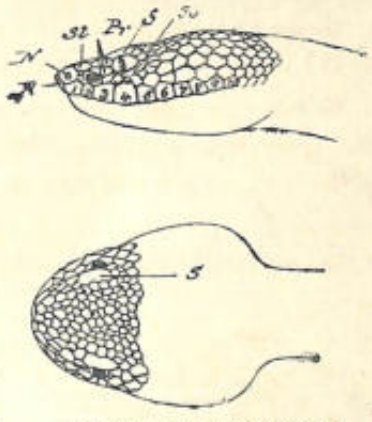


FIG. 27.—Lachesis strigatus (nat. size).

*Supplementary characters*: *Internasals.*—No scales are sufficiently enlarged to deserve the name. *Supraocular.* A single shield. *Nasal.*—Not united to 1st labial; one or more minute scales are intercalated between it and the furrowed shield forming the inner wall of the loreal pit. *Subocular*—Not touching the 3rd labial. *Scales*—Anterior usually 21, (rarely 19); midbody usually 21, (rarely 23); posterior usually 15, (rarely 17).

*Distribution.*—The Western Ghats and the Nilgiri, Anamallay, Shevaroy, and Pulney Hills of Southern India, at altitudes from 3,000 to 8,000 feet. Gray mentions it as common about Ootacamund, and Jerdon as not uncommon in the wooded parts of the Nilgiris; but, judging from the paucity of specimens in museums, and the written testimony of friends, it appears to me an uncommon snake everywhere.

*Poison.*—Jerdon† mentions being bitten by one. A ligature speedily applied, followed by suction, warded off any ill effects, but the skin

* Journal Asiatic Soc., Bengal, Vol. XXII., p. 525.

† Journal Asiatic Soc., Bengal, Vol. XXII., p. 524.

round the bite blackened in a minute or two, detached itself, and came off in his mouth during suction.

*Dimensions.*—Grows to 1½ feet.

*Colour.*—The prevailing colour is brown, mottled darker to form an irregular coarse variegation. A pale buff or yellowish horse-shoe mark on the nape. A dark streak behind the eye. Beneath light-coloured mottled with darker hues.

*Lachesis monticola*—The Large-spotted Viper.

*Identification.*—This is the only species that has no subocular shield, and this character will serve to diagnose it.

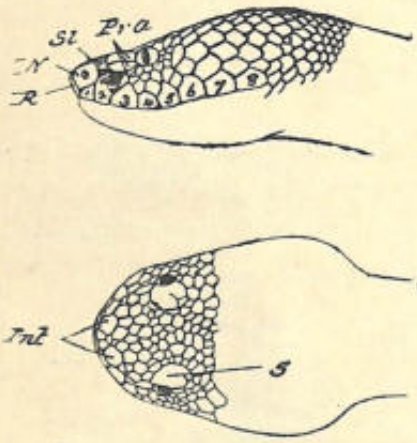



FIG. 28.—Lachesis monticola (nat. size).

*Supplementary characters*: *Internasals.*—A pair, separated by from 1 to 3 small scales. *Supraocular.*—A single shield.—*Nasal.* Not united with 1st labial; no minute scales intercalated between it and the 2nd labial. *Subocular* absent; *2nd labial* furrowed in its upper half, and forming the inner wall of the loreal pit. *Scales.*—Anterior usually 23, (rarely 25); mid-body 23, (rarely 21 or 25); posterior 19, (rarely 21).

*Distribution.*—The Himalayan region (from 2,000 to 8,000 feet) including Hills of Assam, Burmah and Yunnan.

*Poison.*—Stoliczka* mentions a cooly who was bitten by a small one about 14¼ inches in length. He made him suck vigorously, and gave him brandy, and no ill effects were noticed.

*Dimensions.*—Grows to 3 feet.

*Colour.*—Light brown or buff, with large irregularly squarish patches or spots of dark brown on the middle of the back, and a coarse mottling of these two hues in the flanks. Crown dark brown with a buff V bordered dark brown below. Belly yellowish, uniform in front, obscurely spotted, or mottled behind.

* Journal Asiatic Soc., Bengal, Vol. XXXIX., p. 224.

*Lachesis cantoris*—Cantor's Viper.

*Identification.*—Most easily identified by the rows of scales in the middle of the body numbering 29.

*Supplementary characters*: *Internasals.*—A pair separated by one small scale. *Supraocular*—A single shield. *Nasal* partially or completely united with 1st labial; no minute scales intercalated between

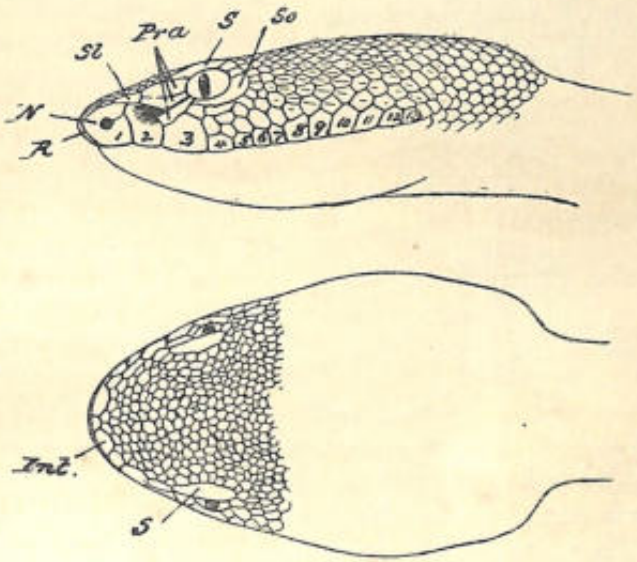



FIG. 29.—Lachesis cantoris (nat. size).
Note confluence of nasal (N) and 1st supralabial (1).

it and the 2nd labial. *Subocular* not touching the 3rd labial. *2nd Labial* furrowed in its upper half, and forming the inner wall of the loreal pit. *Scales.*—Anterior, 27; midbody, 29; posterior, 21.

*Distribution*—Peculiar to the Andaman and Nicobar Islands.

*Poison.*—Stoliczka remarks on the small size of the poison gland even in specimens 3 to 4 feet long, and both he and Dr. Rink who visited the insular groups above mentioned, where they found this snake extremely abundant, elicited information from the natives showing that they (the natives) did not regard the bite as fatal.

*Colour.*—There are two varieties, the one bright green or dull greenish with dark spots, often arranged alternately in five longitudinal series; the other light, or dark brown, spotted with pale greenish. Usually a well-defined white line runs along the flanks, and the head

has frequently a pale lateral streak. Belly whitish or greenish, uniform or mottled.

*Lachesis purpureomaculatus*—Gray's Viper.

*Identification.*—The nasal shield more or less united with the 1st labial, and the scales in the posterior part of the body numbering 19, when taken together will distinguish this from all the rest of the group.

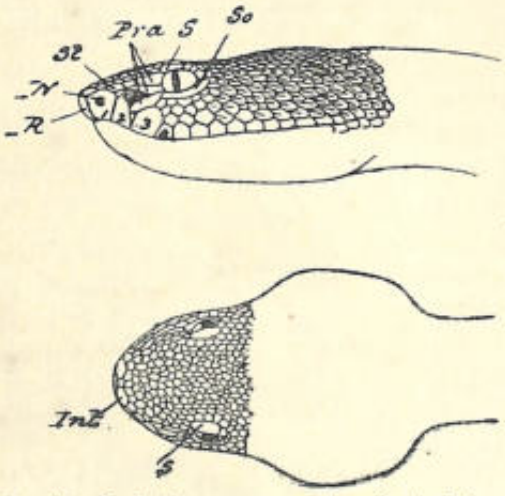



FIG. 36.—Lachesis purpureomaculatus (nat. size).

*Supplementary characters : Internasals.*—A pair in contact with one another, or more usually separated by one small scale. *Supraocular*—A single shield. *Nasal* partially or completely united with the 1st labial ; one or more minute scales intercalated between it and the 2nd labial. *Suboculars*—Not in contact with 3rd labial. *2nd labial* with a furrow in its upper part directed into the loreal pit. *Scales.*—Anterior, 23 to 25 ; midbody usually 25, (rarely 23 or 27) ; posterior, 19.

*Distribution.*—Bengal, the Himalayas from probably the Sutlej in the West, Assam, and Burmah, Andamans, and Nicobars. In India it is not met with in the plains, but in Burmah occurs in hills and plains alike. Has been and is frequently confused with *L. gramineus.*

*Poison.*—Stoliczka's observations with regard to the opinion of the natives in the Andamans and Nicobars show that it is not regarded as fatal to man.

*Dimensions.*—Grows to 4 feet.

*Colour.*—Three varieties are met with: (A) uniform foliage green; (B) uniform purplish-brown, or purplish-black; (C) variegated, purplish-brown and green. Usually a well-defined white or yellow flank line. Beneath uniform greenish or whitish with sometimes obscure mottling.

*Lachesis mucrosquamatus*—The Formosan Viper.

*Identification.*—The scales in the posterior part of the body number 21 or 19, the nasal not united to the 1st labial, and the presence of a subocular establish the diagnosis, but all three characters must co-exist.

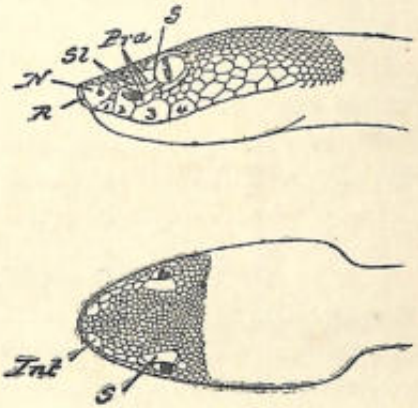



FIG. 31.—Lachesis mucrosquamatus (nat. size).

*Supplementary characters: Internasals.*—A pair separated by from 2 to 4 small scales. *Supraocular*—A single shield. *Nasal*—Not united with the 1st labial, one or more minute scales intercalated between it and the 2nd labial. *Subocular* not touching the 3rd labial. *2nd labial* with a furrow in its upper part directed into the loreal pit. *Scales.*—Anterior, 25 to 27; midbody, 23 to 27; posterior, 19 to 21.

*Distribution.*—Naga Hills and Assam, also Formosa.

*Poison.*—Nothing known.

*Dimensions.*—Grows to 3½ feet.

*Colour.*—Brownish with 3 longitudinal series of blackish spots, the vertebral series being the largest. Belly mottled brownish and white, or uniform whitish.

*Lachesis jerdonii*—Jerdon's Viper.

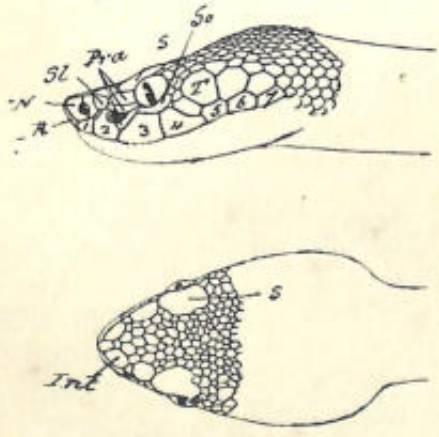



FIG. 32.—Lachesis jerdonii (nat. size).

*Identification.*—The subocular touching the 3rd labial together with 7 to 8 supralabials make diagnosis certain.

*Supplementary characters: Internasals.*—A pair, separated by from 1 to 3 small scales. *Supraocular*—A single shield preceded by an enlarged shield peculiar to this species. *Nasal* not united with 1st labial; small scales may or may not be intercalated between it and the

2nd labial. *Subocular* touches the 3rd labial. *2nd labial* with a furrow in its upper part directed into the loreal pit. *Scales.*—Anterior 21 usually, (rarely 23); midbody 21, (rarely 19); posterior 17, (rarely 15).

*Distribution.*—Khasi Hills, Assam, Thibet.

*Poison.*—Nothing known.

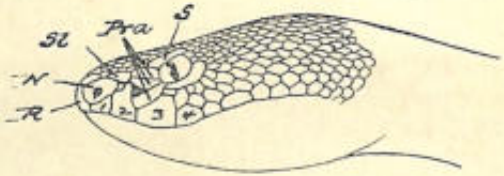
*Dimensions.*—Grows to 2½ feet.

*Colour.*—Variegated greenish and black. Head black; ornamented with yellow. Belly mottled greenish and black.

*Lachesis gramineus.*

The Common Green Viper or Bamboo Snake.

*Identification.*—Scales 15 in the posterior part of the body, supraocular a single shield, supralabials 9 to 12, the 2nd furrowed in its upper half, if co-existing will serve to identify it.



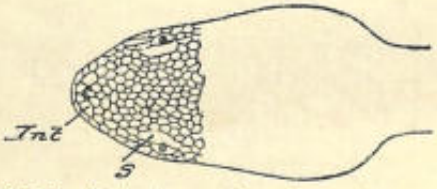




FIG. 33.—Lachesis gramineus (nat. size). Variety from Western Ghats.

*Supplementary characters: Internasals.*—A pair, in contact, or separated by one or two small scales. *Supraoculars*—A single shield. *Nasal*—Sometimes united with 1st labial, sometimes distinct; small scales may or may not be intercalated between it and the 2nd labial. *Subocular* may or may not touch the 3rd labial. *2nd labial* with a furrow in its upper part directed into the loreal pit. *Scales.*—Anterior, 21; midbody, 21; posterior, 15.

*Distribution.*—Much the most plentiful and the most widely distributed of our Indian Pit-Vipers. From the Malayan region it extends through Burma, including the Andamans and Nicobars, to the Himalayan region probably as far west as the Sutlej River. It is found in the Eastern Ghats, Western Ghats, Nilgiris and other hills in the Peninsula of India. It does not occur in the plains of India, but affects an altitude of from 1,500 to 6,000 feet. East of Calcutta occurs in the plains and hills alike.

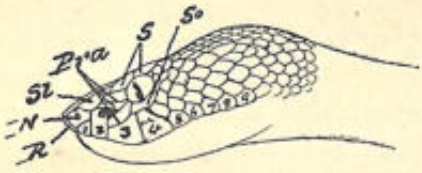
*Poison.*—The bite is rarely if ever fatal, but severe local effects and constitutional disturbances are usually attendant. There is abundant evidence to substantiate this assertion, among Europeans and natives alike.

*Dimensions.*—Grows to 3½ feet.

*Colours.*—Usually vivid foliage-green. More rarely yellowish, or olivaceous or brown, sometimes obscurely streaked or barred with black. A well-defined white or yellow flank line usually. Belly whitish, plumbeous, greenish, uniform or indistinctly mottled.

*Lachesis trigonocephalus*—The Green Tic.

*Identification.*—The supraocular shield divided, and the subocular touching the 3rd labial, if found co-existing, serve to fix its identity.



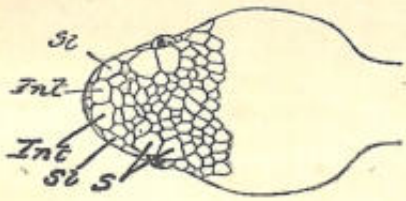




FIG. 34.—Lachesis trigonocephalus (nat. size).

*Supplementary characters: Internasals.*—A pair in contact with one another. *Supraocular* divided. *Nasal* not united with 1st labial; no small scales intercalated between it and the 2nd labial. *Subocular* touches the 3rd labial. *2nd labial* with a furrow in its upper part directed into the loreal pit. *Scales.*—Anterior, 17 or 19; midbody 17 or 19; posterior, 13 or 15.

*Distribution.*—Peculiar to Ceylon where it is common in many parts of the hills. It is known to the planters as the Green Tic Polonga.

*Poison.*—Mr. Drummond Hay has informed me in a letter that he once had a Eurasian conductor bitten by a full grown one in his presence. The bitten hand swelled up at once, but by evening had much reduced, and the following day the swelling had almost entirely disappeared.

*Dimensions.*—Grows to 2½ feet.

*Colour.*—Foliage-green, uniform, or with black blotchings. A black streak behind the eye. Belly uniform greenish or yellowish.

*Lachesis anamallensis*—The Anamallay Viper.

*Identification.*—Supraocular divided, and co-existing with this, a subocular not touching the 3rd labial.

*Supplementary characters: Internasals.*—A pair separated by a small scale. *Supraocular* divided. *Nasal* not united with 1st labial; small scales may or may not be intercalated between it and the 2nd labial. *Subocular*—Not touching the 3rd labial. *2nd labial*, with a furrow in its upper part directed into the loreal pit. *Scales.*—Anterior, 21; midbody usually 21, (rarely 19); posterior, 15 or 17.

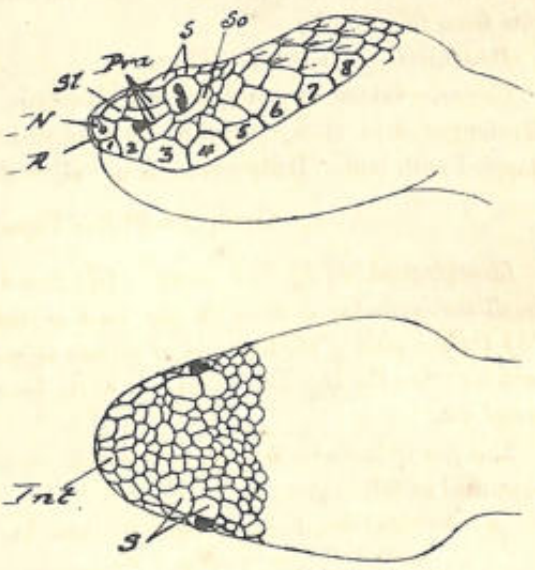



FIG. 35.—Lachesis anamallensis (nat. size).

*Distribution.*—Confined to the Western Ghats and hilly regions south of the Krishna River, where it is quite common, at altitudes ranging between 2,000 to 7,000 feet.

*Poison.*—Jerdon* has known several cases of bite, but none proved fatal. Mr. Henderson has informed me by letter how he was once bitten by one in the forefinger. The snake was half grown. He sucked the wound, and cauterised it at once, and "suffered very little discomfort." For some time afterwards he experienced a sense of weight in this arm when it was held down. Ferguson† relates how Baron Von Rosenberg was bitten by this snake in the foot. He did not know he was bitten, and walked 10 miles before pain asserted itself. He then found the member so swollen he had to cut the boot off. After a night of pain and fever, a cupfull of blood and matter came away, and it was several days before he could wear anything but a

* Journal, Asiatic Society of Bengal, Vol. XXII., p. 525.
† Journal, Bombay Nat. Hist. Soc., Vol. X., p. 9.

slipper. A year later the place swelled up again, became painful, and discharged matter. Ferguson also mentions having met a hill-man with a withered right arm which he (the native) attributed to a bite from this reptile.

*Dimensions.*—Grows to 3½ feet.

*Colour.*—Greenish variegated with blackish, or dark blackish-green. Boulenger says olive, yellowish or reddish-brown. Flanks coarsely dappled with buff. Belly greenish or yellowish.

### Group 5—Pitless Vipers.

*Identification.—(1) Tail round. (2) Snout and crown covered with small scales similar to those on the back of the body*; see Fig. 37. (3) Only a part of the last row of costals is visible on either side of the ventrals when the specimen is laid on to its back (see Fig. 5). (4) No. loreal pit.*

This group includes 4 species referable to 3 genera. They may be identified as follows:—

A. Shields beneath tail similar to those beneath belly (*see* SC., Fig. 9 B) ..... *Echis carinata.*

B. Shields beneath tail divided (*see* SC., Fig. 9 D)

(*a*) Ventrals with 2 ridges (*see* Val., Fig. 37) ..... ..... ..... *Eristocophis macmahonii.*

(*b*) Ventrals not ridged.

3 chains of large spots, one along spine, and one on each side ..... *Vipera russelli.*

1 chain of spots along spine, none on the sides. „ *lebetina.*

### *Echis carinata*—The Little Indian Viper.

The "Kuppur" of Sind. "Phoorsa" of the Bombay Presidency. "Afai" about Delhi. The "Kallu havoo" of Mysore. "Kattu virian" about Madras; and the "Horatta pam," according to Russell, on the Coromandel Coast.

*Identification.*—The undivided state of the shields beneath the tail will admit of no confusion with others of this group.

*Supplementary characters*: *Supraocular* not divided. *Nasal* touches the rostral and the 1st supralabial. *Eye.*—Diameter exceeds its distance

* A few harmless snakes have the snout covered with small scales,—for instance, the Genus *Eryx*. *Bipistes* too may be included with these. In all these, two or often many more rows of costals are visible from beneath (*see* Fig. 3).

to the nostril, and is greater than its distance to the edge of the lip; 2 rows of scales between it and the supralabials. *Supralabials.*—The 4th is the largest of the series (rarely the 3rd). *Sublinguals* touch 3 or 4 infralabials, and 2 small scales behind. *Infralabials* 4 (rarely 3), the 4th touching 2 scales behind. *Scales* in mid-body 27 to 37. *Ventrals* not ridged laterally. *Subcaudals* undivided. During life its peculiar habit of throwing its body into a double coil, inflating itself, and then rubbing one coil against the other so as to produce a sound closely resembling hissing, will in itself proclaim its identity.

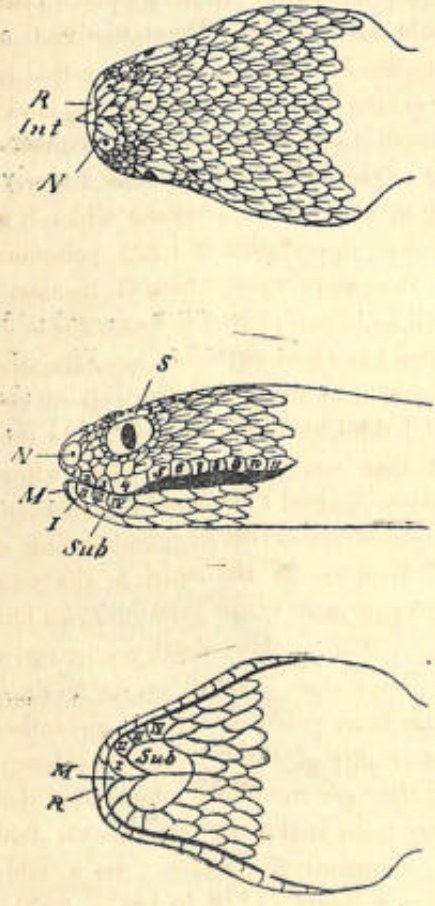



FIG. 36.—Echis carinata (×2½).

*Distribution.*—It occurs throughout a large area of the Indian Peninsula from Cape Comorin to the Himalayas, but being a desert form preferring an arid sandy soil, it is distributed chiefly in isolated patches where it is frequently very common. Jerdon remarks it is common throughout the Carnatic. I have found it especially so about Trichinopoly. I believe it does not occur in the narrow tract between the Western Ghats and the Malabar Coast, nor in Ceylon. To the North-East its limits are not exactly known; if it occurs in Bengal it is scarce. To the North-West it extends through Rajpootana, the Punjab, Sind and Baluchistan to Transcaucasia, and is extremely abundant in these parts. Some idea of its prodigious numbers was furnished by Vidal.* He says that in the Ratnagiri District (Kanara) alone during 6 years Government rewards were paid on an average

* Journal, Bombay Natural History Soc., Vol. V., p. 64.

of 225,721 Phoorsas per annum! Later he remarks that when the Government reward was raised tentatively from six pies to two annas per head, 115,921 were paid for in 8 days (December 2nd to 10th, 1862). Again Candy in the same Journal (page 85) says that in Ratnagiri, in August and September, the Mhars go out with long sticks to which forks are attached, and catch them in thousands for Government rewards. It is an inhabitant of the plains, and becomes progressively scarcer at altitudes ranging up to 3,000 feet, beyond which it is rarely if ever found. Thus Nicholson shows* that of 1,225 poisonous snakes collected in the vicinity of Bangalore upon which Government rewards were paid in the year 1873, only one proved to be an *Echis*.

*Poison.*—Very conflicting opinions have been expressed regarding the virulence of *Echis* poison. It is asserted by many that death is an extremely rare sequel to its bite, but I think there can be no doubt that fatalities are much more frequent than many suppose. Vidal, whose paper in the Bombay Natural History Journal † is a most valuable contribution to the literature on this species, states that he found records of 62 fatal cases treated in the Civil Hospital at Ratnagiri in the year 1878. He estimated that about 20 per cent. of the cases of *Echis* bite proved fatal, and remarks that the poison is slow, death occurring on an average in 4½ days, but that some cases lingered on for 20 days. He says later that the *Echis* is a far more potent factor than any other venomous species in swelling the mortality of the Bombay Presidency. He substantiates this assertion by the very significant observation that in *Echis*-ridden tracts the mortality from snake-bite far exceeds that in districts where this snake is comparatively scarce. In a table compiled from official returns for 8 years (1878 to 1885), for the districts of the Bombay Presidency, he shows that in the districts of Hyderabad, Thar and Parkar, Karachi (Sind), and Ratnagiri (Kanara), where the *Echis* abounds, one man in 5,000 dies per annum from snake-bite, whereas in the districts of Bijapur, Nasik, Ahmednagar and Sholapur, where this snake is rare or absent, only one man in 100,000 dies from snake-bite. Murray‡ says "this little viper is very venomous; although the action of its poison is not quite so quick as that of the cobra, it is equally as potent, and numerous deaths annually occur from its bite." Dr. Inlach, Civil Surgeon at Shikar-

* "Indian Snakes," p. 173.
† Vol. V., p. 64.
‡ "*Reptilia* of Sind," p. 57.

pur* (Sind) says, " A reference to police returns will show that in by far the greatest majority of cases serious injury and death have been caused by the bite of this species." Again he avers "the Kuppur is without exception the most deadly poisonous snake in Sind." Mr. Millard has informed me by letter of the case of an attendant in the Bombay Natural History Society's Rooms who, in October 1903, was bitten by an *Echis* in the temple. He was taken off at once to hospital, admitted that he felt no fear, but in spite of prompt treatment died 24 hours afterwards.

In Delhi, in 1897, I knew, and many times saw a famous snake-catcher called Kallan bring his week's bag to the Civil Hospital where he extracted the poison of cobras, kraits and "afais" for the Civil Surgeon (Major Dennys, I.M.S.) who sent it on to the Government of India. The poison collected, he conveyed his specimens to the Deputy Commissioner for the Government rewards. Each head had to be chopped off, and when later he was counting these out for the satisfaction of an official before payment, one *Echis* head fastened itself on to his finger. The dose of poison under the circumstances must have been very small, nevertheless most alarming symptoms rapidly supervened, and Major Dennys told me that when he visited the man that night he expected he would die, so grave was his condition. He, however, recovered. One must not allow oneself to be misguided by the many records in which dogs and other small animals have not succumbed to the bite of this snake, and infer that man would probably be even less affected. One can find numerous instances of small animals not succumbing to the effects of bites of cobras and Russell's vipers though we know how fatal these poisons usually are.

*Dimensions.*—Grows to about 2 feet.

*Colour.*—Various shades from sandy to dark cedar. A more or less distinct pale sinuous flank line always present. A pale mark on the crown somewhat resembling the imprint of a bird's foot. Belly uniform whitish, or dotted with light brown or dark spots.

*Eristocophis mcmahonii*—McMahon's Viper.

*Identification.*—The ventral shields are ridged on either side unlike other species of this group, and this is the best means of diagnosis (*see* Fig. 37 C.).

* Trans. of the Bomb. Med. and Phys. Soc., Vol. III., p. 80.

*Supplementary characters*: *Supraocular* absent, replaced by

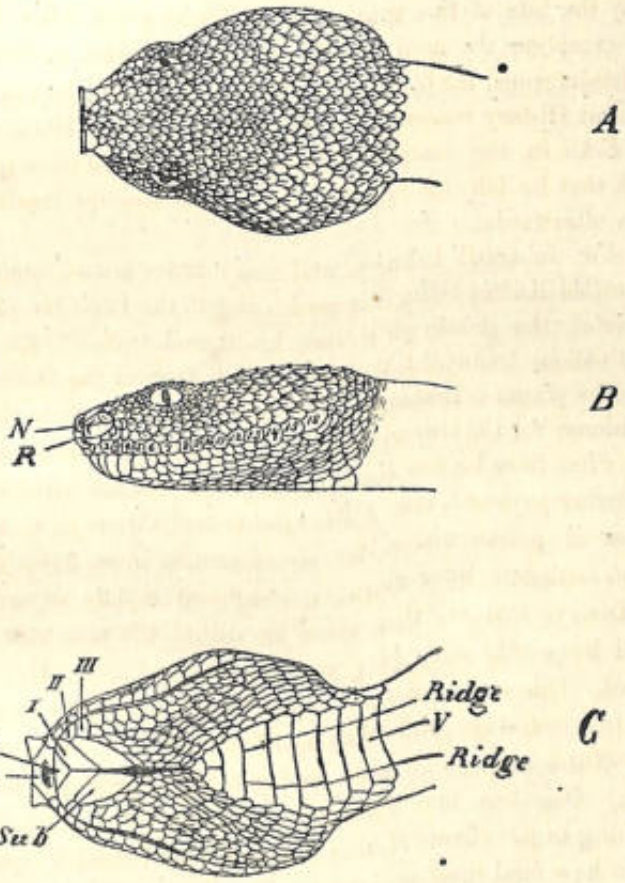



FIG. 37.—Eristocophis mcmahonii (nat. size).

small scales. *Nasal* does not touch the rostral, nor the 1st supralabial. *Eye*.—Diameter less than the distance between eye and nostril; about half the distance to the labial margin; 5 or 6 rows of small scales between it and supralabials. *4th supralabial* not enlarged. *Sublinguals* touch 3 infralabials, and 3 small scales behind. *Infralabials* 3, large, 3rd touching 3 scales behind. *Scales* in the middle of the body 23 to 27. *Ventrals* ridged laterally. *Subcaudals* divided.

*Distribution*.—Very little is known on this point. Baluchistan, where it was discovered by Captain McMahon when delimiting the Afghan-Baluch border, is probably the fringe of its distribution, and it is prob-

ably only to be found at this corner of our Indian possessions. It is a desert form inhabiting sandy tracts.

*Poison.*—Nothing is known.

*Dimensions.*—The largest specimen was about 2 feet.

*Colour.*—Reddish sandy brown, with white edged dark-brown spots along the back.

*Vipera russellii.*

Russell's Viper. The Chain Viper. The Daboia.

The "Tic polonga" of Ceylon. "Kanardi virian" of Tamils in Madras. "Mandali" of Malabar. "Mandalatha havu," and according to Rice "Kolaku mandala" of Mysore. The "Bora," "Chundra bora," "Siah chunder amaitar," and "Jessur" of Bengal according to Fayrer. The "Katuka rekula poda" of Russell (Coromandel Coast?). The "Gunnus" of Bombay. The "Chitar" of Guzerat according to Mosse. The "Khad chitra" of Dantra District in the Bombay Presidency according to Fenton. I am told the "Korail" of Sind. The "Mwe-bwe" of Burmah. Probably also the "Cobra monil" of some natives as suggested by Jerdon; literally "Necklace snake" in Portuguese, and like other names dating from the Portuguese occupation of India, such as "Biscobra," its significance has become obscured, and surrounded with mystery by the native mind.

*Identification.*—The sublinguals touching 4 or 5 infralabials; the subcaudals divided, and the 3 series of large dorsal spots when occurring in the same specimen will establish the diagnosis.

*Supplementary characters*: *Supraocular* a single shield. *Nasal* touches the rostral and the 1st supralabial. *Eye.*—Diameter exceeds distance of eye to nostril, and is subequal to its distance to the labial margin in the adult; 2 or 3 rows of scales between it and the labial margin. *4th supralabial* the largest of the series. *Sublinguals* touch 4 or 5 infralabials and 2 scales behind. *Infralabials* 5 large normally, the 5th touching 2 scales behind. *Scales* in midbody 27 to 33. *Ventrals* not ridged laterally. *Subcaudals* divided.

*Distribution.*—Throughout the whole of the Indian Empire from Ceylon to the Himalayas, and from the most eastern borders of Burmah to the western limits of Sind. It is chiefly an inhabitant of the plains, but is common in some localities from 2,000 to 4,000 feet

and has been met with at altitudes up to 6,000 and 7,000 feet.* In most

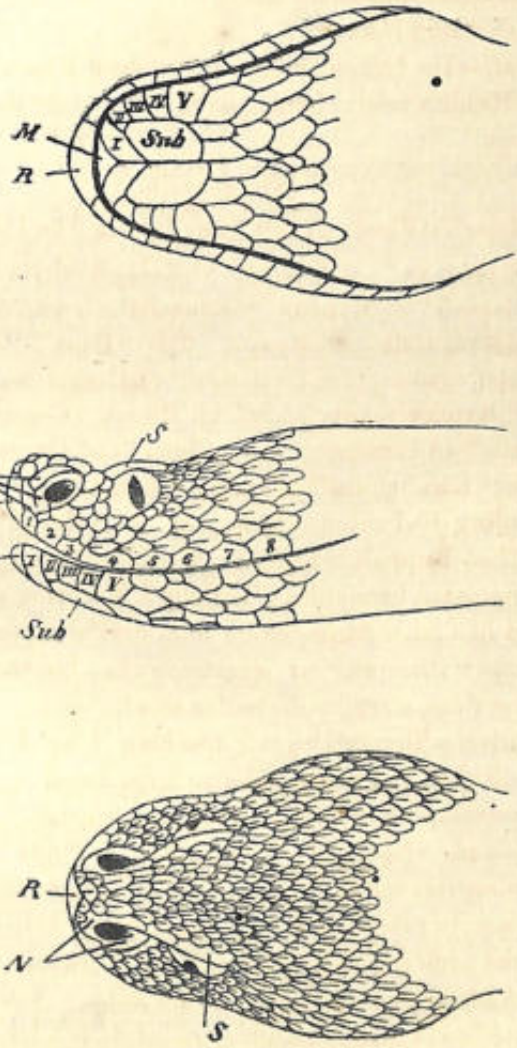



FIG. 38.—Vipera russelli (nat. size).

parts it is quite a common snake, but is especially so in certain localities. Fayrer† says it is very common in the Punjab, and that at Umritsar in 1866 as many as 471 specimens were brought in for Government rewards in one day! Mr. Millard tells me it is common

Kashmir 6,000 ft. (Stoliczka). Nilgiris 6,000 ft. (Henderson, private letter). Pulneys 6,500 ft. (Revd. Father Gombert, private letter). Pulneys 7,000 ft. (Henderson, private letter). Bakgalla, Ceylon, 5,700 ft. (I have received specimens from Mr. Noch).

† *Than tophidia*, p. 55.

near Bombay. Mr. Henderson in a private letter says it is fairly common at Kodai Kanal in the Pulneys. Father Gombert, S.J., in a private letter makes the same remark with regard to the Pulneys. Stoliczka* says it is very common in the south portion of the Kulu Valley. I have found it common at Trichinopoly and Cannanore, and Ferguson† says it is common in the low country at Travancore. Tennent‡ says that at Trincomalee, Ceylon in 1858, the Judge's house was so infested with this species that his family had to quit their quarters, and Bassett Smith§ also remarks on the number of this species in the same place. Evans and I found it common in most parts of Burmah, and in certain parts of that Province they are so numerous that the natives wear grass shoes made with "uppers" when busy in the crops as a protection against this snake, notably at Mahlaing, Magwe, and Myo-thit in Upper Burmah. Theobald ¶ remarks on the commonness of the species in the Tharrawaddy District in Lower Burmah, and about Rangoon. On the other hand, Nicholson‖ shows it is uncommon in the vicinity of Bangalore, where only 2 were brought in for Government rewards out of 1,225 poisonous snakes in the year 1873. Again Murray** says it is not common in Upper Sind. Blanford †† makes the same remark of S.-E. Berar, and Mr. Millar writes me it is rare about Darjeeling. He has only known one, *viz.*, at Kurseong, 4,600 feet, in many years.

*Poison.*—Indubitably fatal to man.

*Dimensions.*—Grows to 5½ feet, but specimens over 5 feet are very exceptional.

*Colour.*—Buff, or light brown with 3 longitudinal series of large spots along the back. These usually consist of three zones a central one of the same colour as the ground, a narrow dark zone, skirted by a still narrower white or buff zone. Some of these spots in the median series often confluent. The spots in the lateral rows are often broken at their lowermost outline. Head ornamented with large dark marks, and a conspicuous pink or salmon V with its apex on the snout. Belly whiti h with dark semilunar scattered spots.

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* Jourl. Asiatic Soc. of Bengal, Vol XXXIX., p. 226.
† Jourl. Bomb. Nat. Hist. Soc., Vol. X., p. 8.
‡ Nat. Hist. of Ceylon, p. 296.
§ Jourl. Bomb. Nat. Hist. Soc., Vol. XI., p. 546.
¶ Cat. Rept., Brit. Burm., p. 64.
‖ Ind. Snakes, p. 178.
** The Rept. of Sind, p. 56.
†† Jourl. Asiatic Soc. of Bengal, Vol. XXXIX., p. 374.

*Vipera lebetina.*

*Identification.*—The sublinguals touching 4 or 5 infralabials; the subcaudals divided; and the absence of the large lateral spots on the si les so typical of the last when occurring together, will suffice to identify this from the rest of the group.

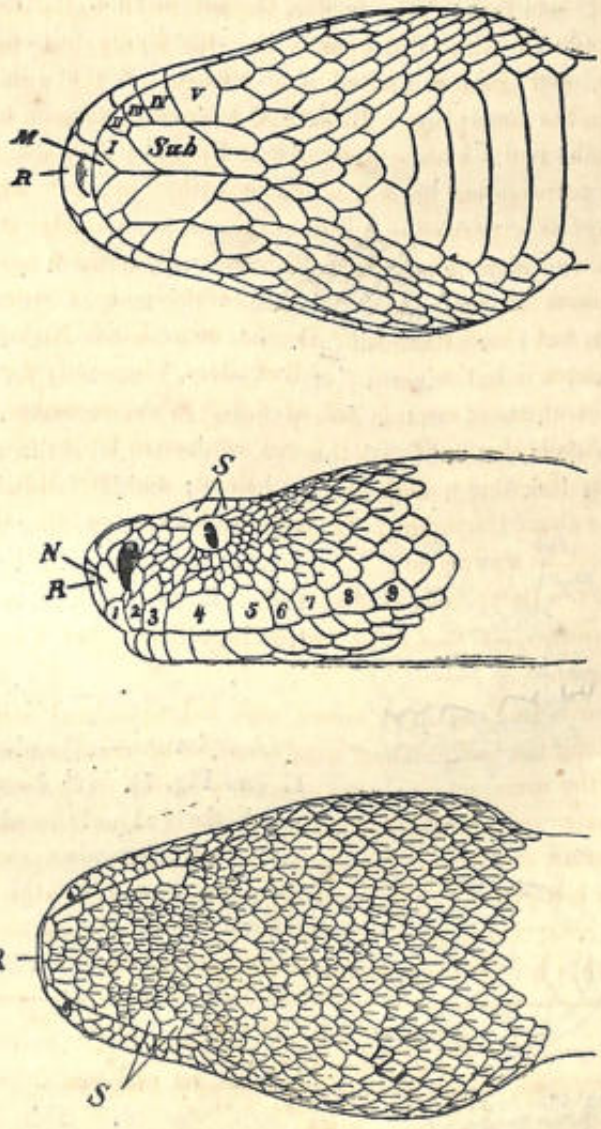



FIG. 39.—Vipera lebetina (nat. size).

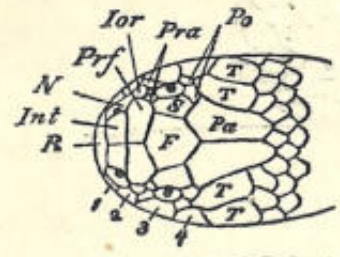
*Supplementary characters.*—*Supraocular* well developed or broken up into small shields. *Nasal* touches the rostral and the 1st supralabial. *Eye.*—Diameter about equal its distance to the nostril, about half its distance from the labial margin; 2 or 3 rows of scales between it and the supralabials. *4th supralabial* the largest of the series. *Sublinguals* touch 4 or 5 infralabials and 2 scales behind. *Infralabials.*—5 large normally, the 5th touching 2 scales behind. *Scales* in middle of body 23 to 27. *Ventrals* not ridged laterally. *Subcaudals* divided.

*Distribution.*—An inhabitant of Northern Africa and South-Eastern Europe, it extends through Asia Minor eastwards so as to include Baluchistan and Kashmir on the fringe of its distribution.

*Poison.*—Nothing known.

*Dimensions.*—Grows to 5 feet.

*Colour.*—Grey or pale brown above, with a dorsal series of large brown spots, often edged with blackish which may be confluent into an undulous band, or with small dark spots or cross-bars, small dark lateral spots, and vertical bars; a large V-shaped marking on the upper surface of the head, and a V-shaped one on the occiput, may be present; a dark streak behind the eye to the angle of the mouth; and usually a dark blotch or bar below the eye; whitish beneath, powdered with grey-brown, with or without dark brown spots; end of tail yellow. All the markings sometimes very indistinct (Boulenger).



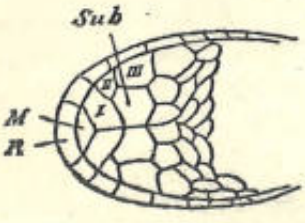




FIG. 40.—Azemiops feæ (after Boulenger).

*Azemiops feæ*—Fea's Viper.

*Identification.*—(1) scales in midbody 17 (*see* Fig. 7). (2) 6 supralabials of which the 3rd only touches the eye. These two points when co-existing will serve to differentiate this from every other snake.

*Supplementary characters.*—*Frontal* unusually broad, about 3 times the breadth of each supraocular. *Nasal* touches 1st and 2nd infralabials only. *Loreal* present. This is the only poisonous snake with large shields on the head in which this shield

occurs. *Præoculars* 3. A very unusual feature. (Except the pit-vipers I know of only one other snake where these shields are 3, *viz.*, *Lytorhynchus paradoxus.*) *Temporals* 2. The upper touching one supralabial only, the 4th. *Eye* with vertical pupil. *Supralabials* 6, the 3rd only touching the eye. *Sublinguals.*—One pair only each in contact with 2 scales behind. *Infralabials* 3 only.

*Distribution.*—One specimen only known discovered by Mons. Fea in the Kachin Hills of Upper Burmah.

*Poison.*—Nothing known.

*Dimensions.*—2 feet.

*Colour.*—Boulenger* says: "Lower parts olive-grey with some small lighter spots; chin and throat variegated with yellow." He further remarks it is strikingly like a harmless colubrine in external appearance.

* Fauna of Brit. Ind., *Reptilia Batrachia*, p. 419.

# FLOWERING SEASON AND CLIMATE.

By

E. Blatter, S.J.

## Part I.

(*With 3 Plates.*)

(*Read before the Bombay Natural History Society on 28th June* 1906.)

In popular and, sometimes, even in scientific books we find so many different opinions as regards the flowering season in the tropics, that it seems to be worth while to inquire into the real facts in order to trace the laws by which the processes in the sexual sphere are governed. There are writers who say that there is scarcely any periodicity in the flowering time in the tropics, whilst others speak of well defined periods.

In the following essay I shall not discuss all the factors which influence the development of flowers, but I shall confine myself to discovering the relations which exist between the flowering season and the climate. For this purpose I examined the floras of different regions of India, Burma, and Ceylon, collecting notes which give information as to the flowering period of the vegetation, and comparing them with the meteorological data of the respective areas.

I shall begin with the Presidency of Bombay, the flora of which has been described by various botanists in former years, and recently by Th. Cooke in his "Flora of the Presidency of Bombay." I borrow the following passage from the preface to Cooke's Flora, where the author gives a short description of the area covered by his botanical explorations: "The Presidency of Bombay," he says, "including Sind and Baroda (which latter State, containing 4,400 square miles, though removed in 1875 from the administrative control of the Government of Bombay, is, for botanical purposes, included within the limits of the Presidency) extends from 13° 53′ to 28° 47′ N. lat. and from 60° 45′ to 76° 30′ E. long., and contains about 196,000 square miles, an area more than 1½ times that of Great Britain and Ireland.

"To the north of the Tapti river, which passes the town of Surat, stretches the flat alluvial and fertile plain of Gujarat, much of it without a hill to break the monotony of the landscape for miles. Sind, still further to the north-west, separated from Baluchistan by the Kirthar mountains which sometimes rise to a height of 7,000 feet, is much of it a plain of desert sand with occasional ridges of low sand-hills.

"South of the Tapti river the country gradually becomes interspersed with hills and further south the Western Ghâts run parallel to the sea-coast for about 500 miles, with a general elevation of nearly 2,000 feet, though occasionally hills rise to a height of 4,000 feet or more above the sea level.

"The low-lying plain between the foot of the Western Ghâts and the sea, interspersed with hills and with a heavy rainfall and a humid and enervating climate, is known as the Konkan, while the Deccan is the extensive elevated plateau behind the Ghâts, interspersed with numerous hills which are either isolated or in short ranges, with a generally light rainfall and a dry climate."[1]

How variable the climate of the area in question is, will be best illustrated by meteorological statistics, which, at the same time, give an exact basis for a comparison with the flowering times. The data, where no special mention is made, are taken from H. F. Blanford.[2]

*Rainfall recorded at 15 Stations.*

| — | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. | Year. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jacobabad, 26 years .. | 0·2 | 0·2 | 0·3 | 0·2 | 0·1 | 0·1 | 1·4 | 1·4 | 0·3 | .. | 0·1 | 0·1 | 4·4 |
| Kurrachee, 31 years .. | 0·3 | 0·3 | 0·2 | 0·2 | 0·1 | 0·2 | 3·1 | 1·8 | 0·3 | 0·1 | 0·3 | 0·2 | 7·8 |
| Hyderabad, 21-24 years .. | 0·1 | 0·1 | 0·1 | 0·2 | 0·1 | 0·4 | 2·8 | 3·2 | 0·8 | .. | 0·1 | .. | 8·0 |
| Deesa, 29-31 years .. .. | 0·1 | 0·2 | 0·1 | 0·1 | 0·2 | 2·2 | 9·8 | 8·5 | 3·3 | 0·8 | 0·1 | .. | 25·5 |
| Rajkot, 20-26 years.. .. | 0·1 | 0·1 | .. | .. | 0·4 | 5·4 | 10·3 | 6·7 | 4·2 | 0·8 | 0·2 | 0·1 | 28·3 |
| Surat, 18-24 years .. .. | .. | .. | .. | .. | 0·2 | 9·1 | 15·8 | 9·8 | 7·3 | 1·4 | 0·1 | 0·1 | 42·1 |
| Tanna, 19-30 years.. .. | .. | 0·1 | .. | .. | 0·4 | 24·8 | 36·2 | 20·1 | 12·8 | 3·3 | .. | .. | 97·5 |
| Bombay, 38-70 years .. | 0·1 | .. | .. | .. | 0·5 | 20·8 | 24·7 | 15·1 | 10·8 | 1·8 | 0·5 | 0·1 | 74·4 |
| Lanauli, 13 years .. .. | 0·2 | .. | 0·1 | 0·1 | 0·6 | 28·1 | 65·3 | 40·4 | 23·8 | 4·8 | 0·4 | 0·2 | 163·9 |
| Mahableshwar, 31-34 years | 0·4 | 0·1 | 0·4 | 0·9 | 1·4 | 47·1 | 102·1 | 68·6 | 32·9 | 5·8 | 1·1 | 0·4 | 261·4 |
| Goa, 26-27 years .. .. | 0·1 | .. | .. | 0·1 | 1·6 | 31·8 | 34·1 | 19·9 | 0·6 | 4·4 | 1·1 | 0·1 | 93·8 |
| Dhulia, 17-28 years.. .. | 0·2 | 0·1 | .. | .. | 0·4 | 4·1 | 4·8 | 4·0 | 4·6 | 2·0 | 0·3 | 0·4 | 21·9 |
| Poona, 44 years .. .. | 0·2 | .. | 0·2 | 0·6 | 1·6 | 5·6 | 6·6 | 4·1 | 4·3 | 4·1 | 0·5 | 0·2 | 28·3 |
| Sholapur, 34 years .. .. | .. | 0·1 | 0·3 | 0·7 | 1·2 | 4·6 | 4·3 | 6·0 | 7·5 | 3·7 | 0·7 | 0·4 | 29·5 |
| Belgaum, 34-35 years .. | 0·1 | .. | 0·5 | 2·0 | 2·8 | 9·3 | 15·2 | 9·0 | 3·7 | 4·7 | 1·2 | 0·3 | 48·8 |
| Mean rainfall .. .. | 0·15 | 0·08 | 0·15 | 0·24 | 0·77 | 12·98 | 21·62 | 14·53 | 7·65 | 2·31 | 0·46 | 0·17 | .. |

1 Cooke: Flora of the Presidency of Bombay, pages V-VI.

2 Blanford: A Practical Guide to the Climates and Weather of India, Ceylon and Burma, Appendix I & III.

*Humidity recorded at 9 Stations.*

| | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Surat .. .. .. .. | 53 | 50 | 51 | 50 | 59 | 68 | 80 | 79 | 70 | 67 | 55 | 55 |
| Bombay .. .. .. .. | 70 | 69 | 73 | 75 | 75 | 82 | 87 | 87 | 86 | 81 | 71 | 70 |
| Poona .. .. .. .. | 41 | 33 | 29 | 31 | 42 | 69 | 79 | 79 | 77 | 58 | 46 | 41 |
| Belgaum .. .. .. .. | 47 | 39 | 41 | 50 | 59 | 80 | 89 | 88 | 86 | 70 | 57 | 50 |
| Jacobabad .. .. .. .. | 46 | 39 | 41 | 38 | 36 | 42 | 53 | 58 | 55 | 46 | 45 | 48 |
| Hyderabad .. .. .. .. | 50 | 43 | 42 | 45 | 45 | 53 | 61 | 65 | 63 | 46 | 48 | 48 |
| Kurrachee .. .. .. .. | 57 | 59 | 67 | 68 | 74 | 74 | 78 | 78 | 76 | 65 | 60 | 57 |
| Deesa .. .. .. .. .. | 38 | 31 | 31 | 28 | 40 | 53 | 74 | 73 | 68 | 44 | 35 | 38 |
| Sholapur .. .. .. .. | 42 | 34 | 29 | 26 | 34 | 56 | 65 | 66 | 70 | 60 | 53 | 49 |
| Mean humidity .. .. .. | 49·3 | 44·1 | 44·8 | 45·4 | 51·5 | 64·1 | 74 | 74·7 | 75·6 | 59·6 | 51·7 | 50·6 |

*Cloud Proportion recorded at 9 Stations.*

| | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jacobabad .. .. .. .. | 2·4 | 3·2 | 3·3 | 3·1 | 1·4 | 1·1 | 2·2 | 2·4 | 0·9 | 0·4 | 0·9 | 1·8 |
| Hyderabad .. .. .. .. | 1·9 | 2·6 | 1·8 | 1·3 | 0·7 | 1·5 | 2·9 | 3·1 | 1·7 | 0·3 | 0·6 | 1·1 |
| Kurrachee .. .. .. .. | 2·6 | 3·1 | 3·3 | 2·3 | 2·2 | 4·5 | 7·1 | 6·8 | 4·5 | 1·0 | 1·2 | 2·1 |
| Deesa .. .. .. .. | 2·0 | 2·2 | 2·3 | 1·7 | 1·1 | 4·5 | 7·8 | 7·5 | 5·2 | 1·6 | 1·0 | 1·6 |
| Surat .. .. .. .. | 0·8 | 0·8 | 0·9 | 1·0 | 1·6 | 5·4 | 8·0 | 6·8 | 6·0 | 2·4 | 0·7 | 1·1 |
| Bombay .. .. .. .. | 1·5 | 1·3 | 1·8 | 2·3 | 4·1 | 7·9 | 9·1 | 8·8 | 7·5 | 4·3 | 2·2 | 1·8 |
| Poona .. .. .. .. | 1·8 | 1·7 | 2·5 | 2·4 | 3·0 | 7·6 | 9·0 | 8·7 | 8·1 | 4·9 | 2·5 | 2·7 |
| Sholapur .. .. .. .. | 2·2 | 1·9 | 2·5 | 3·2 | 4·0 | 7·1 | 8·1 | 8·1 | 8·3 | 5·9 | 3·7 | 3·0 |
| Belgaum .. .. .. .. | 1·7 | 1·5 | 2·1 | 2·6 | 3·4 | 7·7 | 8·8 | 8·5 | 7·7 | 5·5 | 3·7 | 2·9 |
| Mean cloud proportion .. .. | 1·9 | 2·0 | 2·3 | 2·2 | 2·4 | 5·3 | 7·0 | 6·7 | 5·5 | 2·9 | 1·9 | 2·0 |

*Temperature recorded at 9 stations.*

| | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jacobabad .. .. .. .. | 57 | 62 | 74 | 83 | 91 | 96 | 94 | 91 | 88 | 78 | 65 | 58 |
| Hyderabad .. .. .. .. | 63 | 66 | 78 | 89 | 91 | 91 | 86 | 86 | 86 | 83 | 72 | 64 |
| Kurrachee .. .. .. .. | 65 | 68 | 76 | 80 | 85 | 87 | 84 | 83 | 82 | 82 | 72 | 67 |
| Deesa .. .. .. .. .. | 67 | 71 | 81 | 88 | 92 | 90 | 83 | 82 | 82 | 80 | 74 | 69 |
| Surat .. .. .. .. .. | 70 | 72 | 79 | 84 | 86 | 85 | 81 | 81 | 81 | 80 | 75 | 71 |
| Bombay .. .. .. .. | 74 | 75 | 79 | 82 | 85 | 83 | 81 | 80 | 80 | 81 | 80 | 76 |
| Poona .. .. .. .. .. | 72 | 76 | 83 | 86 | 85 | 79 | 75 | 75 | 75 | 78 | 71 | 72 |
| Sholapur .. .. .. .. | 72 | 77 | 83 | 87 | 85 | 82 | 76 | 76 | 77 | 77 | 73 | 70 |
| Belgaum .. .. .. .. | 72 | 76 | 80 | 84 | 80 | 74 | 72 | 70 | 73 | 74 | 73 | 71 |
| Mean temperature ... ... .. | 68·0 | 73·7 | 79·2 | 84·1 | 87·1 | 85·2 | 81·8 | 80·6 | 80·2 | 79·0 | 73·2 | 68·7 |

From these tables we may easily collect how variable are the conditions for the sexual processes of the plant-life. Of all the provinces of India the vast plain of Sind is the driest, and, taken as a whole, the hottest. Where the waters of the Indus do not exercise their beneficial influence upon the vegetation, we find only an arid, sandy and stony

desert. This is especially the case in Upper Sind (represented in our tables by Jacobabad), the dry regions of which are characterized by great variations of temperature, whilst Lower Sind has a more moderate and less arid climate. The dampest and most uniform climatic conditions of India are found in the strip of low country which extends from below the Ghâts to the west-coast. Here the west wind mitigates the intense effect of the tropical sun, and the Ghâts protect the plain against the desiccating winds of the Deccan. In this part of the Presidency the annual mean temperature is almost the same throughout, *viz.*, 79° or 80°. During the summer monsoon the rainfall is very heavy in the Konkan, but not as heavy as on the Ghâts. "The climate of the Deccan, beyond 30 or 40 miles from the crest of the Ghâts, is, as a general rule, very dry. The driest portion of the Deccan is a strip running north and south, parallel with the Ghâts, and from 50 to 80 miles to the east of them. As far south as the latitude of Poona, the zone of country with a rainfall below 30 inches averages not more than 100 miles in width; but to the south of this it extends right across the plateau to the Eastern Ghâts." [1]

After these climatic considerations I shall try to give as exact a statistic account of the flowering periods as possible. The "Flora of British India" and other greater works on Indian vegetation cannot be of any use where regional data are wanted, as it is quite evident, *e.g.*, that the flowering time of a plant in the mountainous region of the Himalaya is quite different from that of the same plant in the lowplain along the west coast of India. The local floras of the Bombay Presidency are not all of the same value as regards the special point of our investigation. The "Bombay Flora" by Dalzell and Gibson (published in 1861) contains only scanty dates as to the flowering of plants. ¶ Of a great number of plants no dates at all are given, of many others not the whole flowering period is mentioned, but, as it seems, only that month in which the respective plant was collected in flower.

In the *Gazetteer of the Bombay Presidency* (Vol. XXV. Botany, 1886) Lisboa gives a good description of the timber-trees, food plants, famine plants, oil-yielding plants, fibrous plants, etc., but the flowering time is added to the description of the timber-trees only. No information as to the time of flowering is found in Gray's most valuable "Botany of the Bombay Presidency." As regards "The

[1] H. F. Blanford, page 172.

Flowering Plants of Western India," by A. K. Nairne, the author himself says in the introduction to his volume: "The same deficiency, and for the same reason, will be noticed as to the time of year when the different species flower." The best and, to a great part, the only information existing, we get from Cooke's "Flora of the Presidency of Bombay." As yet only the first volume and two parts of the second volume have appeared, including all the orders, following Hooker's classification from the Ranunculaceæ up to the Verbenaceæ inclusive. For the rest of the phanerogamic orders I made use of Woodrow's "Catalogue of the Flora of Western India." [1]

In the subjoined table we shall give the flowering times according to months. The flowering period of a plant does not usually occupy one month only, but several and, thus, the same plant may be found in two, three, four, or more columns, the number in each column designating the number of those plants which were seen flowering during the respective month. As the vegetative processes are, for a great part, different in woody and herbaceous plants, it may be said beforehand, that there will be differences in the sexual processes too. I shall, therefore, give separately the flowering periods of the woody plants comprising the trees and shrubs, and of the herbaceous plants comprising the rest.

Whether further distinctions are to be made, we shall see in the course of our investigation.

The following table will, in addition to the flowering time, contain the mean monthly rainfall, humidity, cloud proportion, and temperature of the Bombay Presidency, as given in the above tables:—

| | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean rainfall .. .. .. | ·16 | ·08 | ·15 | ·3 | ·7 | 12·99 | 21·62 | 14·32 | 7·6 | 2·51 | ·46 | ·17 |
| Mean humidity .. .. .. | 49·3 | 44·1 | 41·8 | 45·4 | 51·7 | 61·1 | 74 | 74·7 | 78·1 | 69·6 | 61·7 | 50·5 |
| Mean cloud proportion .. .. | 1·9 | 2·1 | 2·3 | 2·2 | 2·4 | 5·7 | 7·6 | 6·7 | 5·5 | 3 | 1·9 | 1·0 |
| Mean temperature.. .. .. | 68·6 | 71·7 | 79·1 | 84·1 | 87·1 | 85·1 | 81·8 | 80· | 80·2 | 79·1 | 73·2 | 68·7 |
| Flowering times of the woody plants .. .. .. .. | 197 | 223 | 249 | 227 | 186 | 114 | 86 | 129 | 118 | 130 | 154 | 134 |
| Flowering times of the herbaceous plants .. ... . | 126 | 104 | 71 | 48 | 32 | 38 | 103 | 158 | 106 | 392 | 321 | 283 |

[1] *Cf.* Woodrow Journ. Bomb. Nat. Hist. Soc. XI. 118, XI. 265, XI. 420, XI. 635, XII 162, XII. 354, XII. 515, XIII. 427.

As it is very difficult, even after a longer examination of this table, to trace the different relations between the climatic factors and the flowering period I add, in order to give a clearer idea, a graphic representation of the table. (Plate I.)

If we compare in the first place the meteorological curves with the curve representing the flowering times of the woody plants, there is one prominent feature which strikes us most, *viz.*, the coincidence of the maximum of rainfall in July with the minimum of flowering times during the same month. The clouds show their maximum at the same time, and humidity is just a little below its maximum in July, whilst temperature, after having reached its maximum in May, is going down as rapidly as it had risen since March. The flowering times reach their maximum in March, and, at the same time, humidity, clouds, and rainfall are almost at their minimum. The meteorological curves, except that of temperature, are continually rising in April, May, June, and July, during which period the curve of the flowering times is descending. In August the number of the flowering times is increased, whilst the clouds are diminished slightly, and the rainfall considerably. In September, again, the flowering times are less, and, though rainfall as well as clouds are descending, we find humidity at its maximum. After the month of September, the curve of the flowering times is rising decidedly, whilst all the meteorological curves are descending. From our curves we are not able to decide whether any greater influence upon the flowering time is to be attributed to temperature. For the explanation of the fact that the maximum of the flowering times does not coincide exactly with the minimum total of humidity, clouds, and temperature (as this evidently is not in March but in February, though there is only a very slight difference between the two months), we might adduce the reason that the temperature in February is not high enough for a full development in the sexual sphere. Perhaps the statistics of other regions might contribute towards the solution of the question as to the influence of temperature upon the flowering season in the tropics. This much, for the present, may be taken for certain, that to the maximum of rainfall, clouds, and humidity, there corresponds the minimum of flowering times of the woody plants, and to the minimum of the hydrometers the maximum of flowering periods.

A comparison of the flowering times of the herbaceous plants with the meteorological curves furnishes the following details: The minimum

of flowering times is reached in May. Humidity, clouds, and rainfall cannot account for that minimum, and still less so, if we see the curve of flowering times descending since January. But as soon as we take into consideration that the temperature is rising during February, March and April, and reaches its maximum in May, we cannot but suspect a certain relation between temperature and flowering season. Whether there exists such a relation actually we must learn in the course of our investigation. I think we might explain the same fact in this way. We see a comparatively high percentage of flowers in December and January, and a continually decreasing number in February, March, April, and May, not on account of the rising temperature, but because the rainy season still exercises its influence upon the flowering season, stronger in December than in January, and stronger in January than in February, etc. That this effect could be produced by humidity of the soil only is evident, but just this humidity is to a great extent dependent on the temperature, especially in regions like the Ghâts and the Deccan, which, owing to their special geological formation, are more exposed to the desiccating influence of the sun. In this way it seems again, that we are not allowed to neglect entirely the influence of temperature. By the fact, however, that the curve of flowering times rises rapidly and continually from May to October without a great change in temperature, it is shown to evidence that the influence of temperature is so slight, that we may wholly neglect it without incurring any inaccuracy.

How is it that the maximum of flowering times does not coincide with the maximum of rain and clouds and approximately of humidity in July, but with a very low rainfall in October? The fact is easily explained if we bear in mind, that herbaceous plants (with the only exception of many of those which are provided with bulbs, tubers, or rhizomes, *e. gr.* Liliaceæ, Dioscoreaceæ, Taccaceæh, Amaryllidaceæ, Scitaminaceæ, Orchidaceæ, Aroidaceæ) have not got a store of reserve material which enables them to develop flowers as soon as the outer circumstances allow it, but that they have to grow first the vegetative organs (stem and leaves), by means of which they are enabled to produce the necessary material for the construction of the reproductive organs. It is, thus, easily understood why the greatest part of the herbaceous plants is found flowering not at the beginning of the rainy season, but at a later period, according to the time they need for the development of the vegetative organs.

With regard to the orders just mentioned (Liliaceæ, Dioscoreaceæ, etc.), it seems to be an exaggeration to say that they behave like woody plants as to the special point of their flowering season.

It is true, many of them are found flowering during the hot season, but still more during the rainy part of the year. Besides, the number of flowering times, as above given, shows that herbs belonging to other orders flower in the same way during the first half of the year. I add a table of the flowering periods of some orders which all are possessed of tubers, bulbs or rhizomes.

| Orders. | January. | February | March. | April. | May. | June. | July. | August. | September | October. | ovember. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Orchidaceæ .. .. .. | 3 | 2 | 3 | 1 | 13 | 5 | 11 | 5 | 2 | 2 | 1 | 4 |
| Scitaminaceæ .. .. | .. | .. | .. | .. | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 1 |
| Amaryllideæ .. .. .. | .. | .. | .. | .. | 4 | 4 | 1 | .. | 1 | 1 | 1 | 1 |
| Tacceæ .. .. .. .. | .. | 1 | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. |
| Dioscoreæ .. .. .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 1 | .. | .. |
| Liliaceæ .. .. .. .. | .. | 1 | .. | .. | .. | 3 | 3 | 2 | 1 | .. | .. | .. |
| Aroideæ .. .. .. .. | .. | .. | .. | 2 | 1 | .. | 4 | 3 | 4 | 2 | 3 | .. |
| Total .. | 3 | 3 | 3 | 3 | 20 | 13 | 23 | 16 | 15 | 8 | 8 | 6 |

This table is, of course, not decisive, as just of these orders the data available are very incomplete. It is, however, striking that we find so great a number of flowers just during the hottest month of May; after a dry and warm season. Continued observations must be made before we can arrive at satisfactory results.

Highly interesting it would be to trace the relations which exist between the climatic factors and the flowering season of plants belonging to different orders. The following table contains the flowering periods of the herbaceous plants of some orders:—

| Orders. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Malvaceæ .. .. .. .. | 7 | 3 | 3 | . | .. | .. | .. | 1 | 4 | 18 | 17 | 11 |
| Tiliaceæ .. .. .. .. | .. | .. | .. | .. | . | . | .. | .. | 7 | 2 | 1 | 1 |
| Balsaminaceæ .. .. .. | 4 | 2 | 1 | 1 | 1 | .. | . | 2 | 6 | 8 | 4 | 4 |
| Leguminosæ .. .. . | 7 | 3 | 3 | 1 | 1 | 2 | 7 | 23 | 46 | 85 | 28 | 19 |
| Cucurbitaceæ .. .. .. | 1 | .. | .. | .. | . | 12 | 11 | 12 | 10 | 4 | 5 | 1 |
| Umbelliferæ .. .. .. | 1 | 2 | .. | 1 | 2 | 6 | 7 | 7 | 5 | 5 | 3 | 1 |
| Compositæ .. .. .. .. | 16 | 20 | 11 | 4 | 3 | 1 | 1 | 7 | 19 | 15 | 20 | 24 |
| Boraginaceæ .. .. .. | 4 | 1 | 2 | .. | .. | .. | | 3 | 2 | 8 | 4 | 5 |
| Scrophulariaceæ .. .. .. | 7 | 4 | 1 | .. | .. | .. | .. | .. | 1 | 5 | 7 | 5 |
| Graminaceæ .. .. .. .. | 13 | 8 | 6 | 4 | 3 | 2 | 5 | 15 | 39 | 85 | 56 | 30 |

This table shows distinctly the differences in the distribution of the flowering periods between the plants of the various orders, and there must, no doubt, be a reason why so many representatives of the Malvaceæ, Leguminosæ, Graminaceæ, and especially of the Compositæ are observed flowering during the dry season. Whether it is due to a special anatomical structure of those plants, or to a certain adaptation to insects, I am not able to say.

We now proceed to examine the flora and the climatic conditions of another vast area, *viz.*, of North-West and Central India. Dr. Brandis' object in writing his forest-flora was, "to give an account of the arborescent vegetation in the forest tracts of Panjab, the North West Provinces, and of those forests in the Central Provinces which are situated on the Maikal and Satpura range of mountains."[1] Here, again, the author himself may describe the geographical boundaries of the flora. "The northern limit," he says, "may be defined as the arid treeless zone of the inner Himalaya; while to the south the territory is bounded by the open forestless plain which skirts the Maikal and Satpura range from Bilaspur and Berar. The western limit is the Panjab frontier along the foot of the Suliman range; and eastward the territory is bounded by a broken line, which follows the Nepal frontier, first along the Kali river, and, afterwards, parallel with the foot of the Himalaya, until it touches the great Gandak river. From that point, a straight line drawn in a south-south-westerly direction through Benares to Amerkantak and Bilaspur may be regarded as the eastern boundary. Between the British territory of the Panjab and the North-West Provinces in the north, and the Central Provinces in the south, intervene the large and important native states of Rajputana, Malwa, and Bundelkhand, and as the arborescent vegetation of these States is very similar to that of the surrounding British territory, they have been included as far as possible. Most of the trees and shrubs of Sindh, and of the forest tracts of Guzerat, in the vicinity of the Mhye river, and south as far as the Mandevi forests on the right bank of the Tapti, are noticed.

"The northernmost point is the head of the Kaghan valley, drained by a tributary of the Jhelam, in lat. 35°; and the forest tracts furthest west are the Belas, along the Indus in Sindh, in long. 68°."[2]

1 Brandis' Forest-Flora of North-West and Central India. Introduction.

2 Brandis, l.c.

Brandis divides the whole area into four great climatic zones. The first includes the entire arid region of India, *viz.*, South-Panjab, Sind, the States of Buhawulpoor, Khyrpoor, Bikaneer, Jessulmia, and the greater part of Marwar. Here the rainfall is scanty and uncertain, and the atmosphere is dry almost throughout the whole year. The second zone includes the whole northern dry country. Comprising the plains of north and north-east Panjab (except the Sub-Himalayan tract), Delhi, Ajmeer, Gwalior, Bhurtpoor, Jeypur, and Meywar, it surrounds on the north and east the arid region and forms a belt from 100 to 200 miles wide. The normal annual rainfall is between 15 and 30 inches. A heavy monsoon and rainfall of more than 60 inches per annum characterises the western end of the north-eastern moist zone. It includes the coast of Burma, Bengal, the Sub-Himalayan tract, but only a narrow belt extends into the area of Brandis' flora, comprising part of the Gorakhpur and the Northern Oud forests, the Siwalik tract, the Doons, and the outer ranges of the North-West Himalaya. The fourth zone comprises part of the extensive intermediate region, which includes Central India, a large portion of the North-Indian plains, and that part of the Himalaya which stretches between the outer moist belt and the inner arid region of Tibet.

The best method to be adopted would be to describe the four zones separately with their respective floras and climates, because, only in this way we would be able to obtain the wished-for exact results. But everybody acquainted with Brandis' valuable book will understand that it is a thing of impossibility to put together from the rich information it gives the plants belonging to each zone, and even if possible, one difficulty could not be overcome, *viz.*, to find out the exact period of flowering in the different climatic regions. Of local floras, covering parts of North-West and Central India, only two are known to me. Murray described, 1881, "The Plants and Drugs of Sind" in one volume, but no notes as regards the flowering season are given. The other book by Duthie describes the flora of the Upper Gangetic Plain and of the adjacent Siwalik and Sub-Himalayan tracts, which will be treated of later on.

Thus, nothing is left, but to give as many meteorological statistics as are necessary for a fair average of the whole area and to add from Brandis' flora the flowering periods, which are, as is generally admitted, reliable, though not yet complete.

*Rainfall recorded at 40 stations.*

| | January. | February. | March. | April. | May | June. | July. | August. | September | October. | November. | December. | Year. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quetta, 9 years .. .. | 1·6 | 1·[illegible] | 2·4 | 1·3 | 0·[illegible] | ·1 | ·[illegible] | ·6 | ·[illegible] | ·1 | .. | 2·[illegible] | |
| Murree, 17 years .. .. | 4·3 | 5·6 | 4·5 | 3·6 | 3·6 | 3·4 | 12·2 | 13·1 | 5·6 | 1·7 | 1·5 | 2·4 | |
| Simla, 25 years .. .. | 2·8 | 2·7 | 3·0 | 2·8 | 4·7 | 7·9 | 19·3 | 18·1 | 6·0 | 1·4 | ·3 | 1·1 | |
| Chakrata .. .. | 2·3 | 2·7 | 3·2 | 1·7 | 2·9 | 7·9 | 17·[illegible] | 13·7 | 5·6 | ·7 | ·3 | ·1 | |
| Ranikhet, 16 years.. .. | 1·9 | 2·0 | 2·[illegible] | 1·3 | 3·0 | 6·0 | ·2 | 11·6 | 6·0 | 1·1 | ·3 | 1·0 | |
| Pacamarhi, 16 years .. | ·5 | ·3 | ·4 | ·2 | ·6 | 10·8 | 28·[illegible] | 18·2 | 10·1 | 1·9 | ·4 | ·7 | |
| Chikalda .. .. .. | ·5 | ·1 | ·4 | ·1 | ·5 | 11·9 | 17·[illegible] | 16·6 | 12·2 | 4·6 | ·3 | 1·[illegible] | |
| Abu, 27 years .. .. | ·2 | ·4 | ·3 | .. | 1·0 | 5·[illegible] | 22·2 | 22·5 | 9·1 | 2·1 | ·2 | ·2 | |
| Newara Eliya .. .. | 5·6 | 2·5 | 3·0 | 3·6 | 3·9 | 14·[illegible] | 13·7 | 9·[illegible] | 8·9 | 10·5 | 3·2 | 7·9 | |
| Peshawar, 28 years.. .. | 1·8 | 1·2 | 1·8 | 2·0 | 0·7 | 0·[illegible] | 1·7 | 2·0 | [illegible] | 2 | 0 | ·6 | |
| Rawalpindi, 29 years .. | 2·4 | 2·0 | 1·3 | 2·3 | 1·6 | 1·7 | 7·4 | 7·[illegible] | 3·2 | ·6 | ·2 | 1·1 | |
| Sialkot, 29 years .. .. | 1·4 | 1·6 | 1·9 | 1·6 | 1·2 | 3·2 | 11·[illegible] | 9·[illegible] | 3·[illegible] | ·4 | ·4 | ·2 | |
| Lahore, 30 years .. .. | ·7 | 1·1 | 1·1 | ·6 | ·3 | 1·[illegible] | 7·4 | 4·[illegible] | 2·[illegible] | ·6 | ·2 | ·3 | |
| Ludhiana 27 to 31 years .. | 1·3 | 1·2 | 1·[illegible] | ·3 | 1·2 | 2·[illegible] | 9·[illegible] | 6·5 | 4·3 | 1·2 | ·3 | ·3 | |
| Delhi, 34 to 36 years .. | 1·0 | ·5 | ·7 | ·4 | ·7 | 3·4 | 8·5 | 6·9 | 4·[illegible] | ·3 | ·1 | ·5 | |
| Sirsa, 34 to 36 years .. | ·7 | ·5 | ·5 | ·4 | ·5 | 2·3 | 3·7 | 3·5 | 2·[illegible] | ·3 | .. | ·3 | |
| Dera Ishmael Khan, 25 years | ·4 | ·[illegible] | 1 | ·8 | ·4 | ·[illegible] | 1·8 | 1·6 | ·6 | ·1 | ·1 | ·[illegible] | |
| Mooltan, 25 years .. | ·4 | ·3 | ·5 | ·3 | ·5 | ·4 | 2·2 | 1·3 | ·8 | ·1 | ·1 | ·[illegible] | |
| Jacobabad, 28 years .. | ·2 | ·2 | ·5 | ·2 | ·1 | ·1 | 1·4 | 1·4 | ·3 | .. | ·1 | ·1 | |
| Hyderabad, 21 to 24 years.. | ·2 | ·1 | ·1 | ·1 | ·1 | ·4 | 2·8 | 3·2 | ·8 | .. | ·1 | .. | |
| Kurrachee, 31 years .. | ·6 | ·3 | ·[illegible] | ·3 | ·1 | ·[illegible] | 3·1 | 1·8 | ·9 | ·1 | ·1 | ·[illegible] | |
| Bikanir, 9 years .. .. | ·3 | ·3 | ·1 | ·2 | 1·6 | 1·8 | 3·9 | 2·7 | 1·5 | ·1 | ·1 | .. | |
| Jeypore, 18 to 20 years .. | ·3 | ·2 | ·2 | ·2 | ·7 | 3·3 | 9·[illegible] | 6·[illegible] | 3·1 | ·2 | ·1 | ·[illegible] | |
| Ajmere, 24 years .. .. | ·2 | ·3 | ·4 | ·1 | ·7 | 2·5 | 6·9 | 7·3 | 3·4 | ·3 | ·1 | ·[illegible] | |
| Deesa, 29 to 31 years .. | ·1 | ·2 | ·1 | ·1 | ·2 | 2·2 | 9·[illegible] | 8·5 | 3·3 | ·3 | ·1 | .. | |
| Dehra, 37 to 3[illegible] years .. | 2·2 | 1·[illegible] | 1·4 | ·7 | 1·[illegible] | 8·6 | 25·[illegible] | 24·8 | 9·[illegible] | ·3 | ·1 | ·3 | |
| Roorkee, 32 to 33 years .. | 2·0 | 1·4 | 1·0 | ·4 | 1·2 | 5·1 | 12·[illegible] | 12·3 | 5·1 | ·6 | ·2 | ·[illegible] | |
| Meerut, 37 to 39 years .. | 1·0 | ·7 | ·[illegible] | ·4 | ·3 | 3·6 | 9·2 | 7·[illegible] | 4·[illegible] | ·4 | ·1 | ·[illegible] | |
| Agra 37 to 3[illegible] years .. | ·5 | ·3 | ·[illegible] | ·2 | ·1 | 2·[illegible] | 9·[illegible] | 6·[illegible] | 4·[illegible] | ·4 | .. | ·[illegible] | |
| Lucknow, 19 to 20 years .. | ·[illegible] | ·3 | ·[illegible] | 1 | ·9 | 5·[illegible] | 10·8 | 10 | 7·1 | 1·[illegible] | .. | ·[illegible] | |
| Allahabad 37 to 39 years.. | ·3 | ·4 | ·4 | ·2 | ·2 | 4·6 | 11·[illegible] | 9·[illegible] | 6·[illegible] | 2·[illegible] | ·[illegible] | ·[illegible] | |
| Benares, 37 to 39 years .. | ·7 | ·[illegible] | ·4 | ·2 | ·3 | 5·0 | 1[illegible] | 10·[illegible] | 6·[illegible] | 2·1 | ·1 | ·[illegible] | |
| Neemuch, 19 to 20 years .. | ·1 | ·2 | ·1 | ·1 | ·5 | 3·9 | 11·[illegible] | 10·[illegible] | [illegible] | 1·[illegible] | .. | ·[illegible] | |
| Indore, 19 years .. .. | ·4 | ·3 | .. | ·1 | ·[illegible] | 6·8 | 10·[illegible] | 7·8 | 3·1 | 1·2 | ·2 | ·[illegible] | |
| Jhansi, 26 to 27 years .. | ·5 | ·2 | ·4 | 1 | ·3 | 4·0 | 13·6 | 9·[illegible] | 5·[illegible] | ·[illegible] | .. | ·[illegible] | |
| Saugor, 29 to 32 years .. | ·6 | ·5 | ·3 | ·2 | ·7 | 6·3 | 16·8 | 11·2 | 7·2 | 1·3 | ·4 | ·[illegible] | |
| Sut[illegible]a .. .. .. .. | ·7 | ·5 | ·3 | ·1 | ·4 | 5·8 | 15·4 | 11·[illegible] | 5·1 | 1·9 | ·2 | ·4 | |
| Jubbulpore, 41 to 43 years. | ·6 | ·5 | ·5 | ·2 | ·5 | 8·5 | 18·6 | 13·8 | 8·[illegible] | 1·6 | ·3 | ·5 | |
| Seoni .. .. .. .. | ·7 | ·9 | ·5 | ·6 | ·9 | 10·1 | 15·0 | 11·0 | 8·2 | 1·[illegible] | ·4 | ·7 | |
| Akola 25 to 26 years .. | ·5 | ·1 | ·4 | ·1 | ·2 | 5·2 | 7·[illegible] | 6·7 | 5·8 | [illegible]·2 | ·4 | ·[illegible] | |
| Mean rainfall .. .. | 1·05 | ·94 | ·95 | ·77 | 1·1[illegible] | 4·35 | 10·73 | 8·35 | 4·87 | 1·2 | ·45 | ·69 | |

*Humidity recorded at 39 stations.*

| | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. | Year. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quetta .. .. .. | 6. | 6. | 5 | 5. | 4. | 41 | 47 | 43 | 37 | 41 | 42 | 34 | 42 |
| Murree .. .. .. | 57 | 61 | 5. | 51 | 4. | 48 | 72 | 8. | 69 | 4. | 44 | 49 | 56 |
| Simla .. . .. .. | 5. | 54 | 5. | 51 | 45 | 61 | 88 | 91 | 82 | 53 | 50 | 47 | 62 |
| Chakrata .. .. .. | 6. | 63 | 5. | 46 | 5. | 64 | 91 | 94 | 83 | 6. | 56 | 52 | 65 |
| Ranikhet . .. .. | 61 | 60 | 3. | 43 | 5. | 64 | 85 | 86 | 80 | 64 | 57 | 56 | 63 |
| Pachmarhi .. .. .. | 52 | 43 | 3. | 26 | 3. | 65 | 89 | 9. | 83 | 6. | 53 | 54 | 57 |
| Chikalda .. .. . | 52 | 43 | 34 | 27 | 3. | 69 | 91 | 92 | 89 | 65 | 55 | 52 | 59 |
| Mount Abu .. . | 39 | 34 | 30 | 29 | 35 | 65 | 8. | 87 | 76 | 4. | 36 | 41 | 50 |
| Newara Eliya .. .. | 81 | 78 | 7. | 7. | 8. | 88 | 88 | 86 | 86 | 87 | 85 | 83 | 83 |
| Peshawar .. .. .. | 62 | 57 | 57 | 55 | 43 | 3. | 51 | 5. | 56 | 48 | 55 | 62 | 54 |
| Rawalpindi .. .. | 7. | 7. | 6. | 58 | 51 | 49 | 65 | 7. | 67 | 56 | 61 | 67 | 63 |
| Sialkot .. .. . | 70 | 68 | 68 | 43 | 5. | 44 | 66 | 71 | 66 | 6. | 56 | 69 | 59 |
| Lahore .. .. .. | 60 | 5. | 48 | 37 | 3. | 37 | 58 | 61 | 55 | 46 | 47 | 56 | 50 |
| Ludhiana .. .. . | 65 | 64 | 55 | 5. | 47 | 49 | 68 | 70 | 67 | 54 | 52 | 61 | 59 |
| Delhi .. .. .. | 57 | 50 | 43 | 33 | 39 | 48 | 68 | 68 | 65 | 49 | 45 | 52 | 51 |
| Sirsa .. .. .. | 5. | 49 | 44 | 2. | 3. | 42 | 69 | 69 | 56 | 39 | 40 | 51 | 47 |
| Dera Ismael Khan . | 15 | 5. | 49 | 4. | 3. | 44 | 59 | 62 | 56 | 46 | 48 | 52 | 50 |
| Mooltan .. .. . | 58 | 52 | 50 | 45 | 4. | 51 | 59 | 64 | 62 | 53 | 52 | 56 | 54 |
| Jacobabad ... ... . | 46 | 39 | 41 | 3. | 3. | 42 | 53 | 58 | 55 | 46 | 45 | 45 | 46 |
| Hyderabad .. .. | 50 | 43 | 42 | 43 | 41 | 43 | 61 | 65 | 63 | 46 | 48 | 48 | 52 |
| Kurrachee .. .. . | 5. | 39 | 37 | 38 | 74 | 74 | 78 | 78 | 7. | 65 | 50 | 57 | 67 |
| Bikanir .. .. .. | 37 | 3. | 30 | 32 | 3. | 42 | 55 | 61 | 58 | 41 | 35 | 3. | 42 |
| Jeypore .. .. .. | 53 | 45 | 3. | 28 | 33 | 52 | 77 | 73 | 67 | 44 | 42 | 52 | 51 |
| Ajmere .. .. .. | 51 | 46 | 40 | 3. | 3. | 49 | 69 | 74 | 68 | 50 | 45 | 50 | 51 |
| Deesa .. .. . . | 35 | 31 | 31 | 28 | 4. | 53 | 74 | 73 | 79 | 44 | 35 | 38 | 46 |
| Roorkee .. .. .. | 64 | 6. | 49 | 34 | 3. | 51 | 76 | 76 | 72 | 5. | 5. | 62 | 58 |
| Meerut .. .. .. | 63 | 57 | 50 | 4. | 41 | 48 | 71 | 73 | 68 | 53 | 54 | 62 | 57 |
| Agra .. .. .. | 46 | 47 | 38 | 29 | 5. | 44 | 7. | 73 | 67 | 48 | 4. | 53 | 50 |
| Lucknow .. .. .. | 59 | 52 | 43 | 3. | 4. | 54 | 74 | 77 | 72 | 6. | 53 | 58 | 57 |
| Allahabad .. .. .. | 68 | 58 | 4. | 33 | 4. | 5. | 81 | 82 | 8. | 6. | 64 | 6. | 62 |
| Benares .. .. .. | 62 | 5. | 41 | 24 | 4. | 58 | 8. | 82 | 78 | 6. | 6. | 63 | 6. |
| Neemuch .. .. .. | 4. | 3. | 3. | 28 | 3. | 5. | 74 | 76 | 72 | 47 | 3. | 41 | 47 |
| Indore .. .. .. | 44 | 37 | 29 | 24 | 3. | 6. | 8. | 81 | 7. | 5. | 43 | 45 | 51 |
| Jhansi .. .. . | 4. | 41 | 34 | 2. | 3. | 47 | 74 | 76 | 7. | 48 | 3. | 4. | 4. |
| Saugor .. .. .. | 46 | 3. | 3. | 28 | 2. | 5. | 77 | 83 | 78 | 5. | 42 | 45 | 5. |
| Satna .. .. .. | 4. | 8. | 2. | 23 | 2. | 4. | 76 | 77 | 7. | 5. | 4. | 47 | 4. |
| Jubbulpore .. .. . | 5. | 5. | 3. | 2. | 3. | 5. | 81 | 2 | 7. | 6. | 5. | 5. | 5. |
| Seoni .. .. .. | 5. | 4. | 34 | 3. | 3. | 6. | 8. | 0 | 76 | 5. | 5. | 5. | 5. |
| Akola .. .. .. | 47 | 3. | 2. | 2. | 2. | 5. | 7. | 74 | 7. | 6. | 5. | 5. | 5. |
| Mean humidity .. . | 55·7 | 50·4 | 41·1 | 38·4 | 40·3 | 53·4 | 72·5 | 74·3 | 70·0 | 53·2 | 49·7 | 53·7 | 54·8 |

*Cloud proportion recorded at 40 stations.*

| — | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. | Year. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quetta .. ... .. | 4·1 | 4·3 | 4·9 | 3·9 | 2·2 | 1·2 | 1·7 | 1·7 | ·7 | ·5 | ·9 | 3·2 | 2·4 |
| Murree .. .. .. | 5·7 | 5·4 | 6·1 | 5·5 | 4·4 | 3·7 | 6·2 | 6·1 | 3·6 | 2·2 | 2·6 | 4·5 | 4·7 |
| Simla .. .. .. .. | 5·0 | 5·0 | 5·0 | 4·6 | 4·1 | 6·1 | 8·5 | 8·6 | 6·2 | 1·0 | 1·5 | 3·5 | 4·9 |
| Chakrata .. .. .. | 4·5 | 4·8 | 4·2 | 3·7 | 2·8 | 3·2 | 8·2 | ·6 | 6·1 | 1·5 | 1·6 | 3·3 | 4·7 |
| Ranikhet .. .. .. | 3·7 | 4·6 | 3·8 | 3·4 | 3·8 | 5·1 | 8·7 | 8·5 | 6·1 | 1·6 | 1·2 | 2·6 | 4·5 |
| Pachmarhi .. .. . | 2·2 | 2·1 | 2·1 | 2·2 | 1·8 | 6·6 | 8·7 | 8·4 | 7·3 | 2·9 | 1·9 | 2·0 | 4·1 |
| Chikalda .. .. .. | 1·7 | 1·2 | 1·1 | 2·0 | 2·4 | 6·1 | 8·1 | 8·7 | 7·5 | 3·0 | 1·9 | 1·9 | 4·6 |
| Mount Abu .. .. .. | 2·4 | 3·0 | 2·4 | 2·0 | 2·0 | 5·5 | 8·7 | 8·1 | 6·4 | 2·1 | 1·2 | 1·9 | 4·0 |
| Nowara Eliya . .. | 5·0 | 5·5 | 4·1 | 5·0 | 5·7 | 8·1 | 7·5 | 7·1 | 6·3 | 6·4 | 5·9 | 5·6 | 5·9 |
| Peshawar .. . .. | 4·3 | 4·1 | 4·9 | 1·3 | 3·1 | 2·2 | 2·6 | 2·7 | 1·7 | 1·5 | 1·3 | 3·3 | 3·1 |
| Rawalpindi .. .. . | 4·8 | 4·2 | 4·3 | 3·1 | 2·8 | 2·1 | 3·9 | 3·7 | 2·0 | 1·2 | 1·8 | 3·0 | 3·1 |
| Sialkote .. .. .. | 4·1 | 4·3 | 4·5 | 3·0 | 3·0 | 2·4 | 4·8 | 4·7 | 2·7 | 1·1 | 1·9 | 3·1 | 3·4 |
| Lahore .. .. .. | 3·7 | 3·4 | 3·1 | 2·3 | 2·4 | 2·9 | 4·2 | 3·7 | 1·7 | ·8 | 1·2 | 2·5 | 2·8 |
| Ludhiana .. .. ... | 3·7 | 3·6 | 3·1 | 2·8 | 2·2 | 2·9 | 5·7 | 5·2 | 2·1 | ·8 | 1·3 | 2·6 | 3·1 |
| Delhi .. .. .. .. | 3·1 | 3·0 | 3·1 | 2·7 | 2·2 | 3·1 | 6·0 | 5·7 | 3·5 | ·8 | ·7 | 1·8 | 3·0 |
| Sirsa .. .. .. .. | 3·8 | 4·0 | 4·1 | 3·1 | 2·9 | 3·5 | 5·4 | 5·4 | 3·1 | 1·0 | 1·2 | 2·6 | 3·4 |
| Dera Ishmael Khan .. | 3·1 | 2·1 | 3·2 | 2·9 | 1·5 | 1·6 | 2·1 | 2·5 | 1·0 | ·5 | 1·4 | 2·3 | 2·1 |
| Mooltan .. .. .. | 2·6 | 2·0 | 2·4 | 1·8 | 1·3 | 1·0 | 2·2 | 2·1 | 1·1 | ·3 | ·7 | 1·8 | 1·7 |
| Jacobabad .. .. | 2·4 | 3·2 | 3·1 | 3·1 | 1·4 | 1·1 | 2·1 | 2·1 | ·9 | ·4 | ·9 | 1·5 | 1·9 |
| Hyderabad .. .. .. | 1·5 | 2·0 | ·8 | 1·3 | ·7 | 1·5 | 2·9 | 3·3 | 1·7 | ·3 | ·6 | 1·1 | 1·6 |
| Kurrachee .. .. .. | 2·1 | 3·1 | 3·2 | 2·2 | 2·2 | 4·3 | 7·1 | 6·8 | 4·3 | 1·0 | 1·1 | 2·1 | 3·4 |
| Bikanir .. .. .. | 3·2 | 3·8 | 3·1 | 3·1 | 2·7 | 2·8 | 5·6 | 6·0 | 4·0 | 1·3 | ·8 | 2·4 | 3·3 |
| Jeypore .. .. .. | 2·0 | 2·7 | 2·9 | 2·4 | 2·6 | 4·2 | 7·3 | 6·6 | 4·1 | 1·5 | ·7 | 1·8 | 3·3 |
| Ajmere .. .. . | 2·2 | 2·3 | 2·4 | 2·1 | 1·8 | 3·5 | 6·5 | 6·1 | 3·5 | ·9 | ·8 | 1·4 | 2·8 |
| Deesa .. .. . .. | 2·0 | 2·2 | 2·4 | 1·7 | 1·4 | 4·5 | 7·1 | 7·5 | 5·2 | 1·6 | 1·0 | 1·6 | 3·2 |
| Dehra .. .. .. | 3·1 | 4·1 | 3·1 | 3·6 | 3·0 | 4·3 | 7·7 | 7·4 | 4·8 | 1·0 | 1·1 | 2·5 | 3·9 |
| Roorkee .. .. .. | 3·1 | 3·1 | 2·3 | 2·3 | 1·9 | 3·3 | 6·4 | 6·2 | 4·2 | ·8 | ·8 | 2·1 | 3·1 |
| Meerut .. .. .. | 2·9 | 2·7 | 2·6 | 2·1 | 1·9 | 3·2 | 6·7 | 6·3 | 4·1 | ·7 | ·6 | 1·7 | 2·9 |
| Agra .. .. .. .. | 2·0 | 2·4 | 1·9 | 1·5 | 1·3 | 3·6 | 6·4 | 6·3 | 3·9 | ·8 | ·8 | 1·3 | 2·7 |
| Lucknow .. .. .. | 2·7 | 3·0 | 2·7 | 2·1 | 2·0 | 4·7 | 7·7 | 7·4 | 5·4 | 1·5 | ·8 | 1·8 | 3·5 |
| Allahabad ... .. ... | 1·8 | 2·1 | 1·8 | 1·4 | 1·6 | 4·5 | 7·6 | 7·3 | 5·2 | 1·6 | ·9 | 1·6 | 3·1 |
| Benares .. .. .. | 2·1 | 2·3 | 2·1 | 1·7 | 1·9 | 5·0 | 7·6 | 7·4 | 5·5 | 2·3 | 1·1 | 1·6 | 3·4 |
| Neemuch .. .. .. | 2·2 | 1·9 | 2·5 | 2·1 | 2·2 | 5·0 | 8·1 | 7·8 | 5·0 | 2·1 | ·7 | 1·7 | 3·6 |
| Indore .. .. .. | 1·9 | 1·6 | 2·0 | 1·8 | 2·2 | 6·3 | 8·4 | 8·4 | 6·9 | 2·9 | 1·4 | 1·7 | 3·8 |
| Jhansi .. .. .. | ·7 | ·7 | ·2 | ·4 | ·6 | 1·7 | 4·3 | 4·5 | 2·0 | ·3 | ·2 | ·3 | 1·3 |
| Saugor .. .. .. | 1·4 | 1·5 | 1·3 | 1·4 | 2·0 | 4·1 | 6·1 | 5·9 | 4·5 | 1·4 | 1·0 | 1·0 | 2·6 |
| Sutna .. .. .. | 2·1 | 2·3 | 2·1 | 2·2 | 2·8 | 5·1 | 7·1 | 6·8 | 5·3 | 2·2 | 1·2 | 1·6 | 3·4 |
| Jubbulpore .. .. .. | 2·2 | 2·1 | 1·9 | 2·2 | 3·3 | 6·5 | 7 | 8·2 | 6 | 2·7 | 1·7 | 1·9 | 4·0 |
| Seoni .. .. .. .. | 1·6 | 1·7 | 1·4 | 1·7 | 3·3 | 6·1 | 8· | 8·4 | 6·9 | 3·9 | 2·7 | 1·6 | 3·8 |
| Akola .. .. .. .. | 1·2 | 1·5 | 1·1 | 1·3 | 1·9 | 6·2 | 8·5 | 8·0 | 6·4 | 2·5 | 1·3 | 1·5 | 3·5 |
| Mean cloud proportion .. | 2·97 | 3·08 | 3·01 | 2·67 | 2·71 | 4·91 | 6·26 | 6·07 | 4·21 | 1·60 | 1·31 | 2·23 | 3·32 |

*Temperature recorded at 40 stations.*

| | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. | Year. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quetta .. .. .. | 40 | 4[illegible] | 50 | 5[illegible] | [illegible]0 | 7[illegible] | 77 | 7[illegible] | 67 | 5[illegible] | 4[illegible] | 4 | [illegible]8 |
| Murree .. .. .. | 39 | 39 | 4[illegible] | 5[illegible] | 6[illegible] | [illegible]1 | 68 | 6[illegible] | 6[illegible] | 5 | [illegible]1 | [illegible]2 | [illegible]6 |
| Simla .. .. .. .. | 41 | 41 | 5[illegible] | 5[illegible] | 6[illegible] | 6[illegible] | 6[illegible] | 6[illegible] | 61 | 5 | 4[illegible] | 4[illegible] | 55 |
| Chakrata .. .. .. | 42 | 43 | 51 | [illegible]0 | 64 | 67 | 64 | 6[illegible] | 63 | 5[illegible] | 51 | 4[illegible] | 56 |
| Ranikhet .. .. .. | 4[illegible] | 4[illegible] | 57 | 6 | 6[illegible] | 71 | [illegible]1 | 6[illegible] | 66 | 61 | 55 | 4[illegible] | [illegible]0 |
| Pachmarhi .. .. .. | 5[illegible] | 62 | 7[illegible] | 7[illegible] | 8[illegible] | 7[illegible] | 71 | 7[illegible] | 7 | 6[illegible] | 60 | 5[illegible] | 69 |
| Chikalda .. .. .. | 6[illegible] | 67 | 7[illegible] | [illegible]1 | 82 | 7[illegible] | 6[illegible] | 6[illegible] | 68 | 69 | [illegible]5 | 6 | 70 |
| Mount Abu .. .. .. | 5[illegible] | 6[illegible] | 69 | 7 | 79 | 7[illegible] | 70 | 6 | 69 | 70 | 6[illegible] | 5[illegible] | 68 |
| Nowgra Kliya .. .. | 57 | 57 | 5[illegible] | [illegible]1 | 61 | 5[illegible] | 5[illegible] | 59 | [illegible]9 | 5[illegible] | 5[illegible] | 5[illegible] | 59 |
| Peshawar .. .. .. | 5[illegible] | 52 | 6[illegible] | 70 | 8[illegible] | [illegible]9 | 89 | 87 | [illegible]1 | 71 | 5[illegible] | 5[illegible] | 70 |
| Rawalpindi .. .. .. | 4[illegible] | 5[illegible] | 61 | 71 | 81 | 8[illegible] | 87 | 8[illegible] | [illegible]0 | 70 | 57 | 5[illegible] | [illegible]9 |
| Sialkote .. .. .. | 5 | 56 | [illegible]6 | 7[illegible] | 8 | 91 | 87 | 85 | 8[illegible] | 7[illegible] | 6[illegible] | 5[illegible] | 68 |
| Lahore .. .. .. | 5[illegible] | [illegible]5 | 6[illegible] | [illegible]1 | 88 | [illegible]3 | 89 | 8[illegible] | [illegible]5 | 77 | 64 | 5[illegible] | 75 |
| Ludhiana .. .. .. | 52 | 5[illegible] | [illegible]8 | 7[illegible] | 8[illegible] | 91 | 86 | [illegible]0 | [illegible]3 | 75 | 6[illegible] | 54 | 73 |
| Delhi .. .. .. .. | 5 | 6[illegible] | 7[illegible] | 8[illegible] | 8 | 9[illegible] | 8 | 86 | [illegible]4 | 7[illegible] | 6[illegible] | 6[illegible] | 77 |
| Simla .. .. .. .. | 56 | 6[illegible] | [illegible]3 | 8[illegible] | 8[illegible] | 9[illegible] | 8[illegible] | 8[illegible] | [illegible]0 | 7[illegible] | 6[illegible] | [illegible]. | 76 |
| Dera Ishmail Khan .. | [illegible]. | 5[illegible] | 6. | 7[illegible] | 8 | 9[illegible] | 91 | [illegible]0 | 8[illegible] | 75 | 6[illegible] | 5[illegible] | 74 |
| Moultan .. .. .. | 54 | 5[illegible] | 7 | [illegible]6 | 8[illegible] | 9[illegible] | 92 | [illegible]9 | 87 | 77 | 6[illegible] | 5[illegible] | 76 |
| Jacobabad .. .. .. | 5[illegible] | [illegible] | 7[illegible] | 8[illegible] | [illegible]1 | 9[illegible] | 9[illegible] | [illegible]1 | 8[illegible] | 78 | [illegible]5 | 5 | 78 |
| Hyderabad .. .. .. | 6[illegible] | 6[illegible] | 7[illegible] | 8[illegible] | 91 | 91 | 88 | 8[illegible] | 86 | 8[illegible] | 7[illegible] | 6[illegible] | 79 |
| Kurrachee .. .. . | 65 | 6[illegible] | 7[illegible] | 8[illegible] | 85 | 8[illegible] | 8[illegible] | 8 | [illegible]2 | 8[illegible] | [illegible]5 | 6 | 77 |
| Bikanir .. .. .. | 6[illegible] | 64 | 7 | [illegible]5 | 9[illegible] | 9[illegible] | 90 | 8[illegible] | 87 | [illegible]. | 71 | 6[illegible] | 80 |
| Jeypore .. .. .. | 6[illegible] | 6 | 7[illegible] | 8[illegible] | 9[illegible] | 91 | [illegible]4 | [illegible]5 | 8[illegible] | 7[illegible] | 6[illegible] | 6[illegible] | 77 |
| Ajmere .. .. .. | 5[illegible] | [illegible]. | 7[illegible] | [illegible]2 | 89 | 8 | 8[illegible] | [illegible]0 | [illegible]. | 7[illegible] | 6 | 5[illegible] | 74 |
| Deesa .. .. .. .. | 6 | 7 | 8 | [illegible]2 | 9[illegible] | [illegible]0 | 8[illegible] | 8 | 8[illegible] | 8[illegible] | 7 | [illegible] | [illegible]0 |
| Deesa .. .. .. .. | 55 | 5 | 6[illegible] | 77 | 8 | [illegible]4 | 8[illegible] | 79 | 78 | 73 | 6[illegible] | 5[illegible] | 71 |
| Roorkee .. .. .. | 56 | 6[illegible] | 7[illegible] | 8[illegible] | 8[illegible] | 9[illegible] | 8[illegible] | [illegible]4 | [illegible]3 | 7[illegible] | 6[illegible] | 5 | 75 |
| Meerut .. .. .. | 5[illegible] | 6 | 7[illegible] | 8 | 8[illegible] | 9[illegible] | 86 | 8 | 8[illegible] | 76 | 6[illegible] | 5[illegible] | [illegible]6 |
| Agra .. .. .. .. | [illegible]0 | 6[illegible] | 7[illegible] | 8 | 9[illegible] | 9 | 8[illegible] | [illegible]5 | 84 | [illegible]0 | 7 | 6[illegible] | 79 |
| Lucknow .. .. .. | 61 | 6[illegible] | [illegible]7 | 8[illegible] | [illegible]2 | 9 | [illegible] | [illegible]5 | [illegible]3 | 7[illegible] | 6 | 6 | 8 |
| Allahabad .. .. .. | 6 | 6[illegible] | 7[illegible] | 8 | 9[illegible] | 91 | 8 | [illegible]4 | 83 | 7[illegible] | 6[illegible] | [illegible] | 78 |
| Benares .. .. .. | 61 | [illegible]. | [illegible]7 | 87 | 91 | [illegible]1 | [illegible]5 | [illegible]4 | [illegible]3 | 7[illegible] | 6[illegible] | 6 | [illegible]8 |
| Nemuch .. .. .. | 6[illegible] | 6[illegible] | 7[illegible] | 8[illegible] | 8[illegible] | 8[illegible] | 79 | 78 | 78 | 7[illegible] | 6[illegible] | 6 | 75 |
| Indore .. .. .. | 64 | 6[illegible] | 7[illegible] | 83 | 87 | 8[illegible] | 77 | 76 | 7[illegible] | 7 | [illegible] | [illegible] | 74 |
| Jhansi .. .. .. | 6[illegible] | 6 | 7[illegible] | 8[illegible] | [illegible]0 | 8[illegible] | 84 | 8[illegible] | [illegible]2 | 8[illegible] | 7 | 6 | 79 |
| Saugor .. .. .. | 6[illegible] | 6[illegible] | 7[illegible] | 8 | 8 | 8[illegible] | 7[illegible] | [illegible]7 | [illegible]7 | 7 | 6[illegible] | [illegible]4 | 76 |
| Patna .. .. .. .. | 6[illegible] | 6 | 7[illegible] | 8[illegible] | [illegible]0 | 8[illegible] | [illegible]2 | [illegible]1 | [illegible]1 | 7 | 6[illegible] | [illegible]4 | 78 |
| Jubbulpore .. .. .. | [illegible]2 | 6[illegible] | 7[illegible] | 8[illegible] | [illegible]0 | 8 | 79 | 7[illegible] | 7[illegible] | 7[illegible] | 6[illegible] | 6[illegible] | [illegible]8 |
| Seoni .. .. .. .. | 6 | [illegible] | 7[illegible] | [illegible]4 | [illegible]7 | [illegible]2 | 7 | [illegible]9 | [illegible]4 | 7[illegible] | 6[illegible] | 6 | 74 |
| Akola .. .. .. .. | 6[illegible] | 7[illegible] | 8 | [illegible]9 | [illegible]6 | 8[illegible] | 80 | [illegible]9 | [illegible]8 | [illegible]7 | [illegible]0 | [illegible]. | [illegible]8 |
| Mean temperature .. .. | [illegible]6·[illegible] | 60·2 | 70·[illegible] | [illegible]0 | 81·6 | 85·6 | 81·0 | 79·7 | 78·5 | 73·[illegible] | 64·1 | [illegible]7·[illegible] | 72·2 |

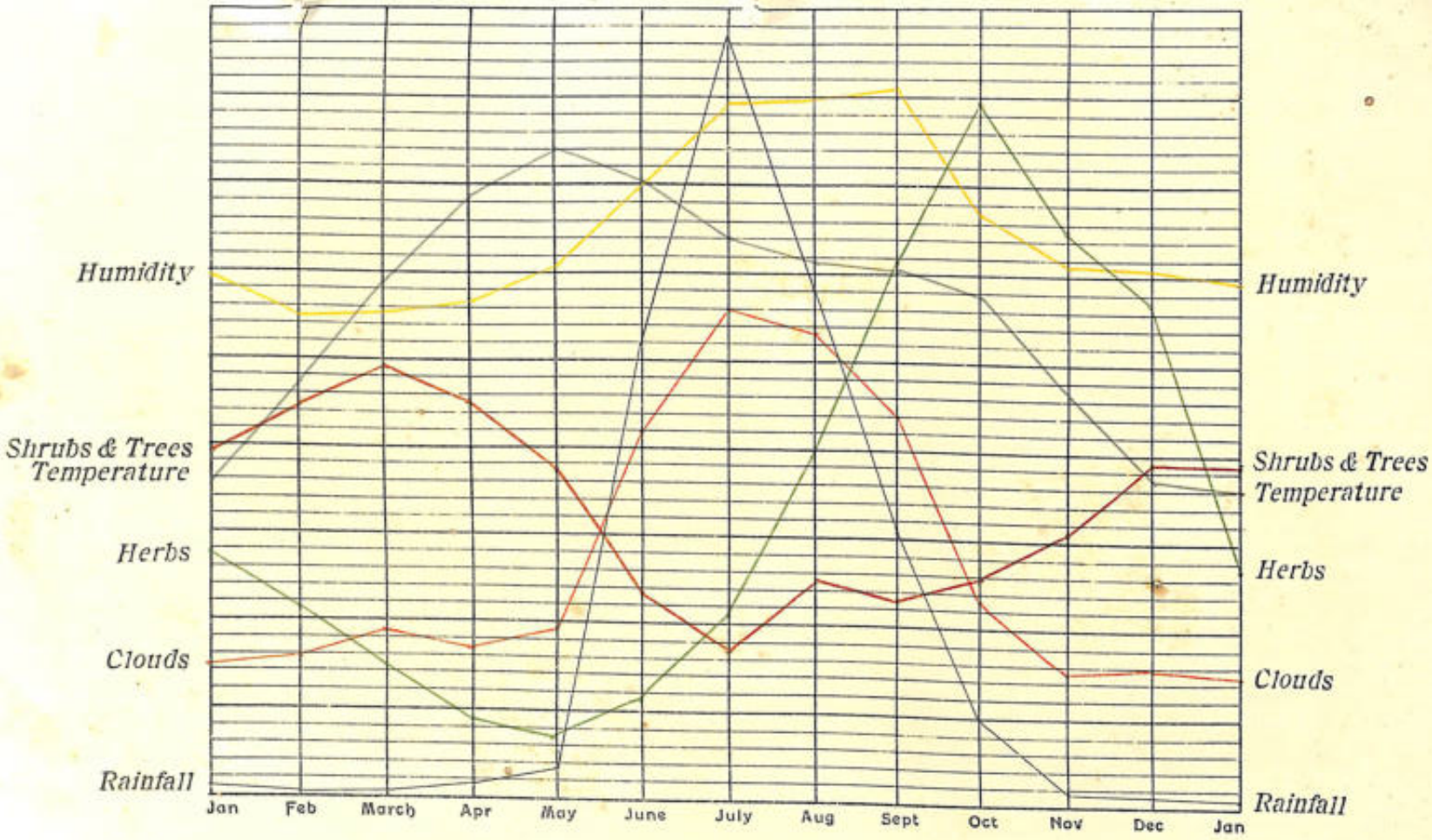
Giving once more the mean monthly rainfall, humidity, cloud proportion, and temperature, and adding, besides the flowering periods of the woody plants (the herbaceous plants not being described in Brandis' flora), we obtain the following table for a comparison between flowering time and climate :—

| | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean rainfall .. .. .. | 1·08 | ·94 | ·95 | ·77 | 1·14 | 4·35 | 10·7. | 8·93 | 4·87 | 1·2 | ·43 | ·69 |
| Mean humidity .. .. .. | 53·7 | 50·4 | 41·1 | 38·4 | 40·1 | 53·4 | 72· | 74 | 70·1 | 53·9 | 49·7 | 53·7 |
| Mean cloud proportion .. .. | 1·97 | 3·08 | 3·01 | 2·67 | 2·48 | 4·01 | 6·23 | 6·07 | 4·25 | 1·10 | 1·38 | 2·23 |
| Mean temperature.. .. .. | 56·8 | 60·2 | 70·3 | 79·0 | 84·0 | 85·6 | 81·0 | 79·7 | 78·3 | 78·. | 64·1 | 57·8 |
| Flowering times of the woody plants .. .. .. .. | 85 | 131 | 155 | 428 | 186 | 213 | 140 | 111 | 63 | 59 | 66 | 66 |

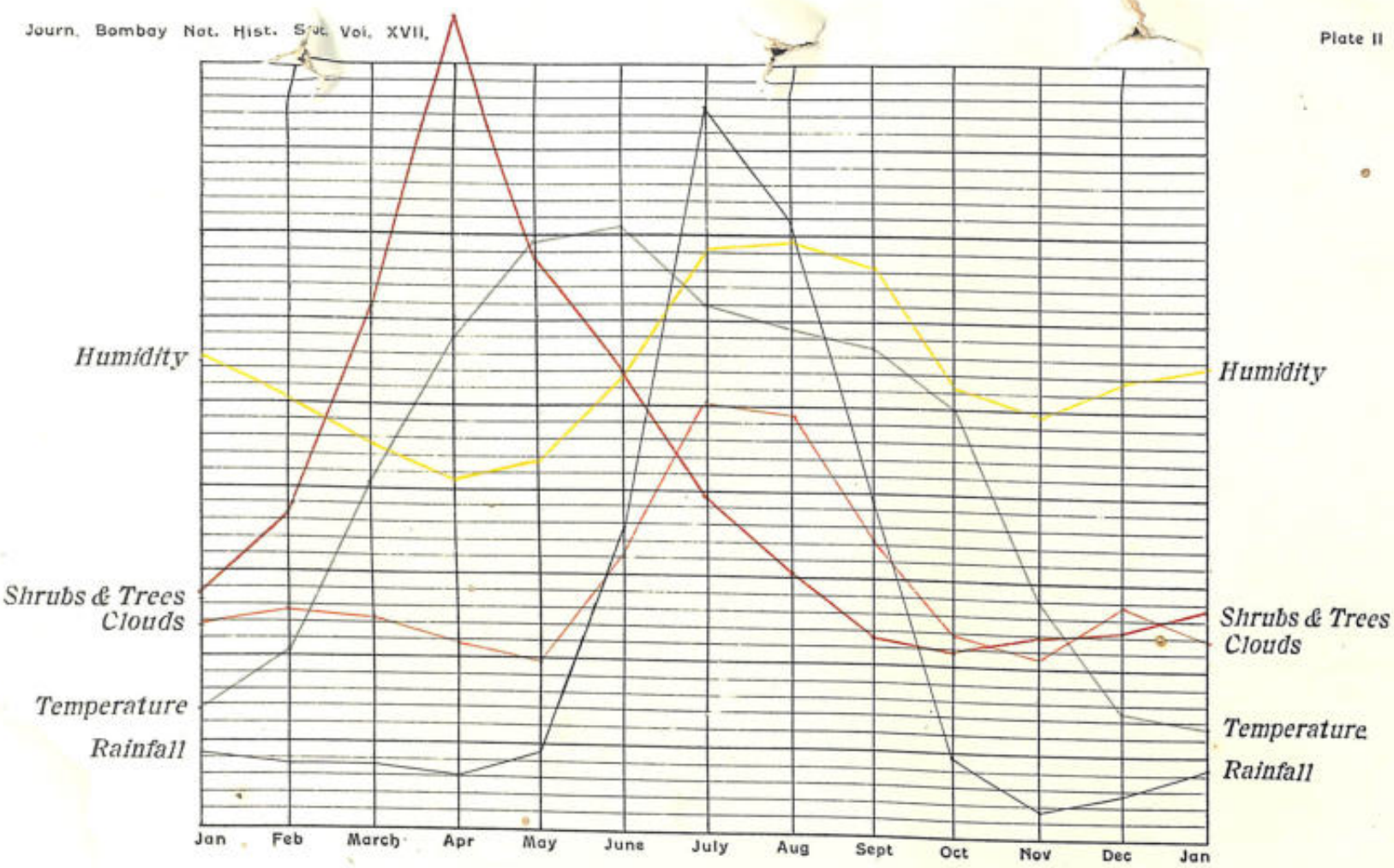
Plate II shows the same graphically.

A short examination of these curves leads to the same results, as did our first graphic representation. The maximum of flowering times coincides with the minima of humidity and rainfall, and with little above the minimum of clouds during the first half of the year. The only difference between the two regions with regard to the flowering season is that, here, it is not the month of March which shows the maximum of flowering times, but the month of April. This is, no doubt, due to the high degree of humidity during January and February. Whilst the curves of rainfall, clouds and humidity are ascending, the curve of the flowering times is descending. This is well shown especially in May, June, and July. As soon as rainfall, clouds, and humidity are approaching their minimum in October, the number of flowering times begins to increase.

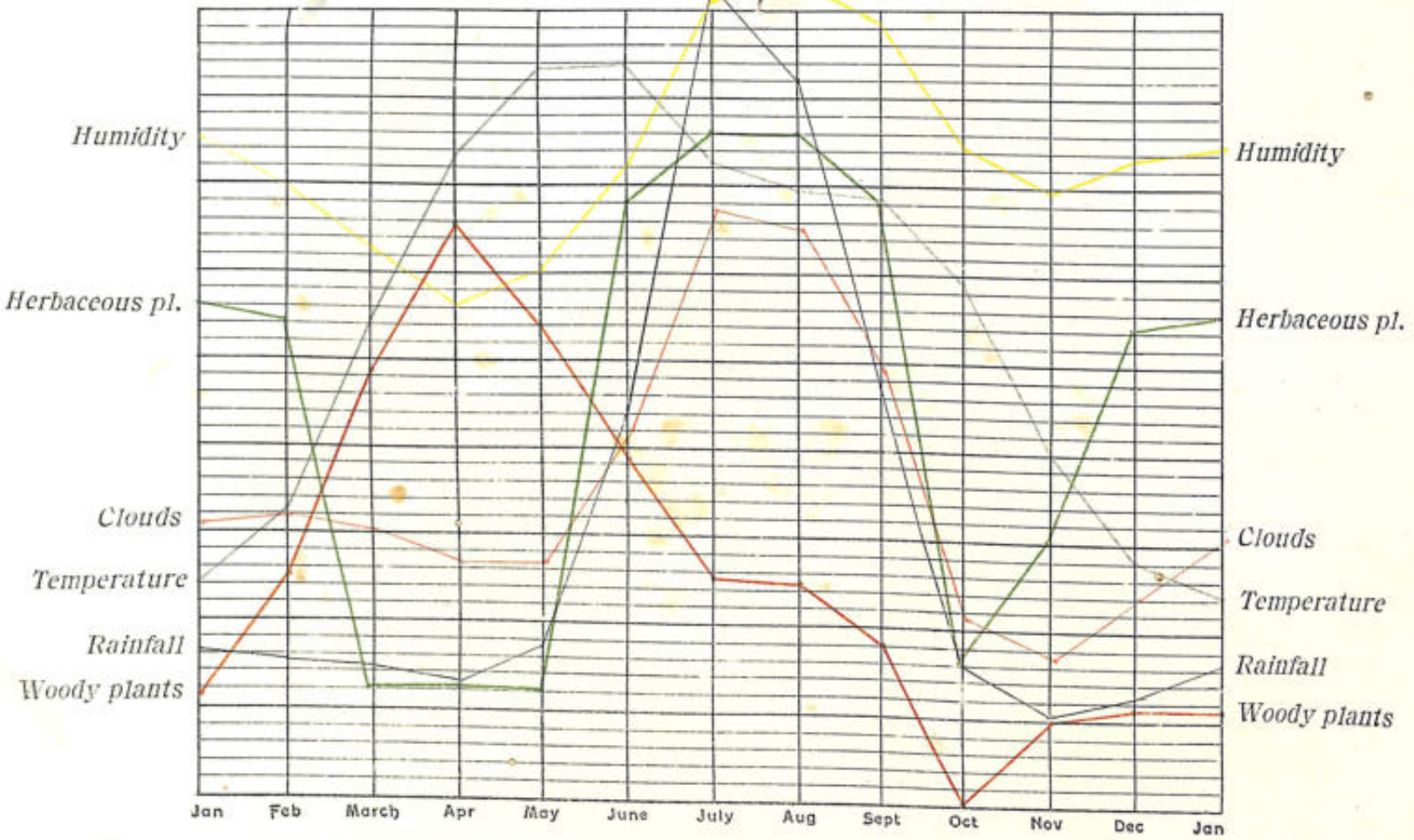
I now pass to the examination of an area which was included in the foregoing, *viz.*, the Upper Gangetic Plain and the adjacent Siwalik and sub-Himalayan tracts. It is worth being treated of independently, because Duthie describes in his flora not only the woody but also the herbaceous plants. There has appeared as yet only one volume, comprising the orders Ranunculaceæ to Cornaceæ. "The area dealt with in this flora," says the author, "amounts approximately to 196,000 square miles. It is bounded on the north and north-east by a portion of the main chain of the Western Himalaya, and on the east by Bengal. On the south and south-west the boundary follows the watershed, from which all the rivers west of the Son, and flowing into the




FLOWERING SEASON AND CLIMATE.




FLOWERING SEASON AND CLIMATE.




FLOWERING SEASON AND CLIMATE.

Ganges and Jumna from these directions, take their origin. The watershed extends along the northern slope of the numerous groups of hills known collectively as the Vindhya mountains, and which separate the Gangetic Plain from the Narbada Valley."[1] With regard to the climate of the North-West Provinces the cool season comes to an end in March. Strong hot winds setting in from the west last well into May. As they are extremely dry, a humidity as low as 6 per cent. has sometimes been recorded. After the greatest heat at the end of May or the beginning of June, the rainy season sets in during the latter half of June. It generally does not rain for more than a day or two at a time, and the rains cease usually in September, lasting generally a week or more longer in the eastern than in the western districts. The cold weather falls begin towards the end of December and last during January and February[2]. Here I add the statistics of the average monthly rainfall of 22 stations which lie within the area of Duthie's flora.

*Rainfall recorded at 22 stations.*

| | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mussoorie, 23 to 35 years .. | 2·3 | 2·9 | 2·0 | 1·7 | 2·8 | 9·5 | 30·2 | 10·2 | 9·9 | 1·0 | ·3 | 1·1 |
| Dehra Dun, 37 to 39 years .. | 2·2 | 1·9 | 1·4 | ·7 | 1·6 | 8·6 | 25·0 | 4·8 | 9·3 | ·8 | ·1 | ·6 |
| Ramkhet, 16 year .. | 1·9 | 2·0 | 2·2 | 1·3 | 3·0 | 6·0 | 12·7 | 11·6 | [illegible] | 1·1 | ·3 | 1·0 |
| Naini Tal, 36 to 38 years .. | 3·0 | 2·8 | 2·5 | 1·6 | 3·4 | 14·9 | 25·9 | 23·0 | 13·8 | 1·4 | ·2 | 1·3 |
| Roorkee, 32 to 33 years .. .. | 2·0 | 1·4 | 1·0 | ·4 | 1·2 | 5·1 | 12·5 | 12·3 | 5·1 | ·6 | ·2 | ·4 |
| Meerut, 37 to 39 years .. .. | 1·0 | ·7 | ·7 | ·4 | ·8 | 3·6 | 7·2 | 7·2 | 4·0 | ·5 | ·1 | ·3 |
| Moradabad, 37 to 39 years .. | ·2 | 1·0 | ·8 | ·3 | 1·0 | 5·3 | 11·8 | 9·9 | 5·0 | ·8 | ·1 | ·4 |
| Bareilly, 37 to 39 years .. .. | 1·0 | ·8 | ·7 | ·3 | ·9 | 6·0 | 14·5 | 9·3 | 6·7 | 1·3 | ·1 | ·3 |
| Agra, 37 to 39 years .. .. | ·5 | ·2 | ·2 | ·2 | ·7 | 2·9 | 9·8 | 6·7 | 4·3 | ·4 | .. | ·2 |
| Lucknow, 19 to 20 years .. | ·8 | ·3 | ·3 | ·1 | ·9 | 5·0 | 10·8 | 11·4 | 7·1 | 1·4 | .. | ·6 |
| Cawnpore, 37 to 39 years . | ·7 | ·4 | ·2 | ·1 | ·5 | 3·5 | 9·7 | 8·8 | 4·8 | 1·2 | ·1 | ·2 |
| Allahabad, 37 to 38 years .. | ·8 | ·4 | ·4 | ·2 | ·3 | 4·6 | 11·9 | 9·4 | 6·7 | 2·3 | ·2 | ·2 |
| Jhansi, 26 to 27 years .. .. | ·5 | ·2 | ·5 | ·1 | ·3 | 4·0 | 13·6 | 10·5 | 5·2 | ·8 | .. | ·2 |
| Gorakhpur, 37 to 39 years .. | ·7 | ·5 | ·4 | ·3 | 1·5 | 7·7 | 13·3 | 13·8 | 8·8 | 2·1 | ·2 | ·1 |
| Benares, 37 to 39 years .. .. | ·7 | ·3 | ·4 | ·2 | ·5 | 5·0 | 12·8 | 11·7 | 6·5 | 2·1 | ·1 | ·1 |
| Jeypore, 18 to 20 years .. .. | ·3 | ·2 | ·2 | ·2 | ·7 | 5·3 | 9·0 | 6·1 | 3·1 | ·2 | ·1 | ·4 |
| Ajmere, 24 years .. .. | ·2 | ·3 | ·4 | ·1 | ·7 | 2·5 | 6·9 | 7·3 | 2·4 | ·3 | ·1 | ·3 |
| Indore, 9 years .. .. .. | ·4 | ·3 | .. | ·1 | ·6 | 6·8 | 10·4 | 7·8 | 3·1 | 1·2 | ·2 | ·2 |
| Neemuch 1[illegible] to 2[illegible] years .. | ·1 | ·2 | ·1 | ·1 | ·5 | 3·9 | 1·2 | 10·4 | 3·5 | 1·0 | .. | ·2 |
| Delhi, 34 to 36 years .. .. | 1·0 | ·5 | ·7 | ·4 | ·7 | 2·4 | 8·3 | 8·9 | 4·5 | ·5 | ·1 | ·4 |
| Sangor, 29 to 32 years .. .. | ·6 | ·5 | ·2 | ·2 | ·6 | 6·2 | 6·8 | 14·2 | 7·3 | 1·3 | ·4 | ·7 |
| Chakrata, 18 years.. .. .. | 2·3 | 2·7 | 2·2 | 1·7 | 2·9 | 7·5 | 17·4 | 15·7 | 5·6 | ·7 | ·2 | 1·1 |
| Mean rainfall .. | 1·10 | ·95 | ·88 | ·49 | 1·17 | 5·70 | 13·85 | 12·01 | 6·3 | 1·10 | ·14 | ·46 |

1 Duthie, Flora of the Upper Gangetic Plain and of the adjacent Siwalik and Sub-Himalayan tracts, Vol. I. Introduction.

2 Blanford, l. c. pages 141—143.

For the mean humidity, cloud proportion, and air temperature I refer to the following stations mentioned in the tables of North-West and Central India: Chakrata, Ranikhet, Delhi, Jeypore, Ajmere, Dehra, Roorkee, Meerut, Agra, Lucknow, Allahabad, Benares, Neemuch, Indore, Jhansi, Saugor.

The monthly average of all these stations is given in the following table, to which I add the mean rainfall and the flowering times :—

| | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. | Year. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean humidity .. .. | 55·7 | 49·0 | 41·1 | 33·0 | 27·5 | 55·1 | 70·0 | 78·4 | 78·8 | 76·1 | 48·6 | 53·7 | 51·8 |
| Mean cloud proportion .. | 2·5 | 2·7 | 2·4 | 2·1 | 1·3 | 4·4 | 7·1 | 6·9 | 4·76 | 1·38 | ·28 | 1·7 | 3·26 |
| Mean temperature .. | 57·1 | 61·7 | 72·3 | 81·5 | 90·7 | 86·9 | 81·1 | 79·1 | 9· | 74·0 | 65·7 | 59·1 | 73·9 |
| Mean rainfall .. .. | 1·10 | ·95 | ·88 | ·49 | 1·1 | 5·70 | 13·85 | 12·1 | 6·0 | 1·10 | ·14 | ·4 | .. |
| Flowering times of the woody plants .. .. | 22 | 52 | 88 | 118 | 96 | 73 | 53 | 52 | 42 | 15 | 450 | 31 | .. |
| Flowering times of the herbaceous plants . | 11 | 27 | 4 | 6 | 4 | 74 | 84 | 81 | 24 | 8 | 1 | 27 | .. |

The same relations are shown graphically in Plate III.

It is not necessary to point out the conclusions which can be drawn from these curves, as they are exactly to the same effect, which we have obtained from our former graphic representations.

*(To be continued.)*

# THE OOLOGY OF INDIAN PARASITIC CUCKOOS.

By E. C. Stuart Baker, F.Z.S.,

## Part II.

(With Plate II.)

(*Continued from page 83 of this Volume.*)

### Cuculus polioCephalus. (Vahl.)

*The Small Cuckoo.*

*Cuculus poliocephalus.* Latham, Ind. Orni., I, p. 214 ; Jerdon, B. of I , p. 324 ; Fairbank, S. F., IV, p. 255 ; David and Wen., S. F., VII, p. 78 ; Hume, Cat. No. 201 ; *id.*, S. F., XI, p. 71 ; Legge, B. of Ceylon, p. 231 ; Vidal, S. F., IX, p. 54 ; David, S. F., X, p. 299 ; Barnes, B. of Bom , p. 124 ; Oates, Ibis, 1889, p. 359 ; *id.*, Humes, Nests and Eggs, 2nd Ed., II, p. 382 ; Shelly, Cat. B. M., XIX, p. 255 ; Osmaston, Jour., Bom. N. H. Soc., XI, p. 472 ; Nehrkorn, Cat. der Eier, p. 171 ; Blanford, A. of B. I., III, p. 208 ; Dresser, Pal Birds, I, p. 471 ; Sharpe, Handl., II, p. 158 ; Reid, Cat. Eggs B. M., III, p. 114.

In the British Museum there are three reputed eggs of this cuckoo which are described by Reid as of a regular, oval shape, smooth and very glossy. They are white, spotted and speckled with umber-brown, more thickly at the large end than elsewhere, and with a few underlying pale-purplish markings. They measure, respectively, ·75″ by ·55″, ·7″ by ·48″, ·75″ by ·54″. These eggs do not at all agree with our authentic Indian eggs, and may or may not be *poliocephalus's* eggs. All are Madagascar taken eggs. There is a figure of one (Plate II, fig. 3) in the catalogue referred to, and from this it is seen that not only in colouration but in shape and everything else these eggs of the B. M. are unlike ours.

The first egg taken in India on record, and which from the light of later discoveries seems to have been correctly identified, is that of Brooks taken at Gulmerg, Cashmere, out of a nest of *Phylloscopus humii* (Hume's Willow-Warbler) on the 2nd June. Oates describes it thus : " It is an elongated, cylindrically ovate egg, nearly the same size at both ends, which are both obtuse, pure white and glossy. The nest contained three of the eggs of *P. humii*, which are only about half the size of this egg, almost glossless and richly spotted with red.

" The egg measures 0·81 by 0·57 inch."

The egg ascribed by Hume to *Chrysococcyx maculatus* (The Emerald Cuckoo) (F. B. I., III, p. 223), and described as a nearly uniform pale

pinkish-chocolate egg is, from what we now know, undoubtedly an egg of the present species. This egg measured ·8″ by ·62″ and was found in the nest of *Stachyrhidopsis ruficeps* (Hume's Babbler).

Mr. Osmaston, in Darjeeling, found, on the 8th July 1903, a young cuckoo in the nest of the same little babbler which he ascribes to *poliocephalus*. Unfortunately, a hunt for traces of the egg was unavailing.

Col. Rattray and Mr. B. B. Osmaston in the same month of 1903, took oviduct eggs of this bird. To Mr. Osmaston, however, belongs the honour of being actually the first, as his bird was shot a few days previously to Col. Rattray's first bird. Thus Mr. Osmaston writes:—"With regard to the *poliocephalus* which laid the pale pinkish-chocolate egg in its death struggles in my hand, the bird was shot, on the 1st June 1903, at an elevation of 7,000, in fairly thick forest." Two other eggs, in every respect identical with that laid by the dying bird, were obtained by the same collector from nests of *Drymochares cruralis* (the White-browed Short-wing). The first is that referred to in this Journal, Vol. XI, p. 472, and was taken by Mr. F. Gleadow whilst nesting in the Tons Valley. The egg is described as of an uniform chocolate colour, similar to one of *Horornis pallidus* (The Pale Bush-Warbler), but lighter in shade and of course much larger. The egg measures ·78″ by ·60″, and was taken in June, the 5th.

The third egg taken by Mr. Osmaston himself on the 15th June, 1903, was exactly similar to the other, but measured ·84″ by ·58″. It was taken at about 7,500′ elevation, near Darjeeling, from the nest of a *D. cruralis*, which was placed against the face of a vertical rock. This egg and the skin of the bird which laid a similar egg in Mr. Osmaston's hand were both sent me for inspection. The skin is without doubt that of *C. poliocephalus*, and the eggs may be described as follows:—

In colour they are a beautiful pink-chocolate, more the colour of *Cettia* eggs than that of any other eggs known to me, but rather deeper in colour, and, when very closely looked into, it is seen that there is a very faint powdering with a deeper tint of the same colour. In shape the eggs are long, perfect ellipses, equal at either end, and the texture is very fine and close, the surface extremely smooth and like satin to the touch. The shell is decidedly fragile.

In 1893 I took four cuckoos' eggs in North Cachar, which, I now think, must belong to this species; they are very much faded since they were taken, but otherwise agree very well with Mr. Osmaston's eggs.

Two eggs were taken in the nest of a fly-catcher of some sort—I *think*, *Niltava macgrigoriæ* (The Small Niltava)—a third in the nest of *N. sundara*, (Rufous-bellied Niltava), and the fourth, which I have given to Mr. Osmaston, was also taken in the nest of *N. macgrigoriæ*. One of my eggs is a perfect ellipse ; the others are very blunt ovals, the texture, &c., being identical with those taken by Mr. Osmaston. The colour is a bright pale chocolate-pink, *exactly* like the eggs of *Cettia orientalis* (Eastern Bush-Warbler), but when taken they were rather darker. One egg when closely examined has a faint ring round the larger end of minute purple-grey specks, all coalescing, with equally minute specks of reddish scattered over the whole surface of the egg. The second egg is similar, but has the ring rather better defined and the reddish specks even more sparse and fine. The third egg shews no specks unless examined under a magnifying glass, when this, too, shews the same fine purple-grey powdering. They measure ·82″ by ·56″, ·84″ by ·57″ and ·79″ by ·59″. They were all taken, in July 1893, at an elevation between 4,000′ and 6,000′.

Eggs similar to Mr. Osmaston's have been taken this year, 1904, by Col. A. E. Ward, in Kashmir, who informs me that he has twice taken eggs of this type, and once the young cuckoo from the nest of *Pratincola maura* (The Indian Bush-Chat).

Again Mr. C. Inglis has been so fortunate this year, 1904, as to secure the rare red egg of *C. poliocephalus* in the equally rare nest of *Oligura castaneicoronata*, (The Chestnut-headed Short-wing), together with the eggs of the latter bird, and, in addition to this, captured the *Oligura* on the nest with a butterfly net.

The egg was taken on the 6th of July near Darjeeling at an elevation of about 6,000′. It was compared with Mr. Osmaston's eggs and found to correspond exactly. This undoubted egg is now in my collection, Mr. Inglis, with great generosity, having given it to me. It measures ·89″×·6″.

Very different in colour to these, but agreeing in all other respects, are the eggs taken from the oviduct by Col. Rattray who wrote to me late in 1903 : –"I this year took no eggs of *Cuculus poliocephalus* from nests, but on the 24th of June and 26th July I shot females containing eggs ready for expulsion ; both were broken, but were easily seen to be in colour a pure white without spots, corresponding with eggs taken by Buchanan, Wilson and self in 1899."

Col. Rattray took other eggs of this Cuckoo of the pure white type from the nests of *Acanthopneuste occipitalis* (The Large Crowned Willow-Warbler). These he describes as "pure white and glossless; the shape is peculiar—a long narrow egg, very blunt at both ends, more like a cylinder with rounded ends. Size ·85" by ·58". The nests were in amongst the roots, in one case, of a fallen pine; how the bird got in I do not know as I had to tear away a lot of roots and earth to get at the nest."

An egg sent me by Major Buchanan as belonging to this Cuckoo agrees with the above. It was taken from the nest of *Acanthopneuste trochiloides* (Blyth's Crowned Willow-Warbler), and in the forwarding letter Major Buchanan informed me that he had taken another exactly similar egg out of the nest of *Lophophanes melanolophus* (The Crested Black Tit).

Col. Wilson also very kindly forwarded three eggs for inspection, all agreeing exactly with the above. They were all taken from nests of *Acanthopneuste occipitalis*.

Similar eggs were taken by Mr. J. Davidson from the same fosterers in Sonamurg.

Herr Kushel *in epistola* notes that "the eggs of *Cuculus poliocephalus* are white with tiny specks of yellowish-brown." He is uncertain, however, of their identity, and adds, "the eggs of *C. poliocephalus* from Japan are dark-reddish-brown, as are the eggs of the foster-parents, *Cettia cantans*", a curious confirmation of Osmaston's and Ward's eggs. [Since the above was written I have obtained from Alan Custan, Yokohama, a magnificent series of seven eggs of this species, all of which were taken from the nest of *Cettia cantans*, with whose eggs those of the Small Cuckoo closely agree in colour. They correspond in all details with the eggs taken by Osmaston, Inglis, and Ward, but are rather richer in colour on the whole.—E. C. S. B.]

The 22 eggs which have passed through my hands average ·83" by ·58". In length they varied between ·78" and ·92" and in breadth between ·54" and ·62". Others which I have not seen, but about which their owners have been so good as to give me full notes, agree entirely with the above descriptions. All the eggs appear to have been taken in June and July, the latter end of June and July being the time in which most were found.

Nehrkorn in his catalogue of eggs, in his own collection, describes eggs sent to him from Madagascar as follows:—"Weiss mit violetten und dunkel-braunen ziemlich grossess Flecken, welche am stumpfen Ende

einen Kranz bilden. 18-20 by 14-15." He does not give the nests from which they were taken, and the eggs, of course, do not agree in the least with our Indian eggs.

The Small Cuckoo during the breeding season is found principally in the Himalayas from 4,000' upwards and in the Sub-Himalayan ranges of Assam, where it descends a good deal lower; thence it extends through North Central China to Japan, where also it would appear to breed freely. Curiously enough, it has not yet been recorded from Burmah, though it must occur in that province, for it is found throughout the Malay Peninsula, Java and Borneo. Like *saturatus* this cuckoo would appear to be more or less resident in the latter countries.

In the cold weather it may be found practically anywhere in India and Ceylon, and is more than probable, as time goes on, it will be found breeding in the Southern Hill ranges, as well as the Sub-Himalayas.

Its call is a dissyllabic note twice repeated, but it has a variety of notes and is a rather noisy bird, and, though some of its notes are more or less musical, others are quite the reverse.

### CUCULUS MICROPTERUS. (Gould.)

*The Indian Cuckoo.*

*Cuculus micropterus.* Jerdon, B. of I., I, p. 326; Hume, S. F., II, p. 191; *id.*, Cat. No. 203; Fairbank, S. F., IV, p. 255; Davidson and Wen, *ibid.*, VII, p. 79; Ball, *ibid.*, p. 207; Cripps, *ibid.*, p. 264; Vidal, *ibid.*, IX, p. 55; Bingham, *ibid.*, p. 167; Butler, *ibid.*, p. 388; Legge, B. of Ceylon, p. 288; Davidson, S. F., X, p. 359; Oates, B. of Burm., II, p. 104; Barnes, B. of Bom., p. 125; Davidson, Jour., Bom. N. H. Soc., I, p. 180; Shelly, Cat. Birds B. M., XIX, p. 241; Nehrkorn, Cat. der Eier, p. 170; Stuart Baker, Jour., Bom. N. H. Soc., X, p. 367; Blanford, A. of B. I., III, p. 210; Dresser, Pal. Birds, I, p. 473.

*Cuculus striatus*, Jerdon, B. of I., I, p. 328.

This, the excessively common Bo-kata-ko Bird, or Broken Pekoe Bird, of Anglo-Indians, known to almost every man, woman or child, who has passed a hot weather or two in India, is yet one of the few remaining cuckoos about whose egg there is no *absolute* certainty. I use the word *absolute*, for as yet no one has taken an oviduct egg or seen the egg laid; on the other hand, Col. Rattray has, I think, fairly well settled the matter for us, and we may take it for granted that his eggs have been properly identified. In one of his earliest letters to me on the subject

he writes, "*Cuculus micropterus* is the most common cuckoo in Murree, and we took seven eggs this year, all but one in nests of *Larvivora brunnea* (The Indian Blue-Chat). I will describe three I took.

"No. I, Murree. 27th May 1899.—One egg, fresh, in nest of *Trochalopterum lineatum* (The Himalayan Streaked Laughing Thrush). At first I put this down to *canorus*, but when we, in June and July, went on finding blue eggs, we, knowing this was the only other large cuckoo breeding there, came to the conclusion it must be *micropterus*.

"I found the nest of *T. lineatum* building about ten days earlier, and on the 24th there were three eggs in it, all undoubtedly belonging to the owner of the nest. On the 27th I passed again and, looking in, saw two eggs only in the nest and two broken eggs outside and a lot of blue-grey feathers on the bush. I examined the eggs and found one smaller, thinner and clearer in shell and also of a much paler blue, so I took both. The nest was on the ground in the middle of the roots of a thick bush, and the cuckoo evidently lost some feathers going in. The egg is a pale clear blue and in size ·83 by ·70."

Now the only cuckoos to whom the above blue-grey feathers could have belonged are *C. canorus*, *saturatus*, *poliocephalus* and *micropterus* and *H. sparverioides*, *nisicolor*, *varius* and *nanus*. *H. nanus* is not found in Kashmir, so may be dismissed at once. *C. saturatus* and *poliocephalus* have been shewn to lay totally different eggs. I shall shew that all the Hawk-cuckoos are now also known to lay eggs quite different to this one, so that it leaves only *canorus* and *micropterus* to be dealt with. Now hitherto no authentic blue egg of *canorus* has been taken, and the texture of this egg and others of the same kind is so totally unlike any *canorus* egg that I do not believe for a minute they belong to that bird. Again *canorus* appears to stop calling, and therefore presumably breeding in June, whereas these eggs were found well on into July.

Yet, again, *micropterus* is even more common, than *canorus*, and if a number of *canorus* eggs of the usual type are found, why should none of the *micropterus* be found ; if found, these alone can be the eggs. Under the circumstances, and by elimination, I think Col. Rattray has proved his case, and I, for one, accept these blue eggs as belonging to *micropterus* until better arguments are advanced to shew that they are not.

After describing the above egg taken in the nest of *Trochalopterum lineatum* Col. Rattray goes on to describe two other eggs, both taken in

the nest of *Larvivora brunnea*, which were placed in holes, one in a rock and one in a bank. These holes were both so small that no cuckoo could possibly have got in to lay the egg, so that these must have been laid on the ground and then placed by the parent-bird in the nest.

Writing to me again after he had found oviduct eggs of *canorus*, *poliocephalus* and *saturatus* Col. Rattray again shews that the blue eggs can only have been those of *micropterus*, and forwarded to me no less than six eggs of this bird, all taken in 1903. These are all of the same type of the egg and were found on the 31st May and 5th of June.

Again, in 1904, Col. Rattray writes me that his evidence is still of a negative character. He adds, however, that at Murree, where *C. micropterus* is much the most common, he found most blue eggs; in Dangagali, where *micropterus* is rare and *canorus* is very common, he found but one blue egg (of *micropterus*), but three of the reddish type of egg of *canorus*.

Col. Wilson has taken numerous eggs which all agree with those taken above.

I have records of eggs taken in the nests of *Trochalopterum lineatum* (The Himalayan Streaked Laughing Thrush), *T. simile* (The Western Variegated Laughing-Thrush) and *Larvivor brunnea* and, on a single occasion only, from a nest of *Suya crinigera* (The Brown Hill-Warbler), *Tarsiger chrysæus* (The Golden Bush-Robin), and *Niltava sundara*.

Mr. J. Davidson, C.S., has also given me a note on the eggs of this bird, but his eggs do not seem to agree with those above noted, and I fancy they will turn out to be *Hierococcyx varius* (the Common Hawk-Cuckoo). He says : "I cannot be absolutely sure of my eggs of this bird. I have only one taken by myself, which was found in heavy forest in the Kanara District on 4th April 1894 in a nest of *Crateropus canorus* (the Jungle Babbler). The egg is clearly a cuckoo's, and the only cuckoo I heard or saw within a dozen of miles was this bird, and it was not uncommon as one would hear three or four in a morning's stroll."

"It is a deep blue (not in the least like the pale blue of *C. jacobinus* (The Pied Crested Cuckoo), but neither so large nor dark-blue as *H. varius* which I have never heard in the neighbourhood. *C. jacobinus* does not occur in Khandesh, except as a passing straggler. I have three other similar eggs. Two are from the Barnes' collection—one taken on 15th May 1895 without locality, sent to him by Mr. Murray, and one

taken in 1903 by Mr. Irvine in Ranchi. I have another sent me from the same place by Mr. Irvine. I cannot vouch for their authenticity."

Now I myself have a *reputed* egg of *Cuculus micropterus* from the Irvine collection, and I have also oviduct eggs of *Coccystes jacobinus* and *Hierococcyx varius*, and I have not the least hesitation in saying that my egg belongs to one of these ; and, as *jacobinus* only occurs as a rare straggler in Khandesh, Mr. Davidson's egg is probably that of *Hierococcyx varius*. Mr. Irvine's egg is slightly darker than any of mine of *H. varius*, but I *have* seen eggs of this bird quite as dark as the reputed *micropterus* egg. In size, shape and texture it agrees perfectly. Not one of my authentic *jacobinus* eggs could possibly be described as *pale* blue.*

Nehrkorn describes the egg of this cuckoo as "Fleich-farben mit-markiten violetten und rost braunen flecken, welche fast nur am stumfen End steken. 24-17 mm. (aus Nest von Buchanga atra) Sikhim."

This is very probably the egg of *Surniculus lugubris* (The Drongo Cuckoo). very improbably that of *Cuculus micropterus*.

Nineteen of the eggs which we suppose to be *micropterus* have passed through my hands, and in ground colour all these are a very palehedge sparrow green-blue, some rather more blue, but varying very little in range of colour. In depth of colouring they range from almost skim milk blue-green to a colour nearly as dark as a hedge-sparrow's egg. Never, however, do they anything like approach the deeper colour of a *Coccystes* egg, not even *coromandus*, much less *jacobinus*.

Most of the eggs are quite spotless, but a few are more or less marked. One egg in my collection, which I owe to Col. Rattray, has a single dark green spot near the extremity of the large end ; another has perhaps half a dozen such marks at the larger and one at the smaller end : in this egg the marks are far more blue than the ground colour. In Col. Rattray's own collection there are one or two eggs which are speckled, always faintly, with pale reddish, or as the owner of the eggs calls it, pale lilac. In one case these markings form a zone about the larger end, but in the others are speckled sparsely all over.

In shape these eggs are all rather broad ovals and, with two exceptions which are rather pointed, decidedly obtuse at the smaller end. In no case have I seen a spherical or elliptical shaped egg such as the *Coccystes* or the *melanocephalus* type.

* Dr. Corbett has had this year, on 24th August 1905, a nest of *Garrulax moniger* (the Nee' lwel-' anghing Th n-h) brought to him containing one of these eggs. It agrees with Rattray's, but is slightly darker than any I have seen of his.

The texture, however, is much as it is in the eggs of the birds just mentioned, especially the latter, that is to say, it is very soft, smooth and satiny to the touch, of very fine, close grain, and, though it possesses a faint gloss, it is quite different to the hard China-gloss of some of the *Garrulax* eggs. The shell is decidedly fragile for the size of the egg, although the texture is so close.

Of the fifteen eggs whose measurements I have taken the average is ·92″ full by ·70″ barely.

The greatest and the least length is ·98″ and ·87″, respectively, and greatest and least breadth ·73″ and ·66″.

The call of this fine cuckoo is perhaps one of the best known of bird's sounds in North-Eastern India and the other parts to which it extends. Its two most popular names—"Bo-katu-ko" in Bengali and the "Broken Pekoe" bird in English—are two of the best representations of its call.

Naflang-kai'o (who stole the fish) in Cachari also well simulates the four notes to which it gives utterance. The call is very melodious and distinctly cuckoo-like in sound, but the bird reiterates it with so great perseverance that it becomes very monotonous. In "Stray Feathers" Hume says that he shot the female calling Bo-kata-ko, but I have only shot males making the call.

The Indian cuckoo has been found practically everywhere in India, except the driest portions of the North-West, and it doubtless breeds more or less over the whole of its habitat, ascending higher up during the breeding season and migrating locally at this time from places where there are no suitable forests or hills. It extends right away through Burma into Malaya and again through Northern Burma into Central Asia, China, Siberia and Japan, breeding in all these countries, though the eggs thence which have been hitherto ascribed to this form are exceedingly doubtful.

### Genus Hierococcyx.

As already pointed out, the difference between this genus and the typical *Cuculus* consists only of the difference in comparative length of the inner wing quills. In *Cuculus* the secondaries in the closed wing only extend to half the length of the primaries, whilst in *Hierococcyx* they always extend to at least two-thirds the length of the closed wing.

The genus contains four species, three of which are more or less common where found, and the fourth, *nanus*, is rare within our limits.

KEY TO SPECIES.

A. No distinct dark cheek band from the eye.
  *a.* Abdomen barred.
    *a.*" Wing always over 8·2" ..... *sparverioides.*
    *b.*" Wing never as much as 8·2"..... *varius.*
  *b.* Abdomen spotted or streaked, never barred ..... *nisicolor.*

B. A distinct dark band, running through eye..... *nanus.*

The above key only holds good as regards the adults, as young *sparverioides* and *varius* both have the lower parts spotted and streaked, the spots becoming bars as the birds grow older. In young *sparverioides* the chin is blackish, in young *varius* the chin is white or rufescent-white like the rest of the lower parts, and in *nisicolor* the chin, throat and upper breast are dark-brown, the feathers more or less narrowly edged with rufous.

This will probably suffice to discriminate between nestlings found in other birds' nests, and is important in forming a clue as to which nests we may expect to get different species of cuckoos' eggs in.

HIEROCOCCYX SPARVERIOIDES. (Vigors.)

*The Large Hawk-Cuckoo.*

*Hierococcyx sparverioides.* Jerdon, B. of I., I, p. 331; Hume, S. F., III, p. 80; IX, p. 72; *id.*, Cat. No. 207; Armstrong, S. F., IV, p. 311; Hume and Dav., *ibid.*, VI, p. 157; Ball, *ibid.*, VII, p. 207; Scully, *ibid.*, VIII, p. 256; Dav., *ibid.*, X, p. 359; Oates, B. of Burm., II, p. 108; Oates, Nests and Eggs, 2nd Ed., II, p. 384; Shelly, Cat. of B. M., XIX, p. 232; Stuart Baker, Jour., Bom. N. H. Soc., X, p. 367; Blanford, F. of B. I., III, p. 211; Dresser, Pal. Birds, I, p. 473.

As regards the eggs of this fine cuckoo Col. Rattray is again in the enviable position of being the only man who has taken an egg absolutely without doubt. He says: "I cannot at all understand or confirm the notes made by Miss Cockburn and Mr. Morgan as to this bird building its own nest, but agree with Mr. Hodgson, as I shot the bird yesterday with an egg ready for expulsion. It was blue, like that of the egg of *Acridotheres*, but larger, not white. It corresponds exactly with an egg I found some years previously in the nest of *Myiophoneus temminckii* (The Himalayan Whistling-Thrush). I had heard these cuckoos' calling in this nullah for some days, and it was one of these birds flying up from the bank that attracted my attention to the *Myiophoneus* nest

which contained three eggs of the owner and this one quite fresh. The one from the oviduct was unfortunately too badly smashed by shot and the fall of the bird to preserve or measure.

"The egg I have is, now much faded, a pale clear blue, glossy and a good deal pointed at the smaller end. Size 1·18″ by ·80″.

Then, together with some eggs sent to me, Col. Rattray sent me the leg of an embryo which he had taken from an egg exactly matching those above described and which he had found in a nest of *Trochalopterum lineatum* (The Himalayan Streaked Laughing-Thrush), together with three eggs of the parent bird. The leg was undoubtedly that of a cuckoo and could have only belonged to this species, so to Col. Rattray belongs the honour of taking three eggs of the Large Hawk-Cuckoo.

It is impossible in writing of this cuckoo's eggs to pass over in silence the accounts of Mr. Morgan and Miss Cockburn as given in Hume's Nests and Eggs.

Mr. Morgan's story cannot be analysed in detail as it is not given in detail, so it is impossible to say more than that the account is utterly unlikely and may be dismissed with the practical certainty that Mr. Morgan must have been mistaken in the bird.

Miss Cockburn's notes are, however, very full, and it is therefore more easy to discuss her opinions. As regards the first nest found the evidence given is entirely that of native collectors. Now these men found a nest in a clump of trees from which a supposed Hawk-Cuckoo flew out. They watched it return to this nest and sit on it, and one of the men fired and missed it; it again returned and was again missed. Next day the nest was not visited, but on the following one the natives again went and took the nest and eggs and shot a Hawk-Cuckoo.

Now there is nothing to prove that the cuckoos either built the nest or laid those eggs. Indeed on the first day it is quite possible that the natives mistook the bird which sat on the nest and that it was really a hawk, not a cuckoo at all, and this is all the more probable when we find that both nest and eggs are described as being *typically* those of a hawk of some kind. When the cuckoo was *shot* nothing is said about its being in or near the nest, merely that it was "there," from which we may conclude that it was on the same or an adjacent tree. The eggs are described as being "perfectly white with a few touches of light brown on two of them; they were much

incubated. The inner skin of these eggs has a greenish-blue colour." This colour of the egg lining makes it almost a certainty that these were hawk's eggs of some kind.

Miss Cockburn's next note merely refers to the finding of a similar nest, empty, found later on. The nest is again described as a typical hawk's nest which "appeared to be a nest that had been used for several seasons," as is a custom with many of the *Falconidæ*. Miss Cockburn saw the bird near the tree, but the servant said he had seen one of them sitting on the nest a few days before. Why a bird should go and sit on her nest after the young were hatched and flown is not easy to say, and this little touch of evidence appears to be one put in by the servant to help out his previous story, instead of which it merely shews that his evidence is worth very little.

The times given—April 11th, three eggs hard set, and May 27th, the young flown—again agree with the probable dates for a hawk's breeding arrangements, but are extremely early for a late breeding bird such as all Hawk-Cuckoos seem to be.

I fear that this account must be relegated also to the fairy books.

Hodgson found young birds being fed by *Trochalopterum nigrimentum* (The Western Yellow-winged Laughing-Thrush) and *Ixops nepalensis* (The Hoary Bar-wing).

Col. Rattray very kindly lent me the egg he took from the nest of *Myiophoneus*. It is a blue-green in colour like a pale egg of *Garrulax moniliger* (The Necklaced Laughing-Thrush) or dark one of *Dryonastes ruficollis* (The Rufous-necked Laughing-Thrush) ; it is paler also than eggs of *Sturnopastor* or *Acridotheres*. The shape is a long oval, decidedly compressed at the smaller end, which is pointed. The texture is unlike that of any other Indian cuckoo's egg, and is intermediate again between the eggs of *Dryonastes* and *Garrulax*. It is very hard, fine grained, and glossy with innumerable, almost mycroscopic, corrugations and some fine longitudinal furrows.

Dr. Coltart and I have a very large number of eggs in our collections which, we believe, will eventually prove also to belong to this cuckoo which are, roughly speaking, deep chocolate-brown in colour. If this proves to be the case, it will be rather analogous to the pure white and chocolate-pink eggs of *Cuculus poliocephalus*.

My reasons for believing them to be of this species are: first and principally, by the process of elimination they can be no other cuckoo.

They are not the eggs of any *Cuculus*, *Coccystes*, *Cacomantis* or *Penthoceryx* which we know, and they are too large for *Chrysococcyx*. They are not *nisicolor* or *varius* amongst the Hawk-Cuckoos, whose eggs not only do not agree in colour, which would not perhaps matter, but they *disagree totally in shape, grain and texture*. In shape, texture and grain they, on the other hand, do agree with Rattray's eggs of *H. sparverioides*.

In 1894 I took one of these eggs from the nest of a *Pellorneum ignotum* (The Assam Babbler), and shot a female *H. sparverioides* near the nest. This egg is described in this Journal (X, p. 367), but knowing as much of cuckoos' eggs as we now do, I certainly should not have said they were the same type as the eggs of *nisicolor* which are elliptical. Since then as long as I was in North Cachar I continued yearly to obtain a few of these same eggs, and now in Lakimpur Dr. Coltart and I get a considerable number, mostly brought in by Nagas who get them in the hills beyond British territory.

The very large majority of our eggs, I should think three out of four are found in the nests of *Arachnothera magna* (The Larger Streaked Spider-hunter), and I have myself taken nests of this bird containing both cuckoos' eggs and the eggs of the foster-parents.

In June, 1896, I was marching over the Ningle Peak, close on 6,000 feet, when I observed a Large Hawk-Cuckoo skulking about in some scrub-jungle with stunted wild plantain trees growing in amongst the other stuff. I shot the bird which proved to be a female, and afterwards found within a few yards a nest of *A. magna* with supposed egg of this bird and one of the owner.

Again the same year and near the same Peak some Nagas found a nest of *A. magna* containing an egg of the parents and two eggs of a cuckoo, and they *said* that their attention had been drawn to the nest by the way a pair of spider hunters were attacking a Hawk-Cuckoo skulking about in some brushwood under the plantain tree to which the nest was attached.

Both Dr. Coltart and myself have repeatedly taken or had brought to us, two eggs in one nest.

I have either taken myself, or had brought to me, eggs in the nests of *Alcippe nepalensis* (The Nepal Babbler) (1), *Niltava macgrigoriæ* (The Small Niltava) (1), *Arachnothera magna* (12 about), *Cyornis rubeculoides* (The Blue-throated Flycatcher) (1), *Drymochares nepalensis* (The Nepal Short-wing) (3), *Pellorneum ignotum* (The Assam Babbler)

(1), *P. mandellii* (Mandelli's Spotted Babbler) (1), *Stachyrhidopsis rufifrons* (Hume's Babbler) (2), *Stachyris nigriceps* (The Black-throated Babbler) (1).

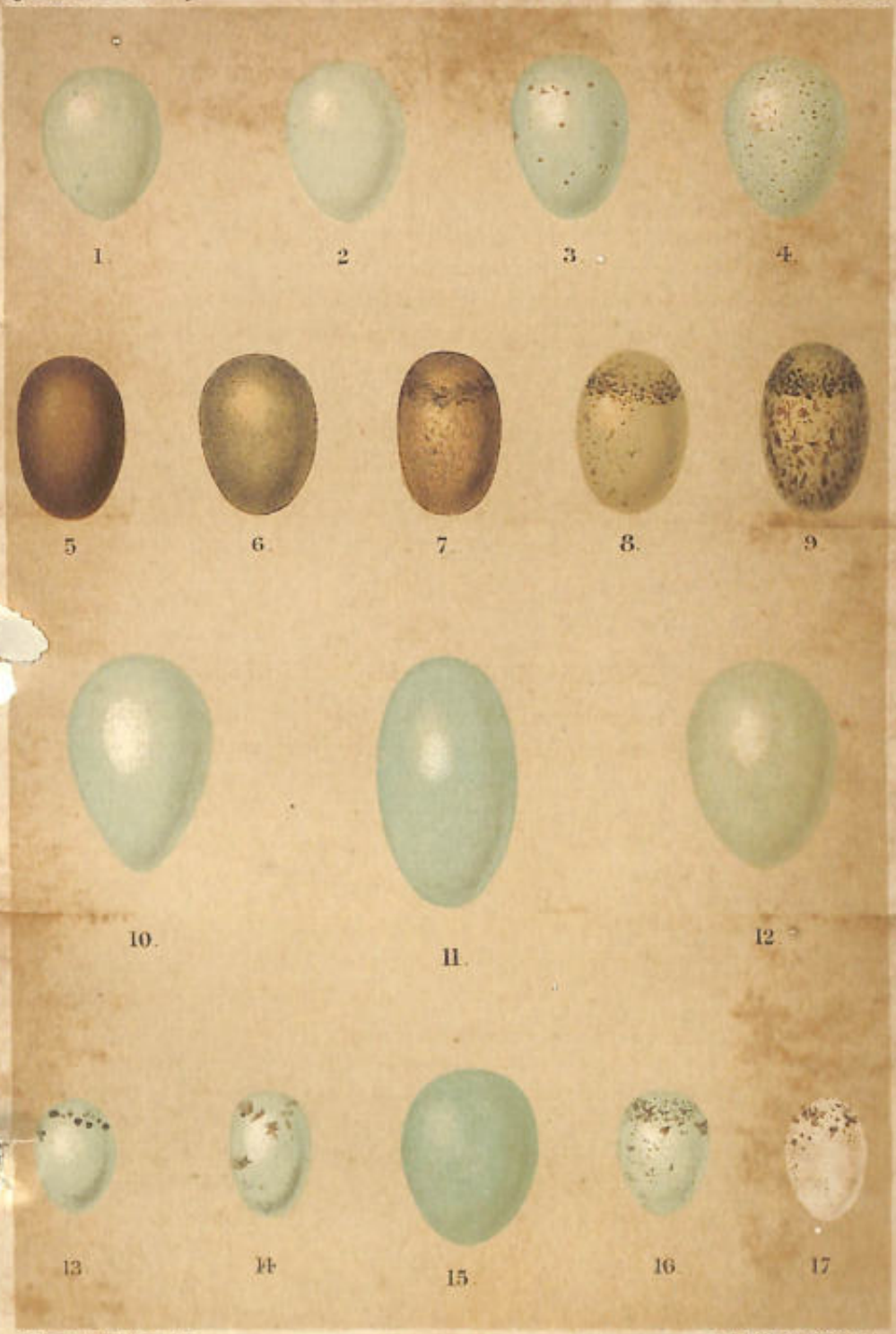
In texture my eggs almost exactly resemble that of the blue egg taken by Col. Rattray, but I have none with the same corrugations, though some of mine have longitudinal furrows, such as his egg shewed. In shape also my eggs agree well with his, a few of them being rather blunter and shorter, but as a whole they are long pointed ovals with the smaller end decidedly compressed.

In colour they range from a light tan-brown, through all shades of olive-brown to a deep olive-brown, or rarely a deep olive-chocolate. In size they vary in length between ·94″ and 1·12″ and in breadth between ·68″ and ·75″. Thirty eggs average 1·05″ by ·72″.

As regards these brown eggs all that can be said at present is that very likely they may be those of *H. sparverioides*, but that there is as yet no proof that they are, whereas, on the other hand, it is proved that that bird lays blue eggs.

Dr. Coltart and I have also each got a blue egg in our collections, taken in nests of *Garrulax moniliger* (The Necklaced Laughing-Thrush), which *may* be those of *sparverioides*; they are queer, long elliptical shaped eggs, of the same colour and texture as Col. Rattray's eggs, having the corrugation even more highly developed, but they are quite different in shape: one of these is shewn in Pl. 11., Fig. 11. It measures 1·4″ by ·78″. Yet another egg which may be that of *sparverioides* is one brought in by Nagas, and which is exactly like a large specimen of *C. micropterus*. It measures 1·12″ by ·88″, and was found in the nest of *Ianthocincla rufigularis* (Rufous-chinned Laughing-Thrush). Since this was written, Dr. Coltart has obtained a blue egg of this Hawk-Cuckoo agreeing exactly with Rattray's, except that it is slightly darker and much more polished than his as might be expected in a recently taken egg.

This fine cuckoo is distributed, according to Blanford, "throughout the Himalayas as far West as Chumba, ascending in summer to elevations of 9,000 feet or more: probably scattered here and there over the better wooded parts of the Indian Peninsula in the cold season, but only recorded from Raipur in the Central Provinces. Common on the Nilghiris in Southern India, but not observed in the Palnis, the Travancore Ranges, nor the Ceylon Hills. To the eastward this cuckoo




E. C. STUART BAKER, DEL. J. GREEN, CHROMO-LITH.

## INDIAN CUCKOOS' EGGS.

1-4. Cuculus micropterus. 5-9. Hierococcyx nisicolor. 10-12. H. sparveroides. 13, 14, 15, 16. Cacomantis passerinus. 17. Hierococcyx varius.

is found throughout the hills South of Assam and Burmah, ranging to China, Japan, the Phillipines, the Malay Peninsula and Borneo."

Its voice is not unlike that of the koel, but it is less harsh and penetrating, and some of its notes are really quite melodious. One of these latter has been described variously as *Chuck-dot-dot* or *Chuck-dol-dol*, and this has a distinctly cuckoo-like sound about it. Its favourite note, however, is one which runs up the scale in repetitions of the sounds *pi-pee-ah*, *pi-pee-ah*, the emphasis on the second syllable, until the bird has got as high as it can, when it re-commences again.

Like most cuckoos, it is often very noisy during moonlight nights, and it is then a perfect torment to would-be sleepers. Both these birds and the koel, doubtless from people not recognizing their notes as distinct, are often called the Brain-fever Bird. The cry which I have called pi-*pee*-ah is by them made into Brain-*fe*-ver. The True Brain-fever Bird is, however, *H. varius*, first cousin to the present bird.

### Hierococcyx varius. (Vahl.)

*The Common Hawk-Cuckoo.*

*Hierococcyx varius*. Jerdon, B. of I., I, p. 329; Adam, S.F., I, p. 373; Butler, *ibid*, III, p. 460; Bourdillon, *ibid*., IV, p. 392; Fairbank, *ibid*, V, p. 397; Vidal, *ibid*, VII, p. 56; Ball, *ibid*, p. 207; Cripps, *ibid*, p. 264; Hume, Cat. No. 205; Scully, S. F., VIII, p. 255; Legge, B. of Ceylon, p. 240; Reid, S. F., X., p. 27; Davison, *ibid*, p. 359; Barnes, B. of Bom., p. 126; David, Jour., Bom. N. H. Soc., I, p. 182; Barnes, *ibid*, IV, p. 18; Oates, Nest and Eggs, 2nd Ed., II, p. 383; Shelly, Cat. B. M., XIX, p. 234; Reid, Cat. Eggs B. M., III, p. 104; Blanford, B. I., III, p. 213; Nehrkorn, Cat. of Eggs, p. 170.

*Hierococcyx nisoides*, Hume, S. F. VII, p. 371.

The egg of the Common Hawk-Cuckoo is one which has long been well known, oviduct eggs having been taken by Bingham, Irvine and Inglis, all these agreeing exactly with one another and also with those reputed to belong to this cuckoo taken from the nest of *varius* babblers.

Mr. S. L. Whymper writing to me from Jeolikote says: "I got an undoubted egg from the nest of *Crateropus canorus* (The Jungle Babbler) in Bareilly as I saw the bird go to the nest."

Mr. T. R. Bell saw a young *H. varius* being fed by a pair of *Crateropus somervillii* (The Rufous-tailed Babbler) and took undoubted eggs from the nest of this babbler.

Mr. J. Davidson, C.S., writes : " I have three eggs of this bird in my collection and have taken others ; of the three kept, two were taken in the nest of *Crater pus canorus* on the 13th and 16th July, 1886, respectively, at Kondebhari, Khandesh. The other was taken at Karwar, Kanara, on the 12th April, 1889, in a nest of *Crateropus griseus* (The White-headed Babbler)."

The Common Hawk-Cuckoo seems almost, if not quite, invariably to deposit its eggs in the nests of either *Argya* or *Crateropus*, the species being apparently a matter of indifference.

The only other nest, as far as is recorded, from which its egg has been taken, was one found by Partridge, a European collector of mine, who shot the bird as it left the nest. The nest and egg were brought in to me, but the real owner was neither shot nor identified. It appeared to be the nest of *Niltava sundara* (The Rufous-bellied Niltava), but it was of course impossible to say for certain.

Oates' in Hume's Nest and Eggs describes the egg thus : " The eggs are rather elongated, rather cylindrical ovals, very blunt at both ends. The shell is fine and glossy. The color is a uniform rather dark greenish-blue. They are larger, more elongated, and darker-colored than those of *C. jacobinus*." Another egg is described in the same place as a rather dark greenish-blue.

The four eggs measured in Hume's Nest and Eggs varied between ·95" and 1·15" in length and between ·75" and ·82" in breadth.

The eggs in my own collection are of three distinct grades of color : the most pale of the three is not very much darker than some of my eggs of *Coccystes coromandus* (The Red-winged Crested Cuckoo) and the darkest is as dark as the darkest egg I have seen of *C. jacobinus*. I have one egg taken by Mr. C. Inglis from the oviduct of a female shot in Tirhoot (21st June, 1901), which is extremely bright in tint and rather dark. This oviduct egg measures 1·2" by ·79", whereas my largest *jacobinus*' egg measures ·98" by ·87", so that though shorter, the latter has greater cubic contents. My shortest *varius*, egg is ·90" and the least broad ·70". All my eggs, and indeed all other eggs which I have seen, have varied in shape between elliptical and spherical, the arge majority are almost true broad ellipses, but I have seen one or two so broad as to be almost spherical. The satiny texture is the same as that of *Coccystes* : the grain is very close and fine, and the shell extremely stout n proportion to the size of the egg.

Mr. E. H. Aitken remarks that the yolk in this bird's egg is more highly colored than it is in that of *C. jacobinus*.

The illustrations of the eggs of *H. varius* and *C. jacobinus* in the B. Museum Catalogue of Eggs are very good, but the measurement of the former are possibly wrongly depicted, as the painting measures 1·2″ by ·76″.

I do not think that *C. jacobinus*' eggs can be discriminated with any certainty from those of *Hierococcyx varius*, though the latter average larger and perhaps average lighter.

Nehrkorn in his catalogue of the eggs in his collection describes the egg as being "dark blue-green flecked with fine specks of ruddy-brown at the larger end." This egg was taken from the nest of *Crateropus canorus* (The Jungle Babbler) with the eggs of the foster parents.

The Common Hawk-Cuckoo is found all over India and Ceylon, being a resident, though perhaps locally migrating, throughout its range. It is found in Cachar, but does not seem to extend up the Brahmaputra valley, where *sparverioides* is exceedingly common.

This is the true "Brain-fever" bird, beloved of all sick Europeans in India, though the Koel and the Large Hawk-Cuckoo are often so called locally, especially where the Common Hawk-Cuckoo is absent.

Its note is the same *pi-pee-ah, pi-pee-ah* as that of *sparverioides*, but it is even more shrill and penetrating, and the bird itself even more persistent. Night or day seems much the same to it, and when the nights are very dark it awakes with the dawn and has double the energy to expend on destroying the rest of every one within hearing.

### Hierococcyx nisicolor. (Hodgson.)

*Hodgson's Hawk-Cuckoo.*

*Hierococcyx nisicolor*, Jerdon, B. of I., I., p. 330; III, p. 871 (Sup.); Hume, S. F. V., pp. 96, 347: *id. ibid.* XI, p. 72; *id.* Cat. No. 206; Hume and Davis, S. F. VI, p. 157; Oates, B. of Burm., II. p. 109; *id.* Nests and Eggs, 2nd ed., II., p. 383; Blanford, Fauna B. I., III., p. 214; Stuart Baker, Jour. B. N. H. S., X., p. 366.

*Hierococcyx fugax*, Shelly, Cat. B. M., XIX, p. 236, *partem*.

The only absolutely authentic egg of this species taken as yet is the one which Mandelli took from the oviduct of a female on the 5th June. This egg is described in "Nest and Eggs" as "a broad oval, scarcely at all pointed towards the small end and a little obtuse at the large end."

The color is a uniform olive brown, and round the large end there is an indistinct zone of a darker shade: the shell is fine and smooth, but there is very little gloss on the egg. It measures ·89″ by ·64.″

Dr. Coltart and I have taken and had brought to us a fine series of cuckoos' eggs which agree, in many cases, in every single detail with the above description and which we have no doubt ourselves are of those o this Hawk-Cuckoo, a very common species both in Assam and in North Cachar.

Prior to 1891 I had had some of these eggs brought to me, but had no idea to what bird they belonged. In that year, however, I came across the egg myself and under circumstances which enabled me to identify the egg as being, in all probability, that of *H. nisicolor*.

I was engaged one morning in hunting in some scrub and grass jungle for the nest of a pair of *Phyllergates coronatus* (The Golden-headed Warbler) which haunted the patch, and whilst so doing disturbed a cuckoo from a tuft of grass close by where I was hunting. On shooting the cuckoo I found it to be female Hodgson's Cuckoo, and in the tuft of grass whence she flew I found a nest of *Stachyrhidopsis rufifrons* containing two eggs of the babbler and a third very much larger and totally different in appearance. The description given by Mandelli would do equally well for my egg, but that mine is larger, measuring ·96″ by ·63″. The olive brown is pale in tint and a clear, bright tone. The texture is fine and smooth with a faint gloss, and the shape is practically that of an ellipse. It was taken on the 14th May, 1891, at Guilang, North Cachar.

A second egg, taken two years after, was found by a bird-skinner of mine in the nest of *Niltava macgrigoriæ* at Gunjong, North Cachar, on the 20th July. A female was brought in with the nest and egg which Partridge, the bird-skinner, told me he had shot as it flew off the nest. This egg is a good deal darker, much more brown and less olive, the color is practically uniform, but when carefully examined shews traces of a ring of fine freckles of a darker color round the larger end. This egg only measures ·87″ by ·64″. The texture and the shape is the same as in that first described.

In the years 1891—1896 several more eggs were taken, all agreeing with either one or the other of these two types or intermediate between them.

In 1896 I took an egg from the nest of *Cyornis rubeculoides*, together with three eggs of the fosterer, which differs in having the ground color

far more green in tone and in having a distinct ring of reddish freckles round the bigger end.

On the 8th of May and 14th September two eggs were brought in to me with nest and eggs of *Arachnothera longirostris* (The Little Spider-hunter) and *Niltava* which are exactly alike one another and differ a little from all the others I have. The ground color is a dull olive grey or stone color, and the whole surface is covered with freckles, smudges and specks of dull reddish, the markings are numerous everywhere, but more so towards the larger end. These eggs measure ·91″ by ·61″, and ·91″ by ·60″ respectively. They are the two dullest, most dirty looking eggs in my collection. One of these eggs is depicted in Pl. II., Fig. 7.

A rather common type of egg is one with a bright olive-green ground color, sometimes very pale and never dark, with reddish specks and freckles, sparse everywhere else, but forming a dense ring about the larger end. Two such eggs taken on the 3rd June, 1903, from the nest of *Cyornis hyperythrus* (The Rufous-breasted Blue Flycatcher) and on the 14th May this year (1904) from the nest of *Cyornis rubeculoides*, measure respectively, ·96″ by ·62″ and 1·01″ by ·61″.

The only other egg calling for description is one taken on the 3rd May, 1903, from the nest of *Turdinulus exul* (The Squamated Babbler), which contained one egg of the fosterer and this one. It has the same pale olive-green ground color as those last described, but it is thickly blotched all over with freckles and small blotches of reddish brown. In this egg there are faint indications of sub-blotches of purple grey, more especially in a zone about the larger end. This is the only egg I have in which secondary markings are discernible. This egg is shewn in Pl. II., Fig. 9.

All my eggs are the same in shape, *viz.*, long ellipses, and in one case only is one end distinctly smaller than the other. The texture is the same in all, but in one very sparsely marked egg there is a decided gloss. The shell is about normal for its size, neither particularly fragile, nor particularly stout. They average in size ·91″ by ·62″, the measurements of the extreme are given in the eggs mentioned above.

Eggs have been taken from the nests of *Niltava sundara*, *Pellorneum mandelli*, *Alcippe nepalensis* (The Nepal Babbler), *Alcippe phayrii* (The Burmese Babbler) and *Drymocataphus assamensis* (Austen's Babbler) in addition to those enumerated already.

Hodgson's Cuckoo is a bird of the north-eastern portion of India, only being found east from Nepal through the Himalayas and the adjoining plains of Assam, Cachar and Sylhet, through Manipur and Burmah to the extreme south where it meets the similar form called *fugax* which may be known by its larger bill.

Its ordinary note is a rather shrill copy of that of *sparverioides* and *varius*, but it is not incessantly repeated, and does not ascend or descend in scale as does the cry of both of those birds. It is very wild and shy, and until one learns what its cry is like, and gets used to the flight and habits of the bird, it gives one the idea that it is very rare. It is during the breeding season rather a skulker amongst brushwood and secondary scrub-jungle, doubtless when thus employed looking for the nest of some bird in which to lay its egg. It is always silent when thus employed, and it is only when perched high up in some lofty tree or, occasionally, on the wing that it gives vent to its call.

### Hierococcyx nanus. (Hume.)

*The Small Hawk-Cuckoo.*

*Hierococcyx nanus*. Hume, S. F., V, p. 490 ; *id.*, Cat. No. 205 *bis*. ; Hume and Davis, S. F., VI, pp. 157, 502 ; Oates, B. of Burm., II, p. 110 ; Shelly, Cat. Birds B. M., XIX, p. 239 ; Blanford, Fauna B. I., III, p. 215.

Nothing is known so far of the oology of this cuckoo. It is a bird very little known : indeed it is possible that even now we do not know its adult plumage. It has only entered the limits of India in the extreme South of Burmah and Tennasserim, and it is also known from Selangor and Northern Borneo.

### Genus Cacomantis.

The genus *Cacomantis* contains, as far as India is concerned, two species of cuckoo, much like, in general appearance, the genus *Cuculus*, but very small, the wing measuring under 5 inches, whereas none of the birds hitherto dealt with have wings as small as 5½.

The two species may be separated from one another by these keys :—

A. Adults having upper parts ashy.

*a*. Abdomen grey or white ..... ..... *passerinus*.

*b*. Abdomen rufous ..... ..... *merulinus*.

B. The young with upper parts brown and rufous.

*c*. Crown and rump with practically no bars ..... ..... *passerinus*.

*d*. Whole upper surface barred ..... ..... ..... *merulinus*.

The nestlings, as far as I know, cannot be distinguished until they assume the plumage of the young noted above.

CACOMANTIS PASSERINUS. (Vahl.)

*The Indian Plaintive Cuckoo.*

*Cuculus passerinus.* Legge, B. of Ceylon, p. 235.

*Polyphasia regia.* Jerdon, B. of I., I, p. 333.

*Cacomantis passerinus.* Ball, S. F., VII, p. 207; Cripps, *ibid.*, p. 265; Hume, Cat. No. 208; Vidal, S. F., IX, p. 55; Butler, *ibid.*, p. 388; Davison, *ibid.*, X, p. 350; Barnes, B. of Bom., p. 127; Oates, Nests and Eggs, 2nd Ed., II, p. 385; Shelly, Cat. of B. M., XIX, p. 277; Blanford, Fauna of B. I., III, p. 216; Reid, Cat. Eggs B. M., III, p. 117.

*Ololygon passerinus.* Butler, S. F., III, p. 461; Fairbank, *ibid.*, IV, p. 255.

To Miss Cockburn belongs the honour of establishing without doubt the identity of the egg of this small cuckoo: her notes are given *in extenso* in Oates' Edit. of Nests and Eggs from which I quote parts.

"On the 17th September, 1870, the nest of the Common Wren-Warbler (*Prinia inornata*) was found, which had two small eggs and a third which was much *larger*, but of something the *same colour*," another similar nest of eggs taken a few hours later, and again a third on the 22nd September, "the same day one of my servants seeing a Plaintive Cuckoo sit very quietly on a hedge shot it. On examination it was found to contain one egg ready to be laid, of the *same colour* and *spots* as those found in the Common Wren-Warblers' nests. The egg was unfortunately broken, but the pieces were sufficient to identify those found in the little Wren-Warblers' nests." After this Miss Cockburn obtained more eggs and also a young Plaintive Cuckoo in the nest of *Prinia inornata*.

Mr. Adams confirming Miss Cockburn's discoveries informed Hume that he "had small boys collecting nests for him, and on two occasions nests of *P. inornata* were brought containing an egg somewhat like that of *P. inornata*, but much larger: in fact, exactly like that described and sent by Miss Cockburn."

Thompson records it as laying in the nest of *Pyctorhis sinensis* (The Yellow-eyed Babbler) and *Lanius erythronotus* (The Rufous-backed Shrike). This is curious, as the eggs of both these birds are much larger than that of the cuckoo, and it is an almost invariable rule for cuckoos to choose birds which lay eggs smaller than they do or, at least, as small.

Hume himself records the snaring of one of these birds on a nest of *Molpastes bengalensis* (The Bengal Red-vented Bulbul).

Mr. T. R. Bell writes me :—"I have several eggs of *Cacomantis passerinus* (The Indian Plaintive Cuckoo). I have seen *Orthotomus* feeding young *Cacomantis* a fair number of times, and about the eggs of this cuckoo being ordinarily laid in Tailor-birds' nests I have not the slightest doubt. The cuckoos' eggs are, as a rule, less blotched (being nearly always spotted and not blotched) than those of the Warbler and, of course, a great deal larger. I have four eggs of *Cacomantis* taken from the nests of *Orthotomus*, and they are three of them white and one bluish, of the two shades that occur in the Warblers' eggs." These notes are recorded from Kanara.

Mr. J. Davidson, C.S., writes in much the same strain :—"I have eggs of this cuckoo taken at Karwar (24th June, 1894, 12th July, 1895, 20th July, 1895, and 10th August, 1895), and have seen many more. All were taken in the nests of *O. sutorius* (The Indian Tailor-bird). They are very similar to one type of the eggs of this bird, but are about half as large again, white with a few reddish spots, mainly at the large end. All the eggs which I have taken myself have the ground colour white, but Mr. Bell tells me that he has taken several with the ground colour blue. I have several times taken a white egg of this bird in a blue clutch of Tailor-birds' eggs."

Mr. B. B. Osmaston was also good enough to lend me an egg of this species taken in the nest of *P. socialis* (The Ashy Wren-Warbler) in Dehra Dun. This is of the blue type, and is the exact *facsimile* of one of the eggs taken by Miss Cockburn and depicted in the Catalogue of the Eggs of the British Museum. This is the egg I have *shewn* in Plate III., Fig. 13. It measures ·70″ by ·50″.

Col. Rattray informs me that he has taken an egg from the nest of *Pericrocotus peregrinus* (The Small Minivet), which is the exact counterpart of the above egg and must belong to *C. passerinus:* it measures ·71″ by ·50″.

An egg from the Irvine collection, but now in mine, agrees well with Miss Cockburn's eggs, but is rather smaller, measuring ·73″ by ·54″; the ground colour is the same pale blue-green, but the markings consist of reddish specks, spots, blotches and smears of pale reddish-brown, with more sparse sub-markings of lavender and pale reddish-grey. In shape it is not quite such a long oval as is usual.

I have not had the luck to take this bird's eggs myself, but was given one by Mr. E. C. Green on the 10th of June this year, 1904, together with three eggs of *P. inornata* which he had taken that morning. The egg was on the point of hatching, but I kept the remnants. In colouration this is of the white type found by Mr. Davidson.

A fair series of these eggs have passed through my hands during the writing of this paper, and, broadly speaking, the eggs may be said to be of two types. Pure white, with sparse blotches or spots, nearly always disposed about the larger end, where they may form an ill-defined ring. The other form is much the same, but has the ground colour a very pale hedge-sparrow's egg blue, and the spots seem, as a rule, to be even more scanty and the ring, if any, even less defined. Irvine's egg is the only one I have seen that does not quite agree with the common forms and that is described above in detail.

Typically the eggs are rather elongated ovals with a fine close grain, smooth surface and, often, a decided gloss. They are rather stout in proportion to their size. The eggs which have passed through my hands have varied in length between ·69″ and ·74″ and in width between ·46″ and ·54″, the average of ten eggs being ·72″ by ·52″. Hume describes the eggs as much larger, *i.e.*, varying between ·78″ by ·81″ in length and ·53″ to ·57″ in width, so that my largest egg is smaller than his smallest. The two eggs of Miss Cockburn's in the British Museum measure ·78″ by ·55″ and ·76″ by ·51″. The figure of this egg in the B. M. Catalogue is very good, though the colour is perhaps a little dark

The range of the Indian Plaintive Cuckoo is thus given by Blanford: "The greater part of India, from the Himalayas to Ceylon inclusive, rare in the North-West, and although found on Mount Abu, wanting elsewhere throughout Rajputana and the Indus Plains. This cuckoo occurs in the Himalayas from Simla to Sikhim, ascending the hills to the westwards up to about 9,000′ according to Jerdon, and its range extends to Eastern Bengal, where it meets the next species. In the peninsula of India it is chiefly found in forest regions, and is most abundant in Bengal, Urissa, the wooded tracts of the latter, and on the hills in the neighbourhood of the Malabar Coast."

I found it not uncommon in Cachar, though *merulinus* was much more so, and have both seen and heard it in Lakhimpur.

Elliot describes its call as *we-whew, whe-whe-e-ew*. It is very much like one of the most plaintive, complaining calls of the Common Dronge

Shrike (*Dicrurus ater*). It is a noisy bird in the breeding season, and keeps up its plaintive cries for a long spell at a time, sometimes hidden in the dense foliage of some extra well covered tree, at other times seated high up on the topmost branch of a tall and sparsely foliaged one. It calls on moonlight nights, as well as in the daytime. Its flight is direct and rapid, and it is a rather shy bird, not allowing a close approach unless it thinks it is very well hidden.

*(To be continued.)*

# THE SNAKE AND ITS NATURAL FOES.

By

Captain F. Wall, I.M.S., C.M.Z.S.

(*Read before the Bombay Natural History Society on 28th June*, 1906.)

The position of the snake in the zoological world is a most unenviable one. How numerous are its enemies will be seen from the fact that it suffers destruction from almost the whole brute creation, beginning with the most exalted man, and passing down the animal scale to creatures as lowly as those included under the division Insecta. It would be hard, indeed, to say from whom it suffers the greatest persecution, but I will enumerate some of its enemies commencing with man, and proceeding down the animal scale.

Class—*Mammalia.*

*Order.*—Primates.—One of its most inveterate foes is undoubtedly man, who even in his most exalted state of civilisation learns almost from the cradle to recoil from its dreaded form, and who from the time that he acquires sufficient strength and courage unmercifully slaughters innocent and culpable alike.

*Love of slaughter.*—One finds abundant illustrations of civilised man's wanton brutality in books of sport, travel and adventure. Mr. E. O. Donovan is responsible for the following unabashed confession.* Speaking of the ruins of an old city near Marma Khan Tepé near the Mergab river which was infested with snakes, he says: "We spent half an hour hunting these up, and killing them with our whips, in consonance with the invariable Turcoman custom." Miss Hopley tells us† how a farmer in Wales at the end of one September was removing a heap of manure when he came upon a bed of snakes and slowworms. 352 were killed with thousands of eggs in clusters. From this motive alone—the love of slaughter—enormous numbers of snakes perish annually at the hands of civilised man. *Scientific motives.*—Again, civilised man from purely venial motives contributes to the yearly death-rate in his scientific researches in the departments of zoology, comparative anatomy, physiology, and toxicology, so that many hundreds of snakes annually reach our numerous laboratories and museums. The depreda-

* "The Merv Oasis," p. 269.

† "Snakes," p. 167.

tions, however, committed by civilised man are probably trifling in comparison with those wrought by the uncivilised and savage, many of whom display an even greater animosity towards these creatures and are brought into more constant and closer association with them.

*Food.*—As food, snakes are even at the present day consumed by some European nations, and many other people habitually eat and relish them. Speaking with Father John the Baptist recently in Mussoorie he informed me that to his certain knowledge many of the poor people in parts of Italy eat snakes, and consider them as attractive as eels, and vipers are said to be eaten by many people in the South of France.* In an interesting article in Cassell's Natural History† mention is made of a traveller in America who sat at table before a dish called "Musical Jack" which had been prepared by some travellers of another party under the same roof. It was prepared from rattlesnake, and was evidently considered by them a great delicacy. It was said to taste like chicken. Hartwig‡ too says that the American Indians often regale on the rattlesnake. Sir T. Mitchell in his book on Australia says he once tasted a boa constrictor himself, and describes it as "very like veal, the flesh being exceedingly white and firm." He also states that the Australian natives eat snakes, and Buckland says § "the flesh of snakes is not uncommonly eaten by the poor Bushmen, and also by the Australian natives."

The python especially seems to find favour as a tit-bit among many people. The Burmans relish it, as do also the Karens. Evans ‖ speaking of a python which had been killed on one of his expeditions, says by the evening on his return he found it had been cooked by the Burmans. Theobald¶ remarks upon the Karens eating its flesh, and says that it looks white and tempting. A writer to *The Field* ** recording the capture of a python whilst incubating her eggs in Travancore, says that the hillmen there (Aryans) are reputed to feed on pythons and their eggs. The Chinese eat this snake in common with many other species, and I was told by a resident in Hongkong how on

* Museum of Natural History, Vol. II., p. 39.
† Vol. IV., p. 65.
‡ "The Tropical World," p. 316.
§ "Curiosities of Nat. Hist." First Series, p. 201.
‖ Bomb. Nat. Hist. Journ., Vol. XVI., p. 519.
¶ Cat., Snakes, Brit. Burma, p. 37.
** Oct. 3rd, 1903.

one occasion when out shooting he encountered and shot a python on the mainland near that island. The Chinese who were with him cooked and made a sumptuous feast off it. Its name in the locality "Hoang Zo," meaning "Aromatic snake," must, I think, refer to the savoury smell its cooking flesh awakens in the Celestial's nostrils. F. im Thurn* speaking of the boa constrictor says that the Chinese alone of all the inhabitants eat and relish the flesh of these snakes. David Livingstone† says that the flesh of the python is much relished by the Bakalahari and Bushmen in Africa, and that when killed and cut up they carry away each his portion like "logs of wood over their shoulders." James Chapman‡ speaks of once having killed a boa in North Bechuanaland in which he found a hare, and remarks that the Bushmen with him not only ate the hare, but the snake as well. C. J. Anderson§ speaks of large snakes which inhabit the swamps about Lake Ugami, and says they are often destroyed by the natives, who devour them with relish. Colonel H. Yule‖ under the word Anaconda, which he makes it appear is really the Ceylon name for the python, says: "It is added that the country people regard this great serpent as most desirable food."

Many other snakes enter into the dietary of various folk. Evans¶ tell us that the Karens eat the flesh of the hamadryad and pronounce it good. Phipson** again says he is informed that the Andamanese eat the hamadryad. In Bangalore I interviewed a man of the Tigala caste who told me his caste ate the Dhaman (*Zamenis mucosus*), but this appears to be the only snake they partake of. The head and a portion of the body anterior to the vent are removed, the snake skinned and cleaned, and then cut into pieces and cooked, and he compared the flesh to chicken in appearance and flavour. Richards†† mentions among other Indian castes the Santhals (who I find are supposed to be the indigenes of Chota Nagpur) and the Dhangars of the same locality as ophiophiles. The Kols, too (a tribe inhabiting the same part of India), according to Mervyn Smith,‡‡ include snakes in their bill of fare.

* Among the Indians of Guiana, p. 134.
† "Journeys and Researches," p. 145.
‡ "Chapman's Travels," p. 292.
§ "Lake Ugami," p. 452.
‖ "Hobson Jobson," p. 16.
¶ Bomb. Nat. Hist. Jourl., Vol. XIV., p. 417.
** Bomb. Nat. Hist. Jourl., Vol II., p. 245.
†† "Landmarks of Snake Poison Literature," p. 66.
‡‡ "Sport and Adventure in the Indian Jungle," p. 140.

I am told that the Kanjars, a wild race of people inhabiting Oudh and Rohilkhand, eat snakes, having decapitated and caudally amputated the body. Mr. Mackinnon tells me the tribe known as Myhras, who inhabit the Dun, devour snakes. David Livingstone* mentions a common watersnake yellow, spotted dark brown, of a harmless kind which the Bayeiye tribe in Africa ate and relished as food.

Cuvier† informs us that the seasnake *Pelamis bicolor* (*Hydrus platurus*) is eaten by the natives of Taheite, and Cantor‡ speaking of the same snake, says it is used as an article of diet in New Guinea, the Molucca Islands, and Otaheite. Campbell§ speaking of the Andamanese credits them with including sea-snakes in their dietary. The same writer‖ says that the Botocudos, Puris, and Caraodos, wild tribes inhabiting Western Brazil, eat snakes among many other animals, and again the same writer¶, speaking of the diet of the Californians, says they prefer reptiles, insects and vermin to mammals and birds, and mentions that they eat snakes with the exception of the rattlesnake.

Doubtless a whole host of other people conciliate their gustatory nerves by practising ophiophagy.

*Medicine.*—Another motive which is responsible for considerable diminution in their numbers is that arising from the medicinal virtues attributed variously to their flesh, organs, or secretions. Probably the mortality from this humane object is even superior to that incurred either by man's serpentivorous tastes, or love of butchery.

Vipers appear to have been especially valued for medicinal purposes in many parts of Europe even up to the recent past.

Both Pliny and Galen** praise the efficacy of viper flesh in the cure "of ulcers, elephantiasis, and other disorders arising from a corrupt state "of the system. The flesh was served to the patient boiled like fish, as "being more efficacious than when taken in the form of powder, or other "dried state," and the account goes on to say that Sir Kenelm Digby's beautiful wife was fed on capons fattened with the flesh of vipers.

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* "Journeys and Researches," p. 72.

† Encyclop. of Nat. Hist, Vol. III, p. 153.

‡ Journ. Asiat. Soc, Bengal, 1847, p. 1057.

§ Brit. Medl. Journal Oct. 14th, 1905.

‖ Brit. Medl Journ., Sept. 16th, 1905.

¶ Brit. Medl. Journ., August 19th, 1905.

** "Encyclop. of Nat. Hist.", Vol. III., p. 1210.

Richards* tells us that "the flesh of vipers dressed as eels was strongly "recommended by Galen as a remedy for elephantiasis (leprosy) * * *, "and the physicians of Italy, and France very commonly prescribed "the broth, and jelly of viper's flesh for the same uses. It appears also "to have been given in England, for Mead observes the patient ought "to eat frequently of viper-jelly, or rather as the ancient manner was "to boil vipers, and eat them like fish; or if the food will not go down, "though really very good, and delicious fare, to make use, at least, of "wine in which dried vipers have been digested six or seven days in a "gentle heat."

The Mead referred to was a celebrated physician who made many observations, and researches concerning snakes, and died as recently as 1754. The same writer further remarks that viper wine "was actually "an acknowledged preparation in the London Pharmacopœia," and further that "Charles II's physician in ordinary, Dr. Thomas Sherley, "recommended what he termed 'Balsam of Bats' as a remedy for "hypochondria; it was composed of 'adders, bats, sucking-whelps, "earthworms, hog's grease (sic), the marrow of a stag, and the thigh-bone of an ox."

Rein† speaks of the Japanese entrapping the poisonous *Trigonocephalus blomhoffii* which they skin, and consume as a nerve strengthening food. This is a very common little snake in Japan, and China, now known as *Ancistrodon blomhoffii*.

Duhalde‡ mentions a snake in the Honan Province of China speckled with white spots, the skin of which Chinese physicians steep in a vial of wine "which they make use of as a good remedy against the palsy."

When I was in Hongkong, I saw in the Chinese medicine men's shops rows of bottles on shelves containing snakes of many kinds preserved as in a museum. Steeping in the preservative were also fragments of vegetable substances—bark, leaves and fruit—and this horrible looking solution was decanted off as occasion required for the treatment of various ailments.

Richards§ remarks: "It is said that the flesh of the cobra was prescribed in Bengal for wasting diseases." Theobald‖ speaks of the

* "Landmarks of Snake Poison Literature," p. 65.
† "Japan," p. 187.
‡ "China," Vol. 1, p. 102.
§ Loc cit. p. 66.
‖ "Catalogue of Snakes, Brit. Burma," p. 37.

Karens using the gall-bladder of the python for medicinal purposes, and that the flesh is eaten by them and "indeed looks white, and tempting."

Carl Bock* makes mention of the Dyaks using the fat of the boa constrictor (*Python reticulatus* ?) in ointments, and says they eagerly pursue the snake for this purpose. Anderson† has the following of the African race the Namaques :—"Many Namaques believe that the "ondara possesses certain medicinal virtues, therefore when they succeed "in killing the reptile" (probably from his description *Python natalensis*), "its flesh is carefully preserved. If a person falls sick, a portion "is either applied externally in the form of an unction, or given to the "patient in a decoction."

In Chambers' Journal‡ a writer speaking of Brazilian snakes says, anent the rattlesnake (*Crotalus horridus*), "the fat of its entrails is "said to be a sovereign remedy for rheumatism," and "the Museum of Natural History" § says that the fat of the Brazilian "Cucuriuba" (*Eunectes murinus*) is melted down and used for various purposes, as in rheumatic pains, sprains, etc. Only recently 2nd Grade Assistant Surgeon Har Prasad, an intelligent and well educated native, told me that he once had a case of insanity which he treated by the ordinary methods in vogue in English practice, but with no beneficial results for two months, at the expiry of which time the relatives begged him to allow a hakim to come in and adopt a native method of treatment. Acceding to their request this man administered cobra poison mixed with vegetable substances into a paste, which he smeared thickly all over the scalp, with the result that a speedy cure was effected.

Fayrer‖ quotes the following on the authority of a learned Kabiráje, showing that cobra venom is extensively used by that caste as a therapeutic agent.

*Physiological action.*—"It is warm, irritant, stimulating, a promoter "of the virtues of other medicines, antispasmodic, digestive, a promoter "of the action of the secreting organs."

*Therapeutical action.*—"Used in the later stage of low forms of fever "when other remedies fail, it accelerates the heart's action, and diffuses

* "The Head Hunters of Borneo," p. 252.
† "Lake Ngami," p. 360.
‡ Feb. 24, 1894.
§ Vol. II., p. 58.
‖ "Thanatophidia," p. 118.

"warmth over the general surface; clears the mind if coma supervene. "In the collapsed state of cholera, it is successfully used. It is employed "in dysentery, and some complicated diseases. Used in epilepsy arising "from cold, relieving the patient from insensibility, and forgetfulness, "symptomatic of that disease. Some practitioners have written that "snake poison is used as an antidote in cases of snake-bite when the body "is cold, and the heart's action is scarcely perceptible. Used in such a "state it accelerates the heart's action, and causes a flow of blood to the "distant capillaries in which circulation has ceased, and diffuses warmth "over the general surface, etc."

Young* gives the following curious recipe for snakebite which the Siamese physicians advocate:—"A piece of the jaw of a wild "hog, a piece of the jaw of a tame hog, a piece of the bone of a goose, "a piece of the bone of a peacock. The tail of a fish. The head of a "poisonous snake."

Mervyn Smith† alludes to the Chentsus, a tribe inhabiting the Nallamalley Mountains of India, skinning two hamadryads which he had shot, and remarks: "The poison fangs, and glands, the palate, and "the gall were carefully preserved for medicine. Diluted with gingelly "oil, the poison is drunk in small portions, and is said to be a wonderful "preservative against all snakebites."

*An Antidote in Snakebite.*—This belief in the efficacy of certain parts of poisonous snakes, and especially the poison as an antidote to snake-bite, is widespread. Mead, already referred to, had the greatest faith in viper's fat as an antidote in viper bite, and claimed that it was the remedy used by the English viper-catchers from whom, after much trouble, he obtained the secret.

Among other "cordial remedies" which Richards‡ tells us were recommended was the "salt of vipers", whatever this may mean. Many tribes habitually swallow snake poison with the idea of acquiring immunity from snake-bite, and there seems little reason to doubt that their belief is well founded as shown by experiment on the lower animals. The Revd. J. Campbell§ speaking of the Hottentots in S. Africa says they will "catch a serpent, squeeze out the poison from under hi

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* "The Kingdom of the Yellow Robe," p. 124.
† "Sport and Adventure in the Indian Jungle," p. 25.
‡ Loc. cit., p. 65.
§ Page 401.

teeth, and drink it." Fontana's viper-catcher, called Jacques, was reputed to swallow spoonfuls of viper venom.*

Fraser† mentions the following well authenticated reports of this practice with the avowed intention of acquiring a tolerance against snake poison. One Alfred Bolton set himself to enquire how the natives in Bushmanland, Namaqualand, Dumaraland, and Kalakari obtained immunity from snake-bite, and ascertained that they are in the habit of extracting the poison-gland of snakes, squeezing them into their mouths, and drinking the contents. Dr. Knobel, of Pretoria, substantiates this observation, and records having met a Bushman shepherd who said he had been in the habit for years of eating snake-venom.

Other people appear to inoculate themselves with the poison to attain the same object. M. D'Abbodie‡ says that the Vatnas of Mozambique inoculate themselves with snake poison to preserve immunity from snake-bite, and Calmette§ observes that a viper-catcher living in the Jura allowed himself to be bitten by vipers once or twice each year to preserve the tolerance he had acquired to their poison.

The Eisowy, a tribe inhabiting Western Barbary, says Drummond-Hay, allow themselves to be bitten by serpents proved to be venomous by a rapidly fatal experiment performed on a fowl and that, at the conclusion of an exhibition, the man commenced eating, or rather chewing, a poisonous snake which, writhing with pain, bit him in the neck and hands until it was actually destroyed by the Eisowy's teeth.

*As an arrow dressing.*—The poison of snakes is collected by certain savages for quite another purpose, *viz.*, that of dressing their arrows, and so dealing death to their foes or to wild beasts hunted for food; and though this does not necessarily imply the destruction of the snake, it is more than probable that where the quarry is a formidable one and shows fight there is little hesitation in killing the creature. The Scythians are reported to have poisoned their arrows with viper venom mixed with human blood. Livingstone‖ speaking of the Bushmen in Africa says they poison their arrows with the piece of the *Euphorbia*

* Loc. cit., p. 75.
† "Nature," April 23rd, 1896, p. 595.
‡ "Academie des Sciences," Feb. 24th, 1896.
§ Bomb. Nat Hist. Journ., Vol. XI, p. 521.
‖ "Journeys and Researches," p. 171.

*arborescens* all over the country, and in some parts the venom of serpents is added to increase its virulence.

Mervyn Smith* says that the tiger slayers in Chota Nagpur poison their arrows with cobra-poison and set them in traps to be sprung. When wounded, the tigers go off and soon die, their movements being watched by the hunters. Sims Woodhead commenting upon a paper which appeared recently by Chalmers† on the poison used by the Fra Fras, a tribe inhabiting, I believe, Uganda, says: "There appears to me to be a probability that the venom is extracted from the heads of snake before they are boiled with the powdered seeds and that this venom may be added to the vegetable poison smeared on the arrow after it has cooled."

*Trade purposes.*—Snakes are captured by many people in some numbers for show purposes, and though the destruction so caused may not amount to much, the captured snakes often speedily emaciate and die, requiring the substitution of others. Indian jugglers always have a few in their stock-in-trade, and are always ready to let the mongoose that accompanies them worry them to death for a few annas.

In addition, they are sometimes called in to rid some infested place of snakes, and doubtless do in some cases justify their errand. The Psylli of Africa appear to perform a similar office. Figuier‡ speaks of these people, and from his description they appear to be a caste of Egyptians, since he says the arts they practise are inherited, and he expressly states that outsiders who seek to become one of the fraternity fail to acquire their arts. They are to be seen in Cairo and Alexandria, and live by exhibiting snakes. They sometimes appear in processions, and carry capacious bags in which their snakes are secreted. These they take out and allow to entwine about their persons, and, in order to excite popular feeling, even cause them to bite their bodies. They claim to have acquired ascendancy over even poisonous snakes, for they include the Egyptian cobra (*Naia haje*) in their stock-in-trade. They also claim to be able to induce snakes to leave their natural haunts, and then catch them, so that when a house becomes infested with these creatures, the Egyptians frequently send

* "Sport and Adventure in the Indian Jungle," p. 104.

† Royal Army Medical Corps Journal, August 1905.

‡ "The Life and Habits of Animals," p. 35.

for these people to rid the premises of these undesirable guests. The Marsi of Italy are reputed to be immune to snake poison, and, I believe, practise somewhat similar arts ; but I can find no authentic description of these people to enlighten me on their habits.

*In the arts.*—Many people question the use of snakes in the animal world, and they may be surprised to learn that some at least are of use for trade purposes other than the barter to which they are subjected for show purposes. Wells* in relating an interesting experience of his shows that the skin of the anaconda (*Eunectes murinus*) is used in Espirito Santo for making riding boots, and he speaks of going to a bootmaker's shop† on one occasion and finding the skin of a snake from which pieces had been cut at each end for the manufacture of boots. The remnant measured 19 feet, and he was told the entire skin measured 25 feet. Colonel Yule‡ also mentions this snake under the names "Sucuriu," "Sucuriuba," and scientifically as *Boa anaconda*, and says its skin is used for boots, shoes, and other purposes. "The Museum of Natural History" mentions the skin of the same snake being used for shoes, portmanteaux, etc. (p. 58).

*Order.*—Carnivora.—*Family.*—Felidæ.—Instances of the Carnivora feeding upon snakes are by no means uncommon. Even His Royal Highness the Indian tiger is evidently not disdainful of such fare when occasion offers, for Inverarity§ records a remarkable illustration of this in the following words :—"On opening the stomach of an old tigress I shot last month, I found in it the tail end of a snake that the tigress had bitten off and swallowed whole ; the portion swallowed measured 2 feet 3 inches in length * * * It appeared to me to be a rock snake."

A specimen of the fishing cat (*Felis viverrina*) which Hodgson had brought to him proved on investigation to have eaten a large snake.

That cats in a domesticated state kill snakes is very well known, and not long since some interest was aroused on this topic in the columns of "The Field."‖ Besides the many examples quoted therein, I can add others. A friend of mine, Mr. Sitwell, told me he once saw a cobra at Bankipore dying after being mauled by a cat. The cat was still pawing it when he came on the scene, and he was told by others

* "Three Thousand Miles through Brazil," p. 167.
† Loc. Cit., p. 171.
‡ 18th and 25th June, 9th July and 13th August 1904.
§ "The Great Thirst Land," p. 147.
‖ "Hobson Jobson," p. 16.

present had reduced it to this dying condition. Parker Gillmore* refers to a cat in South Africa which he saw kill a snake which had entered the drawing-room, having commenced operations by seizing it by the head.

*Family.*—Viverridæ.—Among the Carnivora probably no creatures commit such wholesale slaughter of snakes as the mungoose (*Herpestes*), but whether all of the many species exhibit the same partiality towards this flesh I am not able to say. I was lately informed on good authority of a company of mungoose which was busily engaged in hunting on a railway cutting which gave exceptional scope and opportunity for observation. They instituted a systematic search in the grass, and apparently for snakes. One at any rate was flushed and promptly captured, and the little gang having collected tore it in pieces, and ate the fragments, and immediately dispersed to renew their hunting. The general behaviour of the party as described to me suggested a family being instructed by their parents. Blanford† describes these little animals as "deadly enemies to snakes", and almost every writer on Natural History gives ample evidence of the ravages they commit in the snake world.

*Family.*—Canidæ.—Dogs at any rate in a domesticated state are occasionally known to develop ophidioclastic tendencies, and, this being so, it is more than likely that their feral allies exhibit similar habits, though I am not aware of any authentic instance. I have in my note-book a cutting from a paper I took some time ago, omitting at the time to note the paper and its date, but it was about ten years since. This gives a very interesting account of a dog which was in the habit of killing snakes, and with it was a reproduction from a photograph of the dog standing over one of his dead victims. It was the property of a Mr. J. Smith, of Nhill, Victoria, Australia, and the account says it had killed about 35 snakes in one summer. It eventually succumbed to bites inflicted by a poisonous species with which it engaged in mortal combat. Bryden‡ mentions a dog taking up a green tree snake in his mouth and running off with it. Colonel Yule§ records a bull-dog in the possession of a Staff-Sergeant at Delhi that used to catch cobras.

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* Bombay Nat. Hist. Soc. Journ., Vol. VII, p. 405.

† Fauna, Brit. India Mammalia, p. 121.

‡ "Gun and Camera in South Africa," p. 80.

§ "Hobson Jobson," p. 173.

*Family*—Mustelidæ.—Blanford* includes snakes in the dietary of the beech martin (*Mustela foinæ*), and Miss Hopley† includes the weasel and the badger in her list of serpentivores.

*Order*—Insectivoræ.—There are even instances of these quiet little animals preying on snakes, for Buckland tells us that he demonstrated by direct experiment that his pet hedgehog would eat the grass-snake of Britain, and Miss Hopley† also mentions the hedgehog in her list of animals that devour snakes.

*Order*—Rodentia.—It seems difficult to believe that rats, and even mice, occasionally attack and kill snakes, but such is undoubtedly the fact. Miss Hopley† mentions the rat as one of those that will kill snakes, and I have on very good authority the following remarkable testimony of murine ferocity directed against these reptiles. Assistant Surgeon Robertson narrated to me how he once put a rat into one of his snake cages as food for a large ratsnake (*Zamenis mucosus*). The rat, however, when brought to bay defended itself with great courage and determination, and fought with its would-be master to such purpose that "the snake it was that died." Its tactics consisted in its fixing itself on the back of the reptile's neck, and, having once obtained the mastery, its ferocity and courage were stimulated to such a degree that it fought and killed several other snakes caged with it. Considering it had earned its liberty, it was finally released. The Revd. G. H. R. Fisk‡ tells an even more remarkable story. He had two young ringhals (a poisonous S. African snake, *Sepedon hæmachates*), one 10 inches long, the other 9 in a box. A mouse was put in for them to eat, but when the box was next opened, the rodent was found to be eating one ringhal, and subsequent observation proved that the mouse made an onslaught on the other by fastening itself by its claws on to the snake's back, and then "pecking" it with its teeth. It was dragged round and round the box by the snake in its endeavours to free itself, but managed to elude the snake's repeated attempts to strike it.

*Order*—Ungulata.—*Family*—Cervidæ.—Deer are reputed to kill snakes by jumping upon them. Tennant§ mentions this on the authority of the natives of Ceylon.

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* Fauna, Brit. India Mammalia, p. 161.
† "Snakes," p. 57.
‡ Proc. Zool. Soc., London, 1887, p. 340.
§ Nat. Hist. of Ceylon, p. 295.

*Family*—Bovidæ.—Miss Hopley* includes goats among animals known to destroy snakes, and it is significant that the word "markhor" means "snake-eater" in Persian. Whether this noble beast has been observed to eat snakes I cannot say, but the Encyclopædia of India alludes to this as a fable which is probably the case, the mountain tribes believing that they can kill snakes by looking at them!

*Family*—Suidæ.—There is abundant evidence to prove that pigs are among the most inveterate foes that snakes have to encounter. Parker Gillmore† speaking of South Indiana and Illinois says that rattlesnakes used to be very plentiful there. "Their destruction was principally accomplished by the introduction of hogs which greedily feed upon these reptiles whenever chance throws them in their way. I have several times had opportunities of watching a pig in ar encounter with one of these snakes which they worry as a cleve. terrier would a rat. The hog attacks the rattlesnake with such energy, and rapidity that the assailed reptile has scarcely time to guard himself against the attack when he finds himself in the fatal grasp of his too powerful foe."

Hartwig‡ again says the chief enemy of the rattlesnake is the hog, and Simson§ remarks that he has seen pigs catch and eat snakes.

*Apropos* this porcine habit "The Cyclopædia of India"‖ has the following, speaking of the Negro ophiolatry in the kingdom of Whidah in Africa:—"The hog especially which preys particularly upon several species of these reptiles (snakes), and which is well known to attack with impunity the most venomous of them, is pursued in the Kingdom of Whidah as a public enemy; the Negroes seeing only in this valuable animal an enemy which devours their god." Miss Hopley¶ mentions the peccary among known destroyers of these reptiles.

CLASS—*Aves*.

The list of birds which are known to practise ophiophagy is a very large one, and many of these, especially the larger raptorial species, must inflict a very heavy mortality among the anguine population.

* "Snakes," p. 57.
† "Prairie Forms and Prairie Folk," p. 156.
‡ "The Tropical World," p. 316.
§ Letters on Sport in Eastern Bengal, p. 341.
‖ Vol. V, p. 56.
¶ "Snakes," p. 57.

*Order*—Passeres.—*Family*—Corvidæ.—Mr. Fitzgerald told me recently that he had once seen the tree pie (*Dendrocitta rufa*), or as he called it the "Bobbalink," killing a snake which probably from his description was a *Tropidonotus stolatus*.

*Order*—Anisodactyli. *Sub-order*—Coraciæ.—I have three records of the common roller, or blue jay (*Coracias indica*), killing and eating these reptiles. Grieves,* commenting on a paper on this bird which was contributed by D. D., says: "Cycling along a jungle path one day my attention was attracted to one of these birds which was making a great fuss and noise close to the track along which I was to pass. I dismounted, and was fortunate enough to see a great battle in progress between a blue jay and a small cobra. The latter was about 15 inches long, but it was certainly on its defence, and the blue jay was the attacking party. The cobra was trying to get under cover, but at every move the blue jay attacked it most ferociously, apparently with both beak and claws. Then the cobra would rear its head, expand its hood, and dart at the enemy. The blue jay did not flinch, but at the same moment flicked out its wing horizontally, and off the cobra started again, only to be teased, and tormented. I had been watching this battle for fully five minutes when my dog, which had been roaming about the jungle, rushed up to the spot, and scared away the jay. The second incident occurred in my own compound just a few weeks after the event referred to above. Out in the compound one morning I saw a jay sitting on a low branch of one of the trees struggling with something in its beak. On drawing near I saw that the something was about 8 or 9 inches of snake. The head had already disappeared, so that I cannot say how long the snake might have been, or of what kind."

On the 12th April last year (1905) Mr. Hose, the Deputy Commissioner in Fyzabad, told me he had that morning seen a roller in his compound in the act of swallowing a small snake, and mentioned it as a remarkable incident.

*Sub-order*—Halcyones.—A writer to *The Field* (June 25th, 1904) besides mentioning two cats of his in Queensland that were in the habit of killing snakes says: "But what surprised me still more was to see the laughing jackass or great kingfisher of Australia carry a snake

* "The Madras Mail," 17th September 1904.

to a great elevation, and then drop it on to the hard ground, rendering it helpless."

*Order*—Striges.—Blanford* tells us that the rock horned owl (*Bubo bengalensis*) lives on rats, mice, birds, lizards, and snakes, and what is true of this owl is in all probability true of many others.

*Order*—Accipitres.—*Sub-family*—Gypogeranidæ.—Many species of this order include snakes in their dietary. The Secretary bird (*Serpentarius reptilivorous*) is, I believe, included in the order, and has a world-renowned reputation for destroying these creatures. It is said to disable them by blows from its wings and feet, and is also reported to carry them aloft, and kill them by dropping them. Le Vaillant, who once killed one, found, on investigating its crop, that it had eaten "eleven rather large lizards, three serpents of an arm's length, and eleven small tortoises, besides a number of locusts, beetles, and other insects."

*Sub-family*—Falconinæ.—Among Indian birds of this sub-family that are known to evince serpentivorous tastes are, according to Blanford,† the Indian tawny eagle (*Aquila vindhiana*), the short-toed eagle (*Circaetus gallicus*), the crested serpent eagle (*Spilornis cheela*), Pallas's fishing eagle (*Haliaëtus leucoryphus*), the white-bellied sea eagle (*Haliaëtus leucogaster*), the rufous winged buzzard eagle (*Butastur liventer*), the pied harrier (*Circus melanoleucus*), Fielden's hawk (*Polichierax insignis*). Mr. Mackinnon recently told me that on one occasion he saw a *Circaëtus gallicus* descend into some long grass where it remained some time. Out of curiosity he walked it up, and shot it as it rose. On opening its crop he found 7 snakes, one still alive. They were all of the same species (one of the genus *psammophis*). Aitken‡ says of the sea eagle (*Haliaëtus leucogaster*) that it lives chiefly on sea serpents, and Cantor§ remarks that in two of this species shot in the Gangetic Delta he found remains of sea serpents.

Kites are known to eat snakes at times. I have myself seen the common pariah kite (*Milvus govinda*) stoop into a marsh, and rise with a snake wriggling in its talons, and it is probably this species that

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* Fauna, Brit. Ind.: Aves, Vol III, p. 286.

† Fauna, Brit. Ind.: Aves, Vol. III.

‡ "The Common Birds of Bombay," p. 26.

§ Trans. Zool. Soc., London, 1840, p. 368.

Ferguson alludes to going off with a snake.* Swaysland† also attributes anguine tastes to the kite. The Brahminy kite (*Haliastur indus*), according to an article in the Cyclopædia of India,‡ is credited with a similar habit, for it says: "In the South of India, the accepted type of Garuda is the common Brahminy kite * * * This bird pounces upon, and carries off the cobra in its claws, and kills it." Aitken§ has a picture of a harrier descending upon a snake. It is no uncommon event for sportsmen in this country to witness eagles, kites, and other predaceous birds descend into the jheel, or marsh, and bear away a snake wriggling in their grasp.

*Order*—Ratitæ.—Hartwig‖ ascribes serpentivorous habits to the "American ostriches" or rheas.

*Order*—Gallinæ.—The galline birds, like the accipitrine, contribute very largely to the decimation of these limbless vertebrates. The peafowl (*Pavo cristatus*) is well known to show a partiality to this fare, and in Ceylon I have known people keep tame peafowls with the idea of keeping their premises free from snakes. Bennett, who lived in the south-eastern part of that Island, ascribed the paucity of snakes in the jungle to the abundance of the peafowl whose partiality to snakes, he says, renders them the chief destroyers of these reptiles. Hume and Marshall¶ record the cook on one occasion removing a small snake about 8 inches long from the stomach of one of these birds.

Tennent** says that snakes are frequently eaten by the common barn door fowl in Ceylon, and opines, that the jungle species behave similarly. Drieberg†† mentions having observed a pullet on one occasion in Ceylon (Gokarella) pursuing a snake 12 to 15 inches long, which it killed and swallowed, and though a novel experience to him he ascertained from the resthouse-keeper and others that it is a common event, and that the village poultry, as a rule, attack and make a meal of them. Mr. P. Mackinnon told me recently that on one occasion in

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* Bom. Nat Hist. Soc. Jour., Vol. X, p. 1.

† "Familiar Wild Birds," p. 111.

‡ Vol V, p. 229.

§ "The Common Birds of Bombay," p. 15.

‖ "The Tropical World," p. 321.

¶ "Game Birds of India, Burmah and Ceylon," p. 87

** Nat Hist. of Ceylon, p. 295.

†† Spolia Zeylanica, Vol. III, p. 202.

the Dun when sitting in a verandah he saw a small cobra close beside him, which he rose to despatch when he saw a white fowl running towards it. The fowl attacked vigourously, caught it by the back, and repeatedly pecked it; subsequently, it swallowed it with no ill-effects. What is true of the domesticated breed is probably and equally true of the jungle species; indeed, Gunther* remarks that the jungle fowl preys on young cobras.

*Order*—Grallæ.—*Family*—Otididæ. The great Indian Bustard (*Eupodotis edwardsii*) is a serpentivore according to the authority of Hume and Marshall†, who also give similar evidence against the Bengal florican‡ (*Sypheotis bengalensis*).

*Order*—Limicolæ.—Webber§ is responsible for the following incident which shows that the red-wattled plover (*Lobivanellus indicus*) will put up a good fight against a snake, though in this instance the reptile was not killed. He says: "One day when riding an elephant I discovered how useful the spur was. I saw one of these birds engaged in mortal combat with a snake which was trying to rob her nest * * The bird got the best of the battle, inflicting some sharp blows on the serpent, which retired discomfitted."

*Order*—Herodiones. *Family*—Ibididæ. I can find no recent evidence to show that the Ibis is an ophiophage, but Juvenal,‖ speaking of an Egyptian species, makes no doubt of it in his lines—

> "Who has not heard where Egypt's realms are nam'd
> "What monster gods her frantic sons have fram'd?
> "Here Ibis gorg'd with well-grown serpents, there
> "The crocodile commands religious fear," etc.

*Family*—Ciconiidæ.—Hartwig¶ credits the Adjutant (*Leptoptilus dubius*) with anguine tastes, and Ferguson** remarks that, in the public gardens at Trivandrum, water snakes used frequently to come into the cages of the waterfowl to devour the fish with which they were provided for food and that they were often killed by the herons, but the hair-crested stork (*Leptoptilus javanicus*) took a special

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* Reptiles of British India, p. 354.
† Loc. cit., p. 9.
‡ Loc. cit., p. 25.
§ "The Forests of Upper India," p. 211.
‖ Satire, XV.
¶ "The Tropical World," p. 322.
** Bombay Nat. Hist. Journ., Vol. X., p. 5.

delight in watching for and killing them. The white-necked stork (*Dissura episcopus*) has similar tastes, for two English boys recently told me that they once saw their cook, when cleaning a "beefsteak" bird for the table, remove a snake from its crop.

*Family*—Ardeidæ.—Aitken* reports having seen the little egret (*Herodias garzetta*) trying to swallow a snake, and Ferguson, just quoted, makes reference to herons exhibiting similar tastes.

CLASS—*Reptilia*.

We come now to another large class which numbers in its ranks several whose partiality to a serpentine diet is well known.

*Order*—Squamata.—*Sub-order*—Lacertilia.—Though lizards, like frogs, constitute the snake's especial perquisite in the zoological market, the tables are sometimes turned, and the larger lizards will assert their supremacy and practise ophiophagy, and, as will be seen later, instances have been known where the frog, handicapped though it is in weapons of offence, has been known to pay back some of the scores against its own kind by developing serpentivorous habits. I have collected the following instances of lizards dominating snakes. Mr. Gleadow† tells me he once saw a varan or monitor lizard running off with a live snake, 3 or 4 feet long, in its mouth, which it released on seeing him. He shot the snake, which proved to be a cobra. Dalrymple‡ records a big iguana in S. Australia doing battle royal with a whipsnake. The Revd. J. H. R. Fisk§ mentions a lizard in South Africa attacking and killing a snake, and in the "Museum of Natural History"‖ the following appears:—"The Ammodyte, according to the testimony of M. Host, appears to be a nocturnal species of serpent, and commits great havoc amongst field mice, small birds, and many lizards. It falls a prey itself, however, to one of that tribe of animals. The Scheltopusik (*Pseudopus pallasii*) is one of its most redoubtable and bloody enemies. Shielded by its cuirass of tilelike, hard scales, it is proof against the fangs of the viper, attacks it with impunity, and devours it at leisure."

*Sub-order*—Ophidiæ.—Snakes, and especially certain species, are well known to prey upon one another, and make no hesitation in commit-

* The Common Birds of Bombay, p. 181.
† "In Epistola."
‡ "The Field," June 25th, 1904.
§ "Proc. Zool. Soc., London, 1883, p. 32.
‖ Vol. II., p. 48.

ting cannibalism. The Hamadryad (*Naia bungarus*) has a particularly evil reputation, feeding as it does, almost exclusively, upon snakes; and if its voracity in its native haunts approaches that during captivity, the death-roll from this single species must be very considerable, for Miss Hopley* informs us that one specimen in the London Zoo disposed of as many as 82 snakes in one winter, and a writer to "The Field" (April 16th, 1904) says that a specimen, 8½ feet long (by no means a large one), in the Trivandrum gardens consumed as many as 44 rat-snakes in one year. It is certainly notable that in the majority of instances on record where this snake has been killed, it has been found to have lately fed, and hazarding a guess I think I am well within the mark when I say of all other snakes which are brought to me not more than one in ten contains anything "in gastro." The kraits do not exhibit so voracious an appetite, but those that are killed that have dined give abundant proof of their partiality to the flesh of their own brethren. Many other snakes in a state of captivity prey upon one another, but I do not think that this argues that they would do so in their natural state; and I am inclined to believe that with the majority it is only when hunger presses sorely, that they devour one another. I have collected all the instances I can find where ophiophagy has been perpetrated in a state of nature among our Indian representatives, which I append in tabular form.

| Victor. | Victim. | Authority. | Reference. |
|---|---|---|---|
| *Naia bungarus* ... | *Bungarus fasciatus.* | Primrose ... | Bomb. Nat. Hist. Jourl., Vol. XII, p. 589. |
| *Do.* ... | *Naia bungarus* ... | Evans ... | Bomb. Nat. Hist. Jourl., Vol. XIV, p. 416. |
| *Do.* ... | *Naia tripudians* | Evans ... | Bomb. Nat. Hist. Jourl., Vol. XIV, p. 416. |
| *Do.* ... | *Do.* ... | Craddock ... | Bomb. Nat. Hist. Jourl., Vol. XIV, p. 143. |
| *Do.* ... | *Python molurus?* .. | Aitken ... | Bomb. Nat. Hist. Jourl., Vol. XIV, p. 629. |
| *Do.* ... | *Do.* ... | MervynSmith | Sport and Adventure in the Indian Jungle, p. 19. |
| *Do.* ... | *Not specified* ... | Branson ... | "The Pioneer," 4th Sep. 96. |
| *Naia tripudians*... | *Dipsadomorphus trigonata.* | Wall .. | Bomb. Nat. Hist. Jourl., Vol. XV, p. 524. |
| *Do.* .. | *Macropisthodon rhodomelas.* | Flower ... | Proc. Zool. Soc. Lond., 1896, p. 894. |
| *Do.* ... | *Zamenis mucosus?* | Kinloch ... | "In Epistola." |

* "Snakes," p. 566.

| Victor. | Victim. | Authority. | Reference. |
|---|---|---|---|
| *Bungarus fasciatus* | *Tropidonotus piscator.* | Evans ... | Bomb. Nat. Hist. Jourl., Vol. XIV, p. 599. |
| *Do.* ... | *Not specified* ... | Simson ... | Letters on Sport in Eastern Bengal, p. 246. |
| *Do.* ... | *Do.* ... | Primrose ... | Bomb. Nat. Hist. Jourl., Vol. XII, p. 589. |
| *Do.* ... | *Tropidonotus* ... | Theobold ... | Cat. Snakes, Ind. Mus., p. 73. |
| *Bungarus candidus* | *Lycodon aulicus* .. | Wall ... | Bombay Nat. Hist. Jourl., Vol. XV, p. 706. |
| *Do.* .. | *Zamenis mucosus* .. | Phipson ... | Bombay Nat. Hist. Jourl., Vol. IX, p. 499. |
| *Do.* ... | *Dipsadomorphus gokool* | Traill ... | Bombay Nat. Hist. Jourl., Vol. IX, p. 499 |
| *Do.* ... | *Zamenis mucosus* | Ferguson ... | Bombay Nat. Hist. Jourl., Vol. X, p. 7. |
| *Bungarus sindanus* | *Echis carinata* .. | Boulenger ... | Bombay Nat. Hist. Jourl., Vol. XI, p. 74. |
| *Do. ceylonicus* | *Tropeltides* sp. ... | Günther ... | Rept. Brit. Ind., 1863, p. 344. |
| *Zamenis mucosus* .. | *Zamenis mucosus* | Robertson ... | "In Conversatione." |
| *Do.* ... | *Chrysopelea ornata.* | Flower ... | Proc. Zool. Soc., London, 1899, p. 684. |
| *Do.* ... | *Psammophis condanarus.* | Lightfoot ... | Bomb. Nat. Hist. Jourl., Vol. XV, p. 347 |
| *Do.* ... | *Rhinophis* sp. .. | Green ... | "In Epistola." |
| *Xenopeltis unicolor* | *Zamenis mucosus*... | Theobold . | Jourl Asiat. Soc., Bengal, 1868, p. 37. |
| *Do.* ... | *Tropidonotus stolatus* | Evans & Wall | Bomb. Nat. Hist. Jourl, Vol XIII, p. 352. |
| *Genus Callophis*... | *Calamaridæ* ... | Günther ... | Rept Brit. Ind. 1863, p. 347. |
| *Python molurus* .. | *Naia bungarus* | Donaghy ... | "In Conversatione" |
| *Ancistrodon hypnale.* | *Aspidura trachyprocta.* | Wall .. | Spolia Zeylonica, Vol. III, p. 147. |
| *Oriophis mycterizans.* | *Tropidonotus stolatus.* | Primrose ... | Bomb. Nat. Hist. Jourl., Vol. XV, p. 347. |
| *Dendrophis dendrophilus.* | *Chrysopelea ornata.* | Flower ... | Proc. Zool. Soc., London, 1899, p. 680. |
| *Psammophis condanarus.* | *Echis carinata* .. | Jerdon ... | Jourl. Asiat. Soc., Bengal, Vol. XXII, p. 529. |

*Class* Batrachia.

*Order*—Ecaudata.—It is certainly a remarkable thing for creatures so defenceless as the frogs, to attack and actually overcome animals as well equipped for offence as snakes, but that this occasionally happens must be admitted on so excellent an authority as Mr. E. H. Aitken. He mentions an instance* he witnessed of a bull-frog (*Rana tigrina*) in this country attempting to swallow a snake about 2 feet long, but the struggles of the ophidian proved so violent that the batrachian fell into an adjoining tank, and the end of the encounter was lost to

* Bomb. Nat. Hist. Jour., Vol. IX., p. 506.

view, and to history. This episode does not stand alone, for Symonds* speaks of a bull-frog he once found with a dead snake, *Psammophis crucifer*, (South African) 18½ inches long in its mouth and remarks that the natural food of this snake is frogs!

*Phyla* Arthropoda.

*Order*—Arachnida.—Coming still further down the animal scale we arrive at the arthropods, and I have two instances of centipedes attacking snakes, both already recorded in this Journal.† In Mr. Okeden's case an excellent photograph shows the centipede (*Scolopendra*) in the act of gnawing at the caudal extremity of the snake, which appears to be twice the length of its devourer. In Mr. Cumming's case the centipede boxed with a *Zamenis ventrimaculatus*, attacked it under provocation from its owner, and bit so malignantly that the reptile shortly died.

*Class* Pisces.

*Order*—Selachoidei.—Cantor‡ remarks that from M. Peron's observations, sharks appear to be the natural enemies of the marine serpents.

*Division* Insecta.

*Order*—Hymenoptera.—One reads in Natural History books of the famous driver ants of South America which manœuvre through jungles in military fashion, and attack and destroy all animal life that they encounter, even to creatures of the magnitude of the largest boas. Its humble eastern allies though not employing such methodical tactics, nor acting on so extensive a scale, do occasionally attack and overpower living animals including snakes. A very pretty little green keelback (*Macropisthodon plumbicolor*) I had in captivity was attacked, and reduced to a skeleton one night by ants. Ferguson§ records a similar experience, for which ants (*Solenopsis geminata*) were responsible, their victim, a *Helicops schistosus*, being literally skeletonised.

When I began these remarks I had no idea the list of natural foes to the snake would present so formidable an array, and provide material for so voluminous a paper, but I feel sure that this list, long as it is, could be very considerably supplemented by many of our readers.

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* Proc. Zool. Soc., London, 1887, p. 487.

† Vol XV., pp. 135 and 365.

‡ Trans. Zool. Soc., London, 1840, p. 503.

§ Bomb. Nat. Hist. Jour., Vol. X, p. 6.

# SOME HINTS FOR BEGINNERS ON COLLECTING AND PRESERVING NATURAL HISTORY SPECIMENS.

By E. Comber, F.Z.S.

(*Continued from page 650 of Vol. XIII.*)

## Part IV.

*Note.*—In recommencing this series of papers after so long an interval as five years, I feel that a word of apology is perhaps appropriate. In the first place circumstances intervened which prevented me from being able to spare the requisite time for the preparation of the subsequent parts, and in the second place I felt that so little response had been forthcoming in the way of specimens contributed to our collections, except of course of bird skins, of which we have a number of careful and enthusiastic collectors, that it seemed hardly worth while continuing the series on the last section of the vertebrates (Fishes) and on the several groups of invertebrate animals, which apparently, with the single exception of the Insects, fail to arouse any degree of enthusiasm amongst the present younger generation of our members. However it has been urged on me that the papers were perhaps more generally appreciated than I imagined, and that a few practical notes on the way to set about collecting and preserving the lower animals might at any rate induce a few beginners to try their hands at the job. If the results justify this hope, I shall be more than satisfied.

It is amongst the lower forms of animal life that the way is open to any one, who will take a little trouble, to do a vast amount of really original and useful work, not only in the way of bringing previously unknown, or unrecognised, forms to the notice of naturalists, but of studying and noting the habits and life histories of species already described from their fully developed forms. It is in this latter connection that the true spirit of the field naturalist comes out, as distinguished from the mere collector or museum expert, and I wish again to strongly impress upon the beginner the invaluable assistance of the note book, which is too often ignored. The apparent insignificance of notes at the time should never be allowed to deter a collector from entering them in black and white in his note book, and even the roughest of sketches will often help to recall details that would otherwise be forgotten in a short time if merely entrusted to memory. In years to come it will be found quite surprising how interesting these rough notes become, and how

much information can be picked out from them. Do not be put off by the feeling that this or that must be known already: even if it is, there can be no possible harm done to anyone if you have recorded and confirmed it yourself, and if it is not known, the note may be of the greatest value to yourself and others.

FISHES.

The great class of Fishes, and the closely allied Lancelots and Ascidians, form the lowest group of vertebrate animals. So far as the actual varieties of the fourteen hundred odd species that have been described from British Indian waters are concerned, there are probably not a very great many more to be discovered, except amongst those that inhabit the depths of the oceans around our coasts and opportunities for obtaining such forms rarely come to the ordinary collector. The fishes of our inland waters and of the shallower waters of the coast have long ago been carefully collected and described by great naturalists, first and foremost amongst whom stands the name of Dr. Francis Day, whose great work, "Fishes of India", will long remain the recognised standard on the subject. Unfortunately the cost of this book precludes its being available to many who commence work upon fishes, but Dr. Day was subsequently responsible for the two excellent volumes of the 'Fauna of British India' series.

The opportunities for the field naturalist lie chiefly in the direction of studying the life history, the breeding seasons and places, and the migrations of our fishes—subjects that are of the utmost importance to the economic fisheries of India. Compared with the progress of European and other countries in the way of investigation and protective legislation of its fisheries, India is sadly behind the times, and this too in spite of the fact that the industry is truly an enormous one, providing employment for a large section of its peoples, and forming the main source of food supply to a still larger number. That Government may be moved some day to taking definite action in the matter of the fisheries of the country is to be hoped for, and in this connection we hope shortly to publish a most interesting contribution from one of our members that will go far to show what valuable information can be collected in a comparatively short time with only limited opportunities.

The back numbers of our journal are singularly lacking in information on the subject of our fishes. What is possible in the way of collecting field notes about the commoner fishes is instanced by those

portions of Mr. W. F. Sinclair's series of papers on "The Waters of Western India", that appeared in the earliest volumes of our journal, in which he includes some interesting notes on the fresh water, estuarine and marine fishes of the Konkan. He truly made himself familiar with all the animals that came before his ever watchful eyes and recorded his experiences in a manner always readable and understandable by all.

Quite half the men one meets in India have been, or consider themselves, anglers, and will tell you that they "used to fish at home"; but few of them ever think about it out here unless they have the opportunity some time of going to some recognised mahseer river for a few weeks' leave, for they apparently fail to realise that in almost every corner of the country there is fishing—and generally good fishing—of some sort. It is perhaps because we have it almost at our doors and it is all entirely free without any heavy rent for our friends, who ask us for a few days' fishing, to pay; perhaps it is because out here one has to find out for oneself to a large extent where and how the fish are to be caught; or perhaps it is because so many are inclined to turn up their noses at anything else but fly fishing. In any case there is no getting over the fact that fishing, except for Mahseer, is not a fashionable amusement in India, and that very little is made of the splendid opportunities for angling.

The angler is of course somewhat inclined to confine his attentions to the few fish that give him the best sport, but he can still do a good deal in the way of recording the habits and breeding seasons of the fish he comes across.

So far as the actual collecting of specimens is concerned, one has mainly to fall back upon the opportunities that are afforded by the arrival of the native fishermen with their catches for the market, more especially in the case of marine fishes. In the selection of specimens for preservation it is necessary to confine oneself to very moderate sized ones—say not more than 6 or 7 inches long, except in the case of very slender fishes that can be doubled up in the preserving medium—as otherwise the question of cost of preservative will prove a serious difficulty. These small specimens should of course be supplemented, whenever possible, with notes of the measurements and weights of the largest specimens observed. As almost all fishes are sure to lose a large part of their original colours after immersion for even a short time in any preservative fluid, especially in the case of the more

brilliantly and delicately coloured ones, it is also very desirable to bring out the note-book and record the colouration of the freshly killed specimens. This can of course with advantage be supplemented with a coloured sketch, rough or detailed, as the case may be, of the fish as soon as possible after its capture. If the vernacular name can be added, it is always useful as a means of simple identification of the species to which the notes, &c., refer.

Before turning to the question of preserving specimens, I must again refer to that of labelling, which is of the very first importance. By all means give every specimen a reference number of its own on the very first opportunity after it has come into your possession, and enter all the particulars you can against the corresponding number in your record book. The labelling of specimens that are destined to go into the spirit jar is of special importance, as labels are liable to be torn and lost when a number of specimens are immersed together and subjected to the exigencies of travel. Really strong paper labels, inscribed in hard pencil with full particulars, will do with care; but it is strongly recommended, as an additional precaution, to use a small—say quarter inch square—label made of parchment, inscribed in ink, which will not run if allowed to dry thoroughly, bearing a number corresponding to the entry in the collector's record book, in which of course full particulars are entered.

Turning to the question of preserving, we have much the same simplicity before us as in the case of the smaller reptiles and batrachians, so far, at least, as the moderate sized specimens are concerned. The recognised medium is of course alcohol—as pure as it is obtainable—without the adulterations in the way of caoutchoucin or wood naptha that are insisted upon by the Indian Customs authorities in order to render the spirit undrinkable, even if redistilled. The methylated spirit of the bazaar will, however, suffice temporarily for all practical purposes if nothing better is procurable. Pure (95 per cent.) alcohol can be 'let down,' by the addition of water, to 70 or 75 per cent. In order to reduce spirit of any known strength to the required strength the following simple formula may be useful. Suppose your spirit is of 95 per cent. strength, and you wish to reduce it to 70 per cent., you must take 70 cubic centimetres, or other units, of your spirit and add enough water to make 95 cubic centimetres. With soft specimens it is often advisable to put them first into weak spirit for a

few days and then transfer them to stronger spirit, as this will to a large extent prevent them shrivelling up, which they are apt to do in the full strength spirit. After specimens have been in spirit for some weeks they will be found to have become quite toughened, and in this state they will stand transmission in a nearly dry condition for some considerable time if wrapped up individually in cotton-wool that has been soaked in spirit and squeezed nearly dry.

It must be borne in mind that any spirit used for fresh specimens will gradually become weaker on account of the fluid and fatty matters that are extracted from the specimens, and after a time it will sink below a point where it is useful as a preservative. Unless it be re-distilled, there is nothing to be done but throw it away.

Before placing fishes in spirit they should be washed with water so as to remove the coating of slime, and a deep incision must be made along the abdomen, if the whole of the viscera are not removed, so that the preservative may quickly and effectively reach all parts of the structure. Fishes with fragile scales, that are easily rubbed off—such as the Herring family—should be put in separate bags, or wrapped in a piece of muslin.

As mentioned in the previous part of this paper regarding reptiles, &c., there are many considerable advantages in the use of formalin instead of spirit as a preservative medium, and as more information regarding its use is now available, I shall enlarge somewhat on what I then wrote about it. Commercial formalin is really a 40 per cent. solution of formic aldehyde, and now costs as little as 15*s.* per gallon in London. In Bombay it is obtainable at Rs. 1-8 per 16-oz. bottle, say Rs. 15 per gallon, but as it is used for preservative purposes in a much diluted state, it is far and away cheaper than any alcohol, and is in addition much more portable, as the required solution can be made up on the spot with either fresh or salt water.

Formalin is now-a-days almost universally used by anglers for preserving minnows and other small fishes that are intended for dead spinning baits, and the recognised system for so doing is given in the "*Fishing Gazette*" as follows.—"Thoroughly clean the minnows from "all glutt by placing them in a colander and allowing the water to run "freely over them from the tap, mixing them with very clean hands. "Have ready a clean, wide-mouthed bottle; place, say, 3 dozens in it; "then add as much water so as to merely cover them, adding a teaspoon-

"ful of formalin. After lying in this for two or three days only, "take them out and wipe them with a dry cloth; again clean bottle and "place minnows with same quantity of water and one-half teaspoonful "of formalin, sealing up bottle airtight with wax." A German correspondent of the same paper recently explained that he kept his minnows in the pure formalin for a week and then changed them to a 4 per cent. solution for another week, after which he put them into an empty bottle tightly corked with only a few drops of formalin. He found that they kept in this dry form quite well for two years. From what I can learn it seems doubtful whether the change to a fresh solution after the first few days is at all necessary.

On the use of formalin as a re-agent I cannot do better, I think, than quote from one of the bulletins issued by the Smithsonian Institute (United States National Museum) on the methods employed at the Naples Zoological Station for the preservation of marine animals, translated from the original Italian, as the opportunities for practically testing it have probably been greater there than anywhere else.

"Formalin is a very useful liquid for keeping animals temporarily, "but not for preserving them permanently. Some pelagic animals— "for example certain Medusæ, Pterotrachaidæ, and Salpidæ—may "remain in it for even two or three years without serious detriment, "but if they are not transferred to alcohol by that time they begin "to disintegrate or decompose. Formalin therefore may be used on "a voyage or a long journey when alcohol is scarce or not to be "had. As a provisional fluid it is useful for many animals which are "not contractile, and especially for those which contain no lime spicu- "les, skeleton or shells. . . . In the case of large animals, such "as fish, one must make an injection through the anus of a solution "of at least 5 per cent. strength. For animals of some consistency, "like fish and ascidians, one should use a 2 to 6 per cent. formalin "solution, the general rule being that the softer the animal the weaker "the formalin. . . . It is not necessary to wash objects which "have been in formalin before transferring them to alcohol. . . . "Colours certainly are preserved for a longer time in formalin than "in alcohol, but in time those which are fugitive in one disappear in "the other also. The preservative medium has not yet been discovered "which will permanently preserve the colours which are due to a pig- "ment in the skin or substance of an animal."

Specimens of the larger fishes—such as sharks, rays, &c., that are too big to be preserved in spirits must of course be skinned and as my

personal experience of such work is extremely limited, I prefer to quote the instructions that are issued by the British Museum authorities on the subject. "Scaly fishes are skinned thus:—With a strong pair of "scissors an incision is made along the median line of the abdomen "from the foremost part of the throat, passing on one side of the base "of the ventral and anal fins, to the root of the caudal fin, the cu "being continued upwards to the back of the tail close to the base of "the caudal. The skin of one side of the fish is then severed with a "scalpel from the underlying muscles to the median line of the back; "the bones which support the dorsal and caudal fins are cut through "so that these parts remain attached to the skin. The removal of the "skin of the opposite side is easy enough. More difficult is the prepara- "tion of the head and scapulary region; the two halves of the scapul- "ary arch, which have been severed from each other by the first "incision, are pressed towards the right and left, and the spine is "severed behind the head, so that now only the head and shoulder "bones remain attached to the skin. These parts have to be cleaned "from inside, all soft part, the branchial and hyoid apparatus, and all "smaller bones being cut away with the scissors or scraped off with "the knife. In many fishes which are provided with a characteristic "dental apparatus in the pharynx (Labroids, Cyprinoids), the pharyn- "gial bones ought to be preserved and tied with a thread to the speci- "men. The skin being now prepared so far, its entire inner surface, as "well as the inside of the head, is rubbed with arsenical soap; cotton- "wool or some other soft material is inserted into any cavities or "hollows; and finally, a thin layer of the same material is placed be- "tween the two flaps of the skin. The specimen is then dried under a "slight weight to keep it from shrinking."

Large scaleless fishes are skinned in the same manner, but as there are no scales to be protected from being rubbed off, the skin can be rolled up and packed in spirit or formalin solution to save the trouble of cleaning the head.

It is possible in dry climates to preserve even moderate sized specimens entire by simply drying them, but as they only admit of superficial and incomplete examination they are of little scientific value and the method is not to be recommended.

I trust the foregoing notes may prove of assistance to some of our younger or less experienced members and encourage them to make collections as they get the opportunity.

(*To be continued.*)

# DESCRIPTIONS OF INDIAN MICRO-LEPIDOPTERA.

BY

E. MEYRICK, B.A., F.R.S., F.Z.S.

## II.

(*Continued from page 153 of this Volume.*)

### XYLORYCTIDÆ.

*Ptochoryctis ancistrias*, n. sp.

♂♀. 13-23 mm. Head whitish, sides brownish. Palpi pale ochreous, terminal joint with anterior edge suffused with dark fuscous. Antennæ rather dark fuscous, pectinations blackish. Thorax white, sometimes brownish tinged. Abdomen whitish, in ♂ with more or less developed ferruginous bands. Forewings elongate, moderate, costa moderately arched, apex obtuse, termen obliquely rounded; 4 absent, 7 to costa; shining white, towards dorsum and termen faintly ochreous-tinged; a dark fuscous line posteriorly more or less suffused with brownish, running from ⅔ of costa to dorsum before tornus, strongly rounded-angulated in middle so as to approach termen, more or less obsolete or interrupted on angle, subsinuate inwards on lower half and becoming stronger and darker towards dorsum; sometimes a faint brownish longitudinal mark in disc preceding this line; a more or less marked dark fuscous marginal line round apex: cilia white, round apex with a dark fuscous median line interrupted beneath apex, and tips fuscous-tinged. Hindwings ochreous-whitish or pale whitish-ochreous-grey; cilia ochreous-whitish.

Seven specimens, Maskeliya and Puttalam, Ceylon, from January to May (Pole, de Mowbray, Alston); the single Puttalam specimen is much the smallest. This species differs from the others in the neural characters specified, but is otherwise nearly related, and does not at present seem to require generic separation.

*Ptochoryctis scionota*, n. sp.

♂. 16-17 mm. Head and palpi white. Antennæ white, ringed and towards apex suffused with grey, pectinations blackish. Thorax white, posteriorly tinged with ochreous. Abdomen ochreous-whitish. Forewings elongate, moderate, costa moderately arched, apex obtuse, termen almost straight, oblique; shining white, towards dorsum faintly suffused with pale ochreous: cilia white, beneath tornus pale whitish-ochreous. Hindwings whitish, sometimes faintly greyish-tinged; termen tinged with pale greyish-ochreous; cilia ochreous whitish, more ochreous-tinged towards tornus.

Three specimens, Puttalam, Ceylon, in April and August (Pole).

*Ptochoryctis acrosticta*, n. sp.

♂♀. 11-15 mm. Head, palpi, thorax, abdomen, and legs white; abdomen in ♂ with several more or less indicated ferruginous rings; tarsi indistinctly spotted with grey. Antennæ dark grey, towards base white, pectinations blackish. Forewings elongate, moderate, costa moderately arched, apex round

pointed, termen nearly straight, oblique; shining white; an almost apical dark grey dot: cilia white. Hindwings whitish; cilia white.

Seven specimens, Puttalam and Hambantota, Ceylon, in January, February, and October (Pole).

*Antithyra*, n.g.

Head smooth, side tufts somewhat spreading; tongue developed. Antennæ $\frac{1}{3}$, in ♂ (?), basal joint moderate, without pecten. Labial palpi moderately long, recurved, second joint somewhat rough-scaled beneath, terminal joint as long as second, acute. Posterior tibiæ rough-haired above. Forewings with 2, 3, 4 tolerably parallel, 2 from near angle, 5 absent, 7 to costa, 8 absent, 11 from middle. Hindwings 1, trapezoidal, termen not sinuate, cilia 1; 2 remote, 3 and 4 connate, 5 somewhat approximated, 6 and 7 long-stalked.

*Antithyra vinculata*, n. sp.

♀. 11-12 mm. Head and thorax pale yellow-ochreous, sprinkled with dark fuscous. Palpi pale yellowish, more or less sprinkled irregularly with dark fuscous. Antennæ pale yellowish, dotted with dark fuscous. Abdomen elongate, dark grey, apex pale yellowish. Forewings elongate, narrow, costa gently arched, apex obtuse, termen very obliquely rounded; light ochreous-yellow, irregularly chequered throughout with undefined grey spots irrorated with black: cilia whitish-ochreous, towards base yellower, on basal half with a series of similar spots. Hindwings dark grey; cilia grey.

Five specimens, Peradeniya, Ceylon, in February and March (Green). Larva feeds on minute lichens and algæ on stems of various trees; at first in an hour-glass-shaped case, but later constructs a supplementary tube extending in a straight line in both directions, with lateral triangular pointed projections disposed alternately at equal distances, all concealing valves through which the larva can protrude its head for feeding or observation; if disturbed at one point, it re-appears at another: the entire case is temporarily anchored at either end to the bark; when food is exhausted at one spot, the strands are severed and the case shifted to another situation: pupation in the centre, beneath the median pad (Green). Mr. Green has forwarded specimens of these tubes, which are most remarkable examples of ingenuity and neat construction; the longest is 38 mm. in length, and has ten completed projections on each side.

*Epichostis*, n.g.

Head with appressed scales, sidetufts somewhat raised; tongue developed. Antennæ $\frac{1}{3}$, in ♂ simple, basal joint moderate, without pecten. Labial palpi long, recurved, second joint thickened with appressed scales, slightly rough towards apex beneath, terminal joint as long as second, moderate, acute. Posterior tibiæ shortly rough-scaled above. Forewings with 2 from $\frac{1}{3}$, 3 from before angle, 4 and 5 approximated, 7 to apex, 8 absent, 11 from beyond middle. Hindwings over 1, trapezoidal, apex obtuse, termen hardly sinuate, cilia $\frac{1}{2}$; cell shorter than half wing, 3 and 4 connate, 5 parallel, 6 and 7 approximated towards base.

*Epichostis elephantias*, n.sp.

♂. 15-16 mm. Head whitish-ochreous, middle of crown tinged with fuscous. Palpi ochreous-whitish, second joint with lower ⅔ and a subapical ring fuscous, terminal joint with base and anterior edge towards middle dark fuscous. Antennæ whitish-ochreous ringed with dark fuscous. Thorax whitish-ochreous dorsally fuscous-tinged. Abdomen dark grey, apex whitish-ochreous. Forewings elongate, narrowed towards base, costa gently arched, apex rounded, termen slightly rounded, not oblique; pale silvery-fuscous; a moderately broad whitish-ochreous costal streak from base to near apex, pointed posteriorly, suffused with ochreous-yellow towards costa; two dark fuscous irregular rounded-oblong dorsal blotches edged with whitish-ochreous, reaching costal streak (outline of these blotches somewhat suggestive of that of an elephant); first extending on dorsum from near base to ⅓, second from middle to near tornus; a dark fuscous terminal line interrupted by whitish-ochreous dots on veins: cilia pale whitish-ochreous, towards base more yellowish, with faint pale fuscous antemedian shade. Hindwings rather dark grey; cilia pale grey.

Three specimens, Maskeliya, Ceylon, in April, October, and November (Pole, Green, de Mowbray).

*Myriopleura*, n.g.

Head with appressed scales, sidetufts roughly spreading on crown; tongue developed. Antennæ ¾, in ♂ serrulate, shortly or moderately strongly ciliated, basal joint moderate, without pecten. Labial palpi long, recurved, second joint thickened with appressed scales, somewhat roughened towards apex beneath, terminal joint almost or quite as long as second, moderate, acute. Posterior tibiæ rough-haired above. Forewings with 2, 3, 4 tolerably parallel, 2 from towards angle, 5 approximated, 7 and 8 stalked, 7 to apex or termen, 11 from middle. Hindwings over 1, oblong-ovate, apex obtuse, termen not sinuate, cilia ½—¾, 2 rather near angle, 3 and 4 stalked, 5 approximated, 6 and 7 stalked.

Type *M. psilotis*, Meyr. I have formed this genus to include the two species lately referred by me to *Xyloryeta*, *M. psilotis* and *M. paracyrta*, as I have now several species all showing the same characters. It is distinguished from *Xyloryeta* by the different position of vein 2 of forewings.

*Myriopleura furfurosa*, n. sp.

♂ ♀. 14-19 mm. Head and thorax pale yellowish-ochreous. Palpi whitish-ochreous, second joint more or less suffused with fuscous except apex. Antennæ grey, basal joint yellow-ochreous, ciliations short. Abdomen light grey, sides and apex whitish-ochreous. Forewings elongate, moderate, costa moderately arched, apex obtuse, termen slightly rounded, little oblique; 7 to termen; pale yellowish-ochreous, in ♀ more whitish-ochreous; discal stigmata cloudy, fuscous, first very small and often indistinct, second larger and distinct: cilia whitish-ochreous. Hindwings in ♂ fuscous, in ♀ whitish-ochreous, sometimes fuscous-tinged; cilia pale whitish-ochreous, sometimes greyish-tinged.

Six specimens, Puttalam, Ceylon, in January, February, September, and October (Pole).

*Myriopleura isocentra*, n. sp.

♂. 11-12 mm. Head, palpi, antennæ, and thorax whitish-ochreous; palpi with lower ⅔ of second joint fuscous; antennal ciliations short. Abdomen grey-whitish, apex whitish-ochreous. Forewings elongate, moderate, costa moderately arched, apex obtuse, termen somewhat rounded, little oblique; 7 to termen; whitish-ochreous, tinged with yellowish; discal stigmata moderate, dark fuscous or blackish, strongly marked; series of cloudy dark fuscous dots along posterior part of costa and termen: cilia whitish-ochreous. Hindwings and cilia ochreous-whitish.

Two specimens, Puttalam, Ceylon, in October and December (Pole).

ŒCOPHORIDÆ.

*Hypercallia catausta*, n. sp.

♂ ♀. 12-13 mm. Head pale ferruginous-ochreous. Palpi moderately long, pale ferruginous-ochreous, more or less sprinkled with dark fuscous. Antennæ dark grey, ciliations in ♂ 4. Thorax ferruginous-ochreous, more or less mixed with dark fuscous. Abdomen grey. Forewings elongate, costa gently arched, apex obtuse, termen obliquely rounded; ferruginous-ochreous, variably sprinkled or irrorated with fuscous and dark fuscous; a narrow basal fascia of dark fuscous suffusion; stigmata dark fuscous, plical slightly beyond first discal; a triangular spot of dark fuscous suffusion on costa at ⅔, and one on dorsum towards middle; a subterminal line of dark fuscous irroration, forming a suffused spot on costa before apex and usually one at tornus, otherwise very variable in development, sometimes forming an entire almost marginal band; cilia pale ferruginous-ochreous, basal half more or less sprinkled with dark fuscous. Hindwings in ♂ rather dark grey, in ♀ dark fuscous; cilia in ♂ pale grey, base yellowish-tinged, in ♀ grey or dark fuscous.

Seven specimens, Maskeliya, Ceylon, in January and March (Pole). Varies in depth of colouring and density of irroration.

*Hypercallia alseis*, n. sp.

♂. 12-13 mm. Head ochreous yellow. Palpi long, ochreous-yellow, lower half of second joint sprinkled or suffused with fuscous. Antennæ dark fuscous, ciliations 2½. Thorax and abdomen dark bronzy fuscous. Forewings elongate, costa moderately arched, apex obtuse, termen obliquely rounded; dark fuscous; a rather broad inwardly oblique ochreous-yellow fascia near base; stigmata blackish, plical rather before first discal, these two resting on posterior edge of anterior fascia, second discal placed in an undefined sometimes interrupted ochreous-yellow transverse streak running from a spot on costa beyond ⅔ parallel to anterior fascia: cilia fuscous, on termen pale yellowish on apical half. Hindwings and cilia fuscous.

Three specimens, Maskeliya, Ceylon, in February and March (Pole).

*Eosaympha*, n. g.

Head with appressed scales, sidetufts spreading, tongue developed. Antennæ ♀, in ♂ filiform, simple basal joint moderate, with pecten. Labial palpi long, recurved, second joint with appressed scales, somewhat rough towards apex

beneath, terminal joint as long as second, slender, acute. Posterior tibiæ clothed with long hairs above. Forewings with 4 absent, 7 and 8 stalked, 7 to apex, 11 from before middle. Hindwings ♂, ovate-lanceolate, cilia 1; 4 absent, 6 and 7 rather approximated.

Allied to *Pseudodoxia*.

*Eonympha erythrozona*, n. sp.

♂. 12-14 mm. Head and thorax yellow-ochreous mixed with crimson, face whitish-ochreous. Palpi whitish-ochreous, slightly crimson-sprinkled. Antennæ and abdomen whitish-ochreous. Forewings elongate, costa moderately arched, apex round-pointed, termen very obliquely rounded; deep yellow ochreous; basal area suffusedly mixed with crimson; three narrow irregular oblique crimson fasciæ before and beyond middle, and near apex; a crimson line along apical portion of costa and termen: cilia ochreous-yellowish, round apex mixed with crimson. Hindwings grey; cilia pale whitish-ochreous.

Four specimens, Matale, Ceylon, from October to December (Pole).

*Pseudodoxia chalcias*, n. sp.

♂ ♀. 16-20 mm. Head ochreous-orange. Palpi pale orange-ochreous, second joint dark fuscous except apex. Antennæ bronzy-ochreous, towards base dark fuscous. Thorax dark purplish-fuscous. Abdomen dark fuscous, apex pale ochreous. Forewings elongate, narrow, costa gently arched, apex round-pointed, termen very obliquely rounded; ochreous bronze; base narrowly dark purplish-fuscous; a suffused dark purplish-fuscous terminal fascia, rather broad on costa, narrowed to a point on tornus: cilia dark fuscous. Hindwings more or less dark fuscous, sometimes bronzy-tinged; cilia bronzy-fuscous, sometimes darker-mixed, lighter towards tornus.

Three specimens, Maskelya, Ceylon, in February and March (Pole).

*Pseudodoxia sepositella*, Walk.

(*Gelechia sepositella*, Walk. Tin. 630; *Pseudodoxia limulus*, Durr. Ent. Mo. Mag., 1895, 107.)

There is no doubt about this identification, which Mr. Durrant must have accidentally overlooked. I have received a series of bred specimens from Mr Green, with examples of the cases; the larval habits have been already published.

*Pseudodoxia cretata*, n. sp.

♂ ♀. 13-16 mm. Head, palpi, antennæ, and thorax ochreous white, second joint of palpi externally suffused with dark fuscous except apex. Abdomen whitish. Forewings elongate, narrow, costa gently arched, apex round-pointed, termen very obliquely rounded; 8 often absent; white, more or less sprinkled with pale fuscous and sometimes a few dark fuscous scales; a black dot on base of costa; a fine black dash beneath costa near base; stigmata rather large, black, plical beneath or hardly before first discal; a series of irregular black dots along posterior part of costa and termen: cilia white, irrorated with fuscous. Hindwings light grey: cilia whitish-grey.

Four specimens (three bred), Peradeniya and Matale, Ceylon, in February,

March, and November (Green, Pole). Closely allied to *P. sepositella*, but certainly distinct by the white head and general colouring, and the position of the plical stigma, which in *P. sepositella* is always obliquely before first discal. The three bred specimens were reared by Mr. Green from larvæ feeding in the same way as *sepositella*, and in cases of precisely the same form; he sent me the three cases, carefully labelled with individual numbers corresponding to the specimens, and I see no difference in form; in both species the individual cases vary much in colour and appearance, according to the nature of the sand-grains and refuse employed in their construction, and one of the *cretata* cases is elegantly marbled with dark grey and white.

*Pseudodoxia zopheropa*, n. sp.

♂ ♀. 12-14 mm. Head, palpi, antennæ, and thorax dark bronzy-fuscous. Abdomen fuscous. Forewings elongate, costa moderately arched, apex obtuse, termen rounded, rather strongly oblique; bronzy-fuscous, suffusedly irrorated with dark fuscous; stigmata obscure, dark fuscous, plical beneath first discal: cilia bronzy-fuscous. Hindwings pale bronzy-fuscous; cilia whitish-fuscous.

Six specimens, Puttalam, Ceylon, in February, November, and December (Pole).

*Epicallima isopselia*, n. sp.

♂ ♀. 8-10 mm. Head deep shining bronze mixed with dark fuscous, sides and face white, collar mixed with white. Palpi white, second joint suffused with deep bronze externally except towards apex, terminal joint blackish. Antennæ blackish spotted with white, ciliations in ♂ 2. Thorax shining orange-bronze. Abdomen dark bronzy-fuscous. Forewings elongate, rather narrow, costa gently arched, apex round-pointed, termen very obliquely rounded; shining bronzy-orange; markings shining white, edged with dark fuscous suffusion; a slender basal fascia not reaching costa, somewhat extended on dorsum; slender direct fasciæ at $\frac{1}{4}$ and $\frac{3}{4}$, second interrupted in middle; some irregular subconfluent spots round apex and termen: cilia whitish with a dark fuscous apical line, basal half orange, towards tornus suffused with fuscous. Hindwings lanceolate, cilia 2; dark bronzy-fuscous; cilia dark bronzy-fuscous.

Four specimens, Peradeniya, Ceylon, in February (Green, Pole).

*Epicallima semantris*, n. sp.

♂ ♀. 9-11 mm. Head and thorax shining orange-bronze, forehead shining white. Palpi orange, terminal joint dark fuscous, tip whitish. Antennæ white ringed with dark fuscous, ciliations 1. Abdomen grey. Forewings elongate, narrow, costa gently arched, apex round-pointed, termen extremely obliquely rounded; deep orange; markings white finely edged with dark fuscous irroration; a short almost dorsal mark from middle of base; a narrow somewhat oblique fascia from before $\frac{1}{4}$ of costa to middle of dorsum; a rather large subquadrate spot on costa at $\frac{3}{4}$, more or less confluent beneath with a prætornal spot of purplish-fuscous suffusion; a suffused purplish fuscous apical spot, extended along termen: cilia orange-yellow, towards tornus suffused with purplish-fuscous. Hindwings narrow-lanceolate, cilia 3; grey; cilia light grey.

Six specimens, Puttalam and Kurunegala, Ceylon, from July to December (Pole).

*Scalideutis*, n. g.

Head with loosely appressed scales, sidetufts rather spreading; tongue developed. Antennæ $\frac{3}{4}$, in ♂ pubescent, simple, basal joint moderately elongate, without pecten. Labial palpi moderate, curved, ascending, with appressed scales, second joint not reaching base of antennæ, terminal joint somewhat shorter than second, acute. Posterior tibiæ clothed with long fine hairs above. Forewings with 2 from $\frac{1}{3}$, 7 and 8 stalked, 7 to costa, 11 from before middle. Hindwings 1, very elongate-ovate, cilias; 3 and 4 connate, 5 absent.

Allied to *Borkhausenia*.

*Scalideutis escharia*, n. sp.

♂♀. 17-20 mm. Head whitish-ochreous. Palpi ochreous-whitish, second joint suffused with dark fuscous. Antennæ grey. Thorax fuscous, posterior extremity whitish-ochreous. Abdomen grey, apex whitish-ochreous. Forewings elongate, narrow, costa moderately arched, apex round-pointed, termen very obliquely rounded; pale fuscous, finely irrorated with dark fuscous; spots of dark fuscous suffusion on costa near base and before middle, and a larger dark fuscous spot on costa at $\frac{2}{3}$, costa between these and beyond last often more or less broadly suffused with whitish-ochreous; stigmata blackish-fuscous, plical rather beyond first discal, second discal very large, adjacent and sometimes confluent with third costal spot; sometimes an additional dark fuscous dot between and below discal stigmata; sometimes obscure dark fuscous dots round apex and termen: cilia whitish-ochreous sprinkled with dark fuscous. Hindwings light grey; cilia pale whitish-ochreous.

Seven specimens, Maskeliya, Ceylon, in February and May (Pole).

*Ethmia zelea*, n. sp.

♂. 30 mm. Head, palpi, antennæ, thorax, and abdomen ochreous-yellow; two irregular dots on crown, one on basal joint of antennæ, three anterior and two posterior dots on thorax blackish; anal tuft very large. Forewings elongate, costa moderately arched, apex obtuse, termen nearly straight, rather oblique; deep ochreous-yellow; thirteen black dots, *viz.*, one in middle of base, two small ones beneath costa near base, one in disc at $\frac{1}{4}$, one beneath costa beyond $\frac{1}{4}$, one beneath fold at $\frac{3}{5}$, one in disc above middle, five in a posterior group in disc, and one on tornus; a twice interrupted black streak along upper half of termen: cilia ochreous-yellow, paler towards tips, on upper half of termen wholly dark leaden-grey. Hindwings and cilia pale ochreous-yellow; on undersurface a subcostal furrow from near base to $\frac{3}{4}$, covered by a deep fold of membrane from beneath.

One specimen, North Central Province, Ceylon, in December (Pole). The generic name *Ethmia*, Hb. (which I had overlooked) supersedes *Psecadia*.

*Ethmia acontias*, n. sp.

♂. 17-21 mm. Head and thorax pale whitish-fuscous, a dot on crown, two subdorsal on each side of thorax and two posterior blackish. Palpi whitish,

submedian and subapical bands of second joint, and median band of terminal joint blackish Antennæ grey, basal joint grey-whitish, with a blacki h dot. Abdomen grey, second segment and sometimes first and third with pale ochreous-yellowish dorsal patches, apex ochreous-yellow. Forewings elongate, costa moderately arched, apex obtuse, termen slightly rounded, rather oblique ; pale whitish-fuscous, markings blackish ; a streak from base of costa to beneath costa at $\frac{1}{3}$, brown towards its middle ; an irregular streak along fold from base to near middle, beyond apex of which lies a dot surrounded with whitish ; a median longitudinal streak from before middle to termen beneath apex, its posterior extremity bifurcate ; a series of irregular dots along posterior part of costa and termen ; cilia whitish-fuscous mixed with ochreous-whitish, towards tips ochreous-whitish, with dark fuscous spaces at apex and middle of termen. Hindwings fuscous-whitish, suffused with fuscous towards apex ; cilia pale fuscous, on apical half and towards tornus wholly ochreous-whitish.

Eight specimens, Puttalam, Ceylon, in April and from September to January (Pole).

ELACHISTIDÆ.

*Hieromantis fibulata*, n. sp.

♀. 13-14 mm. Head and thorax yellow-orange, face shining white. Palpi whitish-ochreous. Antennæ whitish-ochreous, eyecap white. Abdomen whitish-ochreous. Forewings very narrow-lanceolate, widest near base, thence narrowed to acute apex ; yellow-orange ; dorsum grey towards base ; a black spot near dorsum beyond $\frac{1}{4}$, centred with a white dot ; beyond this a larger golden-metallic dorsal spot, partially edged above irregularly with black ; a variably developed fuscous terminal streak from apex to tornus, sometimes wide towards costa : cilia fuscous, towards base tinged with orange-yellowish. Hindwings and cilia grey.

Three specimens, Maskeliya, Ceylon, in May and June (Pole, de Mowbray).

*Stathmopoda masinissa*, n. sp.

♂. 17 mm. Head, palpi, and antennæ whitish-ochreous, base of palpi dark fuscous. Thorax dark purplish-grey, with a whitish-ochreous posterior dot. Abdomen rather dark grey. Legs dark grey, middle tibiæ rough-haired above, posterior tibiæ clothed with very large dense expansible brush of hairs above, all tarsi whitish-ochreous, posterior pair spotted with dark grey, with projecting scales at joints. Forewings linear-lanceolate, widest near base, thence narrowed to acute apex ; dark fuscous-grey, faintly purplish-tinged ; a somewhat oblique whitish-ochreous mark from costa before $\frac{3}{4}$ : cilia fuscous-grey. Hindwings dark fuscous, with a narrow longitudinal transparent patch in disc from base to $\frac{1}{4}$ ; cilia fuscous.

One specimen, Matale, Ceylon, in October (Pole).

*Æoloscelis theoris*, n. sp.

♂ ♀. 10-12 mm. Head whitish-ochreous, back of crown yellow. Palpi, antennæ, and abdomen whitish-ochreous. Thorax yellow. Forewings narrow-lanceolate, widest near base, thence gradually narrowed to acute apex; fuscous,

becoming lighter and ochreous-tinged posteriorly; basal ⅓ bright yellow, except a spot of groundcolour on costa near base, dividing line nearly straight or rather irregular, direct; usually some very undefined pale yellowish suffusion on costa about ⅔: cilia pale brownish-ochreous. Hindwings grey; cilia pale brownish-ochreous.

Nine specimens, Puttalam, Peradeniya, and Maskeliya, Ceylon, in April, May, September, and October (Pole, Green).

*Persicoptila libanotris*, n. sp.

♀. 14 mm. Head, palpi, and antennæ whitish-ochreous, face white, antennæ spotted beneath with dark fuscous. Thorax whitish-ochreous suffused with yellow-orange. Abdomen white, suffused with whitish-ochreous towards base, beyond middle with yellow-ochreous lateral spots edged above with dark fuscous. Legs ochreous-yellowish, apex of joints white, anterior and middle tibiæ obscurely banded with dark fuscous, tuft of posterior tibiæ crimson-whitish mixed with blackish. Forewings narrow-lanceolate; greyish-purple irrorated with dark fuscous; base narrowly yellow-orange; a triangular yellow-orange spot extending on costa from before middle to ¾, and nearly reaching dorsum; costa suffused with yellow towards apex: cilia pale greyish-ochreous tinged with purplish and mixed with dark grey, round apex and on costa whitish-ochreous partly suffused with yellow-orange. Hindwings grey; cilia whitish-ochreous.

One specimen, Maskeliya, Ceylon, in February (Pole).

*Scythris chelota*, n. sp.

♂♀. 9-11 mm. Head, palpi, antennæ, thorax and abdomen light greyish-ochreous; abdomen in ♀ ochreous-white beneath. Forewings lanceolate, moderately pointed; 5 present; light greyish-ochreous, sometimes fuscous-tinged, generally more or less strewn with whitish, seldom with a few dark fuscous scales; sometimes a streak of whitish suffusion along fold; plical and second discal stigmata suffused, dark fuscous, sometimes indistinct: cilia light grey or greyish-ochreous, base sometimes sprinkled with whitish. Hindwings ⅔, cilia 3; 5 absent; grey; cilia light grey, sometimes ochreous-tinged.

Nine specimens, Puttalam, Ceylon, from July to September (Pole).

COPROMORPHIDÆ.

*Copromorpha metallitis*, n. sp.

♂♀. 15-19 mm. Head and thorax whitish-ochreous, thoracic crest suffused with fuscous. Palpi fuscous irrorated with darker, apex of second joint, and base and apex of terminal joint, ochreous-whitish. Antennæ whitish-ochreous mottled with dark fuscous. Abdomen whitish-ochreous, fuscous-sprinkled. Forewings elongate, costa slightly arched, apex obtuse, termen slightly rounded, little oblique; 2 from near angle, 3 and 4 closely approximated towards base, 5 approximated at base, 7, 8, 9 closely approximated towards base; whitish-ochreous mixed with purplish-fuscous; costa finely striolated with dark fuscous; about seven more or less irregular transverse series of small pale yellowish raised tufts edged anteriorly with dark fuscous and pos-

teriorly with metallic purple : cilia whitish-fuscous, mixed with darker, with rows of pale points. Hindwings with 3 and 4 connate, 5 approximated ; fuscous paler towards base : cilia fuscous-whitish, with pale fuscous subbasal shade.

Five specimens, Puttalam, Ceylon, in April and October (Pole).

*Copromorpha efflorescens*, n. sp.

♀. 17-19 mm. Head whitish-ochreous, face with a fuscous frontal band. Palpi dark fuscous, apex of terminal joint whitish. Antennæ whitish-ochreous, suffusedly mottled with dark fuscous. Thorax whitish-ochreous, shoulders and crest fuscous. Abdomen whitish-ochreous mixed with fuscous. Forewings elongate, narrowed anteriorly, costa posteriorly moderately arched, apex obtuse, termen somewhat rounded, hardly oblique ; 2 from towards angle, 3, 4, 5 closely approximated, 7, 8, 9 closely approximated ; fuscous (actually ribbed with dark fuscous scales with pale bases) ; about seven irregular transverse series of ochreous-yellow tufts, edged anteriorly with dark fuscous and posteriorly with metallic slaty-purple ; several yellow-whitish marks on veins at ¾, above and below middle : cilia light slaty-fuscous, with rows of pale points. Hindwings with 3 and 4 separate, 5 closely approximated to 4 ; fuscous ; cilia pale fuscous, tips whitish.

Four specimens, Matale and Madulsima, Ceylon, in April and from October to December (Pole, Vaughan). Very like the preceding species, but easily distinguished by the different form of forewings, which are very obviously broader posteriorly, whilst in *metallitis* they are nearly the same width throughout ; the differences in neuration, darker colouring, and posterior whitish marks in disc are also characteristic.

### Chlidanotidæ.

I find it necessary to form this new family for the reception of the three following genera, together with *Trymalitis*, described in my last paper and there referred to the *Phaloniadæ*, and also *Archimaga*, there referred to the *Plutellidæ*. The family is in fact intermediate between the *Phaloniadæ* and *Epiblemidæ* on the one hand, and the *Plutellidæ* on the other, and appears to indicate the real genetic transition between these groups ; it is therefore of much interest. The family characters are as follows :—

Head rough or loosely haired ; tongue short or absent. Antennæ about ¾, simple. Labial palpi ascending or porrected, second joint rough-scaled, terminal joint pointed. Maxillary palpi obsolete. Forewings with 1 bifurcate, 2 from ⅔—¾ of cell, 3 from or near angle, 8 and 9 stalked or coincident, 11 from beyond middle. Hindwings trapezoidal, lower margin of cell without basal pecten of hairs ; 3 and 4 connate, stalked, or coincident, 5 parallel, 6 and 7 long-stalked, 8 free.

*Chlidanota*, n. g.

Head rough ; tongue apparently absent. Labial palpi moderate, porrected, second joint broadly dilated with rough scales towards apex above and beneath, terminal joint moderate, tolerably pointed. Antennæ about ½, simple. Posterior tibiæ with loosely appressed hairs. Forewings with 2 from before ¾,

3 from angle, much curved, 4 absent, 5 straight, 7 absent, 8 and 9 long-stalked, 10 from near 8, 11 from ¾ of cell. Hindwings 1, trapezoidal, cilia ⅔; 4 absent upper margin of cell bent upwards near angle.

*Chlidanota thriambis*, n. sp.

♀. 28 mm. Head and thorax white, shoulders very narrowly fuscous. Palpi white, basal joint and lower half of second dark fuscous. Antennæ grey. Abdomen light greyish-ochreous. Forewings elongate, costa gently arched, apex round pointed, termen rather strongly emarginate beneath apex, obliquely rounded beneath; whitish, irregularly suffused with pale brownish, and strigulated throughout with grey, partly mixed with dark fuscous; a grey suffusion along costa from before middle to near apex, including some irregular ferruginous-brown strigulæ; two sharply-defined blackish-fuscous dorsal spots, reaching half across wing, first at ⅓, forming an irregular narrow rectangularly bent mark, its apex directed posteriorly, second rather broader, erect, anterior edge angulated near dorsum, posterior nearly straight; a round white apical spot, marked with one or two minute blackish strigulæ towards costa anteriorly, and a fine black curved line mixed with brown travelling just within circumference on outer half, its lower extremity shortly produced directly inwards; some irregular black dots or marks on termen: cilia brown, darker round apex, whitish-suffused on tornus and above apex. Hindwings fuscous; cilia light fuscous, becoming whitish-fuscous towards tornus.

One specimen, Ceylon (Pole).

*Electracma*, n. g.

Head loosely haired; tongue short. Labial palpi moderate, curved, ascending, second joint with rough projecting tuft of scales beneath, terminal joint shorter than second, loosely scaled, acute. Antennæ ¾, in ♂ simple. Posterior tibiæ loosely haired above. Forewings with 2 from ⅔, 3 from angle, much curved, 4 closely approximated to 3 at base, 5 remote, straight, 6 to apex, 9 absent, 11 from ¾. Hindwings 1, trapezoidal, cilia ⅔; 3 and 4 stalked.

*Electracma hemichroa*, n. sp.

♂ ♀. 12-13 mm. Head fuscous, face white. Palpi white, somewhat fuscous-sprinkled towards base. Thorax white, anteriorly suffused with rather dark fuscous. Abdomen fuscous, suffused with ochreous towards base. Forewings elongate, costa gently arched, apex round-pointed, termen abruptly and rather deeply excavated beneath apex, rounded beneath; white; anterior half of costa strigulated with blackish; dorsal half of wing strigulated with grey mixed with blackish, with subtriangular erect dark blotches more or less mixed with ochreous at ⅔ and ⅓; costal area on posterior half suffused with light purple-grey, with five yellow-ochreous blackish-edged oblique wedge-shaped marks from costa separated by white costal spaces, second elongated to beneath fourth; a longitudinal streak of dark fuscous suffusion in disc posteriorly; apex of wing forming a yellow-ochreous spot, bisected by a longitudinal white blackish-edged dash; a black dot edged above by a yellow-ochreous mark on termen slightly above middle, and another yellow-ochreous mark lower down:

cilia whitish, suffused with pale fuscous except towards base, above apex white with dark fuscous median and apical lines. Hindwings in ♂ tawny-fuscous, in ♀ rather dark fuscous; cilia light fuscous, with darker subbasal line.

Two specimens, Maskeliya, Ceylon, in June (Pole).

*Metrernis*, n.g.

Head loosely haired; tongue apparently absent. Labial palpi moderate, curved, ascending, second joint with rough projecting tuft of scales beneath, terminal joint rather shorter than second, acute. Antennæ ¾, in ♂ rather thick, simple. Posterior tibiæ loosely haired above. Forewings with 2 from before ¾, 3 and 4 long-stalked from angle, 5 straight, 7 absent, 8 and 9 stalked, 10 closely approximated to 8 towards base, 11 from ¾. Hindwings 1, elongate-trapezoidal, cilia 1; 3 and 4 stalked.

*Metrernis chrolina*, n. sp.

♂♀. 12-13 mm. Head brown, lower part of face and back of crown white. Palpi white, towards base pale fuscous, terminal joint with a fuscous line. Thorax white, shoulders fuscous tinged. Abdomen pale greyish-ochreous. Forewings elongate, costa moderately arched towards base, thence nearly straight, apex round-pointed, termen concave beneath apex, thence obliquely rounded; white, ochreous-tinged except towards costa anteriorly; dorsal half more or less strigulated with fuscous, sometimes partly suffused with pale greyish, with two indistinct dorsal blotches formed of suffused dark fuscous striga, first before middle, second broader, about ¾, with a whitish ochreous mark above its upper anterior angle; five golden-brown oblique marks on posterior half of costa, first two giving rise to pale ochreous-yellowish lines which run near costa almost to apex, fifth apical, separated beneath by a white dash from a pale ochreous-yellow subapical dash which extends into cilia; an indistinct pale yellowish longitudinal line in disc posteriorly; a blackish dot on middle of termen, edged above with pale yellowish: cilia whitish, with two or three indistinct grey bars on basal half, on upper half of termen fuscous-tinged posteriorly, above apex white with golden-brown subbasal and ochreous apical lines. Hindwings grey; cilia pale greyish-ochreous, with two faint grey shades, darker round apex.

Three specimens, Maskeliya, Ceylon (Alston, Pole).

PLUTELLIDÆ.

*Pyrozela*, n. g.

Head loosely haired; tongue developed. Antennæ ¾, in ♂ shortly ciliated, basal joint moderate, without pecten. Labial palpi moderate, curved, ascending, with appressed scales, terminal joint shorter than second, pointed. Maxillary palpi rudimentary. Posterior tibiæ loosely scaled. Forewings with 1 bifurcate, 2 from near angle or 2 and 3 stalked, 7 to termen, 8 and 9 from near 7, 10 from ¾, 11 widely remote, from before middle. Hindwings 1, elongate-ovate, cilia ½-¾; 3 and 4 connate, 5, 6, 7 parallel, 8 free.

Type *P. xanthomima*. Distinguished from *Mieza* and allied genera by neuration of hindwings. To this genus belongs *Mieza sanguinicornis*, Wals., of which I have a good series, and also two undescribed Australian species.

*Pyrozela xanthomima*, n. sp.

♂ ♀. 19-22 mm. Head deep yellow, sides of face crimson, collar deep crimson. Palpi yellow, more or less suffused with crimson except towards apex. Antennæ deep crimson, basal joint yellow. Thorax deep yellow, anterior and lateral margins deep crimson. Abdomen whitish-ochreous. Forewings elongate, costa gently arched, apex obtuse, termen straight, oblique; bright deep yellow, markings deep crimson; an irregular streak along dorsum from base to tornus, curved upwards between middle and $\frac{3}{4}$ so as to leave a semioval dorsal spot of ground colour, on tornus with a short upward projection; a thick inwardly oblique spot from apical extremity of costa, reaching half across wing; besides these, in ♂ costal dots at base and $\frac{1}{3}$, a subcostal dot before middle, an inwardly oblique mark in disc about $\frac{1}{3}$, and a discal dot at $\frac{2}{3}$, in ♀ a suffused streak along basal fourth of costa, another from dorsal streak at $\frac{1}{2}$ to costa before middle, a discal spot at $\frac{2}{3}$ connected with upward loop of dorsal streak, and sometimes some additional variable suffusion connecting these markings in an irregular network: cilia yellow, more or less crimson-tinged towards base, especially in ♀, above apex and beneath tornus deep crimson. Hindwings and cilia pale whitish-ochreous, in ♀ somewhat crimson-tinged towards apex and tornus.

Seven specimens (4 ♂, 3 ♀), Maskeliya, Ceylon, in February, May, and November (Pole). This and the following species are closely allied to *sanguinicornis*, and as the general markings are similar and variable, and also differ more in the sexes than in the species, they are somewhat confusing; the three species are however readily separated by the colour of the hindwings.

*Pyrozela erythromima*, n. sp.

♂ ♀. 14-18 mm. Head and thorax crimson, in ♂ suffusedly spotted with deep yellow. Palpi yellow, sprinkled or suffused with crimson. Antennæ crimson, basal joint usually mostly yellow. Abdomen pale crimson. Forewings elongate, somewhat narrowed anteriorly, costa gently arched apex obtuse, termen nearly straight, oblique; in ♂ bright yellow, with a network formed by four irregular very oblique crimson fasciæ (first almost dorsal, fourth not reaching costa or termen) intersecting with a streak on basal fourth of costa and three very inwardly oblique fasciæ (thus usually leaving about eleven spots of ground colour); in ♀ with similar markings, but the whole almost obscured by general crimson suffusion of ground colour, except that the dorsal and subdorsal spots are lighter or sometimes clear yellow: cilia crimson. Hindwings crimson, thinly scaled anteriorly; cilia crimson.

Nine specimens (5 ♂, 4 ♀), Maskeliya, Ceylon, in January, March, May, August, and October (de Mowbray, Pole). Smaller and narrower-winged than the other two species.

*Conocrotis pieria* n. sp.

♂ ♀. 14-19 mm. Head, palpi, and antennæ white. Thorax white, with a grey dorsal patch and posterior spot. Abdomen pale greyish-ochreous, apex white. Posterior tibiæ clothed with long fine hairs. Forewings elongate, costa

gently arched, apex and termen evenly rounded ; 7 to apex ; white ; a moderate very undefined basal fascia of blue-grey suffusion ; a large yellow-ochreous patch occupying posterior ⅔ of wing except a white marginal streak, edged with blue-grey and finely streaked with blue-grey on all veins ; cilia white, with a blackish-grey basal line round apex and termen. Hindwings light grey ; cilia ½, white, with a faint greyish basal line.

Eleven specimens, all bred, Neboda, Ceylon, in March and April (Green) Larva rather flat, at first reddish, afterwards creamy-white ; constructs flat canopies and galleries of fine silk and comminuted fragments of bark on stems of *Hevea brasiliensis* (Para rubber) ; feeds on lichens and algæ growing on stem ; when pupating, a flattened cocoon or case, with valvular opening, is formed in a shallow depression beneath the silken canopy (Green). From specimens sent, however, I should suppose that the bark itself is freely used as food. A very elegant insect, allied nearly to *C. olympia*, but very much smaller.

*Epistomotis*, n.g.

Head with appressed scales; tongue developed. Antennæ ¾, in ♂ shortly ciliated, basal joint short, without pecten. Labial palpi moderately long, second joint porrected, with long projecting triangular apical tuft of scales beneath, terminal joint longer than second, erect, pointed. Maxillary palpi rudimentary. Posterior tibiæ loosely haired above. Forewings with 1 bifurcate, 2 from angle, very short, 3-6 tolerably parallel, 7 to costa, 8 absent, 11 from before middle. Hindwings 1, elongate-ovate, cilia almost 1 ; 2 remote, 3 and 4 short-stalked, 5 parallel, 6 absent.

Allied to *Ceostoma*, of which it is a development.

*Epistomotis penessa*, n. sp.

♂ ♀. 14-20 mm. Head, palpi, antennæ, and thorax fuscous mixed with white. Abdomen grey-whitish. Forewings elongate, narrow, costa gently arched, apex obtuse, termen very obliquely rounded ; brownish-ochreous or fuscous, irrorated with white ; stigmata dark fuscous, suffused, discal more or less distinct, plical linear, indistinct, very obliquely beyond first discal cilia whitish, irrorated with brownish or fuscous. Hindwings and cilia fuscous-whitish.

Twenty-two specimens, Puttalam, Ceylon, from August to January (Pole).

TINEIDÆ.

*Opostega frigida*, n. sp.

♂ ♀. 4-6 mm. Head and thorax white. Antennæ whitish-grey, basal joint white. Abdomen grey. Anterior and middle tibiæ also bristly. Forewings lanceolate ; shining white ; a narrow triangular or almost linear blackish mark on costa at ⅔ : cilia light ochreous-grey, greyer towards tornus, on costa with an oblique blackish median line to apex of wing, before this white. Hindwings and cilia grey.

Eighteen specimens, Peradeniya, Ceylon, in February (Green).

*Opogona lachanitis*, n. sp.

♂ ♀. 11-15 mm. Head, antennæ, thorax and abdomen shining dark bronzy-fuscous, face and palpi glossy whitish-ochreous, thorax posteriorly edged with

orange suffusion ; palpi stout, truncate. Forewings elongate, costa posteriorly arched, apex acute, termen extremely obliquely rounded ; shining dark purplish-bronzy-fuscous,a broad suffused dull orange patch extending along dorsum from base to beyond middle, towards extremity projecting triangularly upwards so as nearly to touch costa : cilia rather dark bronzy-fuscous. Hindwings dark bronzy-fuscous ; cilia rather dark bronzy-fuscous.

Twenty specimens, Puttalam and Peradeniya, Ceylon, in January, March and from September to November (Green, Pole). Larva feeding in fungus-beds of the common Termite (Green) ; this curious habit should be further investigated. The flattened coxæ and femora appear to form a protective plating of the sternum, which is probably connected with this mode of life.

*Monopis hemicitra*, n. sp.

♂♀. 15-20 mm. Head light ochreous-yellow, hairs in ♂ forming a flat projecting ridge over palpi. Palpi dark fuscous, apex pale, terminal joint longer in ♀. Antennæ pale grey. Thorax dark fuscous. Abdomen pale yellow-ochreous. Forewings elongate, costa strongly arched, apex pointed, termen very obliquely rounded, more strongly in ♂ ; 2 and 3 out of 4, 7 and 8 long-stalked or coincident ; blackish-brown ; several blackish-leaden raised scaletufts towards submedian fold ; a large irregular trapezoidal pale ochreous-yellow patch extending on costa from $\frac{2}{5}$ to $\frac{4}{5}$, narrowed downwards, with a rounded projection on lower side reaching $\frac{2}{3}$ across wing ; discal impression large, within this patch, not transparent : cilia blackish-brown mixed with dark slaty leaden. Hindwings pale bronzy-ochreous, in ♀ suffused with grey ; cilia light ochreous-yellowish.

Five specimens, Puttalam, Ceylon, in November (Pole.) Very like *monachella*, but abundantly distinct structurally by the different neuration (in *monachella* 2 is nearly or quite connate with stalk of 3 and 4, 6 and 7 are stalked, 8 separate), scaletufts on forewings, and facial tuft of ♂ ; the costal patch of forewings is broader as well as yellower, and the projection on lower side is less developed in *monachella*.

*Nemotois scitulellus*, Walk.

(*Glyphipteryx scitulella*, Walk. Tin., 839 ; *Nemotois corybantis*, Meyr.)

I had missed Walker's type of this species.

# THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA

By

L. C. H. Young, B.A., F.E.S., F.Z.S.

## PART II.

*(With Plate B.)*

*(Continued from page 579 of Vol. XVI.)*

### Genus Hypolimnas.

This genus contains two species, both abundantly and universally distributed in our area and both of remarkable interest on account of the peculiar form of sexual dimorphism they display. That is to say, while the males, which resemble each other rather closely, correspond to the usual vanessid form of the allied genera, the females bear no resemblance to them in shape or colour but instead mimic very closely species of two other genera, **Euploea core** and **Limnas (Danais) chrysippus**, in no way related to them.

The reason why they mimic these two species is obvious because the latter owing to their nauseous taste are protected from the natural enemies of butterflies—lizards, birds, dragonflies and so forth. It is also easy to understand why Nature, which is another name for Providence, has ordained that the mimicry should only appear in the female as the latter in fulfilling its ordinary functions has to fly slowly from plant to plant and settle constantly to lay her eggs and is consequently far more exposed to danger than the male.

As to how the mimicry was originally brought about however and became perpetuated under the ordinary laws of heredity in one sex only is a far more difficult problem of evolution to solve, and would take too long to discuss here. The female of **H. bolina**, but for the difference in shape might be considered only a melanised form of the male and from the moment that mimicry began in the direction of the present form would acquire a certain protection from a resemblance however superficial to **E. core**. The case of **H. missippus** however is different, for the male and female are absolutely unlike and it is difficult to understand, if the old adage *natura saltum non facit* be granted, why any of the intermediate stages should have survived as more fit than the presumed original type.

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

Horace Knight, del. Heutschel-Colourtype.

The two species may be readily distinguished as follows:—

| | | | |
|---|---|---|---|
| ♂. | Underside, | ground colour brownish-black. | *bolina.* |
| | ,, | ,, ,, tawny-ochreous. | *misippus.* |
| ♀. | Upperside, | ,, ,, brownish-black. | *bolina.* |
| | ,, | ,, ,, tawny-ochreous. | *misippus.* |

**H. bolina,** L. ♂ *Upperside* glossy black. Forewing with an oval shining blue, white centred, patch beyond the cell, the veins crossing it black. Two conjoined white spots near apex and a submarginal series of from 5 to 6 minute white dots. Hindwing with an oval central patch as in the forewing but larger and a postmedian series of 4 to 5 minute white dots.

The cilia of both wings brown, white-tipped on the veins.

*Underside* brown; forewing with some minute white spots on the costal vein near the base, 2 slightly larger on the upper margin of the cell. The oval patch of the upperside represented by 3 slender white streaks between the veins—or in wet season forms barely traceable. The subapical spots of the upperside smaller and in wet season forms reduced to small dots. The submarginal series of dots more prominent and a marginal series of white patches between the veins generally only prominent towards the anal angle where they are crossed by a brown line.

Hindwing.—The central patch represented by a tolerably broad white band, the veins crossing it brown. The patch, however, is very variable and in wet season forms often hardly traceable. The postmedian series of dots more prominent and the space beyond them more or less suffused with white between the veins and crossed by brown subterminal and terminal lines.

♀ *Upperside* glossy brown; paler towards the outer margin. Forewing with 2 suffused bluish spots on the costa above the cell and traces of an oblique series between the veins beyond the cell, only the upper two of which are as a rule traceable and in dry forms may be represented merely by two whitish spots without any blue sheen. Two subapical white spots and a series of submarginal white spots, more prominent towards the anal angle. The space beyond them whitish between the veins, more markedly so towards anal angle, and crossed by terminal and subterminal brown lines. Hindwing with a post median series of white spots and almost the whole of the space beyond them suffused with whitish, crossed by brown subterminal and terminal lines.

The size of the white spots and patches and the extent and brilliancy of the blue sheen in both sexes of this species are very variable. The blue sheen is more prominent in specimens taken in the wet season or from moist climates and is characteristic to a remarkable degree of specimens from Assam.

Expanse ♂ $2\frac{3}{4}$″ — 3·8″. ♀ $3\frac{1}{2}$″ — $4\frac{1}{2}$″.

*Larva.*—Rich dark brown, head lighter ; armed with 9 longitudinal rows of finely branched spines, a single pair of larger spines on the head.

*Food Plant.—Elatostemma cuneatum.*

Plate B, Fig. 7 male, 7*a* female.

**H. misippus**, L. ♂. *Upperside* glossy brownish black. Forewing a broad oval oblique white patch beyond the cell from vein 7 to below vein 3, a subapical white spot. The area round both spots covered with a blue sheen which however is often hardly traceable and is never as brilliant as in the preceding species. Hindwing with a large rounded white patch in the centre surrounded by a blue sheen as in the forewings. Sometimes traces of a submarginal row of white spots.

*Underside* tawny yellow. The basal half of the forewing darker and shading into dark brown along the costa and towards the anal angle, 3 white spots on the upper margin of the cell and one on the costa beyond it, a broad oblique white patch and subapical spot corresponding to those on the upperside ; a submarginal row of three or four white spots, the spaces between the veins towards margin whitish crossed by brown terminal and subterminal lines. Hindwing crossed by a broad white band, edged with black on the inner margin between veins 7 and 8 and a black quadrate spot towards the middle between the same veins. A white spot surrounded by blackish towards anal angle, vein 16 blackish and a black streak parallel to it from anal angle to near base, a submarginal row of white spot, the spaces between the veins towards margin whitish bounded on either side and crossed by three blackish lines.

♀ *Upperside* rich chestnut. Forewing with the costal margin, apical third of the cell and the whole apical third of the wing black, crossed by a white maculate oblique band consisting of 4 more or less distinct quadrate spots between the veins, a small white spot on the costa before it, and a large apical white spot sometimes divided into two or three with a small white dot beneath it. The space between the

veins towards margin whitish crossed by a black subterminal line. Cilia whitish between the veins.

Hindwing with a blackish quadrate spot about middle of the costa between veins 7 and 8, margin of the wing marked as in the forewing, but the black subterminal line broader and more prominent especially towards the anal angle.

*Underside.*—Forewing marked as on the upperside, but with 3 white spots on the upper margin of the cell and the apical space beyond the white band dull ochreous tawny. Traces of a submarginal row of white spots.

Hindwing as on the upper side but duller ochreous, paler in the disc a black patch preceding the precostal spot and a black patch beyond the outer margin of the cell. A submarginal row of white dots. The terminal, subterminal, and presubterminal black lines being prominent.

The above is the typical form of the female which is a close mimic of the typical form of **L. chrysippus.** There are two other forms of the female which are close mimics of the desert forms **chrysippus** sometimes known as **L. dorippus** and **L. alcippus.** The remarkable thing about them is that while they are of course the common form of the female in areas where **dorippus** and **alcippus** are the usual form of **chrysippus** they also occur in areas—the neighbourhood of Bombay for instance where neither **dorippus** nor **alcippus** have ever been found or are ever likely to be.

They both differ from the type in the white and black markings of the apical area of the forewing being wanting. The area instead being tawny. The **alcippoides** form has the whole of the discal area on both sides of the hindwing whitish. Intermediate forms occur where the outlines of the white apical marking of the forewing can be dimly traced.

*Larva* black, head and legs reddish-brown. Ten longitudinal rows of branched spines, dirty whitish in colour; two long thick branching spines on the head. *Food Plant.—Portulaca oleracea.*

Size: $2\frac{3}{4}$ ♂ at $3\frac{3}{4}$ ♀.

Plate B, Fig. 8 male, 8*a* female.

## Genus VANESSA.

The genus Vanessa will I suppose prove the most familiar of all those dealt with in this series to English readers. It contains many of our commonest and most prominent butterflies, the Peacock the Red Admiral, the two Tortoiseshells and so forth. The species figured

here, the Painted Lady, is of universal distribution excluding of course the arctic and antarctic regions, and is to be found all over India. Another species **V. indica** is to be found in the Nilgiri, Palni and Anamali hills as well as throughout the Himalayas and is practically identical with **V. atalanta**, our Red Admiral, only differing in the red band of the forewings which is less regular in outline and less brilliant in colour. There are also three species of "Tortoiseshell" in the Western Himalayas which are closely allied to our English **V. urticæ**.

**V. Cardui**, L. *Upperside* Brownish orange, mixed with blackish towards base. Forewing with the apical third black, an irregular black spot across the middle of cell, another beyond it smaller and not reaching the upper margin of the cell, a black patch at the end of the cell, the angle between vein 2 and the lower margin of the cell filled up with blackish and a quadrate spot between veins 1 and 2 beyond middle, an oblique band of four white spots between the veins in the black apical area and 3 smaller white spots beyond them. A marginal series of whitish streaks between the veins preceded by suffused blackish spots towards anal angle. Cilia pale between the veins.

Hindwing.—With the blackish mixed basal area larger and extended to include the whole costal area ; an indistinct waved dusky band from it reaching across the wing beyond the cell, a row of five to six black spots beyond it, a submarginal line of black streaks between the veins and beyond it the veins broadly blackish.

*Underside*—Forewing brownish orange, basal area tinged with pink, apical third greyish brown shading to whitish at apex. Spots much as on the upperside. Hindwing olive brown mottled with whitish blotches and crossed by yellowish lines. A submarginal series of ocellated spots with blue or black centres, a subterminal line of black streaks between the veins and terminal black spots on the veins as on the upperside. The male and female do not differ except in size.

*Larva.*—Greyish-ochreous, greenish or brown. A blackish central line and sometimes yellowish lateral lines. Seven longitudinal rows of branching spines. *Food Plant*—in this country *Artemisia*, *Blumea*, etc.; in temperate climes, as its name implies, its most general food plant is the common thistle though it will also readily eat nettles.

Size : $2\frac{1}{4}$" @ $2\frac{3}{4}$".

Plate B, Fig. 9.

(*To be continued.*)

EXPLANATION OF PLATE B.

| | | | | |
|---|---|---|---|---|
| Figure | 7 | Hypolimnas bolina | | ♂ |
| ,, | 7*a* | ,, | ,, | ♀ |
| ,, | 8 | ,, | misippus | ♂ |
| ,, | 8*a* | ,, | ,, | ♀ |
| | 9 | Vanessa cardui. | | |

# INSECT LIFE IN INDIA AND HOW TO STUDY IT,

BEING

A SIMPLE ACCOUNT OF THE MORE IMPORTANT FAMILIES OF INSECTS
WITH EXAMPLES OF THE DAMAGE THEY DO TO CROPS,
TEA, COFFEE AND INDIGO CONCERNS, FRUIT
AND FOREST TREES IN INDIA,

BY

E. P. STEBBING, F.L.S., F.Z.S., F.E.S.

PART IV.

(*Continued from page 685 of Vol. XVI.*)

## Chapter VII.

### ORDER V.—COLEOPTERA (BEETLES).

The Coleoptera or Beetles appear to be wingless Insects, but have really four pairs of wings. The upper pair, which are called the 'elytra,' are hard and horny and shell like, fitting accurately together over the back, thus protecting it and the lower wings which are folded beneath them and are membranous. In the mouth mandibles are present, and the lower lip is divided along the middle. The metamorphosis is complete. Fig. 87 shows a beetle with the right elytra in the position of rest, the left one being held up, thus setting free the underwing. The larva is grublike and changes to a pupa in which all the parts of the perfect insect are distinguishable, but are still white and soft.

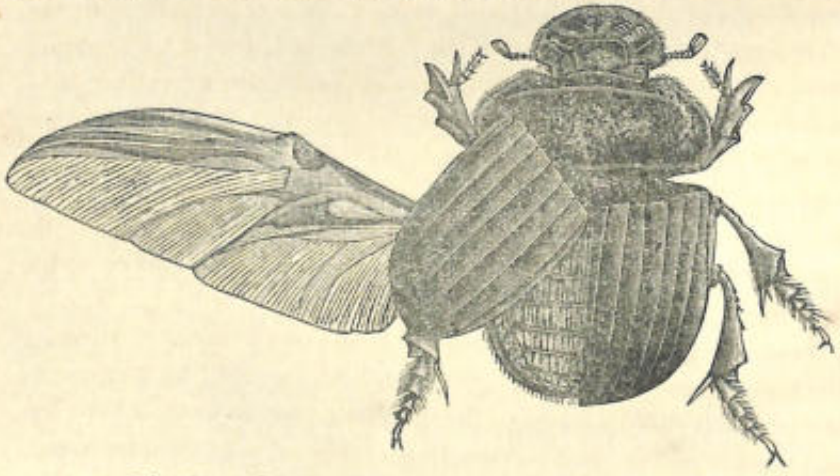

FIG. 87.—A Coleopterous Insect. Heliocopris dominus (Sibsagar). The right elytra is in the position of rest, the left one is elevated allowing the lower wing to be spread out in position of flight.

The beetles are one of the largest and most important of the Orders of Insects as well as being one of the most injurious both in the field and forest. Both larvæ and mature insects bore into vegetable substances of all kinds affecting and often destroying the roots, stems, flowers and seeds of plants.

Beetles are chiefly distinguished from other Insects by the solidarity of their outer covering and by the peculiar nature of their first pair of wings, which are not used as instruments of flight, but merely serve to protect the hinder part of the body. Beetles are not found on the wing as much as other Insects, and therefore, notwithstanding their enormous numbers, they are not met with so frequently as ants, bees, flies, etc. [illegible] at present known is probably about 160,000, or [illegible] they can be found

## INSECT LIFE IN INDIA AND HOW TO STUDY IT.

Plates II and III referred to in the text will appear in a subsequent number.

it. The pro-thorax [illegible]
amount of movement independent of the [illegible]
meso-thorax is much reduced. The meta-thorax is largely developed in winged forms. Fig. 88 shows the under surface of a beetle with the different parts named. It is essential that the student of the Coleoptera should make himself thoroughly acquainted with the nomenclature of the different parts. The elytra frequently have a remarkable sculpture the use of which is usually unknown. When the elytra are shut up, they cover the greater part of the meso- and meta-thorax, abdomen, and the lower wings. At the top there is a triangular portion called the *scutellum*, which forms the upper part of the meso-thorax. The elytra may leave a few of the lower segments of the body exposed.

These elytra are of such importance to the beetle that they are even present in cases where there are no lower wings. When this occurs they are often joined together down the central suture so as to form one piece, although the line representing the junction is always present. When a beetle flies, the elytra open slightly upwards, letting free the lower wings (*vide* Fig. 87). In the common rose-chafer (the green

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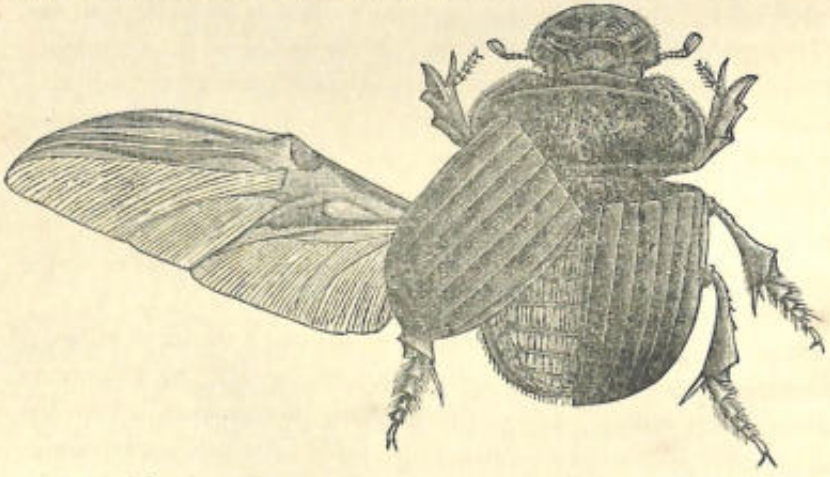


FIG. 87.—A Coleopterous Insect. Heliocopris dominus (Sitsagar). The right elytra is in the position of rest, the left one is elevated allowing the lower wing to be spread out in position of flight.

The beetles are one of the largest and most important of the Orders of Insects as well as being one of the most injurious both in the field and forest. Both larvæ and mature insects bore into vegetable substances of all kinds affecting and often destroying the roots, stems, flowers and seeds of plants.

Beetles are chiefly distinguished from other Insects by the solidarity of their outer covering and by the peculiar nature of their first pair of wings, which are not used as instruments of flight, but merely serve to protect the hinder part of the body. Beetles are not found on the wing as much as other Insects, and therefore, notwithstanding their enormous numbers, they are not met with so frequently as ants, bees, flies, etc. The number of species at present known is probably about 160,000, or thereabouts, and their habits are so varied that they can be found everywhere when looked for. The general form varies much from flat-spherical to long-linear. The head is well developed, with a biting mouth; compound eyes are present, which are not uncommonly divided. Ocelli (simple eyes) are rare. Antennæ eleven-jointed or with fewer joints. These latter are variable in shape and are of importance in classification. The structure of the hard parts of the skeleton is of importance since the classification of the species is entirely based upon it. The pro-thorax is very free and is therefore capable of a considerable amount of movement independent of the after part of the body. The meso-thorax is much reduced. The meta-thorax is largely developed in winged forms. Fig. 88 shows the under surface of a beetle with the different parts named. It is essential that the student of the Coleoptera should make himself thoroughly acquainted with the nomenclature of the different parts. The elytra frequently have a remarkable sculpture the use of which is usually unknown. When the elytra are shut up, they cover the greater part of the meso- and meta-thorax, abdomen, and the lower wings. At the top there is a triangular portion called the *scutellum*, which forms the upper part of the meso-thorax. The elytra may leave a few of the lower segments of the body exposed.

These elytra are of such importance to the beetle that they are even present in cases where there are no lower wings. When this occurs they are often joined together down the central suture so as to form one piece, although the line representing the junction is always present. When a beetle flies, the elytra open slightly upwards, letting free the lower wings (*vide* Fig. 87). In the common rose-chafer (the green

metallic-looking flat beetle to be found upon roses), where the elytra are joined together down the centre they are merely lifted up; when the

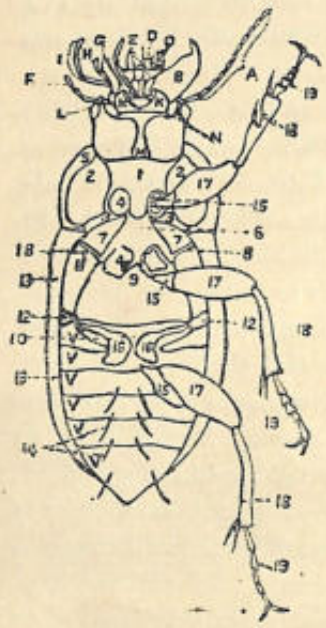


FIG. 88.—Undersurface of a beetle. (Legs and antenna of one side and some parts of mouth removed.) A, antenna; B, mandible; C, labrum; D, ligula; E, paraglossa; F, labial palp; G, inner lobe of maxilla; H, outer lobe of maxilla; I, maxillary palp; K, mentum; L, gena; M, gula; N, buccal fissure; V, plates of ventral segments. 1, Prosternum; 2, prosternal episternum; 3, prosternal epimeron; 4, anterior and middle coxal cavities; 5, inflexed side of pronotum; 6, mesosternum; 7, mesosternal episternum; 8, mesosternal epimeron; 9, metasternum; 10, posterior division of metasternum or ante-coxal piece; 11, metasternal episternum; 12, metasternal epimeron; 13, epipleuron or inflexed margin of elytron; 14, ventral or ambulatory setæ; 15, trochanter; 16, posterior coxa; 17, femur; 18, tibia; 19, tarsus. (Modified from Leconte and Horn.)

elytra are absent, as occurs in some beetles (*Tenebrionidæ*, &c.), there are no lower wings present. The wings proper in beetles correspond to the posterior or lower pair in other Insects. The nervures or veins in the lower wing are broken up to allow of their being folded up under the wing covers (c. f. left lower wing in Fig. 87). The number of tarsal joints present varies from 2—5. One may be hidden and is only seen on dissecting. For classification purposes only those visible are counted. Some of the tarsal joints may be bi-lobed; they are set with a spongy felt-work of hair to help the insects to walk about on plants. Only 5—6 segments of the abdomen are visible. There is often a considerable difference in the sexes amongst beetles. There may be either an increase in size of the antennæ in the males or an enlargement of the interior tarsi; occasionally the number of joints of the tarsi vary in the two. The only music produced is chirping or squeaking by rubbing two files together. Phosphoretic organs are present in glow-worms and fire-flies. These consist of masses of cells connected with a fatty body and are freely supplied with air. The light produced is caused by the oxidation of proteid matter. These organs are situated on the abdomen.

The larva is grub-like, with a distinct head and jaws; sometimes antennæ and six legs are present. They have no special boring apparatus and the sexes are distinct. They usually feed at night and upon all sorts of substances. They are sometimes parasitic upon other animals, but this is not usual. Owing to the difficulty in rearing Coleoptera less is perhaps known about their life histories than of those of other insects. In India until within quite recent years the information on this subject was practically non-existent. As will be seen from the figures in the following Chapters the larvæ vary considerably in appearance. Fig. 89 shows several larval forms of this family.

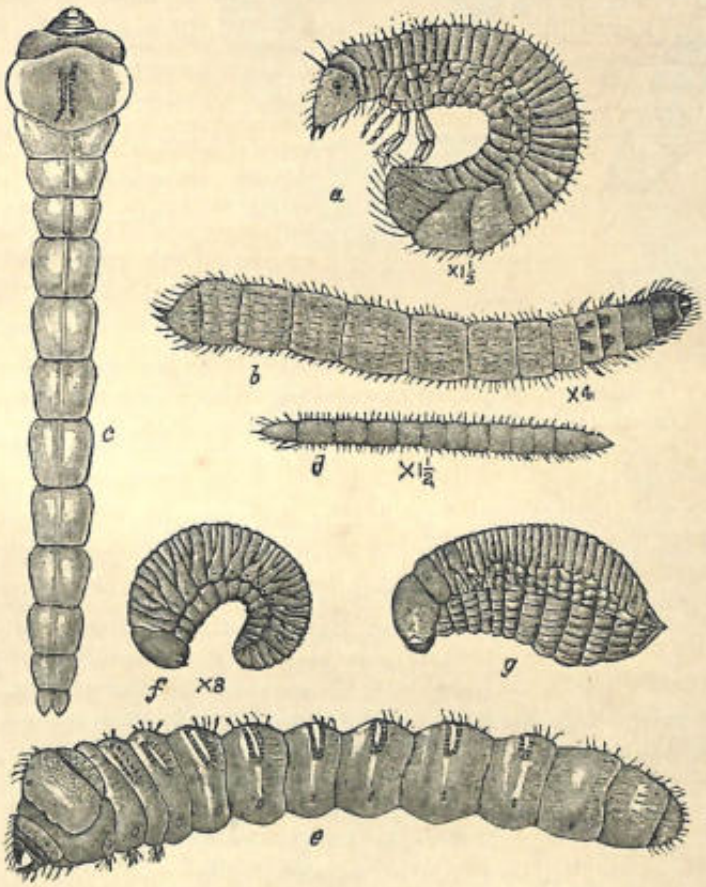



FIG. 89.—Coleopterous larvæ. *a*. Lachnosterna? sp. *b*. Thanasimus himalayensis. *c*. Sphenoptera gossypii. *d*. Elater sp. *e*. Hoplocerambyx spinicornis. (Cerambycidæ) *f*. Scolytus minor. *g*. Cyrtotrachelus longipes (Curculionidæ).

The pupa is quiescent and often enclosed in a rough cocoon. It is usually white in colour. Fig. 90 shows some forms of pupæ. The adult may live without movement near the cocoon for some time after emergence whilst its outer layers of chitin are slowly hardening (this will be found common amongst *Buprestidæ*, *Cerambycidæ*, and the bark borers, *Scolytidæ*, &c.). The beetle when found in this condition in the pupal chamber is yellow or light brown in colour, changing to dark brown or black before it finally emerges from the tree.

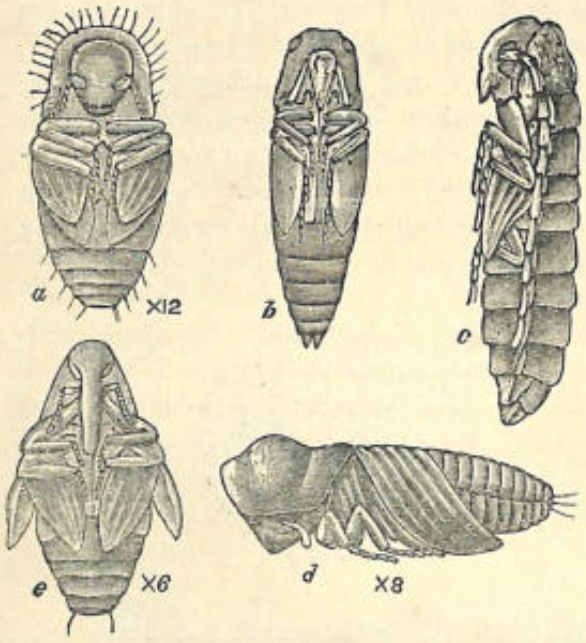



FIG. 90—Coleopterous pupæ. (*a*) Dinoderus minutus (Bostrichidæ). (*b*) Sphenoptera gossypii. (*c*) Hoplocerambyx spinicornis. (*d*) Tomicus sp. (Scolytidæ). (*e*) Calandra sculpturata (Curculionidæ).

The initial classification of the beetles depends upon the number of tarsal joints present on the feet. There are four great groups, and these groups are again divided into series as follows :—

Pentammera—5 tarsal joints present upon all the legs.

- Series, Lamellicornia—Antennæ with the terminal joints broader on one side so as to form a peculiar club, the leaves of which are movable.
- Series, Adephaga or Caraboidea—Antennæ filiform or nearly so.
- Series, Clavicornia—Antennæ usually thickened at the tip or knobbed.
- Series, Serricornia—Antennæ usually serrate along their inner edge.

Heteromera—1st and 2nd pairs of legs have 5 tarsal joints; the third pair have 4 only.

- The families Tenebrionidæ and Cantharidæ only will be considered here.

Tetramera—4. tarsal joints present on all legs.
- Series, Phytophaga—Head not forming a definite prolonged beak.
- Series, Rhynchophora—Head more or less prolonged in front to form a snout or beak (rostrum).

Trimera—3 tarsal joints present on all legs.
- The family Coccinellidæ only will be considered here.

## Pentammera.

*5 tarsal joints on all the feet.*

### Series I.—*Lamellicornia.*

Tarsi five-jointed; antennæ with the terminal joints, called *lamellæ*, usually three in number (sometimes more), broader on one side forming a club, the leaves of which are movable, but in repose look like one piece as they are held close together. Fig. 91 shows several forms of antennæ present in this series. The families *Passalidæ*, *Lucanidæ*, and *Scarabæidæ* are included here; the form of the leaves of the club of the antennæ varies in shape in these three families. The larvæ live in

Fig. 91.—Types of Lamellicorn antennæ. (*a*) Pleurarius brachyphyllus. (*b*) Lucanus lunifer. (*c*) Heliocopris dominus. (*d*) Lachnosterna impressa. (*e*) Oryctes rhinoceros. (*f*) Agestrata orichalcea.

decaying vegetable matter, roots, or dung. They either live in the ground or in the decaying wood upon which they feed. They have a horny head, large jaws and three pairs of legs, and are thick clumsy grubs with curved bodies, the last two segments being of larger size than usual and often swollen out in a bag-like manner (Fig. 89*a*). Many of them possess organs of stridulation.

### Fam. I. Passalidæ.

The upper lip is large and mobile and the mentum is deeply cut out in the middle. The antennæ curl upwards and the plates at

the top are thus brought together. These beetles are usually shining black in colour and are abundant in decaying wood in tropical forests.

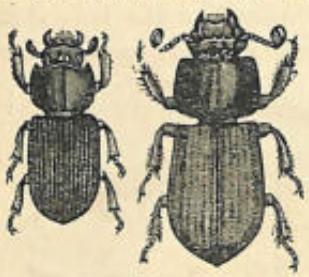


FIG. 92.—Leptaulax dentalis (Bhutan) (*left*). Basilianus andamanensis (Andaman Islands) (*right*).

The larvæ appear to have only four legs, the first pair being short processes which are used to produce sounds by scraping over striated surfaces on the next pair. Very little is at present known about these insects in India. I have however a few notes about some of the common species. *Leptaulax dentalis* (Fig. 92 *left*) is a beetle with a black shining thorax and longitudinally ridged elytra. It is abundant in rotten wood in the Assam Duars and submontane tracts of Bhutan. I have taken it plentifully in rotting trunks of 'sal' (*Shorea*), 'semul' (*Bombax*), etc. *Basilianus andamanensis* is a large shining black beetle with heavily longitudinally striate elytra. It is said to be common in rotting wood in the Andaman Islands (Fig. 92 *right*). *Pleurarius brachyphyllus* (Fig. 93 *left*) has been taken by the writer in decaying stumps in the Ootacamund Hill in S. India. *Tæniocerus bicuspis* (Fig. 93 *right*) is a smaller species from Sikkim.

FIG. 93.—Pleurarius brachyphyllus (Ootacamund Hills) (*left*). Tæniocerus bicuspis (Sikkhim) (*right*).

## Fam. II. Lucanidæ (Stag-beetles).

The stag-beetles are well known owing to the enormous horns present on the head. These horns are really greatly developed mandibles, and are only present in the male beetle. Upper lip is small and the mentum is not cleft. The antennal end consists of a fixed cone, which is rigid and does not open and close (Fig. 91*b*). The reason for or use made of the extraordinary development of the mandibles in the male is still in dispute. Very few close observations of the insects would appear to have been made. The horns are at times as long as the rest of the insect and are armed with formidable projections or teeth. The elytra

entirely cover the dorsal surface of the body. The male is usually larger than the female. A curious point about these insects is the remarkable variation in size found amongst individuals of the same species. If a series of stag-beetles are compared this will be immediately

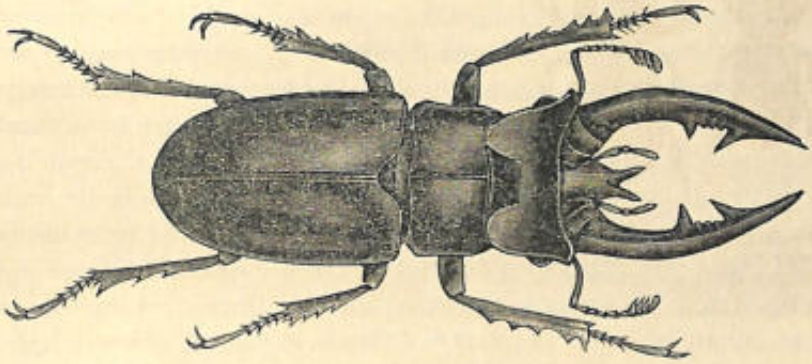


FIG. 94.—Lucanus lunifer (India) ♂.

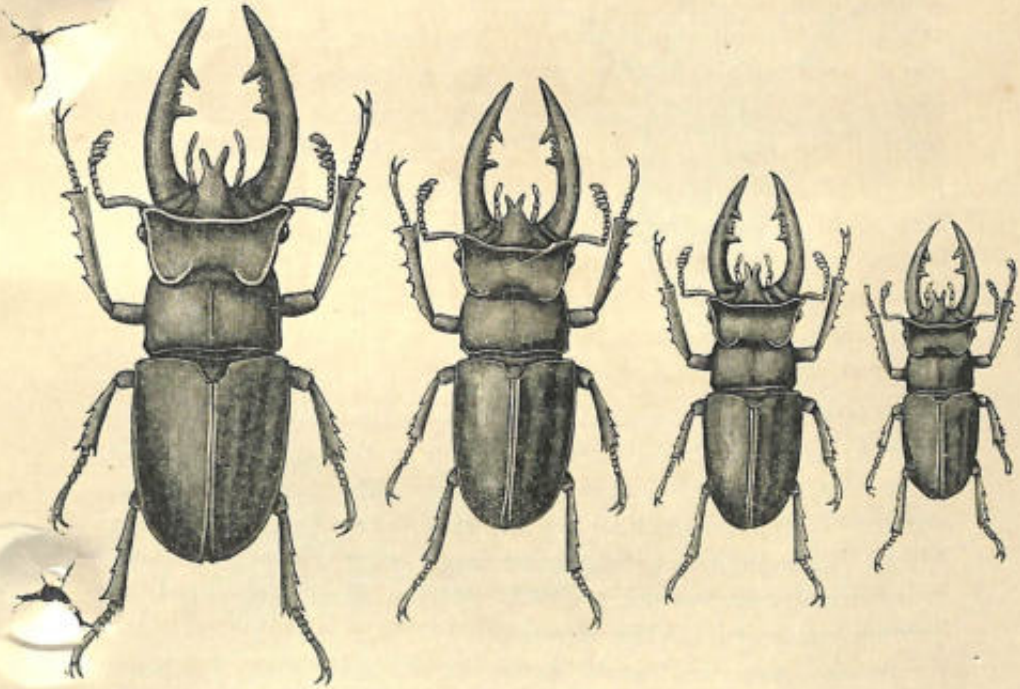


FIG. 95.—Lucanus lunifer (India), male. A number of individuals showing the remarkable variation in size.

noticed (Fig. 95). Five ventral abdominal segments are visible. The larva has the last two segments of its body swollen up in a bag-like

manner (Fig. 89*a*), and lives in decaying wood and roots, spending several years of its existence in this stage. The pupal stage is a short one, but the perfect insect may remain quiescent some time after assuming the imago form before it becomes active.

According to Sharp there are at present between 500 and 600 species of stag-beetles known, the Indo-Malayan and Austro-Malayan regions being richest in them. The common stag-beetle of India, to be found all through the Himalayas, and along the tracts at the foot of these mountains, is *Lucanus lunifer* of which Fig. 94 depicts the male and Fig. 96 the female beetle. They are dark green in colour, the male larger than the female.

In the outer Himalayas the mature beetles are to be found in June and July. It is probable that they issue irregularly during the summer months, as the writer has taken fully-developed larvæ just pupating and also mature beetles in July. Some years ago Lucanid larvæ were reported as tunnelling into green living oak trees in Naini Tal.* Owing to their queer swollen bag-like extremities it is extremely improbable that these larvæ are capable of tunnelling into green hard wood. It is probable if boring was done in hard oak timber, that longicorn larvæ were responsible, and the stag-beetles may have taken advantage of the galleries to lay their eggs in the ones whose edges were rotting and thus becoming softer. The writer has found numerous instances of decaying oak, etc., stumps being full of these larvæ, but no instance of hard green wood being infested. The grubs take several years to reach their full growth. They then pupate in a cocoon constructed of chips of wood.

FIG. 96.—Lucanus lunifer—female.

Another common lucanid beetle in the Himalayas is *Lucanus cantoris*. This insect is to be found in fallen and decaying trees in the Himalayan forests in considerable numbers when searched for.

* Thompson—Report of insects destructive to woods and forests, published by the N.-W. Provinces Government (1868).

Towards the end of April at elevations of 5,000 feet the beetle has been taken in decaying *Betula cylindrostachys*, *Castanopsis tribuloides* and *Symplocos theæfolia* trees. Imagoes were also taken in July, the beetle probably passing the summer in this stage of its existence. It was subsequently found that the insect was common between the elevation of 4,500 ft. to 6,000 ft. in the Eastern Himalayas. In the Western, in Jaunsar, the beetle has also been taken at the end of April at an elevation of 5,000 ft.

A third species of Lucanus, *L. mearesi*, is also to be found in the Darjiling Himalayas. The insect was found cut out of the wood of *Symplocos theæfolia* at elevations of 6,000 ft.

A brightly coloured lucanid is the beetle *Odotonlabis cuvera*, the male of which is black with broad orange margins to the outer edge of the elytra. It is figured in Plate III, Fig. 1.

## Fam. III. Scarabæidæ—(Chafers.)

In this family the leaflets of the antennæ are freely-moveable plates which can be opened and closed together at will by the insects (Fig. 91 *c*). The number of visible ventral abdominal segments is usually six or at the sides seven, never five as in the last two families. The elytra (wing cases) usually leave one or two of the last segments of the body exposed.

The beetles of this family are bulky insects, having a powerful pro-thorax and front legs with flattened spiny tibiæ adapted for digging, as shown in the insect *Hoplosternus furcicandus*, a brownish silvery chafer from Sikkim, depicted in Fig. 97, and better still in the case of *Scarabæus sacer* (Fig. 99). At times the males are armed with long horns of various shapes growing out of the head and pro-thorax. The larvæ are often bulky grubs resembling lucanid larvæ in shape, that is the lower extremity is enlarged in a bag-like manner and curved round (see Fig. 89*a*). The family is an important one amongst insects. About 13,000 species are already known. Both grubs and beetles feed upon plants, decaying vegetation and dung. Several sub-families are distinguished

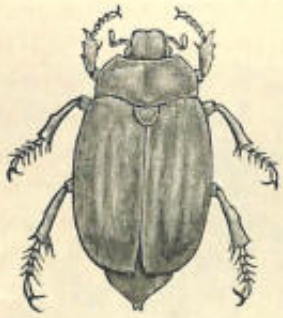


FIG. 97.—A Chafer (Hoplosternus furcicandus) (Sikkim) showing the largely developed front tibiæ which are used for digging purposes.

amongst which we shall allude here to the COPRIDES or Dung beetles, MELOLONTHIDES or Cockchafers proper, DYNASTIDES and CETONIIDES or Rosechafers.

The COPRIDES or dung beetles are the well-known beetles found rolling balls of dung on the roads and commonly entering lighted houses at night; cumbersome bulky insects with a heavy lumbering flight. They form a large group of beetles consisting of some 5,000 odd species. Both beetles and larvæ have the power of producing a stridulating noise by rubbing certain segments over one another.

By far the most interesting division of the Coprides are the Scarabæini. Many species of this division have the curious habit of rolling about balls of dung and earth. The species of this division possess long hind legs which are used for this purpose. Fig. 98 shows the beetle *Copris reflexus* pushing along a ball of dung. This insect is to be found in the North Khasi Hills in Assam. It is on the structure of their legs that the division is based. The Scarabæus is known to most people from its connection with Egyptian mythology. Many of the stone Scarabæi found in Egyptian tombs represent some kind Scarabæini and it has been thought that the ancient Egyptians held these insects as sacred on account of their peculiar habits. *Scarabæus sacer* is a well-known form (Fig. 99). It is not improbable that the highly educated

FIG. 98.—Copris reflexus (North Khasi Hills). The beetle is shown pushing along a ball of dung.

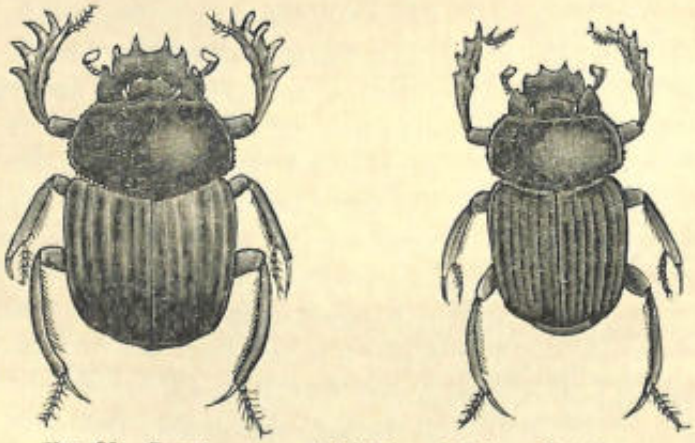


FIG. 99. Scarabæus sacer (Gilgit). ♂ *left;* ♀ *right.*

and clever priests, as can be traced in so many of the ordinances observed by the different creeds throughout India, having studied the habits of the insects and observed that they acted as scavengers, forbade the killing of such useful animals and to ensure the order being carried out caused them to be regarded as sacred. This would be all the easier, owing to the fact that the actions of the beetles to the uninitiated must appear exceedingly curious. It is said that the inhabitants of the valley of the Nile thought the movements of these beetles, when rolling their balls, were typical of the planetary and lunar revolutions; and that the sudden appearance of the beetles after a period of complete absence (which, of course, though unknown to them was passed as the egg, grub and pupa in the ground) was emblematic of a futura life. Although the exact habits of our Indian representatives of the group have not been as yet worked out, it is possible to give a very fair idea of the life history of some of the common species to be met with in the country. The beetles act as scavengers by breaking up and burying the droppings of cattle. The female scarabæids divides off a piece of the dung and forms it into a ball, the size of the latter varying with the size of the insect forming it. The ball, however, is usually of greater dimensions than the insect making it. There is a common small scarabæid, a species of Copris resembling *C. reflexus*, in the Dun below the Mussoorie hills which may be found congregated in scores in cow droppings. It is not an uncommon sight to see several beetles, 3 or 4 together, dragging along one ball. Whether they subsequently feed upon it together or whether one or two only ultimately devour it, I do not at present know. The ball is pushed and dragged to a suitable locality, the hind legs, front legs and head all being made use of to get it along and the insects display an amount of strength and patience in this work which are almost incredible. On reaching the spot decided upon, the ball is buried in a chamber which is dug out by means of the flat spined tibiæ of the front legs. The insect or insects then get in alongside the ball and devour it. It is probable that they spend several months in the beetle stage of their existence and that consequently it is only towards the latter end of this period that the female commences to prepare the ball which is to subsequently provide the food for the offspring. She first digs out a chamber in the ground and then fills it with dung. Observations would seem to show that

different species affect the droppings of different animals and that the beetles are not omnivorous in this respect in India. When the chamber is full the female deposits her egg or eggs (the number is always small) in the portion which contains the freshest and softest material, for the mandibles of the young larvæ on first hatching are soft and incapable of operating on hard materials. Having deposited her eggs she closes up the chamber. In some features of their life history these Insects are exceptional. For instance the female beetle does not usually die after depositing her eggs, as is the common rule amongst Insect life. She remains alive and sees her offspring develop and then, in some cases at any rate, produces another generation. This is very unusual although not without parallels in families which we shall consider in subsequent chapters.

FIG. 100.—Gymnopleurus sinuatus. (Assam).

Amongst Indian Coprides may be mentioned the small *Copris reflexus*, a small shining blackish beetle from the North Khasi Hills in Assam (Fig. 98.) *Gymnopleurus sinnatus* (Fig. 100) is a common cattle and game dung coprid of Assam. A large beetle of this group is the Elephant dung beetle *Heliocopris mouhoutus* of which the stages of larva, and beetle are shown in Plate II., Figs. *a*, *b*. Considerable discussion has taken place over this insect. Two forms of the beetle exist, one being an inhabitant of Assam whilst the other ranges throughout Burma, Southern India and the Malays. Sharp considers the two forms identical under

Fig. 101.—Heliocopris dominus. ♂. (Assam).

the name of *H. dominus** whilst Oberthur thinks there are two distinct species, *H. dominus* in Assam and *H. mouhoutus* in Burma and the Malays, an opinion the writer himself supports. These beetles feed on elephant dung, rolling it into large balls which are intermixed with clay, or they make large balls of the dung and surround them with large clay wedge-shaped masses as shown in Fig. *d*, Plate II. In these latter balls an egg is laid and the grub on hatching out feeds upon the ball of dung. When full fed, by which time it has eaten all the material, it pupates in the hollow which now exists in the clay mass (*vide* Fig. *c*). The habits of these beetles still require further study, but the insect is to be found in the larval and pupal forms in January of the year, the beetle probably issuing sometime during the rainy months.

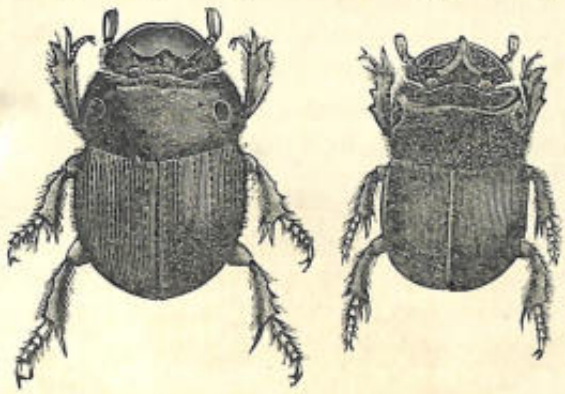


FIG. 102.—Catharsius molossus (Burma). ♂ *left*; ♀ *right*.

*Onthophagus igneus* (Plate III., Fig. 2) is a beautiful little Coprid, with a golden coppery head and thorax and deep blue elytra, found in Southern India. *Catharsius molossus*, Linn, of which the ♂ and ♀ are shown in Fig. 102 is a common Burman coprid beetle. *Leucophilis crassa* is a brown beetle covered with a yellow pulverescence and is to be found round Darjiling. It is depicted in Plate III., Fig. 3.

The MELOLONTHIDÆ are probably as numerous as the Coprides or nearly so as over 4,000 species are known and it is practically certain that there remain many small Indian species to be described. The beetles though varying in size are more or less squarish in build, of some shade of black grey, brown or dull green ; the elytra always leave exposed two segments of the body (pygidium) behind, which is not the invariable rule amongst the Cetoniides, the last abdominal segment being often more or less pointed. The male can be recognised from the female beetle by the

* *Heliocopris mouhoutus* and *dominus* by D. Sharp, Fasciculi Malayensis, Zoology, Part II. N. Annandale and H. C. Robinson, University Press, Liverpool.

larger plates (lamellæ) on the antennæ. The grubs are straight when young but curve and end in the thick bag as shown in Fig. 89*a* as they grow older. All the Indian ones at present known feed upon the roots of plants and trees and are probably a source of considerable loss throughout India every year to ryot, planter and forester alike. The larval life often extends over several years, the time being spent by the grubs, except during the winter months when they retire deep into the earth and more or less hibernate, in feeding voraciously and growing in size. The pupal stage is short but the beetles may remain a considerable time in the ground after leaving the pupa before emerging. This is to allow of all the outer chitinous parts hardening.

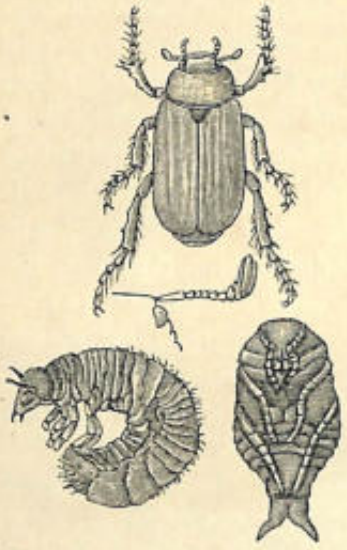


FIG. 103.—Lachnosterna impressa. Larva, pupa, beetle and antenna (*latter enlarged*).

The Indian Museum collections contain some 150 odd Indian species of this group, but it is exceedingly improbable that this number represents anything like the number of species existing on the Indian Continent.

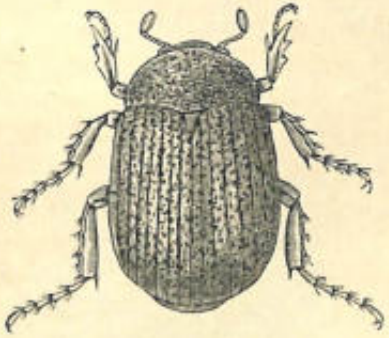
The Melolonthini include one of the best known and most destructive of the insects of this group, the *Lachnosterna impressa* or Indian Cockchafer *par excellence*, a thickish brown beetle of which the larva, pupa and beetle are shown in natural size in Fig. 103. The larvæ of this beetle live in the ground and feed upon roots of all kinds so far as present observations have shown. It moults its skin at intervals until it reaches full size, but never comes to the surface. The time spent in this stage is at present unknown, but it probably exceeds a year and may be several.* The larva is the well-known 'white grub' of Planters in whose nurseries it has long been known to commit considerable havoc amongst the young plants. As an illustration of the damage this insect is capable of it may be mentioned that in 1891 it appeared in vast quantities in some of the Darjiling tea gardens and committed great havoc amongst the young tea plants. In 1883 it did great damage to

* The European species *Melolontha vulgaris* spends more than 3 years in the grub stage whilst the American species *Macrodactylus subspinosus* spends the greater part of a year as a grub.

the public gardens at Darjiling where some 2,695,000 individuals were destroyed. *Lachnosterna serrata* is common in Sikkim. It has red brown elytra and is shown in Plate III., Fig. 4. A larger species, as apparent from its grub, is common in the Himalayan Deodar forests where it is a

FIG. 104.—Serica assamensis (Assam Duars). *a*. beetle on tea leaf, natural size, *b*. beetle enlarged. (× 4).

serious pest of young Deodar seedlings and plants. Amongst other Melolonthidæ species of Serica, Adoretus, Anomala and Holotrichia may be mentioned as noxious pests.



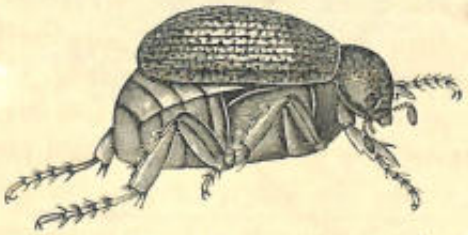


FIG. 105.—Serica calcuttæ (Calcutta). (× 4).

FIG. 106.—Serica alcocki (Dehra Dun). (× 2).

*Serica assamensis*, a small brown beetle, was sent from a Duar's tea garden to the Indian Museum in 1899. It commits the most serious havoc in tea gardens eating up both leaves and the new

stalks of the year. It was found to be an undescribed species. Fig. 104 shows this insect (enlarged) and a tea leaf with beetles *in situ*. *Serica calcuttæ* (Fig. 105) feeds upon rose leaves in Calcutta and *Serica alcocki* (Fig. 106) defoliates *Mallotus philippinensis* in the Dun forests of the Dehra Dun District (N. W. India).

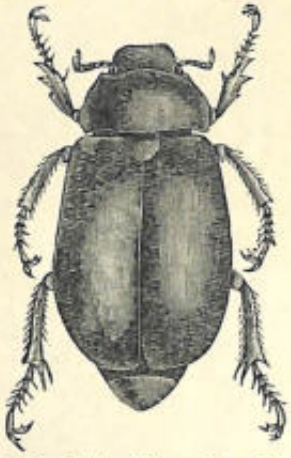


FIG. 107.—Lepidiota bimaculata (Assam).

FIG. 108.—Cyphochilus candidus (Sikkim).

*Lepidiota bimaculata* (Fig. 107) is a large beetle with a green thorax and brown elytra, from Assam, whilst *Cyphochilus candidus* is a large silvery-white chafer common in Sikkim (Fig. 108).

Both *Adoretus bangalorensis* and *A. caliginosus* feed upon rose bushes in South India (Bangalore), the latter species being widely spread throughout India.

Figs. 109 and 110 show enlarged dorsal and side views of these

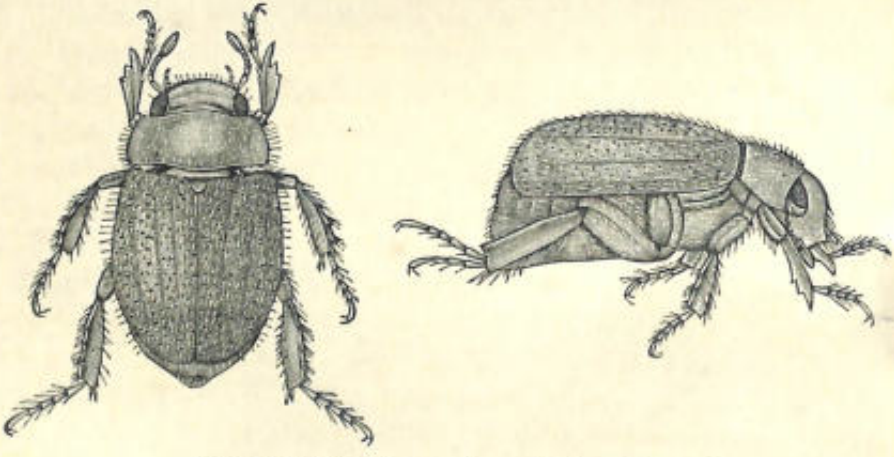
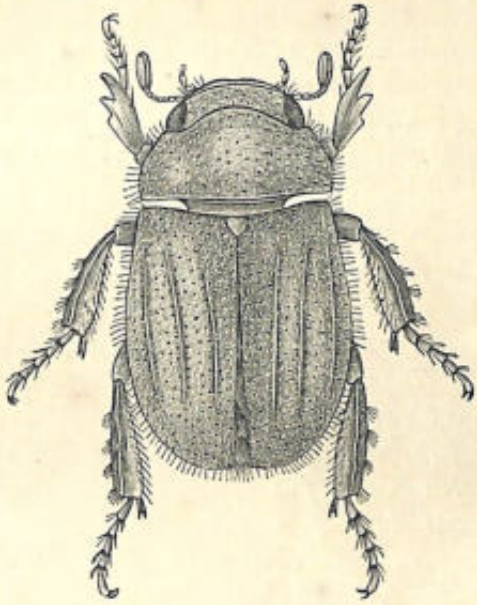


FIG. 109.—Adoretus bangalorensis (Bangalore). (× 4).



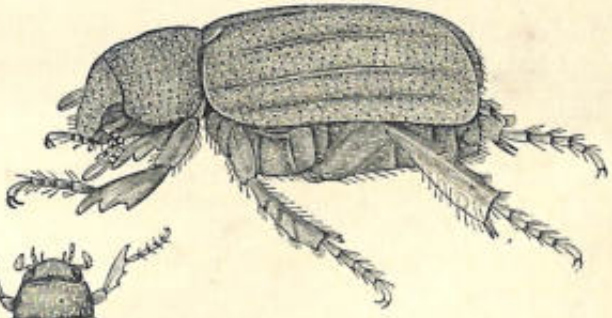


FIG. 110.—Adoretus caliginosus (India). (×4).

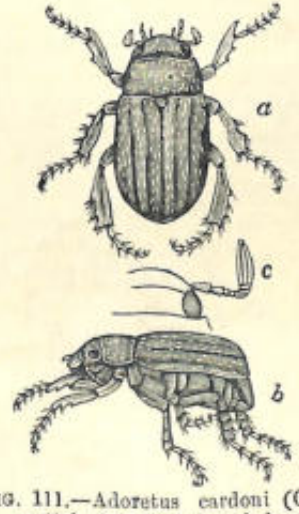



FIG. 111.—Adoretus cardoni (Calcutta). ( × 2) *a*. dorsal, *b*. side view, *c*. much enlarged antenna.

beetles. *Adoretus cardoni* is another chafer which feeds upon rose leaves in Calcutta; it also attacks Cannas as well. A side and back view are shown in Fig. 111.

*Euchirus macleaii* is a large insect belonging to the group Euchirini which has enormously prolonged anterior legs. It is an inhabitant of the N. E. Himalayas and is shown in Plate III., Fig. 5.

The next group to be considered are the Rutelini, a division containing a number of pests. In June 1899 the Superintendent of the Victoria Gardens, Bombay, noted that both the larvæ and imagines of a beetle, subsequently identified as *Anomala dorsalis*, were doing much damage to the lilies in the garden. "They attack one particular kind of *Crinum* only, *viz.*, *C. latifolium*. They come flying in large numbers late in the evening and devour all the flowers most greedily, so that in the morning there is not a single open flower left on any of the plants. The larvæ are found eating the leaves, etc., of Eucharis lilies and tuberoses." The attack was reported again the following year. The beetle responsible is shown enlarged in Fig. 112. A variety of this beetle was named by Brenske *A. dorsalis var. fusca*. *Anomala viridis* is a largish bright green shining chafer reported as stripping leaves off Alder (*Alnus nepalensis*) trees in June between 5,000-6,000 feet elevation in the Darjiling Himalayas. Fig. 113 shows *Holotrichia imitatrix*, a blackish chafer from Sikkim and Fig. 114 *H. andamana*, a shining yellowish brown Melolonthid from the Andamans.

FIG. 112.—Anomala dorsalis (Bombay). ( × 2 ).

*Mimela lewi* is a shining irridescent brilliant metallic green beetle with

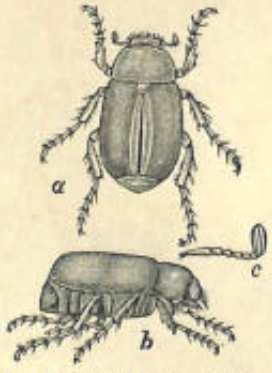



FIG. 113.—Holotrichia imitatrix (Sikkim). *a*. dorsal, *b*. side view, *c*. enlarged antenna.

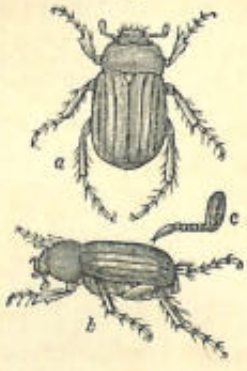



FIG. 114.—Holotrichia andamana (Andaman Islands). *a*. dorsal, *b*. side view, *c*. enlarged antenna.

coppery stripes and reflexions. It is to be found throughout India (Plate III., Fig. 6). Another brilliantly coloured Rutelid to be found in the N.-E. Himalaya is *Popilea cupricollis*, a beetle with coppery shining elytra and dull coppery thorax. It is shown in Plate III., Fig. 7. The above few notes will demonstrate how widely spread are the Melolonthids over the great Continent and the importance, from an economic point of view, of their study being carried out.

The DYNASTIDES include the largest of the beetles of this family although numerically the group is the smallest, containing only about 1,000 odd species. The insects themselves are large bulky creatures, the males often having enormous projections and horns on their heads and pro-thoraces, the use of which is at present but little understood. It is concluded that in some way they are defensive and offensive structures used by the males in battling for the females but there is little authentic proof for this rather obvious supposition. The fact that the males are much larger than the females and that the armature is usually confined to them seems to suggest that some sexual reason exists for the peculiar projections. They possess powers of stridulation, these existing on the dorsal surface of the abdominal segments immediately below the end of the wing cases which rub against them to produce the sound. Members of this subfamily are common in India. Amongst the most important, from the position it occupies as a ruinous pest in parts of the country, is the well-known rhinoceros or date palm beetle

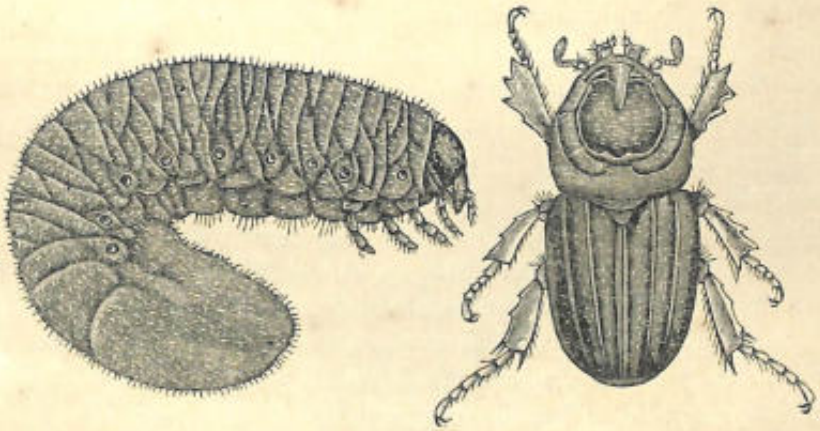
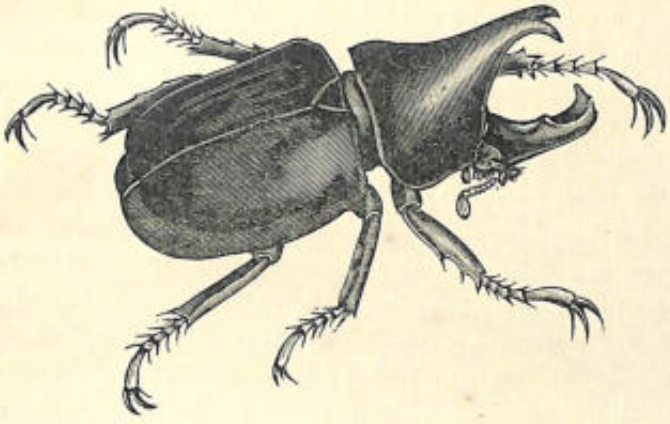


FIG. 115.—Oryctes rhinoceros (Bombay and South India). Larva and beetle.

(*Oryctes rhinoceros*) of which the larva and beetle are shown in Fig. 115. The grub is about 4 inches in length, large, stout, yellowish white with

a brownish head, powerful jaws, 3 pairs of legs on the thoracic segments and its posterior segments are curved round. The beetle is black, shining, massive and large with a prominent horn, which curves backwards, on its head. It is from this horn that it gets its name of rhinoceros beetle. The wing cases are very convex above. There is a large roughly heart-shaped depression on the front of the thorax behind the head which, with the horn on its head, its general form and spined front tibiæ, render the beetles easily recognisable and it is as well that this should be so, for it is, as already stated, a ruinous pest. The insect inhabits more especially the southern half of the Continent, being chiefly confined to the areas in which the date palm, cocoanut, palmyra, &c., trees flourish. It has been reported as plentiful in the Konkan, Kanara, Salem, Kistna and Godavery Districts and is also abundant in Calcutta and lower Eastern Bengal. The palms above mentioned suffer severely from this pest. The beetle seeks out the crown of the tree at night and settles on the growing shoot and bores down into this, thus eating through the folded young leaves so that when these expand they are seen to be full of holes and to have a ragged appearance. In bad attacks the leaf area is thus greatly reduced. It burrows down through the heart of the cabbage, boring out a large tunnel in its operations and ejecting from it a quantity of the fibre which remains protruding from the entrance hole and is a certain sign of the tree being infested. If several beetles attack the growing shoot the tree is sure to die. The beetle lays eggs in dying or dead trees or in any adjacent refuse heaps. The grubs on hatching out feed in these. It will be seen that it is therefore absolutely essential that plantations should be kept clean of all refuse and that all dead and dying trees should be cut out and burnt. The grubs probably take more than a year to reach full size. The pupal or tchrysalis stage is probably a short one and the insect does not feed in his condition. The beetle is a clumsy lazy insect walking slowly and rarely flying in the day time. It has a strong flight at night. It can exist for several weeks without food of any kind. The insects prefer for their operations dirty uncleaned plantations. *Eupatorus cantori*, of which the ♂ and ♀ are shown in Plate III., Fig. 2, is a large shining black beetle with redbrown outer margins to the elytra. It is an inhabitant of Assam. *Chalcosoma atlas* is another large Dynastid beetle common in India. It is dark green in colour with long horns. *Xylotrupes gideon*, also from Assam, is shining black and the male

insect is armed with long horns on the head and thorax as shown in Fig. 116 whilst the female is dull brownish black in colour and is hornless.



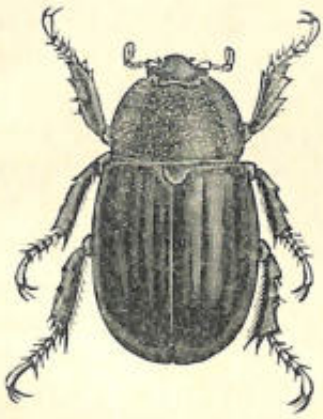


FIG. 116—Xylotrupes gideon (Assam).

The CETONIIDES, the last subfamily of the Scarabæidæ, are well known owing to the great beauty of their colouration, they being the most highly coloured family. They are known to most under the name of rose chafers or rose beetles, being commonly found feeding upon and destroying the petals of roses. Some 1,600 odd species of this group are known. They are particularly addicted to warm regions, although a large number of species are found in the Old World. The beetles are usually to be found active in brilliant sunlight. The method of flight is peculiar in this subfamily; the elytra do not extend down the sides of the body, so that, if they are elevated a little, the wings can be protruded; in other words the elytra are lifted as one piece. This is the mode of flight of most Cetonids.

In India the subfamily is represented by numerous species. *Cetonia maculata* is a bronzy brown beetle (Fig. 117) with white patches on the sides of the thorax, elytra and base of head. It is a common beetle in India. *Rhomborrhina ruckeri* is the Cetonid shown in Plate III., Fig. 8. It is an inhabitant of the Himalayas. *Dicranocephalus wal-*

FIG. 117—Cetonia maculata (India).

*lichii* (Plate III., Fig. 9) is another N. E. Himalaya species. It is a greenish beetle of considerable size with peculiarly curled elongate mandibles and long legs, the anterior ones being especially lengthy. *Macronota penicillata* found in Assam (Fig. 118) is a Cetonid with a curiously ridged triangular yellow thorax and brown shining elytra with yellow spots and yellow apices. Fig. 10, in Pl. III., reproduces the large shining green Cetonid beetle *Agestrata orichalcea* of Burma. In Assam another very common shining green beetle of this group is *Heterorrhina hookeri* (Fig. 119). This beetle is to be found very plentifully in the forests at the foot of the Bhutan Hills in the neighbourhood of the Sunkos and Reidak river and is probably distributed for a considerable distance both to the east and west of these rivers. It is most commonly found upon the Khair (*Acacia catechu*) trees which are at times completely defoliated. A common shining blackish-brown Cetonid of Bengal is *Lomaptera puella* (Fig. 120). Another very common rose chafer beetle to be found throughout India is *Glycyphana versicolor* (Fig. 121), a small reddish-coppery Cetonid with green margins to the thorax, elytra and also along the suture of the elytra, the upper surface of the insect being covered with small white spots, especially numerous on the elytra. This insect is common in Dehra Dun throughout July and August when it feeds upon the petals of the rose bushes.

FIG. 118.—Macronata penicillata (Assam).

FIG. 119—Heterorrhina hookeri (Bhutan Duars).

FIG. 121—Glycyphana versicolor (India).

FIG. 120—Lomaptera puella (Bengal).

(*To be continued.*)

# THE MOTHS OF INDIA.

## SUPPLEMENTARY PAPER TO THE VOLUMES IN "THE FAUNA OF BRITISH INDIA."

## SERIES III, PART III.

By

Sir George Hampson, Bart., F.Z.S., F.E.S.

(*Continued from page* 183 *of this Volume.*)

Sub-family Hadeninæ.

Genus Monima.

| | *Type.* |
|---|---|
| *Monima*, Hübn. Verz., p. 229 (1827) ..... | *miniosa.* |
| *Cuphanoa*, Hübn. Verz., p. 229 (1827) ..... | *stabilis.* |
| *Semiophora*, Steph. Ill. Brit. Ent. Haust., II., p. 188 (1829). | *gothica.* |
| *Tæniocampa*, Guen. Ann. Soc. Ent. Fr. VIII., p. 477 (1839). | *gothica.* |
| *Graphiphora* Hübn. Tent. ined. (nec Ochs.) ..... ..... | *gothica.* |

Proboscis fully developed; palpi porrect, the 2nd joint fringed with long hair in front, the 3rd moderate; frons smooth, with corneous plate below it: eyes large, rounded; head and thorax clothed with hair only, the vertex of head and tegulæ with rather ridge-like crests, the pro- and metathorax with loose crests; pectus and legs hairy; abdomen with lateral fringes of hair and without dorsal crests. Forewing with veins 3 and 5 from near angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hindwing with veins 3-4 from angle of cell; 5 obsolescent from middle of discocellulars; 6-7 stalked; 8 anastomosing with the cell near base only.

Sect. I. Antennæ of male bipectinate with long branches to near apex, of female with short branches.

1705. *a.* Monima eriza, Swinh. A. M. N. H. (7) VII., p. 494 (1901).

♀. Grey-brown with slight rufous tinge. Forewing with the orbicular represented by an oblique black bar, the reniform by a V-shaped mark; the subterminal line broken up into black points, slightly sinuous and incurved in discal fold; some dark points on termen. Hindwing rather paler; the underside whitish irrorated with brown and with dark discoidal point.

*Habitat.*—Kulu. *Exp.* 44 mill.

Sect. II. Antennæ of male bipectinate with rather long branches, the apex serrate, of female serrate.

A. Forewing with blackish or red-brown patch between orbicular and reniform.

*a.* Forewing with dentate black marks before middle of subterminal line ..... *fasciculata.*

*b.* Forewing without dentate black marks before middle of subterminal line ..... *castaneipennis.*

B. Forewing without black or brown patch between orbicular and reniform..... *ferrosticta.*

1701. MONIMA FASCICULATA.
1706. MONIMA CASTANEIPENNIS.
1705. MONIMA FERROSTICTA.

Sect. III. Antennæ of male strongly serrate and fasciculate.

A. Forewing with the subterminal line angled inwards in discal fold ..... *nigrorenalis.*

B. Forewing with the subterminal line not angled inwards in discal fold.

*a* Forewing with more or less prominent small dentate black or brown marks before subterminal line... ... *incerta.*

*b*. Forewing without small dentate marks before subterminal line ..... *cinnamomea.*

1920. MONIMA NIGRORENALIS.

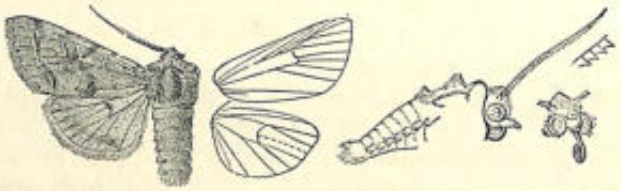


Fig. 114.—*Monima incerta*, ♂. ½.

1706. *a*. MONIMA INCERTA, Hüfn. Berl. Mag., III., p. 298 (1767); Staud. Cat. Lep. pal., p. 201.

*Noctua instabilis*, Schiff. Wien. Verz., p. 76 (1776); Esp. Schmett. IV., pl. 151, f. 3; Hübn. Eur. Schmett. Noct., f. 65; Dup. Lep. Fr., VI., pl. 81, f. 3; Steph. Ill. Brit. Ent. Haust., II., p. 140.

" *trigutta*, Esp. Schmett., IV., pl. 147, f. 4 (1790).

" *contracta*, Esp. Schmett, IV., pl. 151, f. 2 (1790).

" *collinita*, Esp. Schmett., IV., pl. 152, f. 6 (1790).

*Bombyx nebulosus*, Haw. Lep. Brit., p. 120 (1803).

" *subsetaceus*, Haw. Lep. Brit., p. 120 (1803).

" *fuscatus*, Haw. Lep. Brit., p. 122 (1803).

" *angustus*, Haw. Lep. Brit., p. 112 (1803).

*Tæniocampa evanida*, Butl. A. M. N. H. (5), IV., p. 362 (1879).

" *pallida*, Lampa. Tidskr., 1885, p. 72.

" *pallida*, Staud. Stett. Ent. Zeit., 1888, p. 32.

" *pallidior*, Staud. Cat. Lep. pal., p. 201 (1901).

Head and thorax rufous more or less strongly mixed with grey; palpi black at sides; abdomen grey irrorated with brown, the anal tuft and ventral surface tinged with rufous. Forewing grey, thickly irrorated and striated with brown and more or less strongly suffused with rufous; an indistinct subbasal line from costa to submedian fold, followed by a dark point in cell; antemedial line indistinct, slightly sinuous; orbicular and reniform large, with whitish annuli, the former oblique elliptical, the latter with its lower

part filled in with fuscous ; an ill-defined medial shade, oblique from costa to lower angle of cell, then incurved ; postmedial line indistinct, dentate or reduced to a series of minute dark striæ on the veins, excurved from costa to vein 4, then incurved ; subterminal line whitish defined by brown on inner side, forming somewhat dentate marks at middle, angled outwards at vein 7, and slightly excurved at middle ; a terminal series of black points. Hindwing whitish, suffused and irrorated with fuscous brown especially on terminal area ; the underside whitish irrorated with brown, a black discoidal spot and postmedial series of points on the veins.

Ab. 1 *fuscata*. Forewing almost uniform fuscous.

Ab. 2 *pallida*. Forewing paler and greyer.

Ab. 3 *pallidior*. Much paler, forewing grey-white ; hindwing whitish.

Ab. 4 *evanida*. Like *pallidior* but larger, the subterminal line strongly defined by rufous.

*Habitat*.—EUROPE ; W. ASIA ; W. SIBERIA ; W. TURKISTAN ; E. SIBERIA ; JAPAN ; PUNJAB, Simla. *Exp*. 40-50 mill.

*Larva*, Meyr. Brit. Lep., p. 72 ; Barrett. Lep. Brit. V., p. 213, pl. 211 and 212, f. 1.

Green with numerous yellowish or whitish dots ; dorsal and spiracular lines pale yellow or whitish; subdorsal line formed of pale dots ; head green. Food plants : Oak, poplar, hawthorn, etc. 5-7.

1919. MONIMA CINNAMOMEA.

Genus PALPONIMA.

*Type*.

*Palponima*, Hmpsn. Cat. Lep. Phal. B. M., V., p. 432 (1905). *orthosioides*.

Proboscis fully developed ; palpi obliquely porrect, the 2nd joint extending about the length of head and fringed with long hair below, the 3rd joint long and dilated at extremity ; frons with roughened truncate conical prominence ; eyes large, rounded ; antennæ of male bipectinate with long branches to apex, of female ciliated ; head and thorax clothed with hair only, the latter with triangular ridge-like dorsal crest ; tibiæ moderately hairy ; abdomen with dorsal crest on 1st segment only. Forewing narrow, the apex rectangular, the termen nearly straight to vein 3, then oblique ; veins 3 and 5 from near angle of cell ; 6 from upper angle ; 9 from 10 anastomosing with 8 to form the areole ; 11 from cell. Hindwing with veins 3, 4 from angle of cell ; 5 obsolescent from middle of discocellulars ; 6-7 from upper angle ; 8 anastomosing with the cell near base only.

1704. PALPONIMA ORTHOSIOIDES.

Genus SIDERIDIS.

| | *Type*. |
|---|---|
| *Sideridis*, Hübn. Verz., p. 232 (1827) ..... | *evidens*. |
| *Aletia*, Hübn. Verz., p. 239 (1827) ..... | *vitellina* |
| *Hyphilare*, Hübn. Verz., p. 239 (1827) ..... | *albipuncta*. |
| *Crocigrapha*, Grote, Can. Ent. VII., p. 57 (1875)..... | *normani*. |

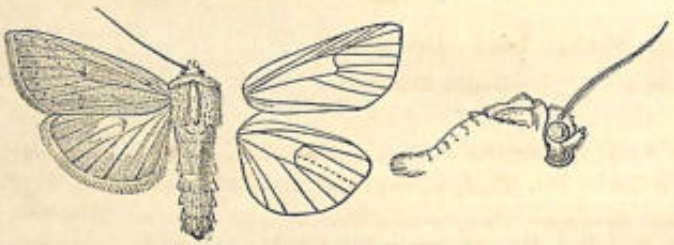
Proboscis fully developed ; palpi short, obliquely upturned, the 2nd joint fringed with long hair in front, the 3rd minute ; frons smooth ; eyes large, rounded ; antennæ of male typically minutely ciliated ; head and thorax clothed with hair only, except a few scales on upper edge of patagia ; the prothorax with spreading crest ; tibiæ fringed with hair ; abdomen with dorsal crest on 1st segment only. Forewing with the apex rectangular, the termen oblique towards tornus ; veins 3 and 5 from near angle of cell ; 6 from upper angle ; 9 from 10 anastomosing with 8 to form the areole ; 11 from cell. Hindwing with veins 3·4 from angle of cell ; 5 obsolescent from just below angle of discocellulars ; 6·7 from upper angle ; 8 anastomosing with the cell near base only.

A. Forewing yellow slightly suffused with rufous ..... *vitellina.*

B. Forewing white with a violaceous tinge ..... *eximia.*

1937.*a*. SIDERIDIS VITELLINA, Hübn. Eur. Schmett. Noct. ff. 379-589 (1827) ; Dup. Lep. Fr. VII., p. 475, pl. 130, f. 4 ; Staud. Cat. Lep. pal., p. 193.

Head, thorax and abdomen yellow tinged with rufous. Forewing yellow irrorated with rufous ; indistinct oblique rufous streaks above and below vein 1 before the antemedial line, which is dentate, oblique from costa to submedian fold, then angled inwards on vein 1 ; orbicular a small rufous spot ; reniform a rufous lunule ; postmedial line somewhat dentate and with minute dark streaks on the veins, slightly incurved to costa and in discal fold, oblique below vein 4 ; subterminal line minutely waved, angled outwards at vein 7 and slightly excurved at middle. Hindwing semi-hyaline white, the veins and terminal area tinged with ochreous ; the underside with the costal area slightly irrorated with rufous.



*Sideridis vitellina*, ♂ 1.

*Habitat.*—EUROPE ; ALGIERS ; CANARIES ; SYRIA ; W. TURKISTAN ; KASHMIR, Scind Valley, Nubra, Rala, Narkundah ; PUNJAB, Kulu, Sultanpur. *Exp.* 40-44 mill.

*Larva*, Meyr. Brit. Lep., p. 69 ; Barrett. Lep. Brit. V., p. 168, pl. 204, f. 3.

Pale reddish brown ; dorsal, subdorsal, and lateral whitish lines edged with brown ; spiracular line pale ; head reddish brown reticulated with black. Food plants : Grasses. 10·5.

1937. *b*. SIDERIDIS EXIMIA, Staud. Iris. VIII., p. 319, pl. 6, f. 7 (1895) ; id. Cat. Lep. pal. p. 161.

♂. Head and thorax white with some brown hair ; palpi pale red-brown ; frons with brown bar above ; tegulæ with diffused brown medial line ; abdomen pale yellow-brown mixed with grey. Forewing white, with a slight violaceous tinge and irrorated with brown ; subbasal line represented by

a black striga from costa and a curved black mark below the cell, retracted to base and followed by a prominent triangular spot; antemedial line double, the outer strong, curved and slightly waved, with slight brown shading on inner side and more prominent shading on outer; claviform brown with its extremity defined by black; orbicular and reniform large, white with brown centres and defined by brown, the former oblique elliptical; medial line oblique from costa to below cell, then dentate and inwardly oblique, the area between it and postmedial line suffused with brown; postmedial line double, very slightly waved, bent outwards below costa, excurved to vein 4, then very oblique, the area beyond it tinged with brown to the subterminal line which has minute dentate black marks before it below costa and at middle, is excurved between veins 7 and 2, and defined by white on outer side; cilia pale brown. Hindwing pale suffused with fuscous especially towards termen and with an ochreous tinge at base; cilia pale brown, white at tips; the underside pale, thickly irrorated with brown, a slight discoidal lunule, curved postmedial line, and traces of subterminal band.

*Habitat.*—TIBET: PUNJAB, Kulu. *Exp.* 34 mill.

Genus BRITHYS.

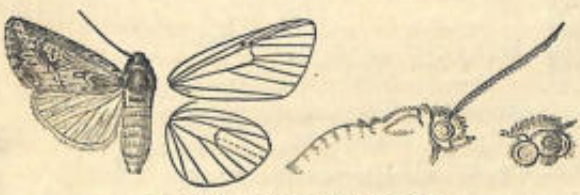
| | *Type.* |
|---|---|
| *Brithys*, Hübn. Verz., p. 226 (1827) ..... ..... ..... | *encausta.* |
| *Cocytia*, Treit. Schmett. Eur. X., ii. p. 29 (1834), nec. Boisd. Lep. 1829..... ..... ..... ..... | *pancratii.* |
| *Glottula*, Guen. Ann. Soc. Ent. Tr. VI. p. 359 (1837) ..... | *pancratii.* |

1586. BRITHYS CRINI, Fabr. Syst. Ent., p. 587 (1775), has precedence over *dominica*, Cram.

Genus ASPIDIFRONTIA.

| | *Type.* |
|---|---|
| *Aspidifrontia*, Hmpsn. Ann. S. Afr. Mus. II., p. 269 (1902) ..... | *semipallida.* |

Proboscis weak; palpi short, oblique, fringed with hair in front; frons with large disk-shaped corneous prominence with raised rim and truncate conical centre; eyes large, round; antennæ of male ciliated; head and thorax clothed with hair and hair-like scales with some scales mixed, without distinct crests; abdomen with dorsal crest at base. Forewing with veins 3 and 5 from near angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hindwing with veins 3·4 from angle of cell; 5 obsolescent from middle of discocellulars; 6·7 from upper angle; 8 anastomosing with the cell near base only.



*Aspidifrontia axylides.* ♂ 1

1679. *b.* ASPIDIFRONTIA AXYLIDES.

Genus POLYTELA.

| | Type. |
|---|---|
| A. Forewing pale pink ..... | *orientalis.* |
| B. Forewing blue black. | |
| *a.* Forewing with apical yellow patch. | |
| $a^1$. Hindwing with the cilia yellow..... | *gloriosa.* |
| $b^1$. Hindwing with the cilia black ..... | *florigera.* |
| *b.* Forewing without apical yellow patch ..... | *chrysospila.* |

1587. POLYTELA ORIENTALIS.

The species is found at Aden, and the locality Nilgris is probably an error.

1588. POLYTELA GLORIOSÆ.

1589. POLYTELA FLORIGERA.

5090. POLYTELA CHRYSOSPILA.

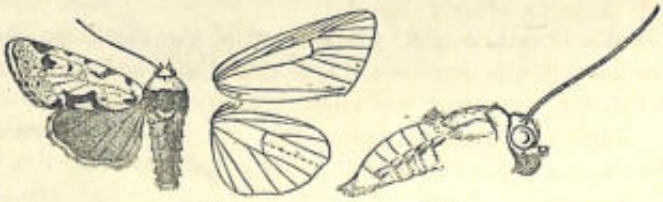
Genus CERAPTERYX. *Type.*

*Cerapteryx*, Cur. Brit. Ent., V., p. 451 (1833)..... *graminis.*

Proboscis fully developed ; palpi short, oblique, the 2nd joint fringed with hair in front ; frons smooth ; antennæ of male bipectinate with moderate branches to apex ; head and thorax clothed with hair only and without distinct crests ; abdomen with dorsal crest on basal segment and lateral tufts of hair. Forewing short, the apex truncate, the termen obliquely curved ; veins 3 and 5 from near angle of cell ; 6 from upper angle ; 9 from 10 anastomosing with 8 to form the areole ; 11 from cell. Hindwing with veins 3·4 from angle of cell ; 5 obsolescent from middle of discocellulars ; 6·7 from upper angle ; 8 anastomosing with the cell near base only.

1699. CERAPTERYX ALBICEPS.

The unique type is a female.



*Cerapteryx albiceps.* ♀ ♀.

Genus DASYGASTER. *Type.*

*Dasygaster*, Guen. Noct. I, p. 201 (1852) ..... *hollandiæ.*

Proboscis fully developed ; palpi oblique, fringed with hair in front, the 3rd joint porrect ; frons with small rounded prominence with corneous plate below it ; eyes large ; rounded ; antennæ of male typically with bristles and cilia ; head and thorax clothed with hair and hair-like scales, the pro- and metathorax with spreading crests ; pectus and abdomen clothed with long hair, the latter with dorsal crests at base and lateral fringes of hair, long in male. Forewing rather short and broad, the apex rectangular ; veins 3 and 5 from near angle of cell ; 6 from upper angle ; 9 from 10 anastomosing with 8 to form the areole ;

11 from cell. Hindwing with veins 3·4 from angle of cell; 5 obsolescent from middle of discocellulars; 6·7 from upper angle; 8 anastomosing with the cell near base only.

Sect. III. Antennæ of male with cilia and bristles; claspers very elongate. hindwing with the termen strongly excised from apex to vein 4.

1924. DASYGASTER REVERSA.

*Habitat*,—NILGRIS; CEYLON; NEW GUINEA; QUEENSLAND.

*Dasygaster reversa*. ♂ ½.

Genus CIRPHIS.

*Type.*

*Cirphis*, Wlk., XXXII, 622 (1865) ..... ..... *costalis*.

Proboscis fully developed; palpi obliquely upturned, the 2nd joint fringed with hair in front, the 3rd short, porrect; frons smooth; eyes large, rounded; head and thorax clothed with hair and scales mixed, the pro- and metathorax with spreading crests; tibiæ fringed with rather long hair, abdomen with dorsal crest on basal segment. Forewing with the apex somewhat acute, the termen obliquely curved, veins 3 and 5 from near angle of cell; 6 from upper angle; 9 from 10 anastomising with 8 to form the areole; 11 from cell. Hindwing with veins 3-4 from angle of cell; 5 obsolescent from middle of discocellulars; 6-7 from upper angle; 8 anastomosing with the cell near base only.

Sect. II. Antennæ of male ciliated.

A. Mid tibiæ of male with thick fringes of long hair and scales on underside.

*a*. Fore coxæ, femora, and tibiæ of male with thick fringes of hair and scales.

*a*¹ Forewing with black spot above median nervure towards end of cell ..... ..... *fasciata*.

*b*¹ Forewing without black spot above median nervure towards end of cell ..... ..... *nainica*.

1934. CIRPHIS FASCIATA, Moore, P. Z. S. 1881, p. 341; id. Lep. Ceyl., III, p 7, pl. 144, f. 6.

*Leucania nigrilinea*, Leech, P. Z. S. 1889, p. 482, pl. 50, f. 8.

1908. CIRPHIS NAINICA, Moore, P. Z. S. 1881, p. 337, pl. 37, f. 15.

*Leucania griseofasciata*, Moore, P. Z. S. 1881, p. 339.

„ *irrorata*, Moore, P. Z. S. 1888, p. 409.

*b*. Mid femora of male with a fringe of long hair and scales.

1934. *a*. CIRPHIS INSULARIS, Butl, P. Z. S. 1880, p. 674; Hmpsn Cat. Lep Phal. B. M. V., p. 486, pl. 91, f. 22.

*Axylia irrorata*, Moore, P. Z. S. 1881, p. 341.

„ *albivena*, Moore, P. Z. S. 1881, p. 342.

Head, thorax and abdomen ochreous ; sides of palpi and frons black, tegulæ with black medial line and black and grey tips ; patagia with some black scales on upper edge, metathoracic crest black, legs striated with blackish. Forewing ochreous slightly irrorated with black, a slight black streak in base of submedian fold; median nervure and base of vein 4 more or less prominently white, with a slight diffused black fascia above and below median nervure, then from lower angle of cell oblique to termen at vein 6 ; antemedial line sometimes represented by black marks above and below median nervure, orbicular and reniform represented by black points or small spots in cell above origin of vein 2 and at lower angle ; traces of a highly dentate postmedial line with two series of black points on it, the inner in the interspaces, the outer on the veins, oblique below vein 4, sometimes quite obsolete ; a terminal series of black points, usually prominent ; cilia intersected with fuscous. Hindwing white tinged with ochreous, the terminal area with brown ; a terminal series of black points ; the underside with the costal area slightly irrorated with fuscous.

*Habitat.*—Formosa ; Punjab, Kulu, Sultanpur, Kangra Valley, Simla ; Madras ; S. E. Borneo. *Exp.* 28-36 mill.

B. Mid tibiæ of male normal.

*a*. Coxæ of male with fringes of scales and hair ; abdomen with paired sublateral fans of large scales, the anal tuft large.

1911. Cirphis loreyi, insert (syns).
*Noctua caricis*, Treit. Schmett, Eur. X., 2, p. 91 (1835).
*Leucania curvula*, Wlk., IX, 102 (1856).
and del. *Leucania tenebrifera* and *Leucania albistigma*.

*b*. Legs of male normal.

$a^1$. Abdomen of male with paired ventral tufts of long hair from base.

$a^2$. Underside of wings of male clothed with silvery scales.

$a^3$. Hindwing of male on underside with the extremity of veins 8 to 3 clothed with long downturned hair.

1890. *a*. Cirphis laniata.

$b^3$. Hindwing of male on underside without downturned hair on veins 8 to 3.

$a^4$. Forewing with dark streaks in interspaces of terminal area.

$a^5$. Forewing with the costal area paler than ground colour.

$a^6$. Forewing with black streak below base of cell..... *inframicans*.

$b^6$. Forewing with rufous streak below base of cell..... *hamifera*.

$b^6$. Forewing with the costal area concolorous..... *decisissima.*

$b^4$. Forewing without dark streaks in interspaces of terminal area..

$a^5$. Forewing with yellow spot with black point on it at lower angle of cell..... *subsignata.*

$b^5$. Forewing with minute white point at lower angle of cell ..... *simplex.*

1893. CIRPHIS INFRAMICANS.

1892. CIRPHIS HAMIFERA.

1891. CIRPHIS DECISISSIMA.

1899. CIRPHIS SUBSIGNATA.

1899,*a*. CIRPHIS SIMPLEX, Leech., Trans. Ent. Soc. 1899, p. 130; Hmpsn. Cat. Lep. Phal. B. M., V., p. 503, pl. 92, f. 7.

Head, thorax and abdomen ochreous tinged with rufous, the last with the ventral tufts of male black. Forewing ochreous suffused with rufous and irrorated with a very few black scales; the antemedial line represented by dark points on median nervure and vein 1; a slight pale point at lower angle of cell, and a dark shade beyond the angle connected with a triangular shade from termen below apex; a curved postmedial series of black points on the veins. Hindwing ochreous whitish, suffused with fuscous brown, except on basal, costal and inner areas, underside of male suffused with silvery scales, except costal area of forewing, a black postmedial point on costa of forewing and a terminal series on hindwing; female ochreous white irrorated with brown, some fuscous suffusion on veins of forewing beyond middle.

*Habitat.*—C. CHINA, Chang-Yang, Kiukiang, Ship-y-Shan; ASSAM, Khasias. *Exp.* 32-38 mill.

$b^3$. Underside of wings of male not clothed with silvery scales.

$a^3$. Forewing with dark streaks in the interspaces of terminal area.

$a^4$. Forewing with the white streak on median nervure hooked on discocellulars.

$a^5$. Forewing with oblique pale fascia between veins 5 and 2 beyond the fascia from apex..... 1-*album.*

$b^5$. Forewing without pale fascia between veins 5 and 2 beyond the fascia from apex ... *albivenata.*

$b^4$. Forewing with the white streak on median nervure not hooked on discocellulars.

$a^5$. Forewing with the ground colour purplish pink.

$a^6$. Forewing with pale streak in lower part of cell ..... *rufipennis.*

$b^4$. Forewing without pale streak in lower part of cell ..... *duplicata.*

$b^3$. Forewing with the ground colour greyish.

$a^6$. Forewing with the costal area pale defined by brown below ..... *albicosta.*

$b^6$. Forewing with the costal area concolorous ..... *micacea.*

$b^2$. Forewing without dark streaks in the interspaces of terminal area ..... *flavostigma.*

1895. CIRPHIS 1-ALBUM.

1895. *a.* CIRPHIS ALBIVENATA, Swinh. Trans. Ent. Soc. 1890, p. 217, pl. 7, f. 7.

♂. Head and thorax violaceous grey tinged with red-brown; palpi fuscous; sides of frons with black bar; tegulæ with three brown lines; patagia with a few black scales near upper edge; mid and hind tibiæ and tarsi streaked with black: abdomen grey, dorsally tinged with fuscous, the anal tuft and ventral surface with ochreous, the abdominal tufts grey and fuscous. Forewing purplish grey, the costal and inner areas irrorated with fuscous, the costal edge brown; a black streak on base of median nervure and an oblique streak above inner margin before middle; a brown shade through the cell and thence obliquely to apex, leaving a fine white streak in lower part of cell; the subcostal nervure and veins arising from it, the median nervure and veins 4·3 streaked with white defined by fine dark streaks, the interspaces with fine streaks, more prominent and blackish above veins 4·3·2; an oblique pale fascia from apex to vein 3, the area beyond it rather darker; a terminal series of black points; cilia intersected with white. Hindwing whitish tinged with fuscous, especially on the veins and towards termen; cilia whitish; the underside violaceous white, the costal and terminal areas irrorated with fuscous, a discoidal spot, postmedial series of short streaks on the veins, and terminal series of points.

♀. More tinged with red-brown.

*Habitat.*—SIKKIM; ASSAM, Naga Hills; BHURMA, Bhámo. *Exp.* 32-34 mill.

1918. CIRPHIS RUFIPENNIS.

1926. CIRPHIS DUPLICATA, Butl. Ill. Het. B.M., VII., p. 8 (1889); Hmpsn. Cat. Lep. Phal. B. M., V., p., 506, pl. 92, f. 11.

*Leucania prominens*, Moore, P. Z. S. 1881, p. 339 (nec Wlk.)

„ *rufula*, Hmpsn. Moths Ind., II., p. 278 (1894).

1928. CIRPHIS ALBICOSTA, Moore, P. Z. S., 1881, p. 338, pl. 37, f. 10.

*Leucania nigrilineosa*, Moore, Lep. Atk., p. 103 (1882).

1928. *a.* CIRPHIS MICACEA, Hmpsn. Ill. Het. B. M., VIII., p. 67, pl. 144, f. 8 (1891).

Head and thorax grey-white with a slight purplish tinge; tegulæ with three brown lines; abdomen ochreous white mixed with brown, the ventral tufts of male brownish and fuscous. Forewing whitish with a slight purplish tinge; the veins white defined by fine dark streaks, the interspaces of terminal half also with dark streaks, the median nervure, except towards base, and veins

4·3 more prominently white; an oblique dark streak above inner margin before middle; the antemedial line represented by obliquely placed black points below costa and in submedian fold, and one nearer base on vein 1, the postmedial line by some points bent outwards below costa and oblique below vein 4; an oblique pale fascia from apex to vein 2, the area beyond it rather browner; a terminal series of black points; the cilia intersected with white. Hindwing semihyaline white, the veins and terminal area tinged with brown; the underside with the costal and terminal areas irrorated with fuscous, a postmedial series of slight streaks and terminal series of points.

The Ceylon form has the thorax and forewing more suffused with red-brown, the latter especially in and below cell and thence obliquely to apex.

*Habitat.*—Bombay, Mahableshwar; Madras, Nilgiris; Ceylon, Dichoya. *Exp.* 30 mill.

1928. *b*. Cirphis flavostigma, Brem. Lep. Ost. Sib., p. 52, pl. 5, f. 11 (1864); Staud. Cat. Lep. Pal., p. 193.

*Leucania singularis*, Butl. A. M. N. H. (5), 1 p. 80 (1878); id. Ill. Het. B. M. II., p. 22, pl. 28, f. 11.

Head and thorax pale ochreous tinged with rufous and mixed with fuscous; some black scales near upper edge of patagia; abdomen ochreous dorsally tinged with fuscous, the ventral tufts of male black. Forewing pale ochreous more or less tinged with rufous, especially in, below, and beyond end of cell, and irrorated with black; a black point at base; an antemedial series of black points connected by an obsolescent dentate line, oblique from costa to submedian fold, then angled inwards on vein 1; orbicular and reniform indistinct, yellowish, the latter with black point in lower angle of cell, and whitish streak on extremity of median nervure, some fuscous suffusion above and below extremity of median nervure, thence curved upwards to termen below apex; a postmedial series of black points connected by a crenulate brownish line, bent outwards below costa and oblique below vein 4; traces of a subterminal line excurved at middle and angled inwards at discal and submedian folds; a terminal series of black points. Hindwing ochreous yellow, suffused with fuscous except on costal area; the underside glossy yellowish white, the costal area slightly irrorated with fuscous, a discoidal point, postmedial series of short streaks on the veins, and terminal series of points.

The typical form from the Amur has the ground colour of forewing white, the markings more ferruginous and contrasting, hindwing with more whitish on costal and inner areas.

*Habitat.*—Amurland; Japan; Corea; C. China; Kashmir, Goorais Valley. *Exp.* 36-42 mill.

*b*¹. Abdomen of male normal.

*a*². Forewing of male on underside with fringes of long hair and scales on vein 1.

1933. Cirphis tangala.

*b*². Forewing of male on underside with fringe of hair and scales on vein 1.

$a^3$. Forewing with short whitish streak on extremity of median nervure.

$a^4$. Hindwing almost uniformly suffused with fuscous.

$a^5$. Forewing with dark streaks in the interspaces of terminal area.

$a^6$. Forewing with black point in lower angle of cell.

$a^7$. Forewing not suffused with rufous.. *goniosigma.*

$b^7$. Forewing suffused with rufous ... .. *dharma.*

$b^6$. Forewing without black point in lower angle of cell..... *rufistrigosa.*

$b^5$. Forewing without dark streaks in the interspaces of terminal area ..... *ignita.*

$b^4$. Hindwing whitish tinged with ochreous ... *formosana.*

$b^3$. Forewing with the median nervure finely streaked with white.

$a^4$. Forewing with dark streaks in the interspaces of terminal area.

$a^5$. Forewing with black streak in base of below submedian fold.

$a^6$. Hindwing whitish, the veins and terminal area more or less strongly suffused with brown.

$a^7$. Forewing with short black streaks above veins 3·4·5 ... ... . ..... ..... *comma.*

$b^7$. Forewing without black streaks above veins 3·4·5 ..... *bifasciata.*

$b^6$. Hindwing ochreous white ..... *roseilinea.*

$c^6$. Hindwing pure white ..... ..... .. *polemusa.*

$b^5$. Forewing without black streak in base of submedian fold.

$a^6$. Forewing with distinct blackish shade below median nervure.

$a^7$. Forewing with short dark streak from lower angle of cell to the oblique pale fascia from apex ..... ... ..... *abdominalis.*

$b^7$. Forewing with the dark shade from termen extending to lower angle of cell ..... ..... *lineatipes.*

$b^6$. Forewing without distinct blackish shade below median nervure.

$a^7$. Forewing with the postmedial line reduced to points..... *compta.*

$b^7$. Forewing with the postmedial line waved ..... *megaproctis.*

$b^4$. Forewing without dark streaks in the interspaces of terminal area ... ..... ..... ..... ..... *sinuosa.*

$c^3$. Forewing with white point at lower angle of cell.

$a^4$. Forewing with dark streaks in the interspaces of terminal area... ..... ..... ..... *irregularis.*

$b^4$. Forewing without dark streaks in the interspaces of terminal area.

$a^5$. Forewing with the reniform absent.

$a^6$. Hindwing white, the terminal area more or less suffused with fuscous ..... *albistigma.*

$b^6$. Hindwing nearly uniformly suffused with fuscous ..... .. . ..... ..... ..... *fragilis.*

$b^5$. Forewing with the reniform represented by a pale patch.

$a^6$. Forewing with oblique dark streak from apex..... ..... *unipuncta.*

$b^6$. Forewing without oblique dark streak from apex ..... ..... ..... *corrugata.*

$d^3$. Forewing without white point at lower angle of cell.

$a^4$. Forewing with the orbicular represented by a dark spot.

$a^5$. Forewing with the reniform represented by a dark spot.

$a^6$. Forewing without brown fascia beyond lower angle of cell .. ..... ..... *denticula.*

$b^6$. Forewing with brown fascia beyond lower angle of cell... ..... .. *pastea.*

$b^5$. Forewing with the reniform absent..... *yu.*

$b^4$. Forewing with the orbicular absent or pale.

$a^5$. Hindwing whitish suffused with brown.

$a^6$. Forewing with the reniform represented by a pale patch..... ..... *semiusta.*

$b^6$. Forewing with the reniform absent..... *modesta.*

$b^5$. Hindwing uniform fuscous.

$a^6$. Forewing without rufous streak on median nervure.

$a^7$. Hindwing on underside with fuscous suffusion on inner half of wing..... *metaphœa.*

$b^7$. Hindwing on underside without fuscous suffusion on inner half of wing ..... *hypophœa.*

$b^6$. Forewing with rufous streak on median nervure ..... ..... *rubriseeta.*

1894. *a.* CIRPHIS GONIOSIGMA, Hmpsn. Cat. Lep. Phal. B. M., V., p. 515, pl. 92, f. 14 (1905).

♂. Head and thorax ochreous mixed with reddish brown and black ; tegulæ with black line near tips ; abdomen with large ochreous genital tufts. Forewing pale ochreous ; a reddish and black shade on median nervure and in cell from base to postmedial line, at base extending to vein 1 ; a black point at base of costa ; the antemedial line represented by a black striga from costa, a streak on subcostal nervure, and an obsolescent line towards inner margin, angled inwards on vein 1 ; a prominent white mark on extremity of median nervure ; postmedial line represented by some black points on the veins, bent outwards below costa, then obliquely curved to middle of inner margin, another series of points beyond it arising from the same point at vein 7, angled at vein 4, then oblique, and joined at vein 4 by a brown and black shade from termen below apex ; the terminal area with brownish streaks in the interspaces and white streaks on the veins ; a terminal series of small black lunules ; cilia chequered black and white. Hindwing fuscous, ochreous towards base and inner margin ; the cilia ochreous ; the underside ochreous irrorated with black and suffused near the curved black postmedial line.

*Habitat.*—CEYLON, W. Haputale. *Exp.* 34 mill.

1894. *b.* CIRPHIS DHARMA, Moore. P. Z. S. 1881, p. 338, pl. 37, f. 17 ; Hmpsn. Cat. Lep. Phal. B. M., V., p. 516, pl. 92, f. 15.

Head and thorax ochreous mixed with bright rufous ; sides of palpi and frons tinged with fuscous ; tegulæ with dark lines near base and extremity ; patagia with some black scales near upper edge ; abdomen ochreous dorsally tinged with brown. Forewing ochreous, more or less suffused with rufous except on costal and inner areas, which are irrorated with black ; the veins defined by rufous streaks, and the interspaces streaked with rufous ; a subbasal black point on costa ; the antemedial line represented by black points on costa, below cell, in submedian fold, and on vein 1, oblique from costa to submedian fold ; the median nervure streaked with fuscous, a white streak on its extremity slightly hooked on discocellulars, with a black point before it in lower angle of cell and a small black patch beyond it ; veins 4·3 slightly streaked with white ; traces of a highly crenulate postmedial line produced to a prominent series of black points on the veins, bent outwards below costa, and oblique below vein 4, where it is met by an oblique shade from termen just below apex ; a terminal series of black points. Hindwing ochreous suffused with fuscous except base and costal area ; the cilia ochreous ; the under side ochreous, the costal and terminal areas irrorated with black, a discoidal lunule, indistinct sinuous postmedial line, with series of short streaks on the veins and terminal series of points.

*Habitat.*—PUNJAB, Dharmsála ; SIKHIM ; ANDAMANS. *Exp.* 40 mill.

1894. CIRPHIS RUFISTRIGOSA, Moore. Hmpsn. Cat. Lep. Phal. B. M., V., p. 516, pl. 92, f. 16. Del. *Leucania rufescens and dharma.*

1894. *c.* CIRPHIS IGNITA, Hmpsn. Cat. Lep. Phal. B. M., V., p. 519, pl. 92, f. 18 (1905).

♂. Head and thorax purplish red mixed with ochreous ; tegulæ with traces of three lines ; patagia with some black scales near upper edge ; abdomen ochreous tinged with rufous. Forewing orange-yellow, suffused with purple-red except below cell near base, in end of cell, on inner margin and terminal area ; the costal area white sparsely irrorated with black, and with greyish fuscous suffusion below it ; median nervure streaked with greyish fuscous, its extremity with white, a greyish fuscous patch beyond the cell between veins 5 and 3 ; subbasal line represented by a black point on costa, the antemedial line by an obscure series of points oblique from costa to submedian fold, then angled inwards on vein 1 ; a postmedial series of points bent outwards below costa, and oblique below vein 4, where it is met by an oblique shade from termen below apex ; the veins of terminal area with slight pale streaks ; a terminal series of black points. Hindwing ochreous suffused with fuscous brown, the termen tinged with pink ; cilia ochreous ; the underside pale ochreous, the costal and terminal areas tinged with purplish pink and irrorated with fuscous, a discoidal spot and postmedial and terminal series of points.

*Habitat.*—Assam, Khasis. *Exp.* 34 mill.

1894. *d.* Cirphis formosana, Butl. P. Z. S. 1880, p. 675 ; Hmpsn. Cat. Lep. Phal. B. M., V., p. 518, pl. 92, f. 20.

*Leucania adusta*, Moore, P. Z. S. 1881, p. 335.

„ *semicana*, Pag, Zoologica, XII., p. 75, pl. ii, f. 37 (1900).

Head and thorax ochreous tinged with rufous ; tegulæ with slight dark tips ; abdomen pale brownish, the anal tuft ochreous. Forewing ochreous suffused in parts with flesh colour and sparsely irrorated with black ; the veins defined by slight fuscous streaks, the interspaces of terminal half also streaked with fuscous ; traces of an antemedial series of black points oblique from costa to submedian fold, then angled inwards on vein 1 ; traces of ochreous orbicular and reniform stigmata, the latter with black point in lower part and short yellow streak below it on extremity of median nervure ; a postmedial series of black points bent outwards below costa and oblique below vein 4, connected by traces of a highly crenulated line ; an oblique dark shade from termen below apex ; a terminal series of black points. Hindwing whitish, the veins and terminal half suffused with fuscous brown ; the underside with the costal and terminal areas tinged with purplish pink and irrorated with black, a postmedial series of short black streaks on the veins and series of black points on apical half of termen.

*Habitat.*—Formosa ; Punjab, Manpuri ; Sikhim ; Assam, Khásis ; Travancore, Pirmád ; Ceylon, Pundaloya, W. Haputale ; Selangore ; Borneo ; N. Guinea, Bismarck Arch. *Exp.* 36 mill.

1927. Cirphis comma, Linn. Faun. Suec. II., p. 316, (1861) ; Dup. Lep. Fr. VII., p. 83, pl. 106, f. 1 ; Steph. Ill. Brit. Ent. Haust III., p. 73 ; Staud. Cat. Lep. pal., p. 192.

*Noctua turbida*, Hübn. Eur. Schmett. Noct., f. 617 (1827).

„ *congener* Hübn. Eur. Schmett. Noct., f. 618 (1827).

*Leucania nigrofasciata*, Hmpsn. Moths. Ind., II., p. 279 (1894).
„ *rhodocomma* Püng. Iris., XIII., p. 120, (1900).

*Habitat.*—EUROPE; ARMENIA; ASIA MINOR; W. SIBERIA; W. TURKISTAN; MONGOLIA; TIBET; E. SIBERIA; PUNJAB, Kulu.

*Larva.* Meyr. Brit. Lep., p. 69; Barrett. Lep. Brit., V., p. 163, pl. 203, 3.

Greyish ochreous to reddish brown; dorsal and subdorsal lines pale or whitish, edged with dark brown and with a brown line between them; lateral and spiracular lines pale ochreous separated by a dark brown space; head brown marked with blackish. Food plants: Grasses, 8-4.

1927. *a.* CIRPHIS BIFASCIATA, Moore P. Z. S. 1888, p. 410; Buil. Ill Het. B. M., VII., p. 51, pl. 126, f. 13.

♀. Head and thorax ochreous white; tegulæ tinged with purplish pink and with two slight dark lines; palpi, pectus and legs tinged with pink; abdomen pale, dorsally tinged with brown, ventrally with pink. Forewing rufous, the costal area pale ochreous to middle, the inner area to near tornus; a slight whitish streak on median nervure from before middle, the veins beyond the cell slightly streaked with white; a black point in lower angle of cell, a more or less distinct postmedial series of points; a slight triangular dark shade from termen below apex, cilia pink. Hindwing ochreous whitish tinged with fuscous, especially towards termen; cilia pinkish at base. Underside of forewing with the cell and area below and beyond it suffused with fuscous.

*Habitat.*—PUNJAB, Dharmsála. *Exp.* 36 mill.

1927. *b.* CIRPHIS ROSEILINEA; Wlk. Journ. Linn. Soc. Zool. VI., p. 179, (1862); Hmpsn. Cat. Lep. Phal., B. M., V., p. 523, pl. 92, f. 26.

*Leucania simillima*, Wlk. Journ. Linn. Soc. Zool., VI., p. 179 (1862).

Head and thorax grey mixed with pale brown and tinged with purplish red; abdomen ochreous dorsally tinged with brown, ventrally irrorated with black; the clasps of male with thick tufts of hair. Forewing ochreous white tinged with vinous red, the costa irrorated with black; the veins white, defined by purple-brown streaks; the interspaces also streaked with purple-brown; a black streak below base of cell and an oblique streak above inner margin before middle; a brown shade below median nervure; a black point in lower angle of cell; a postmedial series of black points bent outwards below costa and oblique below vein 4; a pale oblique fascia from apex defined by brown above and below by a triangular brown shade from termen below apex; a terminal series of black points. Hindwing ochreous white; the underside with the costal area irrorated with brown, the termen sometimes with series of black points.

*Habitat.*—N. CHINA; MADRAS; TRAVANCORE, Pirmâd; CEYLON, Kandy; SINGAPORE; BORNEO. *Exp.* 30-34 mill.

1931. CIRPHIS POLEMUSA.

1903. CIRPHIS ABDOMINALIS, insert (syn.) *Leucania moorei*, Swinh. A. M. N. H. (7) X., p. 50 (1902).

1903. *a.* CIRPHIS LINEATIPES, Moore, P. Z. S. 1887, p. 335. Hmpsn. Cat. Lep. Phal. B. M., V., p. 525, pl. 92, f. 30.
*Leucania percisa*, Moore P. Z. S. 1888, p. 410.

Head and thorax pale ochreous brown, head browner; tegulæ with two dark lines; abdomen whitish tinged with ochreous. Forewing pale brownish ochreous, sometimes tinged with purplish pink and irrorated with fuscous; the veins with slight whitish streaks defined by fine brown lines, median nervure and vein 4 with stronger white streaks, the former defined below by a brown fascia; a triangular brown shade from termen below apex; a black point in lower angle of cell; a curved postmedial series of black points on the veins and a terminal series. Hindwing whitish tinged with brown, especially on the veins and terminal half; the underside with the costal and terminal areas slightly tinged with brown and irrorated with fuscous, some black points on termen.

*Habitat.*—PUNJAB, Kulu, Sultanpur, Simla, Dharmsála; ASSAM, Khásis.
*Exp.* 34-38 mill.

1900. CIRPHIS COMPTA.

1900. *a.* CIRPHIS MEGAPROCTIS, Hmpsn. Cat. Lep. Phal. B. M., V., p. 532, pl. 93, f. 10 (1905).

♂ Head and thorax ochreous white; palpi blackish at sides; frons with black bar; tegulæ with two black lines and black tips; patagia with some black scales near upper edges; legs irrorated with black, mid tibiæ with two black streaks, hind tibiæ with one, spurs banded with black; abdomen ochreous white, a sublateral series of small black spots, the ventral surface irrorated with black. Forewing ochreous white, the costal and inner areas slightly irrorated with black; the veins white defined by fine fuscous streaks, the inter spaces of terminal area also streaked with fuscous; traces of an antemedial series of points oblique from costa to the submedian fold, where there is a more prominent point, then strongly angled inwards on vein 1 and outwards above inner margin; a black point in lower angle of cell; a postmedial series of black points bent outwards below costa and oblique below vein 4, partially connected by a crenulate line; a very slight triangular fuscous shade from termen below apex; a terminal series of black points. Hindwing white, the veins and termen tinged with brown, the underside with the costal area slightly irrorated with black, a postmedial series of slight streaks on the veins and a terminal series of points from apex to vein 2.

*Habitat.*—CEYLON, Haputale, Kandy. *Exp.* 30 mill.

1904. CIRPHIS SINUOSA.

1937. CIRPHIS IRREGULARIS insert (syns.)
*Leucania consosa*, Snell. Tijd. v., Ent. XX., p. 24, pl. 2, f. 13 (1877).
„ *sepulchralis*, Lucas, P. Roy. Soc. Queensl. XV., p. 149 (1900).

1937. *a.* CIRPHIS ALBISTIGMA, Moore, P. Z. S. 1881, p. 337, pl. 37, f. 9; Hmpsn. Cat. Lep. Phal. B. M., V., p. 543, pl. 93, f. 33.

Head and thorax grey to pale olive-brown mixed with dark brown; tegulæ with two dark lines; abdomen grey, dorsally tinged with fuscous. Forewing

pale olive-brown to grey-brown, more or less thickly irrorated with fuscous; the veins of costal area defined by fine brown streaks, hardly visible except in the paler specimens, the interspaces also streaked with brown towards apex; a slight black streak below base of cell; a slight fuscous shade on each side of median nervure, extending beyond the cell to the triangular brown shade from termen below apex; the antemedial line represented by obliquely placed black points on costa and below cell; a small, rather V-shaped white spot with brown centre at lower angle of cell; a postmedial series of black points bent outwards below costa and oblique below vein 4, sometimes with traces of a crenulate line before it; a terminal series of black points. Hindwing semi-hyaline white, the veins, termen and inner area tinged with brown; the underside with the costal and terminal areas irrorated with brown.

*Habitat.*—SIKHIM; MADRAS, Gooty, Nilgiris, Coimbatore. *Exp.* 32-38 mill.

1912. CIRPHIS FRAGILIS.

1913. CIRPHIS UNIPUNCTA, insert (syns.).

*Spælotis punctulata*, Blanch. Gay's Chile, Ins. VII., p. 74 (1852).

*Leucania adultera*, Schaus., Trans. Am. Ent. Soc., XXI., p. 232 (1894), & del. *Leucania adusta*.

*Larva*, Cote's Indian Museum Notes, III., p. 135.

1·12″. Head glabrous, pale red; body pale yellowish-green; three dark dorsal lines; a black lateral stripe with pale yellow line below it and a series of five black spots; prolegs pale green. Feeds in the heart of the millet stalk and does immense damage to the ripening crop. Pupates in the earth (W. H. Campbell)

1923. CIRPHIS CORRUGATA.

1905. CIRPHIS DENTICULA.

1905. *a.* CIRPHIS PASTEA, Hmpsn. Cat. Lep. Phal. B. M., V., p. 550, pl. 96, f. 13 (1905).

♀. Head and thorax ochreous white mixed with dark brown; palpi brownish at sides; frons with brown bar; tegulæ with three brown lines; patagia with some black scales near upper edges; tarsi with dark rings; abdomen ochreous white, dorsally suffused with brown, ventrally irrorated with black. Forewing ochreous white irrorated and striated with rufous and dark brown; some brown suffusion below middle of costa; orbicular represented by a small round brown spot, the reniform by a large rather diffused lunule; a diffused brown fascia beyond lower angle of cell connected with a triangular shade from termen below apex; a curved postmedial series of black points with an ill-defined brown shade beyond them; a terminal series of black points; cilia ochreous white intersected with brown. Hindwing whitish tinged with brown, especially on terminal area; cilia white with a brownish line through them; the underside white irrorated with brown, a black discoidal lunule and terminal series of points.

*Habitat.*—ASSAM, Khásis. *Exp.* 36 mill.

1906. CIRPHIS YU. Guen. Noct. 1, p. 78 (1852).
*Leucania exempta*, Wlk., XI., 710 (1857); Hmpsn. Ill. Het. B.M., IX., p. 90, pl. 161, f. 9.
„ *costalis*, Moore, P. Z. S. 1877, p. 603, pl. 59, f. 11.

1909. CIRPHIS SEMIUSTA.

1910. CIRPHIS MODESTA.

1910. *a*. CIRPHIS METAPHÆA, Hmpsn. Cat. Lep. Phal. B. M., V., p. 552, pl. 93, f. 32 (1905).

♂. Head and thorax pale ochreous; some black scales on upper edge of tegulæ and patagia; abdomen fuscous with ochreous segmental lines, anal tuft and ventral surface. Forewing :pale ochreous slightly tinged with rufous and irrorated with fuscous on terminal area; antemedial line represented by a slight speck in submedian fold; a slight point in lower angle of cell; postmedial line indistinct, crenulate and produced to dark points on the veins, oblique below vein 4, and incurved at discal and submedian folds; an oblique shade from termen below apex; a terminal series of black points. Hindwing dark fuscous brown; cilia ochreous with a brownish line through them. Underside of forewing suffused with fuscous except on marginal areas, a small dark spot on costa beyond middle; hindwing ochreous white irrorated with fuscous, the area below the cell suffused with fuscous to near termen, a discoidal lunule with streaks before it on median nervure, traces of a postmedial line, a terminal series of points.

*Habitat*.—MADRAS, Palni Hills. *Exp*. 42 mill.

1910. *b*. CIRPHIS HYPOPHÆA, Hmpsn. Cat. Lep. Phal. B. M., V., p. 553, pl. 94, f. 14 (1905).

♂. Head, thorax and abdomen grey, tinged with pale red-brown; palpi tinged with black at sides; frons with lateral black bars; tegulæ with medial black line; patagia with a few black scales near upper edge; fore femora black above; legs and ventral surface of abdomen slightly irrorated with black. Forewing greyish slightly tinged with rufous and irrorated with black; subbasal line represented by a black point on costa, antemedial line by a series of black points oblique from costa to submedian fold, then bent inwards; extremity of median nervure and lower discocellular whitish, with a black point in lower angle of cell and a more or less developed black mark beyond the angle; a postmedial series of black points bent outwards below costa, incurved at discal fold, and oblique below vein 4, a terminal series of black points. Hindwing fuscous, paler towards costa; some black points on termen; cilia ochreous white. Underside of forewing suffused with black except marginal areas; hindwing whitish irrorated with black, a discoidal spot, sinuous punctiform postmedial line and terminal series of points.

*Habitat*.—CEYLON, Maskeliya. *Exp*. 34 mill.

1910. *c*. CIRPHIS RUBRISECTA, Hmpsn. Cat. Lep. Phal. B. M., V., p. 553, pl. 94, f. 15 (1905).

♂. Head and thorax ochreous tinged with rufous; palpi tinged with fuscous at sides; patagia with some black scales on upper edge; abdomen

ochreous dorsally tinged with fuscous. Forewing ochreous sparsely irrorated with black, the inner half tinged with pale purplish brown ; a rufous streak on median nervure ; a black point in lower angle of cell ; faint traces of two postmedial series of points on the veins, oblique below vein 4 ; an oblique rufous streak from termen below apex ; some black points on termen. Hindwing fuscous, the cilia ochreous white. Underside ochreous ; forewing with the cell and area below it and beyond lower angle suffused with fuscous ; hindwing irrorated with fuscous, slight fuscous streaks beyond lower angle of cell, some points on termen.

*Habitat.*—BHUTAN. *Exp.* 40 mill.

Genus BOROLIA.

| | Type. |
|---|---|
| *Borolia*, Moore, P. Z. S. 1881, p. 334 ..... | *fasciata.* |
| *Eurypsyche*, Butl. Trans. Ent. Soc. 1886, p. 392 ..... | *levini.* |

Proboscis fully developed, palpi obliquely upturned, the 2nd joint fringed with hair, the 3rd short, porrect ; frons smooth ; eyes large, rounded ; antennæ of male ciliated, thorax clothed with hair and scales and without crests ; tibiæ moderately fringed with hair ; abdomen clothed with rough hair at base, but without crests. Forewing with the apex somewhat acute, the termen obliquely curved ; veins 3 and 5 from near angle of cell ; vein 6 from upper angle ; 9 from 10 anastomosing with 8 to form the areole ; 11 from cell. Hindwing with veins 3·4 from angle of cell ; 5 obsolescent from middle of discocellulars ; 6·7 shortly stalked ; 8 anastomosing with the cell near base.

Sect. II. Antennæ of male minutely ciliated.

A. Palpi with the 3rd joint rather long and porrect.

1917. BOROLIA ALBIVITTA.

B. Palpi with the 3rd joint short.

*a*. Forewing with white streak on median nervure.

$a^1$. Forewing with black streak below base of cell..... ..... *percussa.*

$b^1$. Forewing without black streak below base of cell.

$a^2$. Forewing without black point in lower angle of cell.

$a^3$. Forewing with antemedial black point on vein 1 ..... *aspersa.*

$b^3$. Forewing without antemedial black point on vein 1..... *venalba.*

$b^2$. Forewing with black point in lower angle of cell.

$a^3$. Forewing not irrorated with fuscous. *incana.*

$b^3$. Forewing irrorated with fuscous ... *byssina.*

*b*. Forewing without white streak on median nervure. *fasciata.*

1898. BOROLIA PERCUSSA, Butl. P. Z. S. 1880, p. 674.

*Leucania howra*, Moore P. Z. S. 1881, p. 357, pl. 37, f. 16.

,, *basilinea*, Swinh. Trans. Ent. Soc. 1890, p. 220, pl. vii, f. 6.

*Habitat.*—FORMOSA; SIKHIM; BENGAL, Calcutta; BURMA, Bhámo; JAVA.

1901. BOROLIA ASPERSA, Snell. Tijd. v. Ent. 1880, p. 42, pl. 4, f. 1.

*Leucania homopterana*, Swinh. Trans. Ent. Soc. 1890, p. 219, pl. viii, f. 12.

*Habitat.*—BURMA, Rangoon; CELEBES.

1930. BOROLIA VENALBA, insert (syn.)

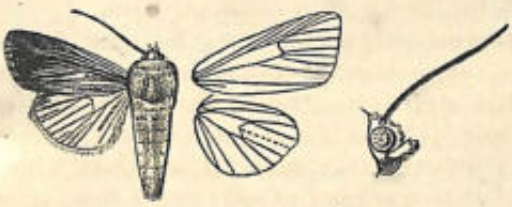
*Leucania linearis*, Lucas, P. Soc. Queensl. VIII, p. 85 (1894).

& del. *L. lineatipes*.

*Habitat.*—CHINA; SIKHIM; BENGAL, Barrackpur; CEYLON; SINGAPORE QUEENSLAND.

1930.*a*. BOROLIA INEANA, Snell. Tijd. v. Ent. 1880, p. 43, pl. 4, f. 2.

Head and thorax whitish tinged with pinkish; abdomen ochreous white, with sublateral series of black points. Forewing flesh-pink, leaving paler fasciæ in discal and submedian folds and above vein 6; the veins streaked with white and defined by fine, slightly darker streaks, the interspaces of terminal area also with slight dark streaks; a black point in submedian fold below origin of vein 2, a point in lower angle of cell, a curved postmedial series and a terminal series. Hindwing semihyaline white, tinged with ochreous towards termen, on which there is a series of dark points.



*Borolia venalba*. ♂ ½

*Habitat.*—SIKHIM; CELEBES. *Exp.* 32 mill.

1902. BOROLIA BYSSINA.

1925. BOROLIA FASCIATA.

## Genus MELIANA.

*Type.*

*Melia*, Curt. Brit. Ent. VI., p. 200 (1829), nec. Bilb. Crust.
1820 ..... *flammea*.

*Meliana*, Curt. Brit. Ent. VI., Index (1892) ..... *flammea*.

*Neleucania*, Smith, Pr. U. S. Nat. Mus. XXV., p. 203 (1902). *niveicosta*.

Proboscis fully developed; palpi obliquely upturned, fringed with hair in front; frons with rounded prominence with corneous plate below it; eyes large, rounded; head and thorax clothed with hair, with scales below it and without crests; tibiæ fringed with very long hair; abdomen without crests. Forewing, with the apex somewhat acute, the termen rather obliquely rounded; veins 3 and 5 from near angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hindwing with veins 3·4 and 6·7 shortly stalked; 5 obsolescent from middle of discocellulars; 8 anastomosing with the cell near base.

Sect. II. Antennæ of male ciliated.

A. Forewing with short black streak in end of cell in discal fold ..... *vana.*

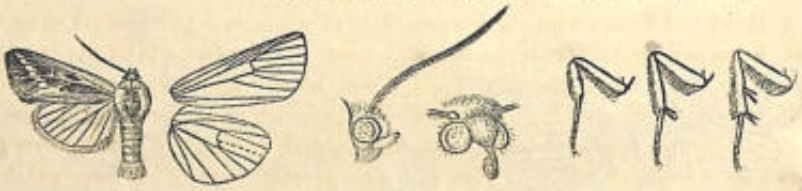
B. Forewing without black streak in end of cell in discal fold.

*a.* Forewing with the white streak on median nervure expanding into a spot at lower angle of cell ..... *vittata.*

*b.* Forewing with the white streak on median nervure slender.

*a*1. Forewing with slight dark streak in cell in discal fold ..... *curvilinea.*

*b*1. Forewing without dark streak in cell in discal fold ..... *uniformis.*



*Meliana vana*, ♂ ½.

1897. MELIANA VANA.

1896. MELIANA VITTATA.

1929. MELIANA CURVILINEA.

1932. MELIANA UNIFORMIS. Sub-family ACRONYCTINÆ.

1659.*a*. AMPHIPYRA TRAGOPOGONIS, Linn. Faun. Suec., p. 316 (1761), Hübn. Eur. Schmett. Noct., p. 40.

,, *turcomana*, Stett. Ent. Zeit. 1888, p. 32.

Head and thorax grey-brown sometimes with a reddish tinge, or the head and collar with the scales tipped with white; abdomen grey-brown. Forewing silky grey-brown sometimes with a reddish tinge or slightly irrorated with white; a black point in middle of cell and two on discocellulars. Hindwing ochreous white suffused with brown and sometimes with a reddish tinge; the underside whiter, the costal and terminal areas irrorated with brown, a small discoidal lunule.

*Habitat.*—EUROPE; W. & C. ASIA; KASHMIR, Scinde Valley; PUNJAB, Sultanpur. *Exp.* 42 mill.

1717.*d*. EUPLEXIA FASCIATA, Leech. Trans. Ent. Soc., 1900, p. 68.

Head and thorax purplish red-brown, the scales sometimes tipped with grey; tegulæ with black medial line; tarsi fuscous ringed with ochreous, abdomen reddish-brown tinged with ochreous and greyish, the crests darker. Forewing purplish red-brown, the ante- and postmedial areas suffused with grey-white except towards costa; subbasal line, double, waved, from costa to vein 1; antemedial line double at costa, then waved and angled inwards on the veins; claviform moderate, defined by black and sometimes

filled in with fuscous; orbicular and reniform defined by black, the former round, the latter with some white in its outer part, two white points on its inner edge and four or five on its outer; a medial striga from costa; postmedial line indistinctly double, dentate, bent outwards below costa and incurved below vein 3; subterminal line indistinct, greyish, excurved at vein 7 and slightly dentate at veins 4·3; a terminal series of small black lunules and sometimes grey points at the veins. Hindwing ochreous suffused with fuscous brown, especially in female; cilia ochreous with a dark line through them; the underside paler with dark discoidal spot, sinuous postmedial line and diffused subterminal line, more or less showing through to upperside.

*Habitat.*—W. China; Punjab, Kulu, Sultanpore, Simla; Sikhim Tibet, Yatung. *Exp.* 38·42 mill.

1717. *e.* Euplexia leprosticta, n. sp.

♂ Head and tegulæ white and brown; thorax white with paired black spots on pro. meso-and metathorax, the last with some red-brown on their upper edge; legs fuscous and white, the tarsi banded with black; abdomen white irrorated with brown. Forewing brown tinged with greenish and irrorated with black; indistinct double dentate black antemedial, medial, postmedial and subterminal lines; some rounded white patches with pale greenish centres; a large patch at base of inner area; a patch on middle of costa conjoined to a discoidal spot; two patches on apical part of costal area the 1st largest; a smaller patch near tornus; a postmedial series of white points. Hindwing pale strongly tinged with brown on terminal half.

*Habitat.* Ceylon, Matele (Pole). *Exp.* 40 mill. Type in B. M.

1722 *a.* Euplexia niveifera, n. sp.

♂ Head and thorax black and brown, the greater part of frons, vertex of head, tegulæ, patagia and vertex of thorax white; pectus brown irrorated with grey, the legs blackish, the tarsi ringed with white; abdomen brown. Forewing olive-brown; a white patch at base of costa traversed by two waved black lines and with a black spot on its lower edge; an oblique crenulate antemedial white line defined by black on each side from subcostal nervure to inner margin; the medial area mostly suffused with black; the orbicular and reniform white edged with black, the latter with black lunule on it, conjoined to some white spots on costa and the former with an irregular white patch below it; a crenulate black postmedial line defined by white on outer side, bent outwards from below costa to vein 4 below which it is incurved; a dentate subterminal line with the area beyond it white with small blackish spots on it except towards apex and larger spots at middle and above tornus; a crenulate black terminal line; cilia intersected with white. Hindwing brown with paler patch below end of cell, traces of a postmedial line angled on vein 4; a blackish streak on vein 2 and white spot before termen; cilia white at tips; underside suffused with grey with black discoidal spot and diffused curved postmedial and subterminal lines.

*Habitat.*—Simla 7,000, (Pilcher). *Exp.* 40 mill. Type in B. M.

1833.*b*. AMYNA PULVEREA, Leech. Trans. Ent. Soc. 1900, p. 114.

Head and thorax cupreous red-brown or fuscous mixed with grey; tarsi with white rings; abdomen greyish ochreous mixed with brown. Forewing cupreous red-brown or fuscous brown irrorated with grey; an indistinct waved grey subbasal line from costa to submedian fold; an indistinct waved dark antemedial line defined by grey on inner side; orbicular small obscurely defined by grey; reniform ill-defined, grey; an oblique shade from lower angle of cell to inner margin; postmedial line indistinct, dark, dentate, defined by grey on outer side, bent outwards below costa, incurved at discal fold and below vein 4; some pale points on costa towards apex; subterminal line grey defined by brown on inner side, angled outwards at vein 7 and excurved at middle; a terminal series of minute white points. Hindwing ochreous brown or fuscous; the underside greyer with small discoidal spot and sinuous postmedial and obscure subterminal lines.

*Habitat*.—BR. E. AFRICA, Kikuyu, Eb. Urru; W. CHINA, Ni-tou, Omei-shan, Ta-chien lu, Moupin; KASHMIR, Scinde and Goorais Valleys; PUNJAB, Simla, Murree; SIKHIM. *Exp*. 26-32 mill.

1833. *c*. AMYNA POLIASTIS, n. sp.

♂. Head whitish, thorax grey-brown; abdomen whitish dorsally tinged with brown. Forewing grey-brown with slight darker irroration; the orbicular and reniform indistinct edged by slight red lines, the reniform rather 8-shaped; traces of an antemedial line angled in submedian fold; an indistinct postmedial line formed by a double series of points, slightly excurved from costa to vein 3; an oblique subterminal line arising from apex. Hindwing whitish tinged with brown, the cilia white.

*Habitat*.—PUNJAB Ferozpur (Nurse). *Exp*. 24 mill. Type in B. M.

1839. *d*. CALLOPISTRIA INSULARIS, Butl. A. M. N. H. (5) X., p. 230 (1882).

Head and thorax clothed with olive or red-brown and fuscous scales abdomen olive-brown banded with fuscous, legs rufous, the tarsi tinged with white, the mid and hind femora fringed with blackish hair. Forewing olive or reddish-brown suffused with fuscous, the veins streaked with white; a curved whitish subbasal line from costa to submedian fold; a curved dark antemedial line defined on each side by white and bent inwards to inner margin; orbicular small with blackish centre and whitish annulus, open above; reniform whitish expanding above and narrow below with a lunulate centre defined by black; a white and black bar beyond the cell between veins 5 and 3; postmedial line double, on a white band, bent outwards, below costa, excurved to vein 4, then incurved, some white points beyond it on costa; a white subterminal band with some fuscous at middle, emitting a spur inward to postmedial band, angled outwards to termen at vein 5, then forming a double line, the inner angled inwards in submedian fold, the outer angled outwards on vein 1, cilia with a fine white line at base and white tips. Hindwing fuscous brown, the cilia ochreous with a dark line through them, the underside whitish irrorated with fuscous, a dark discoidal lunule and minutely waved sinuous postmedial line.

The white markings of forewing sometimes tinged with pink or the ground color yellowish-white with the markings olive ochreous and the hindwing tinged with red.

*Habitat.*—NATAL; BURMA, Hsipaw; BORNEO; PULO LAUT; NEW HEBRIDES; SOLOMONS, Alu, Duke of York I. *Exp.* 24-30 mill.

1847. *a.* CALLOPISTRIA TRILINEATA, Wlk. Journ. Linn. Soc. Zool. VI., p. 137 (1862); Swinh. Cat. Het. Mus. Oxon. II, pl. 1, f. 10.

*Penicillaria quadrinotata*, Wlk. Journ. Linn. Soc., Zool. VII, p. 65 (1864).

*Plusia duplicilinea*, Wlk. Journ. Lin. Soc. Zool. VII., p. 70 (1864).

Head and thorax bright rufous mixed with some white scales; abdomen whitish tinged with rufous, the dorsal crests rufous. Forewing bright rufous with a slight purplish tinge and some blackish suffusion in parts; the veins with fine whitish streaks; subbasal line white, acutely angled outwards in cell; an obliquely curved whitish streak from submedian fold to vein 1 before the antemedial line which is double, blackish filled in with white and defined by white on outer side, strongly angled outwards below cell and very oblique towards inner margin; reniform represented by an oblique rather Y-shaped white mark, its arms slightly defined by brown and its foot extending to antemedial line and with a white spot beyond it, beyond lower angle of cell; postmedial line double, black filled in with white and defined on outer side by white traversed by a brown line, strongly bent outwards below costa and incurved below vein 4, some fuscous suffusion beyond it before the subterminal line which is represented by two oblique white striæ below apex with a slight striga below it, then an oblique streak from vein 5 to termen at vein 4 and another from termen at vein 3 to submedian fold and a diffused mark towards tornus; a slightly waved white line just before termen, angled outwards to termen at veins 4·3; a dark line through the cilia. Hindwing white, the terminal area suffused with reddish-brown; a fine waved dark terminal line defined by whitish on inner side; the underside with slight discoidal lunule and curved, minutely waved postmedial line.

*Habitat.*—CEYLON, Pundaluoya, Haldamulla; BORNEO, Sarawak; QUEENSLAND. *Exp.* 34 mill.

1877. *Caradrina lineosa*, insert CARADRINA ALBOSIGNATA, Oberth. Et. Ent., V., p. 72, pl. iv, f. 1 (1880), which has precedence.

1887. CARADRINA FASCIATA, insert (syn) *Caradrina pratexta*, Swinh. A. M. N. H. (7) XV., p. 152 (1905).

Sub-family FRASTRIANÆ.

1968.*b.* DIPHTHERA IMRAY n. s.p.

♀. Head white with some black on palpi and between antennæ; tegulæ green edged with black; patagia green with white spot on shoulders and rufous tips; thorax, pectus and legs black and white; abdomen black irrorated with white, the dorsal crests rufous, the anal tuft tipped with

white. Forewing grass-green; a white spot at base below cell; a subbasal black mark on inner area followed by black and white spots on costa and in cell and white streaks in submedian fold and on vein 1; antemedial black points on costa, below cell and on inner margin; claviform white; orbicular and reniform white defined by black, the former small, round, the latter with black point on it and its lower edge excised; a black medial line oblique from costa to lower angle of cell, then incurved and expanding round outer edge of claviform; the veins beyond the cell streaked with white and with a series of black points on them; costa with black and white points towards apex; a subterminal black band with dentate white marks on it at veins 6·3·2; black spots just before termen below apex and vein 6; cilia chequered black and white. Hindwing black; cilia black and white. Underside of forewing black with white marks on costa and termen; hindwing white irrorated with black very thickly on costal area, irregularly waved medial and postmedial lines and a diffused subterminal line.

*Habitat.*—TRAVANCORE, Pirmâd (R. S. Imray). *Exp.* 38 mill. Type in B. M.

1769. *c.* PERCIANA VIOLESCENS, n. sp.

♂. Head fuscous brown mixed with grey; palpi white in front; tegulæ tipped with white; pectus and legs white, the tarsi banded with brown; abdomen fuscous brown with white band at base, the anal tuft ochreous. Forewing fuscous brown; two obliquely placed black points at base; a white point at middle of cell; a fine whitish postmedial line oblique from costa to vein 5, then retracted to lower angle of cell, excurved in submedian interspace and above inner margin and angled inwards on vein 1, with diffused violaceous grey beyond it; an indistinct waved subterminal line with two black points on it below costa, excurved at middle, then incurved; a series of dark striæ on costa towards apex and on termen. Hindwing pale fuscous brown; the underside paler with dark discoidal lunule and indistinct curved postmedial line.

*Habitat.*—TRAVANCORE, Pirmâd (R. S. Imray); BALI (Doherty). *Exp.* 16 mill. Type in B. M.

1971. *a.* PERCIANA OBSCURA, n. sp.

♂. Pale-brown strongly irrorated with dark-brown and fuscous; abdomen with the large basal tuft black. Forewing with a slight purplish tinge; a diffused oblique black medial band from upper angle of cell to inner margin, the area beyond it suffused with black; an obscure pale postmedial line oblique from costa to discal fold where it is angled; some pale and black points on costa towards apex; a terminal series of black striæ. Hindwing fuscous.

*Habitat.*—CEYLON, Gampola (Mackwood). *Exp.* 26 mill. Type in B.M.

1981. BRYOPHILA KHASIANA, insert *Euplexia repetita*, Swinh. A. M. N. H. (7) XV., p. 499 (nec Butl.)

1987. *a.* ERASTRIA FERRIMACULA, n. sp.

Hindwing with veins 3·4 stalked in male.

Head and thorax pale olive-green ; palpi at sides, antennæ and fore legs blackish ; abdomen olive-brown tinged with fuscous. Forewing pale olive-green ; traces of a curved waved subbasal white line defined by a few blackish scales ; a double, waved, oblique antemedial black line becoming whitish and obsolescent on inner half ; a tuft of raised ferruginous scales in middle of cell, and a tuft of black scales on discocellulars ; orbicular and reniform represented by diffused confluent white patches ; medial line black, excurved and obsolescent at middle ; postmedial line double, blackish filled in with white, obsolescent except at costa, bent outwards below costa, excurved to vein 4, then incurved, some black and white points beyond it on costa ; subterminal line indistinct, irregular, whitish defined by a dark shade on inner side, angled outwards below costa, excurved at middle and to tornus, a terminal series of small black spots ; cilia grey and fuscous. Hindwing fuscous brown ; the cilia whitish with a dark line through them ; the underside whitish irrorated with fuscous, a black discoidal spot with striga from costa above it, a curved diffused postmedial line.

*Habitat*.—Khásis. *Exp*. ♂ 24, ♀ 28 mill. Type in B. M.

1988. *a*. ERASTRIA CŒNIA, Swinh. A. M. N. H. (7), VII, p. 471 (1901).

Head, thorax and abdomen whitish tinged with rufous; palpi blackish at sides, tarsi banded with black; abdomen dorsally banded with black. Forewing whitish largely suffused with rufous ; the antemedial line white defined by brown, oblique from costa to submedian fold where it is acutely-angled, then angled inwards on vein 1 ; the whitish area terminates on costal half obliquely at middle of wing and is followed by a blackish patch extending on costa to apex and down to vein 2, leaving the terminal area pale ; reniform leaden-grey with blackish centre and outline produced to short streaks on the veins beyond lower angle of cell ; an indistinct oblique, minutely waved dark line from lower angle of cell to inner margin, the postmedial line white, oblique from costa to vein 7, then excurved and angled inwards in submedian fold ; a white subterminal line, slightly angled outwards at vein 7 and excurved at middle with short black streaks on its inner side on veins 4 and 3 or on 3 only ; a terminal series of black points. Hindwing yellowish more or less completely suffused with brown ; an indistinct dark discoidal point and curved postmedial line, distinct and the latter waved on underside.

*Habitat*.—Sikhim ; Khásis ; Jaintia Hills. *Exp*. 26 mill.

2001. *a*. MALIATTHA MARGINALIS, Wlk. Journ. Linn. Soc. Zool., VII., p. 49 (1864) ; Swinh. Cat. Het. Mus. Oxon., II., p. 51, pl. 1, f. 9.

„ *stolasa*, Swinh. A. M. N. H. (7) XV., p. 154. (1905).

Head, thorax and abdomen whitish tinged with rufous ; tarsi fuscous with pale rings. Forewing whitish suffused with rufous, the basal area except towards costa paler ; an indistinctly double, obliquely curved and slightly waved antemedial line ; postmedial line indistinctly double, sinuous, oblique from costa to vein 7, excurved to vein 4, then oblique and defined by white on outer side

towards inner margin ; some black and white points on costa towards apex ; a more or less developed diffused oblique black fascia from apex crossing the postmedial line ; a white bar on termen from below apex to vein 5 ; cilia whitish mixed with fuscous. Hindwing fuscous ; cilia whitish mixed with fuscous, the underside whitish tinged with brown and irrorated with fuscous.

*Habitat.*—Assam, Khásis ; Sarawak ; Pulo Laut ; Java. *Exp.* 20-22 mill.

2013. Hyela fervens. n. sp.

Ochreous tinged with olive ; forelegs banded with fuscous. Forewing with waved white ante- and postmedial lines excurved at middle, the former defined on outer side by black scales, the latter on inner side and with white annulus on its outer edge beyond the cell ; an incomplete white subterminal line angled outwards at vein 7 and inwards at discal and submedial folds, excurved at middle. Hindwing ochreous tinged with brown ; cilia ochreous with a brown line through them. Underside suffused with fuscous ; hindwing with discoidal spot and indistinct curved postmedial and subterminal lines.

*Habitat.*—Canara, Karwar (Bell) ; Madras, Belgaum (Watson). *Exp.* 18 mill. Type in B. M.

2016. *a.* Megalodes insocia, Wlk., XII, 788 (1857).

*Acontia concinnula*, Wlk., XII, 789 (1857).

,, *pyralina*, Wlk., XII, 789 (1857).

*Metaplioplasta sima*, Wllgrn. Wien. Ent. Mon., IV, p. 17 (1860).

*Acontia conifrons*, Auriv Œfv. Ak. Förh., XXXVI (7), p. 66 (1879).

*Tarache porphyria* (♀), Butl. P. Z. S., 1898, p. 420.

*Agrophila burmana*, Swinh. A. M. N. H. (7), XV, p. 153 (1905).

♂. White ; palpi and sides of frons tinged with fuscous, abdomen with ochreous ; fore and mid tibiæ banded with fuscous. Forewing with two waved fuscous antemedial lines with patches before them on costa and inner margin ; medial and postmedial spots on costa ; incomplete small black-ringed orbicular and reniform stigmata ; the terminal area blackish, narrow at costa, angled inwards to just beyond the reniform at vein 6 and to origin of vein 2 below the cell ; an indistinct double minutely waved black postmedial line forming the inner edge of dark area at costa, incurved below vein 4 and with slight dentate black marks on it beyond the cell ; an irregular interrupted subterminal white line ; a terminal series of black points ; cilia white at middle and below apex. Hindwing yellowish white slightly tinged with brown on costa and terminal areas.

♀. Thorax suffused with fuscous ; forewing fuscous brown with some irregular white marks before the antemedial lines and two conjoined spots on costa beyond middle ; hindwing wholly suffused with brown.

*Habitat.*—Sierra Leone ; Sokotra ; Br. E. Africa ; Damaraland ; N'Gamiland, C. Colony ; Kutch ; Bombay ; Ceylon ; Burma, Beeling, Thayetmyo. *Exp.* 24 mill.

2025. *a.* Tarache anormalis. n. sp.

♀. Head and thorax clothed with red-brown, red, white and black scales ; mesothorax with a pair of white tipped orange tufts ; pectus and legs greyish,

the latter banded with black above, the fore tibiæ rufous ; abdomen fuscous irrorated with grey above, grey below, a pale rufous, dorsal tuft on 1st segment. Forewing red-brown largely suffused with purple-red ; the costa with series of dark marks ; antemedial dark spots above and below vein 1 ; orbicular indistinct with some leaden-grey in its lower part ; reniform leaden-grey with pale annulus and placed on a large patch of dark suffusion ; the postmedial line sinuous, bent outwards below costa, excurved to vein 3, then incurved, a quadrate blackish patch beyond it on costa and slight streak on each side of vein 5 ; some black points on termen and a larger spot at vein 5. Hindwing dark-brown ; the cilia ochreous with a dark line near base.

*Habitat.*—S. INDIA, Gooty (Campbell). *Exp.* 30 mill. Type in B. M.

2037. *b*. TARACHE PLUMBICULA. n. sp.

♂. Head and thorax brown mixed with dark leaden-grey ; palpi in front and frons paler ; pectus and legs ochreous white, the tibiæ and tarsi banded with black ; abdomen ochreous white irrorated and suffused with brown. Forewing dark leaden-grey suffused with black ; a whitish patch at base of inner margin ; traces of a double waved black antemedial line ; an obscure paler oblique medial mark from costa to median nervure ; a reddish streak in and beyond end of cell ; a spot of the ground colour on a whitish patch on apical part of costa ; a subterminal series of small dentate black spots ; a terminal series of black striæ. Hindwing ochreous white suffused with fuscous towards termen, widely on apical area ; a dark terminal line.

*Habitat.*—CEYLON, Matalé (Pole). *Exp.* 26 mill. Type in B. M.

2045. *a*. XANTHOPTERA RUBRIFUSA. n. sp.

♂. Head and thorax reddish mixed with dark brown ; pectus and legs greyish and black, the tarsi black with pale rings ; abdomen ochreous with ill-defined fuscous bands. Forewing greyish mostly suffused with crimson, the terminal half much darker, becoming paler again towards termen ; an indistinct waved antemedial line ; traces of a dark discoidal lunule ; an indistinct waved subterminal line excurved below costa and at middle ; cilia crimson red. Hindwing fuscous ; the underside greyer with small discoidal spot and indistinct sinuous postmedial line.

*Habitat.*—CEYLON, N. Central Province (Alston). Exp. 26 mill. Type in B. M.

2052. *a*. XANTHOPTERA NICEA, Swinh. A. M. N. H. (7). VII. p. 470 (1901).

♂. Ochreous tinged with red-brown ; tegulæ with fuscous lines ; some fuscous on vertex of thorax. Forewing with the inner area suffused with black ; numerous brown striæ on costal area ; an antemedial ochreous and dark-brown patch above vein 1 and ochreous spot on inner margin ; the orbicular and reniform with greyish centres and black outlines, the former small round, the latter large with its upper and lower extremities produced ; a black-defined comma-shaped mark below end of cell ; the postmedial line indistinct, minutely dentate, bent outwards below costa, slightly incurved in discal fold and strongly in submedian fold ; the subterminal line pale, double, minutely waved, angled at vein 4, then oblique and filled in with dark brown running

as a streak to termen at vein 4 ; a terminal series of black points, a small triangular leaden-grey spot above middle and the terminal area leaden-grey towards tornus. Hindwing dark reddish-brown ; the cilia ochreous ; the underside ochreous tinged with brown towards termen ; a black discoidal spot, a strongly crenulate curved postmedial line and a terminal series of points.

♀. Forewing with the inner area not dark ; a semicircular dark-brown patch from costa at antemedial line to the subterminal line and extending to vein 2 below which there is a short black fascia ; a black spot between the orbicular and reniform.

*Habitat.*—ANDAMANS, Port Blair. *Exp.* 36 mill.

2057. COSMIA TRANSVERSA.

♂. Hindwing with the costal half suffused with purplish fuscous.

CEYLON, Kandy (Mackwood).

2058. *a.* COSMIA BISIGNATA. n. sp.

♀. Head and thorax ochreous ; palpi with black mark at side of 2nd joint ; antennæ brown ; fore and mid tibiæ streaked with black ; tarsi black ringed with white ; abdomen white dorsally slightly tinged with brown. Forewing pale brownish ochreous ; subbasal line represented by a black point on costa and slight striga from cell ; antemedial line indistinctly double, sinuous, with black point at costa ; reniform a rather S-shaped black mark with pale outer edge conjoined to a rather triangular blackish mark on costa, and with traces of a line from it to inner margin with fuscous point in submedian fold ; postmedial line rather indistinct, double, excurved from costa to vein 4, then incurved, a quadrate blackish mark beyond it on costa ; subterminal line pale, slightly defined by fuscous on inner side, very minutely waved, ending at tornus; a terminal series of black points. Hindwing white slightly tinged with grey especially on terminal area ; the underside white, the costal and terminal areas irrorated with pale brown, a slight discoidal lunule.

*Habitat.*—MADRAS, Bellary, Ramandrug, 3,000′ (Campbell). *Exp.* 32 mill. Type in B. M.

2065. *a.* METACHROSTIS PECTINATA. n. sp.

Antennæ of male bipectinate with rather long branches, of female serrate and fasciculate.

Head, thorax and abdomen black-brown mixed with some grey. Forewing black-brown overlaying greyish brown and with a purplish tinge ; the postmedial area sometimes paler, a small black spot below cell near base ; an indistinct curved antemedial line with slight orange mark on it in cell ; a small orange discoidal lunule with some darker shading between it and inner margin ; postmedial line bent outwards below costa, slightly angled inwards in discal fold and strongly incurved below vein 4 ; subterminal line formed of small orange spots, slightly excurved at vein 7 and middle. Hindwing fuscous brown.

*Habitat.*—CEYLON, Maskeliya (Pole), Kandy (Mackwood). *Exp.* 18-22 mill. Type in B. M.

2067. *a*. METACHROSTIS PAUROGRAPTA, Butl. Trans. Ent. Soc. 1886, p. 403.

♀. Head and thorax grey-brown irrorated with black; tegulæ with blackish line and edged with black behind; tibiæ and tarsi blackish above with pale rings; abdomen brown. Forewing brown suffused with greenish grey; irregularly waved subbasal, antemedial, medial and postmedial black lines arising from costal spots, the last three strongly excurved below cell; some obscure blackish subterminal spots, the spot in discal fold most distinct; a terminal series of points. Hindwing dark-brown with blackish terminal line.

*Habitat*.—CEYLON, Clodagh; AUSTRALIA, Rockhampton. *Exp*. 20 mill.

2072. *a*. METACHROSTIS LAMIA, Swinh. A. M. N. H. (7), VIII, p. 129 (1901).

♂. Head, thorax and abdomen brown tinged with grey; legs with grey bands. Forewing grey-brown, an indistinct waved brown subbasal line from costa to submedian fold with a diffused brown shade between it and the waved antemedial line; medial shade diffused, below the cell extending to postmedial line; a black discoidal bar defined by grey on outer side; postmedial line defined by grey on outer side, minutely waved, bent outwards at vein 6, angled inwards in discal fold and incurved below vein 4, a blackish patch beyond it between veins 6 and 4; subterminal line indistinct, grey, slightly angled outwards at vein 7 and excurved at middle, with a slight brown shade before it at costa and with black streaks beyond it, above and below vein 5; a terminal series of small black and grey lunules; the costa with short grey streaks between the lines. Hindwing fuscous brown; cilia greyish at tips; the underside irrorated with grey, a small discoidal spot and curved postmedial line.

*Habitat*.—BURMA, Beeling. *Exp*. 20 mill.

2076. *a*. METACHROSTIS ILLOSIS, n. sp.

♂. Head and thorax reddish mixed with black; pectus and legs ochreous brown, the tibiæ and tarsi banded with black; abdomen ochreous brown suffused with black. Forewing greyish mostly suffused with fuscous brown, leaving the terminal area and the postmedial area below vein 5 paler, the medial area except towards costa reddish brown; a pinkish subbasal line from costa to submedian fold with two slight black streaks on an ill-defined pale patch beyond its lower extremity; an obliquely curved, slightly waved, whitish antemedial line, pinkish at costa; a narrow oblique reniform stigma with whitish annulus, some black suffusion before it in and below cell; postmedial line dark, defined on outer side by pinkish on costal area and purplish below vein 6, oblique towards costa, excurved at vein 6 and middle, then incurved and slightly waved, some black beyond it between veins 7 and 5, on which it is produced to streaks, some pinkish points on costa; subterminal line indistinct, pale, excurved at vein 7 and middle and with two slight black streaks before it below costa; a terminal series of small dark lunules with prominent black point at submedian fold; cilia black at apex. Hindwing fuscous brown; the underside whitish, irrorated, and the costal area suffused with fuscous, a small discoidal lunule, sinuous postmedial line and diffused subterminal line.

*Habitat.*—CEYLON, Maskeliya (Alston). *Exp.* 26 mill. Type in B. M.

2077. METACHROSTIS HYPINOIDES, insert (syn.) 2840, c. *Falcimala sagittifera*

2083. *a.* METACHROSTIS FAUSTA, Swinh. A. M. N. H. (7) XI, p. 506 (1903).

♀. Head and thorax brown mixed with fuscous; abdomen reddish-brown tinged with fuscous and with the extremity ochreous. Forewing olive ochreous suffused with purplish fuscous to the postmedial line and irrorated with some white scales; an indistinct black subbasal line from costa to submedian fold; antemedial line double, slightly waved and filled in with olive ochreous; orbicular and reniform small with brownish centres and olive annuli defined by black, the former round; postmedial line double filled in with white, oblique from costa to vein 6 where it is obtusely angled, then inwardly oblique; a diffused apical brown patch, a spot on inner margin before tornus and some slight suffusion at middle of termen. Hindwing pale fulvous yellow; some fuscous suffusion at base, a discoidal point and fine terminal line; the underside irrorated with fuscous, a small discoidal spot, curved minutely waved postmedial line and spot on termen near tornus.

*Habitat.*—TENASSERIM, Tandong, 4,000′. *Exp.* 22 mill.

2085. *a.* METACHROSTIS HEMIPHÆA. n. sp.

Head and thorax greyish usually mixed with fuscous, or uniform rufous; tarsi fuscous with pale rings; abdomen dorsally brownish suffused with fuscous ventrally whitish. Forewing with the basal half grey or brownish more or less suffused with fuscous, the terminal half dark-brown shading into purplish, towards postmedial line, then red-brown, a double straight subbasal line from costa to submedian fold; a double straight antemedial line with black point on its outer edge in cell; a slight black discoidal lunule; postmedial line brown on a narrow grey band, oblique from costa to vein 7 and slightly incurved at discal and submedian folds; subterminal line pale grey, very minutely waved, excurved at middle, then incurved; a terminal series of black points. Hindwing fuscous, the cilia greyish at tips; the underside grey irrorated with fuscous, a small discoidal spot, sinuous postmedial line and diffused subterminal line.

*Habitat.*—MADRAS, Gooty (Campbell), Nilgiris (Hampson); CEYLON, Colombo (Mackwood), Hambantota (Pole). *Exp.* 24-26 mill. Type in B. M.

# BIRDS OF THE PROVINCES OF KASHMIR AND JAMMU AND ADJACENT DISTRICTS.

By

A. E. Ward.

## Part II.

### Fam. Laniidæ.

(469). *Lanius lahtora.*—The Indian Grey Shrike is found in Jammu.

(472). *Lanius homeyeri.*—Homeyer's Grey Shrike. This bird is recorded from Gilgit.

(476). *Lanius erythronotus.*—The Rufous-backed Shrike. Widely distributed; one of the common birds of Kashmir.

(478). *Lanius colurio.*—The Red-backed Shrike. Dr. Scully records this bird at Gilgit.

(488). *Tephrodornis pondicerianus*—The Common Wood-shrike. A single specimen found in Poonch.

(495). *Pericrocotus brevirostris*—The Short-billed Minivet breeds in Kashmir.

(499). *Pericrocotus roseus.*—The Rosy Minivet appears to be rare and is apparently confined to Jammu and Poonch.

(500). *Pericrocotus peregrinus.*—The Small Minivet.

(505). *Campophaga melanoschista.*—The Dark-grey Cuckoo-shrike, found on Murree Road, Jammu, and Poonch.

### Fam. Oriolidæ.

(518). *Oriolus kundoo.*—The Indian Oriole, breeds in Kashmir up to about 6,000′. I have seen these birds at an altitude of 7,500′.

### Fam. Sturnidæ.

(529). *Sturnus humii.*—The Himalayan Starling is rarely found in Kashmir in winter, but is very plentiful in the early spring and summer; it breeds from April to June from 5,000 feet to about 7,000 feet.

(532). *Sturnus menzbieri.*—The Common Indian Starling migrates through Kashmir in spring, and rarely stays to breed, but eggs have been taken in the Lolab, &c.

(530). *Sturnus porphyronotus.*—The Central-Asian Starling. No records of this bird breeding in Kashmir appear to exist.

(544). *Temenuchus pagodarum.*—The Black-headed Myna was obtained in Achhabal Reserve, June 5th.

(549). *Acridotheres tristis.*—The Common Myna.

### Fam. Muscicapidæ.

(557). *Muscicapa grisola.*—The Spotted Flycatcher. Apparently confined to Baltistan and Gilgit.

(558). *Hemichelidon siberica.*—The Sooty Flycatcher breeds in large numbers in Kashmir and generally constructs its nest under the bark of birch trees.

(560). *Siphia strophiata.*—The Orange-gorgeted Flycatcher is apparently rare.

(562). *Siphia albicilla.*—The Eastern Red-breasted Flycatcher. The eggs of this bird were found in Dachgam valley (6,000′) on 28th May and the bird identified by Mr. Stuart Baker.

(563). *Siphia hyperythra.*—The Indian Red-breasted Flycatcher. Several specimens have been recorded from various parts of Kashmir and the adjacent valleys.

(567). *Cyornis leucomelanurus.*—The Slaty-blue Flycatcher. Very plentiful; breeds in June and July.

(568). *Cyornis superciliaris.*—The White-browed Blue Flycatcher is plentiful.

(575). *Cyornis rubeculoides.*—The Blue-throated Flycatcher. I have not found this bird breeding in any of the districts we are dealing with.

(579). *Stoparola melanops.*—The Verditer Flycatcher is not often met with, but I have specimens from Kashmir marked April and May, mostly from near Srinagar.

(588). *Alseonax latirostris.*—The Brown Flycatcher. This bird is rare and probably not to be found west of the Chandra-Baga in Kishtwar.

(589). *Alseonax ruficaudus.*—The Rufous-tailed Flycatcher. Widely distributed; breeds at considerable altitudes.

(592). *Culicicapa ceylonensis.*—The Grey-headed Flycatcher is rare, but is recorded from the Lolab and Kashmir valley.

(598). *Terpsiphone paradisi.*—The Indian Paradise Flycatcher. A well known summer visitor.

(604). *Rhipidura albifrontata.*—The White-browed Fantail Flycatcher is rare.

(605). *Rhipidura albicollis.*—The White-throated Fantail Flycatcher.

FAM. TURDIDÆ.

(608). *Pratincola caprata.*—The Common Pied Bush-Chat. A few specimens obtained.

(610). *Pratincola maura.*—The Indian Bush-Chat is plentiful and is found up to 7,000′ altitude and perhaps higher; in summer it generally breeds at about 5,000′ to 7,000′.

(615). *Oreicola ferrea.*—The Dark-grey Bush-Chat is fairly common.

(617). *Saxicola albinigra.*—Hume's Chat is recorded from Gilgit. (Fauna of British India, Birds, Vol. II.)

(618). *Saxicola picata.*—The Pied Chat. I had a specimen which was marked Liddar, Kashmir, 7,000′.

(619). *Saxicola capistrata.*—The White-headed Chat (doubtful).

(620). *Saxicola opistholeuca.*—Strickland's Chat; migrates through Baltistan and is recorded from Gilgit.

(621). *Saxicola pleschanka.*—The Siberian Chat; breeds in Kashmir side valleys.

(623). *Saxicola vittata.*—The Black-backed Eared Chat; recorded from Gilgit.

(624). *Saxicola œnanthe.*—The Wheat-ear Chat is recorded in the Fauna of British India, Birds, Vol. II. I have not found this bird as yet.

(625). *Saxicola isabellina.*—The Isabelline Chat has been found in Baltistan.

(626). *Saxicola deserti.*—The Desert Chat is rarely met with, and in the spring only.

(627). *Saxicola montana.*—Gould's Chat was obtained on the Fotu-la, Ladak Road, May 31, and a single light-blue egg, 79″ × 51″, found at Pangong Lake, June 23rd. A fairly common bird in summer in Ladak; next season I hope to find out more about the nesting of the bird.

(628). *Saxicola chrysopygia.*—The Red-tailed Chat (doubtful).

(630). *Henicurus maculatus.*—The Western Spotted Forktail breeds in Kashmir in June and July, generally at about 7,000.'

(637). *Microcichla scouleri.*—The Little Forktail is seldom met with.

(638). *Chimarrhornis leucocephalus.*—The White-capped Redstart breeds generally high up; is common. Eggs found June and July.

(639). *Ruticilla frontalis* —The Blue-fronted Redstart is known to breed at about 9,000′ and upwards in May and June.

(642). *Ruticilla erythronota.*—Eversman's Redstart. Nearly all my specimens were obtained in the early spring near Somagai.

(643). *Ruticilla hodgsoni.*—Hodgson's Redstart. A single specimen was from Chusal, Ladak, where it was breeding.

(644). *Ruticilla rufiventris.*—The Indian Redstart. The eggs of this bird have been brought down from Ladak by my collectors.

(645). *Ruticilla erythrogaster.*—Güldenstadt's Redstart. My specimens are from Kashmir, obtained in the spring and from Ladak in summer.

(646). *Rhyacornis fuliginosus.*—The Plumbeous Redstart. A very common bird in all the hill streams and rivers.

(648). *Cyanecula wolfi.*—The White-spotted Blue-throat is found in Ladak, but is rare. A specimen obtained in the Ladak Road.

(647). *Cyanecula suecica.*—The Indian Blue-throat is common.

(651). *Calliope pectoralis.*—The Himalayan Ruby-throat. Breeds in Kashmir; a common bird.

(652). *Calliope tschebaiewi.*—The Tibet Ruby-throat. This bird is to be found near Chusal, Ladak. Capt. Leslie found what are supposed to be this bird's eggs on the borders of W. Tibet.

(653). *Tarsiger chrysæus.*—The Golden Bush-Robin not yet obtained.

(654). *Ianthia infilata.*—The Red-flanked Bush-Robin.

(657) *Adelura cæruleicephala.*—The Blue-headed Robin. The specimens I have obtained are marked April, Kashmir.

(661) *Thamnobia cambaiensis.*—The Brown-backed Indian Robin. Is recorded from the Murree Road.

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(666) *Merula maxima.*—The Central Asian Blackbird. Breeds in Kashmir at high altitudes in May and June.

(673) *Merula castanea.*—The Grey-headed Ouzel. I found numbers in 1904, at about 8,000'. This bird perches on the tops of the fir trees and is hard to secure. During some seasons it is very rarely found. Breeds in May. See Catalogue of Eggs, British Museum.

(675) *Merula ruficollis.*—The Red-throated Ouzel is occasionally found in Kashmir in winter.

(676) *Merula boulboul.*—The Grey-winged Ouzel.

(677) *Merula atrigularis.*—The Black-throated Ouzel is very common in the lower jungles during the winter.

(678) *Merula unicolor.*—Tickell's Ouzel is a very common bird.

(686) *Crociclila citrina.*—The Orange-headed Ground-Thrush. I have no specimen from Kashmir, but it doubtless occurs in the lower ranges.

(690) *Petrophila erythrogastra.*—The Chesnut-bellied Rock-Thrush. This bird most probably is to be found in Kishtwar, &c.

(691) *Petrophila cinclorhyncha.*—The Blue-headed Rock-Thrush is plentiful.

(693) *Petrophila cyanus.*—The Western Blue Rock-Thrush. The specimens I have are from Kasgil and Baltistan and were obtained in the summer.

(694) *Monticola saxatilis.*—The Rock-Thrush has been obtained once in the Leddai Valley. The specimen is in the British Museum. I have others from Baltistan found in the summer.

(695). *Turdus viscivorus.*—The Missel-Thrush breeds in the forests of Kashmir and is plentiful during the winter in the lower valleys.

(696) *Turdus pilaris.*—The Fieldfare. I am assured this bird is to be found, but I have never met with it in Kashmir or Jammu Provinces.

(698) *Oreocincla dauma.*—The Small-billed Mountain-Thrush. I think this bird cannot be common; I have rarely seen it.

(701) *Oreocincla mollissima.*—The Plain-backed Mountain-Thrush. Was obtained near Somajai, January 19th, 1904.

(708) *Cinclus kashmiriensis.*—The White-breasted Asiatic-Dipper is common at various altitudes, and is found throughout the country. It often breeds near glaciers.

(709) *Cinclus asiaticus.*—The Brown Dipper. A very common bird. Appears to breed during the whole spring and early summer.

(711) *Cinclus sordidus.*—The Sombre Dipper. I have not found this species.

(712) *Accentor nepalensis.*—The Eastern Alpine Accentor. This bird is said to breed in Eastern Ladak. It is found in Chin and in Baltistan and Gilgit. I have not yet succeeded in tracing the line of migration and have never observed it in Kashmir proper.

(713) *Accentor himalayensis.*—The Altai Accentor. Large flocks pass through Kashmir in the spring.

(715) *Tharrhaleus rubeculoidis.*—The Robin Accentor. Very common in the N. E. of Ladak in summer where it breeds in May and June, building in bushes.

(716) *Tharrhaleus atrigularis.*—The Black-throated Accentor is common in Kashmir in the spring, evidently when migrating.

(717) *Tharrhaleus fulvescens.*—The Brown Accentor. I have the eggs and a specimen from Chausa Ladak and also from the borders of Western Tibet.

(718) *Tharrhaleus strophiatus.*—The Rufous-breasted Accentor. This bird was found breeding at 11,000′ in June 28, in Kashmir; and migrates through Kashmir in spring in flocks.

(719) *Tharrhaleus jerdoni.*—Jerdon's Accentor. Breeds in Soonamurg, Leddar and Sinde Valleys in June and July.

FAM. PLOCEIDÆ.

(720) *Ploceus baya.*—The Baya. Is not found in the hills, being confined to the plains of Jammu Province.

(723) *Ploceus manyar.*—The Striated Weaver Bird. I have not as yet found this bird in Poonch or Jammu. It is not a visitor to Kashmir.

(734) *Uroloncha malabarica.*—The White-throated Munia.

(738) *Sporæginthus amandava.*—The Indian Red Munia. My specimens are marked "plains of Jammu."

FAM. HIRUNDINIDÆ.

(804) *Chelidon urbica.*—The Martin breeds in Ladak and I have eggs from the lower hills besides those from Ladak.

(805) *Chelidon kashmiriensis.*—The Kashmir Martin. I have found this bird breeding in July in Suru.

(808) *Cotile riparia.*—The Sand Martin.

(809) *Cotile sinensis.*—The Indian Sand Martin.

(810) *Ptyonoprogne rupestris.*—The Crag-Martin. The eggs of this Martin were obtained on the Shyok river north of Leh.

(813) *Hirundo rustica.*—The Swallow, a summer visitor.

(818) *Hirundo smithii.*—The Wire-tailed Swallow is also a summer visitor.

(819) *Hirundo fluvicola.*—The Indian Cliff-Swallow.

(822) *Hirundo nepalensis.*—Hodgson's Striated Swallow. I have no specimens of this bird or of the preceding species.

(824) *Hirundo rufula.*—The European Striated Swallow is apparently a summer visitor to the distant districts of Gilgit and Baltistan.

FAM. FRINGILLIDÆ.

We have still a great deal to learn regarding the migrations and breeding of this family, and information comes in slowly. As the Finches are very migratory and visit distant parts, my collectors have, I regret to say, done but little; it is not easy to get men to travel in Northern Ladak and Tibet, and during my own journeys I was peculiarly unsuccessful in finding nests. Mr. Stuart Baker has corresponded with me on this subject and been most obliging. Next year if all goes well I trust I shall have more to report.

(743) *Pyrrhorhamphus carneipes.*—The White-winged Grosbeak. Of this Grosbeak I have no record from Kashmir proper.

(741) *Pycnorhamphus icteroides.*—The Black and Yellow Grosbeak. This is a very common bird, and is found in the spring in flocks. This year (1905) the birds, owing to the heavy snows on the hills, stayed down until late in June, but they generally move up to about 9,000′ early in May.

(744) *Mycerobas melanoxanthus.*—The Spotted-winged Grosbeak. I have not yet got a specimen, but this bird is recorded from various parts.

(745) *Pyrrhula aurantiaca.*—The Orange Bull-finch. I have not yet got the nest. This bird is very plentiful and is found at all seasons in Kashmir moving upwards in May.

(746) *Pyrrhula erythrocephala.*—The Red-headed Bull-finch is certainly a rare bird in Kashmir, but is recorded.

(753) *Phyrrhospiza punicea.*—The Red-breasted Rose-Finch. A common bird in summer in the eastern part of Ladak and breeds in July at about 14,000 ft.; it is not found at Chusal.

(754) *Propasser thura.*—The White-browed Rose-Finch. A considerable number pass through Kashmir in the spring, and may be seen in small flocks pecking about under the bushes; migrates to Ladak, but whether it passes into Tibet to breed I am not sure. A bird was seen in Kashmir at 7,000′ in September.

(757) *Propasser grandis.*—The Red-mantled Rose-Finch.

(758) *Propasser rhodochrous.*—The Pink-browed Rose-Finch. This bird is not rare at high elevations in summer and I have specimens from the lower hills obtained in the early spring.

(761) *Carpodacus erythrinus.*—The Common Rose-Finch is found in Kashmir, Baltistan and Ladak.

(762) *Carpodacus severtzovi.*—Severtzoff's Rose-Finch. I am doubtful about the only specimen labelled Kashmir, but this Finch is found towards the Ladak boundary.

(764) *Erythrospiza mongolica.*—The Mongolian Desert-Finch. As far as I am aware this bird has not been found on the Kashmir side of the snowy passes.

(765) *Procarduelis nepalensis.*—The Dark Rose-Finch appears to be rare.

(767) *Carduelis caniceps.*—The Himalayan Gold-Finch as a rule migrates over the Kashmir passes, but some few breed in the hills as low down as 7,000′.

(768) *Callacanthis burtoni.*—The Red-browed Finch evidently breeds in Kashmir. I have obtained it in summer in the Wadhwan and Leddar valleys.

(769) *Acanthis fringillirostris.*—The Eastern Linnet appears to be rare.

(770) *Acanthis brevirostris.*—The Eastern Twite has been recorded from the Indus valley near Gilgit and elsewhere in those parts.

(771) *Metoponia pusilla.*—The Gold-fronted Finch. The only place where I have found this bird breeding is in Baltistan. I have eggs from Suru.

(772) *Hypacanthis spinoides.*—The Himalayan Green-Finch is a common bird ranging up to about 8,000′.

(774) *Fringilla montifringilla.*—The Brambling migrates through Kashmir.

(776) *Passer domesticus.*—The House-Sparrow.

(778) *Passer hispaniolensis.*—The Spanish Sparrow. I found this bird in the Nowboog valley in July.

(779) *Passer montanus.*—The Tree-Sparrow.

(780) *Passer cinnamomeus.*—The Cinnamon Tree-Sparrow is a very common bird breeding in May, June, and July at elevations up to 8,000′.

(782) *Pertronia stulta.*—The Rock-Sparrow is recorded in Fauna of British India as a winter visitor to Gilgit. Found on the Indus in April.

(784*a*) *Montifringilla mandellii.*—Mandelli's Snow-Finch. The only specimen I have obtained is from Ladak.

(784) *Montifringilla ruficollis.*—The Red-necked Mountain-Finch. About this bird I am very doubtful, but it is said to have been obtained over the border beyond eastern Ladak.

(785) *Montifringilla adamsi.*—Adams's Mountain-Finch. I have never obtained this bird in Kashmir proper, but have found it just over the Lagila Pass and secured an egg 15 July—white, 85″×56″; this bird is to be found in Ladak in summer.

(787) *Fringillauda sordida.*—Stoliczka's Mountain-Finch breeds in Kashmir, generally under stones; the eggs are white.

(788) *Fringillauda brandti.*—Brant's Mountain-Finch. Whether by chance or owing to scarceness, I have only one specimen found in June at about 16,000′ in Ladak.

(789) *Emberiza schæniclus.*—The Reed-Bunting. This bird I have not succeeded in getting inside our frontiers, but it is recorded from Gilgit.

(790) *Emberiza fucata.*—The Grey-headed Bunting. I have not obtained this Bunting, and imagine it must be rare in Kashmir.

(792) *Emberiza leucocephala.*—The Pine-Bunting. A few are to be seen in the early spring in most parts of Kashmir.

(793) *Emberiza stewarti.*—The White-capped Bunting is rarely to be seen.

(794) *Emberiza stracheyi.*—The Eastern Meadow Bunting is resident.

(795) *Emberiza buchanani.*—The Grey-necked Bunting is seldom to be found even in the migrating season, which is in the early spring.

(796) *Emberiza hortulana.*—The Ortolan Bunting. I have no information about this Bunting; it is *said* to have been obtained.

(799) *Emberiza melanocephala*—The Black-headed Bunting is only found when migrating. I have not yet seen it in Kashmir Proper.

(803) *Melophus melanicterus.*—The Crested Bunting.

(*To be continued.*)

# NOTES ON ANDAMAN BIRDS,

## WITH ACCOUNTS OF THE NIDIFICATION OF SEVERAL SPECIES WHOSE NESTS AND EGGS HAVE NOT BEEN HITHERTO DESCRIBED.

By

B. B. Osmaston, I.F.S.

Part II.

(*Continued from page* 163 *of this Volume.*)

1078. *Chætura indica.*—The Brown-necked Spine-tail.

Common near the top of Mount Harriet. Breeding place unknown.

1084. *Collocalia francica.*—The Little Grey-rumped Swiftlet.

Colonies of this swiftlet breed in caves by the shore on South Bulton, Niell, Chiruja tapu and other islands. On March 18th I visited such a cave on the South Cinque Island. The floor of the cave was just above high water level, and the concave surface of the roof was about 10 feet from the ground, and was covered with freshly-built nests. These nests are the best edible variety of commerce. They are white, opaque and translucent, and consist of inspissated saliva with little or no extraneous matter. They are more or less half-cupshaped, and they weigh about half an ounce each. The cave I am describing is a small one, only about 12 feet long by 6 feet broad, and it contained about 100 nests. Most of the nests contained 2 fresh eggs. There were a few large active crabs moving about among the nests in the roof, which did not appear to interfere with the eggs, though possibly they may destroy the freshly hatched young.

The eggs are long ovals, with little or no gloss.

Length 0·73″ to 0·85″. Breadth, 0·52″ to 0·55″. Average of 20 eggs, 0·80″ × 0·54″.

1085. *Collocalia linchi.*—Horsfield's Swiftlet.

This is the commonest swiftlet in the Andamans, being found almost everywhere. It breeds in vast numbers in the saw mills on Chatham, as well as in various caves along the seashore, *e. g.* at Chiruja tapu. The nests are composed of moss, consolidated with small quantities of mucilaginous saliva. In the Chatham saw mills, however, moss is not used, but casuarina leaves and sometimes cocoanut fibre instead. Neither the casuarina tree nor the cocoanut palm is indigenous in the Andamans. The nests of this species are of no value for commercial purposes on account of the large proportion of extraneous matter they contain. The average weight of a nest is one-sixth oz. The eggs—two in number—are laid chiefly in February and March.

Length, 0·61″ to 0·75″. Breadth 0·41″ to 0·46″. Average of 24 eggs, 0·69″ × 0·44″.

1094. *Caprimulgus andamanicus.*—The Andaman Nightjar.

Not uncommon in suitable places, especially in dry hilly jungle. The note of this bird is a "chuck, chuck, chuck . . . " repeated fairly rapidly.

I found a single egg slightly incubated on April 9 lying on the dry leaves in a patch of deciduous forest on Baratang Island. Another broken egg lay about 2 feet away in the ground. The parent-bird when disturbed flew yards away and then kept moving about, raising her wings and opening her mouth.

I found another nest with two half-fledged young in a similar situation at Stewart Sound on May 4. The egg is broadly elliptical, with a slight gloss. The ground is pale salmon, with dull pinkish-brown spots and blotches and underlying grey markings.

Dimensions of egg, 1·1″ × 0·84″

1107. *Cuculus micropterus.*—The Indian Cuckoo.

Common and noisy from April to June.

1120. *Eudynamis honorata.*—The Indian Koel.

Very common in the cold weather, arriving September-October, and leaving in April. They do not breed in the Andamans.

1132. *Centropus andamanensis.*—The Andaman Coucal.

Common wherever there is thick cover. Noisy, especially in the evenings, when they give their call of "Hoop, Hoop," &c. They also have a curious chuckling call, as well as a low grating one inaudible unless one is quite close. They breed in July, building the usual large globular nest of twigs lined with dry cane or palm leaves, which is placed in some dense shrub or thicket at no great height from the ground. The eggs, generally 3 in number, are white and glossless, bearing usually yellow stains which cannot be removed.

Length, 1·28″ to 1·47″. Breadth, 1·06″ to 1·13″. Average of 6 eggs, 1·40″ × 1·10″.

1137. *Palæornis magnirostris.*—The Large Andaman Paroquet.

Exceedingly common everywhere.

1145. *Palæornis fasciatus.*—The Red-breasted Paroquet.

Perhaps the commonest bird in the Andamans. Comes into Port Blair in tens of thousands in December and January, devouring the paddy.

1148. *Palæornis tytleri.*—The Red-cheeked Andaman Paroquet.

Not so common as the last, but still very numerous. I found a nest in a hole in an avenue tree (Padouk) 15 feet from the ground on 20th February. It contained two fresh eggs.

1150. *Loriculus vernalis.*—The Indian Loriquet.

Exceedingly common, especially in Port Blair, feeding on fruit, especially guavas. They lay their eggs at the bottom of holes in stumps, the eggs being usually below the level of the ground. The nest cavity is lined with a layer of green leaves, cut into segments. Four eggs are laid, which are white and glossy.

The average of 4 eggs gave 0·76″ × 0·62″.

1152. *Strix flammea.*—The Barn-Owl or Screech-Owl.

I caught a full-grown specimen of this owl in a field. It is now alive in the Calcutta Zoological Gardens.

1173. *Scops balli.*—The Andaman Scops Owl.

This owl is common everywhere, but thoroughly nocturnal and therefore rarely seen. I found a nest in a hole in a Padouk tree with a single fresh egg,

the bird being captured on the nest. I retained her alive in captivity for 4 days in hopes she would lay other eggs, but with no success. I then let her go at a distance of about 2 miles from the site of her nest and on another island. About 3 weeks later on re-visiting the nest-hole I found it occupied again by another (or the same ?) owl with two fresh eggs.

The eggs are of the usual *Scops* type, and the average of 3 eggs gives 1·22″ × 1·01″.

1188. *Ninox obscura*.—Hume's Brown Hawk-Owl.

A young bird of this species was brought to me in May 30. It fed on rats and mynahs, and is now alive in the Calcutta Zoological Gardens.

1217. *Spilornis cheela*.—The Crested Serpent-Eagle.

Very common, especially near mangrove swamps. I saw one capture an eel about a foot long in shallow water.

1224. *Haliaëtus leucogaster*.—The White-bellied Sea-Eagle.

Fairly common throughout the Andamans, but not more than one pair is found in any one locality. I have seen their nests on Craggy, Sir Hugh Rose, and the South Cinque Islands. They are built on lofty trees and are usually almost inaccessible without special climbing appliances.

1234. *Circus cinereaceus*.—Montagu's Harrier.

Common from November to March throughout the open country round Port Blair.

1237. *Circus æruginosus*.—The Marsh-Harrier.

Less common than the above. Frequents marshes as at Nadahachang.

1248. *Accipiter virgatus*.—The Besra Sparrow-Hawk.

Not uncommon near Port Blair. I found two nests. One on April 24 at Baratang Island was situated in a dense and rather lofty mangrove forest, the nest being at the top of a mangrove pole about 30 feet from the ground. It contained one young bird and two eggs on the point of hatching. On April 27 I found a second nest in a Padouk plantation near Gobang. It was made of sticks just like a crow's, but lined with green leaves and contained 3 incubated eggs. The nest had been built in a leafless tree and was most conspicuous. The eggs were dull white, boldly blotched, and occasionally streaked with chocolate brown. One egg had none of the dark markings, but was speckled and spotted all over with a light shade of brown.

Average of 3 eggs 1·44″×1·21″.

1254. *Falco peregrinus*.—The Peregrine Falcon.

I twice saw a peregrine seated on the same tree near Brigade Creek. She had a large paroquet in her claws on the first occasion.

1276. *Osmotreron chloroptera*.—The Andaman Green Pigeon.

Common, frequenting the various kinds of fig trees in large or small flocks. I could not ascertain when or where they were building.

1284. *Carpophaga ænea*.—The Green Imperial Pigeon.

Very common throughout the extensive and lofty forest growth all over the Islands. I found a nest on April 10 containing a single hard set egg.

The nest was the usual platform of sticks in a moderate-sized tree in the forest. The egg measures 1·29″ × 1·34″.

1289. *Myristicivora bicolor.*—The Pied Imperial Pigeon.

Rare in the Andamans though common in Narcondam.

1290. *Calœnas nicobarica.*—The Nicobar Pigeon.

This pigeon is not, I believe, so rare as is generally supposed in the Andamans. It frequents thick forest and is not easy to see. I shot one on Havelock Island on February 1st.

1291. *Chalcophaps indica.*—The Bronze-winged Dove.

Common everywhere in suitable places. I found a nest in a low shrub in thick forest on May 29. It contained a single fresh egg of a pale *café-au-lait* colour.

1309. *Turtur cambayensis.*—The Little Brown Dove.

This dove is reported as common in the Andamans, but I have not come across it.

1311. *Œnopopelia tranquebarica.*—The Red Turtle-Dove.

Exceedingly common in and around Port Blair, breeding in April and May. This dove was rare in Hume's time (1873), but has multiplied apparently with the increase in area under cultivation.

1313. *Macropygia rufipennis.*—The Andaman Cuckoo-Dove.

Not common but found widely distributed in high forest. The call of this dove is peculiar, somewhat resembling that of *Cuculus canorus*, the Common Cuckoo.

1375. *Francolinus pondicerianus.*—The Grey Partridge.

This partridge has been introduced into the settlement and has now become naturalized in all the open country around, viz., Aberdeen, Protheroepur, Garacharama and Bumtitan.

1390. *Hypotænidia obscurior.*—The Andamanese Banded Rail.

Very common in marshy meadows and reedy swamps. It does not readily rise and has a slow heavy flight. I found a number of nests in tufts of grass and rushes in swampy ground between June 15 and August 15. The nest is merely a pad of dry grass usually well concealed in the rushes. Six eggs appears to be the full complement. They are slightly glossy and in colour pale dun, spotted and blotched, chiefly at the broad end, with reddish brown or bright chestnut and with some underlying greyish markings. One egg in each clutch is usually coloured differently to the rest, being much paler, with less red and more grey in the markings.

Length from 1·38″ to 1·54″. Breadth from 1·05″ to 1·16″. Average of 20 eggs, 1·46″ × 1·09″.

1401. *Amaurornis phœnicurus.*—The White-breasted Water-hen.

This bird is very common and exceedingly noisy. It frequents thick jungle far from water as well as brushwood near streams and swamps. In the evenings in spring it is particularly garrulous, emitting a most extraordinary variety of improbable sounds. It is locally known as the "Jangli murghi".

I found many nests in June and July containing, as a rule, 4 eggs in each. They were built sometimes in thick brushwood, and sometimes on the ground in rushes and grass.

1420. *Esacus magnirostris.*—The Australian Stone-Plover.

One or more pairs of this fine plover frequent the shore of almost every island, *e. g.* North Bulton, Niell, Sir Hugh Rose, Cinques, &c. I failed to find their eggs, but they certainly breed in the spring.

1421. *Dromas ardeola.*—The Crab-Plover.

Not common in the Andamans. I saw a large flock of about 60 or 70 at Rogolochang (Baratang Island) in April, and secured several by stalking them in the shore after dark.

1425. *Glareola orientalis.*—The Large Indian Pratincole.

Rare. I shot one out of a pair, at the Vadakachang swamp, early in March.

1430. *Strepsilas interpres.*—The Turnstone.

Fairly common. I shot 5 out of a flock of about 20 on North Bulton on 5th May. They were in fine rufous breeding plumage.

1439. *Charadrius fulvus.*—The Eastern Golden Plover.

Fairly numerous in the cold weather, being found in grass lands and on the banks of tidal creeks.

1442. *Ægialitis geoffroyi.*—The Large Sand Plover.

Not uncommon in Port Blair in the spring.

1454. *Numenius arquata*—The Curlew.

Common on muddy shores and along tidal creeks, generally solitary or in pairs, and very wary. They come in about October and disappear in April.

1455. *Numenius phæopus.*—The Whimbrel.

Similar habits to the above, but less wary and more numerous, being often found in small flocks of 3 or 4 to a dozen.

1460. *Totanus hypoleucus.*—The Common Sandpiper.

This is the commonest of our shore birds, being found almost everywhere in suitable open, damp places. They are the first of the summer emigrants to arrive and the last to leave. A few stragglers may usually be seen well on into May, and by the middle of August they begin to return from their northern breeding haunts.

1472. *Tringa ruficollis.*—The Eastern Little Stint.

Shot at Nadakachang swamp in January.

1473. *Tringa subminuta.*—The Long-toed Stint.

Shot at Nadakachang swamp in March in the same spot which had been occupied by *T. ruficollis* earlier in the year.

1484. *Gallinago cœlestis.*—The Common Snipe.

A single specimen of this snipe was shot last season by Captain Howard-Vyse.

1485. *Gallinago stenura.*—The Pintail Snipe.

Common in suitable places throughout the cold weather. They begin to arrive in September and disappear in April.

1512. *Sterna melanauchen.*—The Black-naped Tern.

Very common around the Andamans, frequenting the more sheltered east coast during the S. W. Monsoon (May to October) and the west coast for the remaining 6 months to avoid the north-easterly breezes. They breed on small rocky islands off the east coast from May to July, laying one or two eggs, which vary a great deal in colour. The majority are greyish in ground with numerous spots of dark or light brown. Some eggs are much warmer in colouration, with reddish brown blotches, and some have the ground colour of the egg yellowish-brown or pale-green instead of grey.

1554. *Ardea manillensis.*—The Eastern Purple Heron.

Not uncommon in open swampy places, as at Nadakachang.

1561. *Herodias garzetta.*—The Little Egret.

Flocks of these birds are often to be seen around Viper, Flat Bay and towards Namunagarh. I could not ascertain their breeding haunts.

1564. *Leptorodius sacer.*—The Eastern Reef Heron.

Common on every rocky shore and island. They breed from April to June, chiefly on rocky islands. The nest consists of a few sticks roughly put together and is placed in some low bush or between rocks on the ground. The eggs, 2 or 3 in number, are pale blue and glossless.

1572. *Ardetta cinnamomea.*—The Chestnut Bittern.

Common in fresh-water swamps, being found usually in pairs. I found numerous nests between June 25 and August 15 containing 3 or 4 eggs almost pure white or with the faintest conceivable green tinge. The nest is merely a pad of rushes bent down to support the eggs a few inches above the water.

1589. *Dendrocygna javanica.*—The Whistling Teal.

Fairly common around Port Blair, but not so numerous as the Oceanic teal. They breed throughout August and September. Three nests I have seen have been placed on the ground in swamps, well concealed from view by rank vegetation and creeping ferns.

About 10 eggs are laid, which are broad ovals and pure white.

The average of 8 eggs gives 1·82″ × 1·44″.

1598. *Nettium albigulare.*—The Andaman Teal.

The Oceanic teal arrives in Port Blair in large numbers towards the end of May, where they remain until October or November.

In the winter months they frequent outlying fresh-water jheels such as are found near Craggy Island, North Reef Island, Niell, the Brothers, Templeganj and other places. They breed, as far as my experience goes, invariably in holes in lofty and often dead trees, and the eggs are therefore very difficult to procure.

A man brought me down 10 eggs from near the top of a huge Padouk tree on August 4. They were nearly fresh.

They are rather long, elliptical ovals, cream coloured, and much discoloured They varied in length from 1·86″ to 2·02″ and in breadth from 1·40″ to 1·47″, the average of 9 eggs being 1·93′ × 1·43″,

# A LIST OF BIRDS FOUND IN THE MYINGYAN DISTRICT OF BURMA.

BY

K. C. MACDONALD.

PART II.

(*Continued from page* 194 *of this Volume.*)

XXII.—FAMILY *Upupidæ*.

1067. *Upupa indica.*—The Indian Hoopoe.

Local name "Taung-pi-sot". A resident, although locally migratory bird. In January the Myingyan cantonment appears full of them,—half a dozen under every big tree,—yet in March scarcely a bird is to be seen there. It sometimes screeches when on the wing like a flushed snipe but louder and harsher. I took two eggs from a nest at the bottom of Popa on the 9th June and again four fresh eggs on the 28th May. The nest was in a hole of a tree, about 10 feet from the ground.

XXIII.—FAMILY *Cypselidæ*.

1074. *Cypselus subfurcatus.*—The Malay House Swift.

Local name "Pyanhlwa meekya". One or two colonies breed annually on the cliffs of the Irrawaddy at Pagan and at Sale. At the end of February 1902 I saw no trace of the birds at their usual places, but my man brought me many eggs at the beginning of April. The nests are made of straw, feathers, grass, etc., cemented with saliva and sand, and placed in holes in the cliffs from 3 inches to 2 feet deep. The same holes in the cliffs are used year after year, each successive nest being made further in and behind the preceding year's one, the holes apparently deepened as required.

1076. *Tachornis infumatus.*—The Eastern Palm Swift.

Local name "Pyanhlwa". Common.

1086. *Macropteryx coronata* —The Indian Crested Swift.

Only met with on Popa where it is common and breeds. I came across a fully fledged young bird on the 10th April.

XXIV.—FAMILY *Caprimulgidæ*.

1091. *Caprimulgus asiaticus.*—The Common Indian Nightjar.

Local name "Mye-wot". Very common. Eggs from April till June or July.

1096. *Lycornis cerviniceps.*—The Great Eared Nightjar.

I shot one bird on Popa in April.

XXV.—FAMILY *Cuculidæ*.

1104. *Cuculus canorus.*—The Cuckoo.

I found quite a number of cuckoos were flying about the Myingyan old cantonment during the cold weather of 1901-02. Its stay is very short.

1113. *Cacomantis merulinus.*—The Rufous-bellied Cuckoo.

Quite common.

1118. *Coccystes jacobinus.*—The Pied Crested Cuckoo.

Common during the breeding season.

1119. *Coccystes coromandus.*—The Red-winged Crested Cuckoo.

I shot a specimen at Shawdawtaung on the 2nd June 1902. An egg I took from a nest of *Garrulax moniliger* the same day I think belongs to this bird. They are occasionally met with throughout the district.

1120. *Eudynamis honorata.*—The Indian Koel.

Common during the cold weather and noisy during the breeding season, March and April.

1123. *Rhopodytes tristis.*—The Large Green-billed Malkoha.

Common anywhere where there is thick jungle. In April these birds seemed to be in pairs on Popa, but I never found the nest.

1130. *Centropus sinensis.*—The Common Coucal or Crow-Pheasant.

Local name "Bôt". Occurs throughout the district. A nest with one egg was found on the 17th June. The nest was composed of green leaves lined with straw, and was saucer-shaped, not globular.

1133. *Centropus bengalensis.*—The Lesser Coucal.

I have not killed this bird, but am satisfied that I have seen it fairly often in pieces of thick jungle.

XXVI.—FAMILY *Psittacidæ.*

1136. *Palæornis indoburmanicus.*—The Large Burmese Paroquet.

Local name "Kyet Taw". Common all over the district. Breeds from December to February and lays five eggs averaging 1·21″ × 1·03″ in size.

1138. *Palæornis torquatus.*—The Rose-ringed Paroquet.

Local name "Kyet Tama". Very common throughout the plains, but do not ascend Popa.

1140. *Palæornis rosa.*—The Eastern Blossom-headed Paroquet.

Local name "Kyet Lein". I once noticed a flock of these birds at Wetloo on the 9th January. They allowed me to approach close enough to make quite sure that they were Blossom-headed birds. They are common on Popa and breed during March and April.

1142. *Palæornis finschi.*—The Burmese Slaty-headed Paroquet.

Local name "Kyet Kala". This is the common paroquet of Popa. It is rare, but not wanting, in the plains. It breeds after the usual manner during January and February. Eight eggs measure on the average 1·06″ × ·98″.

1145. *Palæornis fasciatus.*—The Red-breasted Paroquet.

Local name "Kyet Yinni". On the 20th May 1900, a young bird of this species was captured and given to me at Pagan. The black neck stripe was broad and distinct from the first. The red breast began to appear only about July 1901 and the following September the bird was in full plumage. I have seen flocks of thousands of these birds on the slopes of the Chin Hills.

XXVII.—FAMILY *Strigidæ.*

1152. *Strix flammea.*—The Barn-Owl or Screech-Owl.

Local name "Didot". Fairly common over the district. I took 7 eggs from

a barn-owl's nest in November 1899, leaving none, but on going back to it 3 days later found two more eggs in it.

1157. *Asio accipitrinus.*—The Short-eared Owl.

Very common in the grassy "thamin" country round Kanna and the Pin Chaung.

1160. *Syrnium indrani.*—The Brown Wood-Owl.

This bird is to be found sparingly on Popa.

1164. *Ketupa zeylonensis.*—The Brown Fish-Owl.

One of my collectors sent me a skin and two eggs of this bird which he procured on the Pin Chaung in March 1903.

1169. *Bubo coromandus.*—The Dusky-horned Owl.

Blanford says this bird has not been recorded farther south than Manipur. It is, however, fairly common in this district. A skin that I procured is in the British Museum.

1180. *Athene brama.*—The Spotted Owlet.

Local name "Zigwet". A perfect nuisance. Breeds in our houses and the trees in our gardens and everywhere else. The eggs, I have, measure on the average 1·19″ × 1·01″.

1187. *Ninox scutulata.*—The Brown Hawk-Owl.

A skin I sent to the British Museum was identified as this species. I got it on Popa.

XXVIII.—Family *Pandionidæ.*

1189. *Pandion haliaëtus.*—The Osprey.

Local name "Linyon." Seen occasionally on the Irrawady river or on the jheels along its bank. I have not noticed it except in the cold weather.

XXIX.—Family *Vulturidæ.*

1191. *Otogyps calvus.*—The Black Vulture or Pondicherry Vulture.

Local name "Lintahni" or "Ladàni". Always to be met with in a crowd of vultures, but never common. Nests in Myingyan from January to April. My eggs average 3·25″ ×2·56″.

1196. *Pseudogyps bengalensis.*—The Indian White-backed Vulture.

Local name "Lintak-mwe" or "Ladamwe". The commonest vulture of this part; eggs from November to February.

I think *Gyps tenuirostris* is represented in the district, but am not certain.

1203. *Aquila vindhiana.*—The Indian Tawny Eagle.

Local name "Wunlo". Rare. The eggs were brought to me in December.

1207. *Hieraëtus fasciatus.*—Bonelli's Eagle.

Local name "Linyon". The first bird of this species I obtained in Myingyan I had identified by Colonel Bingham. Since then I find it is not rare. It breeds on the largest trees. My eggs were all taken during January.

1212. *Spizaëtus limnaëtus.*—Changeable Hawk-Eagle.

I shot a bird on Popa and identified it as of this species.

1217 *Spilornis cheela.*—The Crested Serpent-Eagle.

A fairly common bird on Popa. I found its nest with one egg each time

on two occasions. On one occasion the bird allowed itself to be taken on the nest.

1220. *Butastur teesa.*—The White-eyed Buzzard-Eagle.

Local name "Gyothein". Common over all the district. The nest is as often in a leafless tree as a thickly foliaged one and usually from 20 to 30 feet from the ground.

1223. *Haliaëtus leucryphus.*—Pallas's Fishing-Eagle.

Local name "Linyon" or "Wunlo". Common along the river bank, where it breeds on the largest trees from November to January. In the throat of a nestling I once found fully four inches of the tarsus of an egret unbroken and projecting from its bill. The nestlings are covered with dense dark-grey down.

1228. *Haliastur indus.*—The Brahminy Kite.

Local name "Sôn-gaung", "Sôn-gaung-pyu". Common in the west parts of the district. Breeds from January to March.

1229. *Milvus govinda.*—The Pariah Kite.

Local name "Sôn". Common, breeding from January to March.

1232. *Elanus cæruleus.*—The Black-winged Kite.

Found near the Talokmyo and Tanaungdaing jheels. I took two eggs on the 6th January and found a nest with three young birds, just able to fly, on the 4th April. Both nests were about 15 feet from the ground: one in a thickly foliaged tree, the other in a leafless one.

1236. *Circus melanoleucus.*—The Pied Harrier.

Common during the cold weather; a bird of the dry country.

1237. *Circus æruginosus.*—The Marsh Harrier.

Local name "Thein". Found near the jheels and tanks in the cold season.

1244. *Astur badius.*—The Shikra.

Occurs, but is not common in the district. I have seen only three or four birds during five years and have never found the nest.

1257. *Falco jugger.*—The Laggar Falcon.

Local name "Gyo-theing". The only true falcon I have observed in the district. It is, however, common and breeds freely on the high cotton trees near the river and elsewhere from January to March.

1262. *Erythropus amurensis.*—The Eastern Red-legged Falcon.

One bird obtained on Popa on the 5th April 1903.

1265. *Tinnunculus alaudarius.*—The Kestrel.

A rare bird in the cold weather.

XXX.—FAMILY *Columbidæ*.

1271. *Crocopus phœnicopterus.*—The Bengal Green Pigeon.

Local name "Ngu". Common.

1278. *Osmotreron bicincta.*—The Orange-breasted Green Pigeon.

A solitary specimen obtained on the 14th March 1901 on the border of the Sagaing district near Kanna.

1284. *Carpophaga ænea.*—The Green Imperial Pigeon.

Local name "Hnget-ma-nwa".—Also a solitary specimen shot on the 3rd

December. This turned out to be a wounded bird for whose appearance I cannot account.

1292. *Columba intermedia.*—The Indian Blue Rock-Pigeon.

Local name "Ko". Flocks of these birds, much interbred with domestic pigeons, are to be met with on the cliffs along the Irrawaddy river from Pagan to Yenangyaung. They give good sport from a boat or from the top of the cliffs as the birds fly out from below. This latter I have found most difficult shooting.

1304. *Turtur orientalis.*—The Rufous Turtle-Dove

Not a common bird by any means but distributed throughout the district. On the nearly flooded islands in the river during August these birds were numerous, but not in flocks. I found a nest with one egg on Popa on the 11th April 1902.

1308. *Turtur tigrinus.*—The Malay Spotted Dove.

Local name 'Gyo-lé-byauk". Very common, breeding all the year round. My eggs measure on an average 1·05" × 88", being rounder than the usual dove egg.

1310. *Turtur risorius.*—The Indian Ring-Dove.

Local name "Gyo-lin-bya". Very common over all the district. Breeds principally during the latter end of the rainy season.

1311. *Œnopopelia tranquebarica.*—The Red Turtle-Dove.

Local name "Gyo-ni-bu". This at certain seasons is also a common bird. Sometimes seen in large flocks, but I have never found the nest, nor have I been able to procure the eggs from the natives. I have seen a purplish dove or pigeon unknown to me on Popa, but have not been able to procure a specimen. He is likely to be *Alsocomus puniceus*, which I know inhabits the neighbouring district of Pakokku.

XXXI.—FAMILY *Phasianidæ*.

1328. *Gallus ferrugineus.*—The Red Jungle Fowl.

Local name "Taw Kyet". Not very common and very difficult to observe. I have seen the white ear-lappeted birds domesticated in the monasteries. Eggs taken from March to June.

1354. *Excalfactoria chinensis.*—The Blue-breasted Quail.

I have procured this bird, a male and female, only once. This was in the swamp near Yezon, on the 8th August and I think they were breeding then.

1355. *Coturnix communis.*—The Grey Quail.

I once only came across grey quail in the Myingyan district, but then secured a bird with the rufous spots on the outer webs of the quill feathers. This was at Sattein on the 16th December 1901.

1356. *Coturnix coromandelica.*—The Rain Quail.

Local name "Ngon". A common resident breeding freely from July to September.

1374. *Francolinus chinensis.*—The Chinese Francolin.

Local name "Kah". This is the only partridge of the district to my

knowledge. I have heard rumours of a wood partridge on Popa, but have never seen the bird or any one who has. The Chinese francolin breeds during the rains.

XXXII.—FAMILY *Turnicidæ*.

1382. *Turnix pugnax*.—The Bustard Quail.

Scattered sparsely throughout the district. My eggs were found in July. Possibly *T. blanfordi* is also in the district. It is found in Pakokku.

XXXIII.—FAMILY *Rallidæ*.

1389. *Hypotænidia striata*.—The Blue-breasted Banded Rail.

This bird is quite common in the marsh at Yezon, although very seldom seen. During the breeding season, which I found to be July and August, the nests are plentiful in the bog as well as the surrounding rice fields. The birds sit very close and absolutely refused to rise on the wing. One bird sitting on eight eggs escaped between my legs as I tried to capture it on the nest, and although I had 5 or 6 men within a few seconds tramping the rice all round, it never again appeared. The average of 17 eggs works out 1·3″×1·02″.

1398. *Amaurornis fuscus*.—The Ruddy Crake.

Three eggs I took in the Yezon marsh from a Rail's nest I believe to be those of this bird. But I have never seen the bird and had no time to snare it. The eggs measure on the average 1·15″×91″.

1401. *Amaurornis phœnicurus*.—The White-breasted Water-hen.

This is a rare bird in the district. I have come across it very seldom and have never taken the nest.

1402. *Gallinula chloropus*.—The Moorhen.

Local name "Baung dot". I found this fairly plentiful in the Yezon marsh, but never met with it elsewhere in the district. Nests ready for eggs were found on the 11th August.

1404. *Porphyrio poliocephalus*.—The Purple Moorhen.

Local name "Mènyo". A common bird in all the jheels. Breeds during August and September.

1405. *Fulica atra*.—The Coot.

Local name "Mè-nyo". Very plentiful on all the jheels during the cold weather but then disappears almost entirely and I think does not breed anywhere in the district but may do so on Paunglin lake in the Minbu district.

XXXIV.—FAMILY *Gruidæ*.

1410. *Grus sharpii*.—The Burmese Sarus.

Local name "Gyo-Gya". A rare and irregular visitor.

XXXV. FAMILY. *Œdicnemidæ*.

1418. *Œdicnemus scolopax*.—The Stone-Curlew.

Common on the stony jungle which is so plentiful in the district. Appears to breed in May and June.

1419. *Esacus recurvirostris*.—The Great Stone-Plover.

Local name "Kwe Kaw yit". I have seen them singly and in small flocks on the sand banks of the Irrawaddy, but seldom I have taken their eggs in March.

XXXVI.—Family *Glareolidæ*.

1425. *Glareola orientalis*.—The large Indian Pratincole, or Swallow-Plover.

A colony of these birds appeared on the Tanaungdaing plains about March 1899 and 1900 and bred there. Both years I was unfortunate in not being able to visit them during the egg time, but on the 1st June 1900 I picked up a young bird in down. They have not re-appeared since. Stragglers are met with all the year round.

1427. *Glareola lactea*.—The Small Indian Pratincole, or Swallow Plover.

Local name "Thaung-din". In large flocks on the sand banks of the river and the edges of the jheels throughout the year. They breed on the sandbanks in March, when hundreds of their eggs may be taken. I wonder if it has previously been remarked how these birds come in over the jheels near the river to feed in the evenings. They are always the last diurnal birds one sees when waiting for the flighting duck and when they suddenly disappear it is best to be at the "ready".

XXXVII.—Family *Parridæ*.

1428. *Metopidius indicus*.—The Bronze-winged Jacana.

Very common during the cold weather, but more or less disappears as the jheels dry up. I have taken the eggs in Pakokku district and no doubt it breeds in Myingyan as well.

1429. *Hydrophasianus chirurgus*.—The Pheasant-tailed Jacana.

The notes on the above species apply equally to this. If anything, *Hydrophasianus* is the more plentiful.

XXXVIII.—Family *Charadriidæ*.

1432. *Sarcogrammus atrinuchalis*.—The Burmese Wattled Lapwing.

Local name "Titidu". A common and noisy bird and most disagreeable to the still-hunter. Breeds in the stony jungle during April and May. A series of 13 eggs measure on the average 1·56″ × 1·13″.

1434. *Microsarcops cinereus*.—The Grey-headed Lapwing.

A winter visitor when it is common on the banks of the river.

1435. *Hoplopterus ventralis*.—The Indian Spur-winged Plover.

Local name "Sit-talaing". Found in pairs and small flocks all over the district. Breeds on the sandbanks of the Irrawady or in the dry beds of nullahs during April and May. The eggs are quite distinguishable from those of *Sarcogrammus* and run smaller.

1439. *Charadrius fulvus*.—The Eastern Golden Plover.

Does not appear in great numbers, although small flocks are usually met during the snipe shooting season. The 1st of September is the earliest date I have noticed this bird.

1447. *Ægialitis dubia*.—The Little-ringed Plover.

The little ringed plover is a common resident, although its numbers diminish during the summer months.

1451. *Himantopus candidus*.—The Black-winged Stilt.

Very plentiful during the cold weather. A few birds remain to breed. I saw

two young birds with their parents near Myingyan on the 10th July 1900 and found a nest containing four fresh eggs on the 1st June 1901 at Kanna tank.

1452. *Recurvirostra avocetta.*—The Avocet.

Each winter a flock or two may be seen on the sandbanks of the Irrawaddy or Chindwin rivers.

1454. *Numenius arquata.*—The Curlew.

A common bird on the river during the cold weather and not at all rare during the summer. I have seen them on the almost flooded islands in the Irrawady during July and August when they were almost invariably in pairs.

1456. *Limosa belgica*—The Black-tailed Godwit.

I have a note of having shot and identified one of two birds seen on Paunglin lake on the 14th May 1900. Paunglin is in the Minbu district adjoining Myingyan. I shot one out of a flock of 6 or 7 birds on Yuabe jheel on the 11th January 1903.

1460. *Totanus hypoleucus.*—The Common Sandpiper.

Local name " Ye hnaung ". Common in the cold weather.

1461. *Totanus glareola.*—The Wood Sandpiper.

Local name for all sandpipers is " Yehnaung". This, with the next five species, are all found in the district during the cold weather, but in what proportional quantities I am unable to say.

1462. *Totanus ochropus.*—The Green Sandpiper.

I have shot this bird and seen others on the 11th August. These were residents I believe.

1463. *Totanus stagnatilis.*—The Marsh Sandpiper or Little Greenshank.

*Vide* No. 1461.

1464. *Totanus calidris*—The Redshank.

Common during the cold weather. Its plaintive call is frequently heard at night.

1465. *Totanus fuscus.*—The Spotted Redshank.

*Vide* No. 1461.

1466. *Totanus glottis.*—The Greenshank.

Shot and identified on the Kanna jheels. Probably plentiful. The call is similar to that of the Redshank.

1469. *Calidris arenaria.*—The Sanderling.

Although said by Blanford to be a bird of the sea coast, I shot one among some grey plover on the Irrawady near Myingyan on the 11th November 1902.

1472. *Tringa ruficollis.*—The Eastern Little Stint.

Not in great numbers.

1473. *Tringa subminuta.*—The Long-toed Stint.

Idem No. 1472.

1482. *Scolopax rusticula.*—The Woodcock.

Mr. Carey has informed me that woodcock have been met with in the district near Pyinzi, but I have not come across any myself.

1484. *Gallinago coelestis.*—The Fantail Snipe.

Local name " Ye ngon". Our snipe season here commences about the

middle of October and goes on to the end of March, some birds staying even till May. During the season 1899 and 1900 I kept a tally of the different species, and of 460 birds fantails were in the proportion of 30 to one pintail. The latter when brought to hand, and not draggled, were all noticeably larger birds.

1485. *Gallinago stenura.*—The Pintail Snipe.

*Vide* No. 1484.

1487. *Gallinago gallinula.*—The Jack Snipe.

A rare bird. Mr. Prideaux shot three birds during the season 1898-99 and I shot one only among 461 birds the following season. These are the only ones I have seen, but a few others have no doubt been killed in the district.

1488. *Rostratula capensis.*—The Painted Snipe.

Occurs, but is not common on our jheels. A few birds breed on the Yezon marsh and I found a nest containing one egg there on the 11th August 1902.

## XXXIX.—Family *Laridæ.*

1489. *Larus ichthyaëtus.*—The Great Black-headed Gull.

Local name "Labine". One large gull visits us during the cold weather —I suppose of this species.

1496. *Hydrochelidon hybrida.*—The Whiskered Tern.

Local name for all terns is "Zin-yaw". Met with on the jheels as well as on the river principally during the cold weather.

1503. *Sterna seena.*—The Indian River-Tern.

Common throughout the year. Breeds on the sandbanks in the river during February and March in company with other terns, swallow-plovers and scissor-bills.

1504. *Sterna melanogaster.*—The Black-bellied Tern.

A common resident; breeds during February and March.

1509. *Sterna sinensis.*—The White-shafted Ternlet.

I found a few birds breeding along with the river terns and got some eggs. They are not very plentiful.

1517. *Rhynchops albicollis.*—The Indian Skimmer or Scissors-bill.

Common on the river and breeds with terns.

## XL.—Family *Pelecanidæ.*

1523. *Pelecanus philippensis.*—The Spotted-billed Pelican.

The only Pelican I have come across in the district. It may be found all the year round, but does not breed anywhere I know of.

## XLI.—Family *Phalacrocoracidæ.*

1526. *Phalacrocorax carbo.*—The Large Cormorant.

This bird is not at all common. I have seldom met with it and have never found it breeding.

1528. *Phalacrocorax javanicus.*—The Little Cormorant.

Exceedingly common and breeds in large colonies, sometimes in company with herons, egrets and darters during the rains.

1529. *Plotus melanogaster.*—The Indian Darter or Snake-bird.

Local name "Dingyi". Very common along the river and in the jheels; breeds throughout the rains and on to November.

XLII.—FAMILY *Ibididæ*.

1541. *Ibis melanocephala.*—The White Ibis.

I have seen this species on the river and once on Yuabe jheel. They are usually in flocks of 6 to 12, and if shot at, go straight away. I have not found their nests.

1543. *Inocotis davisoni.*—Davison's Black Ibis.

Local name "Ka-yu sot". Fairly common on the banks of the Irrawaddy and neighbouring jheels. Breeds on the lofty cotton trees during February and March. The nest is comparatively small and a lot of the sitting bird is usually visible from below. The eggs are of two kinds, some pale unspotted blue and others with the same ground colour but sparingly spotted with dull red.

1544. *Plegadis falcinellus.*—The Glossy Ibis.

Is found occasionally on the same ground as *I. davisoni* Breeds in large colonies which I think *I. davisoni* never does.

XLIII.—FAMILY *Ciconiidæ*.

1548. *Dissura episcopus.*—The White-necked Stork.

Common in the cold weather, when it is met with in flocks of from three and four up to fifty or more. It breeds in the district and I have taken the eggs in February and March. These eggs were all white, more or less dirty, but no bluish tinge.

1549. *Xenorhynchus asiaticus.*—The Black-necked Stork.

Local name "Hnet-kya-gyi". Common throughout the year and breeds freely, making its nest usually on the topmost branches of the large cotton trees along the bank of the river. This year one of these nests was blown away in a storm the day before I was going to take the eggs which I felt sure were there. The birds rebuilt the nest and one was standing sentry on it as I passed the other day again (November). I left them in peace. I found a nest in which there was one egg on a low tree some 20 feet high standing in the Paunglin lake.

1550. *Leptoptilus dubius.*—The Adjutant.

Local name "Don-zat". A bird I shot at Sameikon had a Russell's viper in its stomach. The bird was eaten by the Burmans who dissected it. Not common.

1552. *Pseudotantalus leucocephalus.*—The Painted Stork.

This bird is common but I have not been successful in finding where it breeds. I shot a young bird with its parents on Tanaungdaing jheel on the 17th August.

1553. *Anastomus oscitans.*—The Open-bill.

Seen in large flocks of from 40 to a hundred birds. In grey plumage during January and assuming breeding plumage in March. I however have never found it breeding.

XLIV.—Family *Ardeidæ*.

1554. *Ardea manillensis*.—The Eastern Purple Heron.

I have seen this bird frequently in the jheels at Talokmyo and Tanaungdaing, but have never found the nest.

1555. *Ardea cinerea*.—The Common Heron.

Local name "Nga-hit". Is common and breeds twice in the year. I have at least taken eggs in March, July, August and September.

1559. *Herodias alba*.—The Large Egret.

Local name "Byaing-ngan". Fairly common. A large colony of the species along with little cormorants and common herons were breeding at a village opposite Kyaukye on the 7th August. I got 3 or 4 full clutches of their eggs then quite fresh.

1560. *Herodias intermedia*.—The Smaller Egret,

and

1561. *Herodias garzetta*.—The Little Egret.

Both breed in the district during May, June and July.

1562. *Bubalcus coromandus*.—The Cattle Egret.

Local name "Byaing". Is very common and breeds at the same time and often in company with other kinds of egret.

1565. *Ardeola grayi*.—The Pond Heron.

Local name "Byaing auk". Common, although I have never found its nest.

1567. *Butorides javanica*.—The Little Green Heron.

I shot a young bird of this species near Myingyan in August which Mr. Comber kindly identified for me, but I have seen no others.

1568. *Nycticorax griseus*.—The Night Heron.

Quite common, although I do not know whether it breeds here or not.

1572. *Ardetta cinnamomea*.—The Chestnut Bittern.

Local name "Yebot", which being translated means The Water Coucal, no doubt owing to the similarity of the call.

This bird is very common and breeds in numbers in the Yezon swamp during August. I think I have seen the yellow and black bitterns also in the jheels here, but not having shot any I do not include them in my list.

XLV.—Family *Anatidæ*.

1579. *Anser ferus*.—The Grey Lag Goose.

Local name "Ngan". Usually arrives here, which must almost be its southern terminus, at the beginning of November and leaves us early. I have not shot one after January, and I find that every bird I have shot has been on a jheel, whereas all the barred-headed geese recorded in my game book have been shot on the sandbanks of the river.

1583. *Anser indicus*.—The Barred-headed Goose.

This goose is commoner than the grey lag and remains with us longer, the 17th of March being the latest date recorded in my game book. *A. indicus* is met with as low down the river as Yenangyaung and may be farther.

I once saw a dark goose in a flock of barred-headed and took it for a white-fronted goose, but failed to bag it.

1584. *Sarcidiornis melanotus.*—The Comb Duck.

Local name "Mauktin". Common all the year round. Colonel Keary told me they bred at the foot of the Shan Hills some 20 miles east of our eastern boundary. Captain Penny, I.M.S., and I weighed a very large male comb duck which we shot at Paunglin on the 11th December 1901 and he turned the scale at 6 lb. 2 oz.

1588. *Casarca rutila.*—The Brahminy Duck or Ruddy Sheldrake.

Local name "Hintha". The Brahminy is the first of the migratory ducks to arrive here in any numbers and very nearly the last to leave. He is the noisiest, handsomest and least edible duck I know.

1589. *Dendrocygna javanica.*—The Whistling Teal.

Local name "Sisali". Common on Tanaungdaing and Tanokmyo jheels. I shot a female on the 7th August 1902 with eggs in her about the size of a 16-bore bullet.

1590. *Dendrocygna fulva.*—The Large Whistling Teal.

Seem to be almost as common as its smaller relative during the cold weather but I don't know whether it breeds in the district or not.

1591. *Nettopus coromandelianus.*—The Cotton Teal.

Local name "Kalagat". Very common all the year round and no doubt breeds, although I have not taken the nest.

1593. *Anas poecilorhyncha.*—The Spotted-billed or Grey Duck.

Local name "Taw-be". A resident bird. Eggs have been brought to me in October and I came on a brood of ducklings only a few days old at Panyo on the 13th December 1902. This appears very late and I am inclined to think that all water birds have to breed late here owing to the fact that the height of the water in their breeding haunts is quite unsettled because of rises and falls in the river until October. About the end of September the water begins to fall in earnest and only then would it be safe for those birds that nest on the ground or on the shrubs in the jheels to commence building. In September I found a clutch of 14 eggs of the present species deserted because a sudden rise had inundated the nest. The eggs were fairly fresh and were blown out and eaten by the Burmans with me.

1595. *Chaulelasmus streperus.*—The Gadwall.

Very uncommon in Myingyan. Appears early but does not remain on our jheels.

1597. *Nettium crecca.*—The Common Teal.

Birds in good plumage are not shot before January. Very plentiful.

1599. *Mareca penelope.*—The Wigeon.

In December 1898 I shot a wigeon out of a flight of Pintail duck, but this is the only time I have come across it.

1600. *Dafila acuta.*—The Pintail.

Does not appear in very great numbers and one is lucky if there are half a dozen pintails in a bag of 30 birds.

1601. *Querquedula circia.*—The Garganey or Blue-winged Teal.

Numerous, and supplies more birds to a day's bag than any other variety. They come in October and leave us in March or the first week in April.

1602. *Spatula clypeata.*—The Shoveller.

A fairly common migrant.

1606. *Nyroca ferruginea.*—The White-eyed Duck.

This and the next two species are very erratic in their visits to us. Sometimes one or even two may fail to put in an appearance at all during the year. Of the three, *N. ferruginea* is probably the most common.

1607. *Nyroca baeri.*—The Eastern White-eyed Duck.

1609. *Nyroca fuligula.*—The Tufted Duck.

1610. *Clangula glaucion.*—The Golden-eye.

I shot a golden-eye in the district once, but the occurrence is not properly authenticated as I unfortunately lost the skin.

1615. *Podicipès cristatus.*—The Great Crested Grebe.

Mr. Bertram Carey shot one of these birds near Myingyan about Xmas 1899.

1617. *Podicipes albipennis.*—The Indian Little Grebe, or Dabchick.

Common, and breeds in most of the tanks and jheels. I have taken eggs in December and January and also in August and September, so I fancy they breed twice in the year.

# A LIST OF PUBLICATIONS RELATING TO INDIA

FROM

## THE "ZOOLOGICAL RECORD," 1903 AND 1904.

The following list of publications has been compiled from the "Zoological Record" for the last two years that are at present available, with a view to assisting those members of the Society who may be working at some particular subject and who may not have access to all the papers and periodicals relating thereto. The papers and notes that have appeared in our own Journal have of course been omitted. For the present it has only been considered necessary to include the publications under the headings—General Subjects, *Mammalia, Aves, Reptilia* and *Batrachia, Pisces, Mollusca* and *Insecta*, as so few of our members are interested in the lower classes of animals. It is proposed to continue the preparation of a similar list to the present one on the publication of future volumes of the "Zoological Record."

### "ZOOLOGICAL RECORD," 1903.

#### GENERAL SUBJECTS.

The Fauna and Geography of the Maldive and Laccadive Archipelagoes. 2 Vols. By J. Stanley Gardiner.

In the Andamans and Nicobars. By C. B. Kloss.

#### MAMMALIA.

On a new Rat of the *Mus rufescens* group from Simla. J. L. Bonhote. Ann. and Mag. Nat. Hist. (7), XI, pp. 291-296.

Notes on Mammals observed in the Darbhanga district, Bengal. G. Dalgleish. Zoologist (4), VII, pp. 94-99.

Mammals collected by Dr. Abbott on the coast and islands of N.-W. Sumatra. G. S. Miller. P. U. S. Mus., XXVI, pp. 457-84. (2 plates.)

Descriptions of 11 new Malayan Mouse-deer. G. S. Miller. P. Soc., Washington. XVI, pp. 31-44.

Seventy new Malayan Mammals. G. S. Miller. Smithson Collect, XLV. pp. 1-73. (19 plates.)

On the species of the genus *Rhinopoma*. O. Thomas. Ann. Nat Hist. (7), XI, pp. 496-99.

#### AVES.

A contribution to our knowledge of the Birds occurring in the Southern Shan States, Upper Burma. C. T. Bingham. Ibis 1903, pp. 584-606 (2 plates).

On some new species of Birds from the Mekong Valley. C. T. Bingham. Bull. B. O. C., XIII, pp. 54-56.

On a new species of *Suthora*. C. T. Bingham. Bull. B. O. C., XIII, p. 63.

British Bean Geese. F. W. Frohawk. Zoologist, 1903, pp. 41-45. (1 plate.)

On a new Silver-Pheasant from Upper Burma. E. W. Oates. Ann. Nat. Hist. (7), XI, p. 231.

On the Silver-Pheasants of Burma. E. W. Oates. Ibis, 1903, pp. 93-106.

Birds collected by Dr. Abbott and C. B. Kloss in the Andaman and Nicobar Islands. C. W. Richmond. P. U. S. Mus., XXV, pp. 87-314 (1902).

Birds collected by Dr. Abbott and C. B. Kloss on the Coast and Islands of N.-W. Sumatra. C. W. Richmond. P. U. S. Mus., XXVI, pp. 485-523.

On a new species of *Suthora* from Yun-nan. G. Rippon. Bull. B. O. C., XIII, p. 54.

On a new species of *Proparus* from Yun-nan. G. Rippon. Bull. B O. C., XIII, p. 60.

On a new species of *Œgithaliscus* from Yun-nan. G. Rippon. Bull. B. O. C., XIII, p. 18.

An Ornithological Journey to Fars, S.-W. Persia. H. F. Witherby. Ibis, 1903, p. 501.

On *Erythacus gutturalis* in South Persia. H. F. Witherby. Bull. B. O. C., XIII, p. 62.

On the nest of *Lusciniola neglecta*. H. F. Witherby. Bull. B. O. C., XIII, p. 62.

On the eggs of *Chettusia leucura*. H. F. Witherby. Bull. B. O. C., XIII, pp. 62-63.

### Reptilia and Batrachia.

Remarks on the Herpetological Fauna of Ceylon. A. Willey. Spolia Zeylonica, I., pp. 1-13, 81-89 and 116-117.

### Pisces.

On the more remarkable Freshwater Fishes of Ceylon. A. Willey. Spolia Zeylonica, I, pp. 3-9 and 19-22.

On the Fishes of the Maldive Islands. C. T. Regan in J. S. Gardner, Fauna Maldive and Laccadive Archipelagoes, I, pp. 272-281.

### Mollusca.

Additions to the genus *Streptaxis*. G. K. Gude. P. Malac. Soc., V., pp. 262-266. (1 plate.)

A classified list of the Helicoid Land Shells of Asia. G. K. Gude. J. Malac., X., pp. 5-16 ; 45-62 ; 83-98 ; 129-136. (1 plate.)

Descriptions of 2 supposed new species of *Cyathopoma* (*C. peilei* and *C. serendibense*). H. B. Preston. P. Malac. Soc., V., p. 340. (Fig. 9.)

A revision of the *Columbellidæ* of the Persian Gulf and N. Arabian Sea. J. C. Melvill. J. Malac., X., pp. 27-31 (Fig. 9.)

Descriptions of 68 new Gastropoda from the Persian Gulf, &c., dredged by F. W. Townsend. J. C. Melvill and R. Standen. Ann. Nat. Hist., XII., pp. 289-324. (4 plates.)

The genus *Scala* as represented in the Persian Gulf, &c. J. C. Melvill and R. Standen. J. Conch, X., pp. 340-351. (1 plate.)

Description of *Marginella lateritia*, n. sp., from the Andaman Islands. J. C. Melvill and E. R. Sykes. P. Malac. Soc., V., p. 410. (Fig.)

Collection of Molluscs. E. A. Smith in "Fauna and Geogr. of the Maldive and Laccadive Archipelagoes," Vol. II., pp. 589-630. (2 plates.)

INSECTA.

Notes of a tour in the North Canara District of India in search of mosquitoes. E. H. Aitken. Journal of Tropical Medicine, V, pp. 325-6, 341-2.

A revision of the *Amblipodia* group of butterflies of the family *Lycænidæ*. By G. T. Bethune Baker. Jour. Zool. Soc., London, XVII, 1-164.

*Hymenoptera orientalia*, or contributions to the knowledge of the *Hymenoptera* of the Oriental zoological region. By P. Cameron. Mem. Manchester Soc., XLVII, No. 14.

Descriptions of 19 new species of *Larridæ*, *Odynerus* and *Apidæ* from Barrackpore. By P. Cameron. Tr. Ent. Soc., London, 1903, 117-132.

Descriptions of 12 new genera and species of *Ichneumonidæ* and 3 species of *Ampulex* from the Khasia Hills. By P. Cameron. Tr. Ent. Soc., London, 1903, pp. 219-38.

On some new genera and species of parasitic and fossorial *Hymenoptera* from the Khasia Hills. By P. Cameron. Ann. Nat. Hist., xi, 173-185, 266-72, 313-31, 363-71, 565-83.

Description of new genera and species of *Hymenoptera* from India. By P. Cameron. Leitschr. Hym. Dipt., iii, pp. 9-16, 177-84, 298-304, 337-44.

Description of 10 new species and 9 new genera of *Ichneumonidæ* from India, Ceylon, and Japan. By P. Cameron. Entomologist, XXXVI., pp. 233-41, 259-60.

Undescribed Oriental *Rhynchota*. By W. L. Distant. Entomologist, XXXVI., pp. 1-2.

On a new genus of Tineid Moths. By J. Durrant. Indian Museum Notes, V., p. 92.

On *Coleoptera* collected in India by Messrs. H. E. and H. L. Andrewes. By H. S. Gorham. Ann. Soc. Ent. Belgique, xlvii.

Description of a new Coccid. By E. E. Green. Indian Mus. Notes, V., p. 63.

Remarks on Indian Scale Insects. By E. E. Green. Indian Mus. Notes, V., pp. 93-103.

Description of the new genera and species of phytophagous *Coleoptera* collected by H. L. Andrewes and T. R. D. Bell in the Nilgiri Hills and Canara. By M. Jacobi. Ann. Soc. Ent. Belgique, xlvii.

Insect Pests of Coffee in South India. By H. M. Lefroy. Bull. No. 2. Dep. Agric., India, 19 pp.

Notes on the Insect Pests of forest trees. By L. de Niceville. Indian Mus. Notes, V., pp. 103-212.

New species of Indian Aculeate *Hymenoptera*. Ann. Nat. Hist., xi, pp. 393-403, 511-26, 528-49.

New species of Indian *Chrysididæ*. Entomologist, xxxvi, pp. 10-12, 40-42.

Contributions towards a monograph of the Oriental *Aleurodidæ*. By H. W. Peal. Jour. Asiat. Soc., Bengal, lxxii, p. 61-98.

The Aculeate *Hymenoptera* of Barrackpore. By G. A. J. Rothney. Tr. Ent. Soc., London, 1903.

New species of Lamellicorn *Coleoptera* from the Nilgiri Hills. By D. Sharp, Ann. Nat. Hist., xi, pp. 467-73.

On the acquisition of alar appendages by the spruce forms of *Chermes Abietis-piceæ* in the N.-W. Himalayas. By E. P. Stebbing. Jour. Asiat. Soc., Bengal, xxii, p. 57.

A note on the discovery of *Thanasimus* sp. prox *nigricollis* in the N.-W. Himalayas. By E. P. Stebbing. Jour. Asiat. Soc., Bengal, lxxii, p. 104.

A first note on the life history of *Chermes Abietis-piceæ*. By E. P. Stebbing. Jour. Asiat. Soc., Bengal, lxxii, p. 229.

The life history of *Arbela tetraonis*, Moore. A destructive insect pest in the Casuarina plantations in Madras. By E. P. Stebbing. Jour. Asiat. Soc., Bengal, lxxii, pp. 252-7.

Insect pests of the sugarcane in India. By E. P. Stebbing. Indian Museum Notes, V, pp. 64-91.

Departmental notes on Insects that affect forestry. By E. P. Stebbing. No. 2, Calcutta, 1903.

Economic Entomology, its study, aims and objects. By E. P. Stebbing. P. Asiat. Soc., Bengal, 1903.

Notes on the *Culicidæ* of Dehra Dun. By F. W. Thomson. Jour. Trop. Medicine, vi., pp. 314-5.

The pests and blight of the tea-plant. By Sir George Watt and H. H. Mann. Calcutta, 1903.

1904.

GENERAL SUBJECTS.

Report to the Government of Ceylon on the Pearl Oyster Fisheries of the Gulf of Mannar, with supplementary reports upon the marine biology of Ceylon. W. A. Herdman and others. 2 Vols., with plates.

MAMMALIA.—*Nil.*

AVES.

514.—On new species from the Southern Chin Hills. G. Rippon. Bull. B. O. C., XIV, p. 83 and 84.

REPTILIA AND BATRACHIA.

Additions to the collection of Oriental Snakes in the Indian Museum. N. Annandale. Jour. Asiat. Soc., Bengal, LXXIII, p. 208-212. (1 plate.)

Descriptions of new Frogs and Snakes from Yun-nan. G. A. Boulenger. Ann. Nat. Hist. (7), XIII, p. 130-134.

PISCES.

On a collection of Fishes made by Mr. John Graham at Yunnan Fu. C. T. Regan. Ann. Nat. Hist. (7) XIII, p. 190-194.

MOLLUSCA.

273.—The Helicoid land Shells of Asia. Corrections and additions. G. K. Gude. J. Malac., XI, p. 93-97.

272.—Note on *Corilla erronella*, Nev. G. K. Gude. J. Malac., XI, p. 45 and 46.

238.—Descriptions of some new species and varieties of *Cataulus* from the collection of the late Hugh Nevill, Esq. H. Fulton. Ann. Nat. Hist., XIII, p. 452 and 453.

241.—On some new species of *Melania* and *Jullienia* from Yun-nan and Java. H. Fulton. J. Malac, XI, pp. 51 and 52. (1 plate).

436.—Descriptions of 28 species of Gastropoda from the Persian Gulf, &c., dredged by Mr. F. W. Townsend, J. C. Melvill. P. Malac., Soc., London, VI, p. 158-169. (1 plate.)

438.—Descriptions of 12 new species and 1 variety of Marine Gastropoda from the Persian Gulf, &c., collected by Mr. F. W. Townsend. J. C. Melvill. J. Malac., XI, p. 79-85. (1 plate.)

440.—*Cypræidæ* of the Persian Gulf, &c., as exhibited in Mr. F. W. Townsend's Collections. J. C. Melvill and R. Standen. J. Conch, XI., p. 117-122.

433.—Descriptions of 23 species of Gastropoda from the Persian Gulf, &c., dredged by Mr. F. W. Townsend. J. C. Melvill. P. Malac., Soc., London, VI, p. 51-60. (1 plate.)

434.—On *Berthais*, a proposed new genus of Marine Gastropoda from the Gulf of Oman. J. C. Melvill. P. Malac., Soc., London, VI, pp. 61-63.

579.—Natural History Notes from H. M. Indian Marine Survey steamer "Investigator," Series III, No. 1. On Mollusca from the Bay of Bengal and the Arabian Sea. E. A. Smith. Ann. Nat. Hist., XIII, pp. 453-473. (14 plates.)

502.—Descriptions of some new species of Cingalese and Indian Marine Shells. H. B. Preston. J. Malac., XI, p. 75-78. (2 plates.)

INSECTA.

A new Alysiid from Ceylon. By W. H. Ashmead. Ent. News. Philad., XV, p. 113.

Le Xylotrechus quadrupes et ses ravages sur les caféiers du Tonkin. By L. Bouky. C. R. Ac., Paris., CXXXIX, p. 932-4.

Descriptions of new species of *Cryptinæ* from the Khasia Hills, Assam. By P. Cameron. Trans. Ent. Soc., London, 1904, pp. 103-133.

A new species of *Bembex* from the Khasia Hills (*Bembex Khasiana*). By P. Cameron, *ibid.*, p. 123.

Description of a new genus and some new species of East Indian *Hymenoptera*. By P. Cameron. Entomologist, pp. 306-9.

Descriptions of new species of aculeate and parasitic *Hymenoptera* from Northern India. By P. Cameron. Ann. Nat. Hist., XIII, p. 211-233.

On some new species of *Hymenoptera* from Northern India. By P. Cameron, *ibid.*, pp. 277-303.

Descriptions of new genera and species of *Hymenoptera* from India. By P. Cameron. Zeitscher Hym. Dipt., iv., pp. 5-15.

Description of a new species of *Juartinia* from Deesa, India. By P. Cameron, *ibid.*, pp. 89-90.

Description of a new species of *Athalia* (*Tenthredinidæ*) from India. By P. Cameron, *ibid.*, p. 108.

On some butterflies from Tibet. H. J. Elwes. Deutsche. Ent. Leitschr, Iris., XVI, pp. 388-91.

On some new and little known butterflies mainly from high elevations in the N.-E. Himalayas. By J. M. Fawcett, P.Z.S., 1904, ii, pp. 134-141.

Cold Weather Mosquito Notes from the United Provinces, N.-W. India. By G. M. Giles. J. Trop. Med. vii., pp. 1-22-49.

Cold Weather Mosquito Notes from India. Malaria in Umritzar and its causes. By G. M. Giles, *ibid.*, pp. 83, 104, 120, 133, 149.

The *Coccidæ* of Ceylon. By E. E. Green. Part III, London, 1904.

Notes on some Ceylon Butterflies. By E. E. Green. Spolia Zeylonica, ii, p. 75.

The Lac industry of Ceylon. Ann. Bot. Gardens, Peraden, i, Supplement.

The *Tettigidæ* of Ceylon. By J. L. Hancock. Spol. Zeylonica, ii, pp. 97-137.

Indian Beeswax (*Apis dorsata, etc.*). By D. Hooper. Agric. Ledger, 1904, No. 7.

The *Cicindelidæ* of Ceylon. By W. Horn. Spolia Zeylon, ii, pp. 30-44.

Another contribution to the knowledge of Indian Phytophagous *Coleoptera*. By M. Jacobi. Ann. Soc. Ent. Belg., xlviii, pp. 380-406.

A monograph of the *Anopheles* Mosquitoes of India. By S. P. James and W. G. Liston. Calcutta, 1904.

Some breeding experiments on *Catopsilia pyranthe* and notes on the migration of butterflies in Ceylon. By N. Manders. Tr. Ent. Soc., London, 1904, pp. 701-8.

Notes on the life history of *Gongylus gongyloides*, a mantis of the tribe *Empusides* and a floral simulator. By C. E. Williams. Tr. Ent. Soc., Lond., 1904, pp. 125-8.

The dragonflies (*Odonata*) of Burma and Lower Siam. 1, Subfam. *Calopterygina*. By E. B. Williamson. P. U. S. Mus., XXVIII, No. 1389.

# NOTES ON THE GENUS *TATERA* WITH DESCRIPTIONS OF NEW SPECIES.

BY

R. C. WROUGHTON.

[*Extract from a paper in the Annals and Magazine of Natural History, Vol. XVII, No.* 101, *pp.* 474-499, *with Notes on, and Descriptions of, the African and Asian species of the genus.*]

Section III.—ASIA.

Tail dark above and below, with pale bands along the sides ; tufted.

A. Size large (175 mm.)

*a*. Mottled with black ; hind foot 42 mm., upper molar series 7. (Syria.) ..... (28) *taniura*, Wagn.

*b*. Uniform colour ; hind foot 41 mm., upper molar series 6·3. (E. Persia.) ..... (29) *persica*, sp. n.

*c*. Mottled black ; hind foot 39 mm., upper molars 6. (C. Persia.)..... ... (30) *p. scansa*, subsp. n.

*d*. Uniform colour ; hind foot 38 mm., upper molars 5·5. (U. P. India.)... (31) *indica*, Hardw.

B. Size smaller.

*a*. Tail (200 mm.) and hind foot (45 mm.), very long. (S. India.)... ..... (32) *cuvieri*, Waterh.

*b*. Tail normal.

$a^2$. Hind foot 41 mm., skull breadth 23, molars 6·5. (S. W. Persia.) ..... (33) *Bailwardi*, sp. n.

$b^2$. Hind foot 39 mm., skull breadth 25, molars 6·5. (S. W. Persia) ..... (34) *B. monticola*, subsp. n.

$c^2$. Hind foot 41 mm., skull breadth 22, molars 6. (Ceylon)..... ..... (35) *ceylonica*, sp. n.

Section III.—ASIA.

The colour-pattern of the tail makes this a very compact group. Unfortunately it is very badly represented in the collection. A small collection made by Mr. Woosnam quite recently, and presented to the museum by Col. Bailward, has enabled me to recognize somewhat confidently the *taniura* of Wagner, and thus to discriminate other Persian forms ; but although we have the type of *indica*, the material from India is so very poor both in quantity and quality that, beyond identifying Waterhouse's *cuvieri*, a strongly marked species, I have not ventured to base any conclusions on the specimens available for study.

(28) *Tatera taniura*.

*Meriones taniurus*, Wagner, Schreb. Säug., Supple. III., p. 471 (1842).

5. 10. 4. 28-29. Bund-i-Khel, Karun River, S. W. Persia (*Col. Bailward*). Alt. 250′.

Wagner described *Meriones taniurus* from Syria. We have no specimens unfortunately from this locality, but experience in other genera seems to show

that there is little change in the forms westward from the Euphrates until the Jordan basin is reached. Wagner's description is too vague by itself to indicate more than a large *Tatera*. He, however, gives the following dimensions, *viz.* :—Head and body (measured along curves on a stuffed specimen) 8″-9‴ (=230 mm.), tail 7″-3‴ (= 190 mm.); hind foot 1″-8‴ (42 mm.).

The average dimensions of the above-named two specimens are—

Head and body 187 mm.; tail 190; hind foot 42; ear 29.

Skull: greatest length 47; basilar length 37; zygomatic breadth 26; length of upper molar series 7; bullæ 12·5.

These specimens may, I think, be confidently accepted as representing typical *taniura*.

(29) *Tatera persica*, sp. n.

6. 1. 2. 5-6. Seistan. (Seistan Arbitration Commission.)

A large *Tatera*, as large as or even larger than either *taniura* or *indica*.

The whole upper surface of a uniform pale sandy colour, with no apparent black grizzling, though a certain proportion of the hairs on the back are black-tipped; an area above the eyes and the cheeks paler, giving the impression of a darker band from the snout over the crown between the ears; the dark band above and below the tail showing more admixture of black than the dorsal area, the terminal black "tuft" about one-fourth of the total length of the tail. The skull strong and broad, and the upper-incisors very stout and broad. Unfortunately the dimensions were not recorded by the collectors, but I give the following as probably correct:—

| | | | | | Skull. | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | H. & B. | Tl. | H.f. | Ear. | G.l. | B.l. | Zyg. b. | Mol. | Bullæ |
| *Type*.—6. 1. 2. 5 | Adult—190 | 200 | 41 | 24 | 45 | ? | 25 | 6·1 | ? |
| 6. 1. 2. 6 | Yg. „ 190 | 190 | 40 | 25 | 45 | ? | 25 | 6·3 | ? |

*Hab*.—Seistan.

*Type*.—B. M. No. 6. 1. 2. 5. An adult. Collected in September 1905.

(30) *Tatera persica scansa*, subsp. n.

4. 6. 1. 3.—Kerman, Persia (*Sykes*). Alt. 5,700.′

Rather smaller than typical *persica*. Ground-colour much as in that species, but a very marked black grizzling on the posterior dorsal area above the root of the tail; the dark bands of the tail are also much darker than in *persica*, and the terminal "tuft" occupies about one-third of tail-length. The skull is broad as in *persica*, but neither it nor the molars are so stout. The emargination of the anterior border of the infraorbital plate, which in *persica* is represented by at most a shallow arc, is in this specimen so deep that the emargination becomes distinctly "**C**"-shaped. That this character is constant I am not, however, in a position to affirm.

The following are the dimensions:—

Head and body 180 mm.; tail 193; hind foot 39; ear 26.

Skull: Greatest length 45; basilar length 35; zygomatic breadth 25; upper molar series 6; bullæ 12·5.

*Hab*.—Kerman, Persia.

*Type.*—B. M. No. 4. 6. 1. 3. An adult male. Collected by Mr. Sykes on the 1st February 1903, and presented to the museum.

(31) *Tatera indica.*

*Dipus indicus*, Hardw. Linn. Trans. VIII, p. 279 (1807).

11·g. "India" (Type.)

Hardwicke describes the colour as "bright bay mixed with pencil-like strokes of dark-brown longitudinally disposed," and gives the size as:—Head and body 6·5″; tail 7″; tuft for last 2″ dark-brown. I put the normal dimensions as follows:—

Head and body 180 mm.; tail 190; hind foot 38.

Skull: Greatest length 46; zygomatic breadth 23; length of upper molar series 5·5.

The skull is much broken, but suffices to show that it is more delicately made and long and narrow as compared with those of the Central Asian forms; the upper molars, however, are fairly stout for their size.

(32) *Tatera cuvieri.*

*Gerbillus cuvieri.*—Waterh. P. Z. S. P. 56 (1838).

99.12.21.2. Moli Jeri, Tinniveli (*Barber*).

5.11.25.2. Ramnad Madura (*Annandale*).

These specimens I refer quite confidently to *cuvieri*, Waterhouse. They closely agree with his description both in colour and proportions. The following may therefore be taken as normal dimensions for this species:—

Head and body 165; tail 200; hind foot 45; ear 22.

Skull: Greatest length 44; basilar length 34; zygomatic breadth 23; length of upper molar series 6; bullæ 12.

The extraordinary length of the hind foot, considering the size of the animal, was relied on by Waterhouse to distinguish this species from *indica*, and to this may be added the proportionally very long tail. The upper molars are fairly stout, but the incisors are much narrower than in any Asian form that I have seen except *ceylonica*.

(33) *Tatera Bailwardi*, sp. n.

5.10.4.30. Bund-i-khel, Karun river, S. W. Persia (*Col. Bailward*). Alt. 250′.

5.10.4.31. Shus, near Dizful, S. W. Persia (*Col. Bailward*). Alt. 500′.

5.10.4.32. Ram Hormaz, near Awaz, S. W. Persia (*Col. Bailward*). Alt. 500′.

53.1.6.83. Mound of Susa, Khuzistan, S. W. Persia (*Loftus*).

50.10.21.5. Euphrates Expedition.

This species differs from *taniura* in hardly anything but size; in detail of colouring I can detect but the very smallest differences; the white patches on the face are rather more marked in this species, forming an indistinct but continuous line of pale colouring from the sides of the muzzle, over the eyes, to the base of the ears. Its consistently smaller size in all details, however, and the fact that the type specimen was taken at the same time and place as the specimens which I have identified as *taniura*, from which it is clearly distinct, has determined me to give it a specific name.

The following are some measurements :—

| | | | | | Skull. | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | H. & B. | Tl. | H.f. | Ear. | G.l. | B.l. | Zyg.b. | Mol. | Bullæ |
| *Type.*—5.10.4.30. ♂. Adult | ... 166 | 182 | 41 | 28 | 44 | 34 | 23 | 6·5 | 11·5 |
| 5.10.4.31. ♀. Old | ... 161 | 176 | 41 | 28 | 44 | 34 | 23 | 6·5 | 11·5 |
| 5.10.4.32. ♂. Adult | ... 166 | 167 | 40 | 28 | 45 | 35 | 23 | 6·5 | 11·5 |

*Hab.*—Bund-i-Khel, S.-W. Persia.

*Type.*—B. M. No. 5·10·4·30. An adult male. Collected by Mr. Woosnam on the 6th March 1905, and presented to the museum by Col. Bailward.

(34) *Tatera Bailwardi monticola*, subsp. n.

5.10.4.33. Mala Mir, S. W. Persia (*Col. Bailward*). Alt. 3,300′.

The same size as *Bailwardi*, of which it is apparently a high-level form. Ground-colour much less rufous than in that species giving it a soberer general colouration. The skull very broad and much stouter and the bullæ markedly larger. The following are the dimensions :—

Head and body 164 mm. ; tail 177 ; hind foot 39 ; ear 28.

Skull : Greatest length 46 ; basilar length 35 ; zygomatic breadth 25 ; length of upper molar series 6·5 ; bullæ 12·5.

*Hab.*—Mala Mir, S.-W. Persia.

*Type.*—B. M. No. 5.10.4.33. An old female. Collected by Mr. Woosnam on the 12th April 1905, and presented to the museum by Col. Bailward.

(35) *Tatera ceylonica*, sp. n.

52.5.9.31. ♂. Ceylon (*Kelaart*).

In colouration *ceylonica* differs but little or not at all from *cuvieri*,—*i.e.*, from the specimens which I have identified as that species. It is dark cinnamon-brown along the centre of the back (probably due to the black tips of the hairs in that area), pallid along the sides. Above the eyes, and behind them to the ears and the cheeks, dull white. The following are dimensions :—

Head and body 160 mm. ; tail 150 ; hind foot 41 ; ear 20.

Skull : Greatest length 44 ; basilar length 33 ; zygomatic breadth 22 ; length of the upper molar series 6 ; bullæ 11.

*Hab.*—Ceylon.

*Type.*—B. M. No. 52.5.9.31. An adult male. Presented to the museum by Dr. Kelaart.

Notwithstanding its colour-resemblance it is easily distinguishable from *cuvieri* by its extremely short tail and much shorter hind feet. The skull is about as in *cuvieri*, but the upper molars are finer and narrower than in that of any other Asiatic form.

# MISCELLANEOUS NOTES.

## No. I.—BREEDING HABITS OF THE GREAT CRESTED GREBE (*PODICIPES CRISTATUS*).

Being one of the handsomest as well as the most interesting, perhaps, of all water fowl, a few notes concerning the breeding habits of this bird may prove acceptable to some readers of this journal. During the years 1904-05 I had exceptionally good opportunities of watching a pair of these birds nesting, and the following notes were made on the spot. The birds were first seen on April 17th (1904) and almost at once commenced nesting. On the morning of the 19th I again visited the place and found the two birds swimming apart from each other. After a short time they met and began to spar with their bills—no doubt a pairing gesture. What I took to be the female bird then scrambled up on a small islet and disappeared among the reeds. A pair of coots (*Fulica atra*) were nesting on the same place and tried to drive what I took to be the male bird away. Once they were successful, but after a time the grebe became master of the situation and drove the coots away. The way he drove off one coot was distinctly ingenious. Diving some little distance apart, he suddenly came right up under the coot and fairly "torpedoed" the coot out of the water. The male bird then rested on the water near the islet, drying and preening its feathers. When it wished to clean its breast, it would turn right over on its back, with one leg sticking up in the air.

The female bird when she landed on the islet did not stand upright, but dragged herself along on her belly. I did not revisit the place again until May 1st, and found the female bird sitting close. The male was swimming near at hand and again drove some coots away that came too near the nest. On September 2nd I saw the young birds in company with the parents (two in number) which were very attentive to them and feeding them with small fish. On September 11th I could only see one young one with the old birds. On October 30th I saw only the young one, the old ones had left. This year (1905) the grebes returned to the same place on February 25th. At first I only caught sight of one bird which was in full breeding plumage. On looking through my field glasses I saw it treading water, splashing with its wings, and spinning round and round like a teetotum with crest raised to its full extent. Presently with neck stretched in front of him (I say "him" for this was the one I took to be the male) he uttered a hoarse croak, and lay flat on the water, flapping his wings vigorously. I saw then the cause of this excitement, for coming towards him was another grebe also stretched along the water in the same strange position as the first. The two met breast to breast and chattered together and sparred with their bills. This second bird was not like the first and still retained the winter plumage and was probably an immature female. The two then swam in company with each other and visited the nesting place of last year. This was, however, covered with water, with the exception of a few stumps of wood and

reeds. The male bird appeared, however, to recognise the place and dived bringing up a bunch of weed which he offered to the other bird. The two played with it for a little while, then left it. What made the grebe bring up this weed? For they do not feed on it; it is the stuff their nests are made of. Could he have mistaken the time of year and thought the nest ought to have been commenced? No, it was only perhaps a passing whim, or he would not have finally left the weed. I am certain this young bird was not the female of last year, and probably this action, on the part of the male, of lifting the weed was to shew the female how and where to build the nest.

The cries of these two grebes sounded like 'erak erak erak erak ka ka' and at other times like 'ak ah ak ah' and 'er erak er erak" mingled with a buzzing sound. On February 28th I again visited the place and saw the grebes meet, shake their heads, and indulge in the usual "spar." When these birds are at rest the head is drawn back between the shoulders, with the bill either straight in front or else tucked under a wing, and usually one leg sticking out of the water. They are constantly preening their feathers, and their breasts shine in the sun as silver, especially that of the young bird, which is a brighter colour than the older one, and has a purer white breast. The time these birds remained under water after a dive, I noted, was from 3 to 5 minutes. When diving they either roll sideways under and disappear without a ripple, or in head first. On March the 5th I saw the female grebe was much more advanced about the head than she was a week ago, and showed a decidedly more bushy crest. It is remarkable how birds of the genus *Podicipidæ* come into breeding plumage so early. They are frequently found thus long before winter is over, and a friend of mine tells me he had seen and shot red-throated divers (*Colymbus septentrionalis*) (nearly allied to the grebe family) in midwinter in full summer dress.

GORDON DALGLIESH.

GODALMING, SURREY,
*2nd February* 1906.

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## No. II.—PACKS OF WOLVES IN PERSIA.

While after Urial in August I came on a pack of 11 wolves, of which I managed to shoot 3. Is not this very unusual at this time of year? The Persians here say they have never heard of a pack of so many wolves in the hot weather. There were only two pups in the pack.

J. W. WATSON, CAPT., I.M.S.

TURBAT-I-HYDERI, PERSIA,
*4th October* 1905.

[Presumably the wolves referred to belonged to the European species, *Canis lupus*, which extends down to Baluchistan and Western Sind. The occurrence of so large a pack is certainly unusual; and Dr. Blanford remarks that, "as a rule, they occur solitary or in pairs, but at times, and especially in the winter,

they associate in packs, sometimes of large numbers." The young are born in spring or early summer.

E. COMBER,
*Honorary Secretary,*
Mammal Department, Bo. Nat. Hist. Soc.]

## No. III.—URIAL IN PERSIA.

While in the Kara Dagh and Hazar-Masjid hills on the Russian Frontier, I saw the heads of several wild sheep, which seem to differ from Urial, as they had an extra curl on them, *i.e.*, they curved round and then outwards again. I regret that I had no time to go after them. The heads seemed a little bigger than the ordinary Urial and the horns were strikingly different.

Is there anything known of a separate species of sheep in N.-E. Persia?

J. W. WATSON, CAPT., I.M.S.

TURBAT-I-HYDERI, PERSIA,
*4th October* 1905.

[As regards the varieties of the Urial or Sha (*Ovis vignei*), Dr. Blanford does not separate the forms that have been described under the names of *O. cycloceras* (Hutton) and *O. blanfordi* (Hume) specifically. The Sha of Ladak, generally known as *O. vignei*, is usually larger than the Urial of the Punjab, Sind and Baluchistan, generally known as *O. cycloceras*, and the circle made by its horns is wider. In the variety from Kelat and Baluchistan, to which the name *blanfordi* was applied, the horns diverge throughout so as to form an open spiral instead of each lying in one plane or nearly so. Thus the tips of the horns are very much farther apart than in the typical *O. vignei*, in which the horns in diverging are curved round nearly in a circle.

E. COMBER,
*Honorary Secretary,*
Mammal Department, Bo. Nat. Hist. Soc.]

## No. IV.—A PANTHER PLACING ITS KILL UP A TREE.

In the *Field* of 24th February there is an account, over the *nom-de-plume* "Dibra Singh," of the shooting of a panther that is specially interesting on one point and perhaps worth bringing to the notice of members of the Society. It is best explained by quoting the writer's words :—

"I retraced my steps towards camp, and when within 500 yards of my tent, and close to the garden, the attention of the hawk-eyed shikari was drawn to some vultures on a tree. On going up to the tree we were astonished to find the body of a nearly full-grown chital stag in the fork made by the lowest branch, about 8 feet from the ground. The trunk of this tree was absolutely straight, but an examination of the trunk and of the ground beneath showed that, however improbable it was, there remained no doubt that the stag had been placed there by a panther. To remove the stag, build a machan, and

tie up a goat to a stake rammed firmly in the ground was a matter of an hour at the most, and by 3 p.m. I was seated in the machan, but this time without a shikari.

"About 4 p.m., something gray moved in a half right direction from the machan, and on closer observation I made out the form of a very large panther lying with his head on his paws watching the goat; but so exactly did the colour of the skin match the ground that had it not been for the slight movement of the tail I should never have noticed him. After a few minutes he bounded towards the goat, which ran round the stake, followed by the panther, which made a blow with his paw, missing the goat. On this he immediately bounded back to his point of vantage, and after a few minutes made another dash at the goat. This time business, not play, was meant, and almost simultaneously with his seizure of the goat was the report of the Paradox.

"On returning to the tree the goat seemed none the worse from the experience, having only two wounds, one on the top and one underneath the neck. This on return to camp we found was due to the fact that most of the panther's teeth, both in the upper and in the lower jaw, were missing. Unfortunately, the tape measure had been forgotten, so there was no possibility of taking any reliable measurements. The panther was, however, exceptionally large and powerful, as was to be expected from his having dragged the chital up a tree with a straight and bare trunk, and from the reports we had received of the size and strength of the celebrated wadi-wallah."

Have any of our members come across a similar occurrence?

E. COMBER.

22*nd March* 1906.

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## No. V.—TIGERS HAMSTRINGING THEIR PREY BEFORE KILLING.

Reading Mr. Allan's letter in Vol. XVI, No. 3, I thought an experience I had might be of interest.

In December 1904 I was down the Tennaserim River in Burma on a shooting trip. I had been out on the previous day and noticed tracks of buffalo. The next day when I was out, after going some distance, we heard a tremendous bellowing. On working up to the spot, which was in thick jungle, we saw a tiger had tackled a large cow buffalo, he was then hanging on to her hind quarters, the buffalo dragging herself along slowly. I got an easy shot at the tiger and killed him. After finishing off the buffalo I noticed that both the hind legs were hamstrung, the tendons beeng completely severed.

P. HUDSON,
The King's Regiment.

NASIRABAD, RAJPUTANA,
25*th March* 1906.

MALFORMED BLACKBUCK HORN.

*ANTILOPE CERVICAPRA.*

### No. VI—A BROWN CROW.

An individual of *Corvus splendens* (The Indian house-crow) which resides in and about the compound of Mr. Justice Woodroffe in Russell Street, Calcutta, is light brown throughout, except for the ashy neck, which is light ashy. The wings shine bronze in the sun. It is persecuted by the other crows.

A. C. LOGAN, I.C.S.

CALCUTTA, 24*th March* 1906.

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### No. VII.—A BROWN AND WHITE CROW.

I send you a specimen of *Corvus splendens* shot at Versova by the Rev. L. Kraig, S.J., in spite of her disguise in brown and white, which she possibly put on in order to escape the general extermination of her race in Bombay. No doubt the most recent case of sudden adaptation to highly unfavourable surroundings!

The eyes of the bird were quite normal, not showing the slightest shade of pink. Bill and legs are brown, nasal bristles, crown of head, sides of face ophthalmic region, chin, and throat light brown; ear coverts greyish brown; hind head, nape, interscapularies white; breast brownish white, abdomen, undertail coverts and vent greyish brown but the feathers changing to white at their bases; lower back dirty white, rump greyish brown, uppertail coverts darker brown. Lesser coverts brown, tips brownish white; median coverts lighter brown than the lesser coverts, brownish white tipped; greater coverts brown, externally and towards the tips nearly white; primaries, secondaries and tertiaries show different shades of light brown, externally and towards the tips whitish. Undersurface of wings more uniformly ashy brown.

E. BLATTER, S.J.

ST. XAVIER'S COLLEGE,
BOMBAY, 29*th March* 1906.

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### No. VIII.—A MALFORMED BLACKBUCK HEAD.

*(With an Illustration.)*

I send a photograph of a black buck horn that is curiously malformed. It may be of interest as from enquiries made, no reason can be given for the malformation. The animal was shot by Captain Mackenzie of the 13th D. C. O. Lancers near Saugor and was well known there. Captain Mackenzie tells me the buck was with a party of does and was very fat indeed. On examination the testes shewed no signs of injury and were normal in size. The horn as shewn in the photograph makes a complete turn, passing under the skin near the eye, striking the bone of the horn at the base, and turned up splitting the horn in its growth.

R. H. RATTRAY, LIEUT.-COL.,
22nd Punjabis.

JHELUM, 20*th March* 1906.

## No. IX.—FASCINATION BY LIZARDS.

I see that Major Rogers, lecturing on snake poisons at Calcutta, is reported to have said that the idea that birds were fascinated by snakes was due to the fact that the bird had already been bitten and the snake was merely waiting for its collapse.

This recalls to my mind an incident which came under my observation many years ago. I was encamped at Raiwala on the bank of the Ganges in the Dehra Dun district. One day while sitting near my tent under the shade of the mango trees, my eye was attracted by a hoopoe which was going through the most extraordinary antics. It would run forward, apparently peck at something and then run back again ; this it kept on repeating. I got up to go nearer and see what was happening. I took my eye off the bird and walked up to within some 20 yards of where it had been. It had now moved into a slight hollow a few yards from the base of one of the old mango trees and was then in a most extraordinary attitude. It was standing, but apparently leaning back on its tail, and moving its head up and down opening and closing its bill as if it was gasping for breath. Unfortunately it never occurred to me to see if there was any external cause for this, and thinking that the bird had a fit I walked up to it. When I got close to it, away bolted a large monitor (?) lizard into the hollow mango tree. The lizard, apparently some 3 ft. long, must have been lying within 3 or 4 feet of the hoopoe. The moment the lizard bolted, the bird flew off apparently none the worse. It was clearly fascinated by the monitor. Naturally I have never ceased regretting that I did not see the monitor in time.

ST. GEORGE GORE, COL., R.E.

CAWNPORE, *3rd April* 1906.

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## No. X.—OCCURRENCE OF THE INDIAN RED-BREASTED FLYCATCHER (*SIPHIA HYPERYTHRA*) IN BENGAL.

To-day one of my men brought me in a fine male of this species, which he shot near here. Oates in Vol. II, Birds, Fauna of British India—gives the following account of the distribution of this bird :—"Summers in Kashmir and winters in Ceylon. This species has not yet been procured in the intervening countries during the periods of migration." I send this note as I consider it interesting and of scientific value.

CHAS. M. INGLIS.

BAGHOWNIE FTY., DARBHANGA, *5th April* 1906.

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## No. XI.—A NOTE ON THE MIGRATION OF THE COMMON INDIAN BEE-EATER (*MEROPS VIRIDIS*).

Until I went to Lahore I was accustomed to look upon the common Indian bee-eater as a permanent resident in most parts of the plains, with the exception of such places as Bombay and Calcutta, where there are not many suitable

nesting sites. This appears to be the general view of the habits of the bird. Thus Dr. Blanford says of it:—"A resident in general, but locally migratory in some places: thus it is said to leave the island of Bombay from April to September." Mr. E. H. Aitken writes in the same strain: "In Bombay it is to be seen everywhere from the end of the rains till the beginning of the hot season, but disappears in the interval. Yet it is not ranked as a migratory bird and is not so in the usual sense. It only leaves us during the breeding season, because it cannot find comfortable family quarters in our island." I am now inclined to believe that this bird is a regular migrant. I arrived in Lahore on October 19th, 1905, and from that day until March 8th, 1906, I did not set eyes upon a bee-eater. Since March 8th I have not seen less than fifty a day: during the summer months bee-eaters are nearly as common as mynas. Residents of Lahore tell me that the bee-eaters always leave the place during the cold weather. The bee-eater comes to Lahore to breed.

According to Colonel Cunningham bee-eaters are only temporary residents in Calcutta. They winter there, leaving with wonderful regularity at the beginning of every hot weather. With regard to their arrival in Calcutta he writes: "From a record of the dates of its occurrence during a period of eight years, it appears that it took place five times in the second week, once on the fourth day, once on the seventh day, and once in the third week of October, and from a much more extended series of observations the thirteenth of the month comes out as the normal date. These dates are to be taken as referring to the arrival of the birds who propose to spend the winter in the place; for in almost any year small parties may be seen and heard passing high overhead for some days before any come to settle down." It would thus appear that the migration from Calcutta is a regular one and not merely a going outside the city to breed. The observations of Mr. Benjamin Aitken point to the fact that the Bombay birds similarly migrate. "With regard to the island of Bombay I have no doubt whatever that the common bee-eater migrates as verily as the common swallow or the grey wagtail. . . In my notes I have the 6th October 1865 and the 9th October 1866 recorded as the days of first appearance of the bee-eater in Bombay in those years. The date of their disappearance in 1867 was the 14th March."

In many parts of India the common bee-eater is to be found all the year round. From this, however, it does not follow that there is no migration in those places. For example, the bee-eaters of Benares may leave that place in March to go towards Lahore but their place may be taken by the birds which have come from Calcutta. This point could be settled only by marking certain birds. But hitherto very few observations upon the subject appear to have been made. Do the bee-eaters, found in localities east of Calcutta, leave them during the hot weather?

What is the most westerly part of India, or the most northerly part, in which there is an exodus of bee-eaters during the winter months? Are there any parts of the plains of India where these birds are never observed? If any of

the members of the Society can give answers to the questions may I express the hope that they will not fail to do so? Moreover will those who dwell in the various parts of the country watch in future to see whether any migration takes place? Until I came to Lahore I paid no attention to the subject of migration of this species. During the eighteen months that I was in Madras I never discovered any bee-eaters nesting, and suggested that possibly the species left Madras to breed. As the common bee-eater is never abundant in Madras it is quite possible that there was some migration which escaped my notice.

Two other birds, which are exceedingly abundant in Lahore during the hot weather but leave the place for the winter, are the Yellow-throated Sparrow (*Gymnorhis flavicollis*) and the Purple Sun-bird (*Arachnecthra asiatica*).

D. DEWAR, I.C.S.

LAHORE, PUNJAB, 12*th April* 1906.

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## No. XII.—THE BOLDNESS OF PANTHERS.

I send you an account of an adventure a friend and his wife, not to mention the dog, had with a leopard which shows what bold beasts they are occasionally. I give the account as written to me: "The evening before last, my wife and I had quite an adventure with a leopard. We had gone to look at a small pool in a river, and were riding back along the river bed, the jungle being some 80 yards away from the bank. Suddenly I spotted a leopard on the edge of the bank looking at the dogs. I shouted to the dogs to come close up and immediately the leopard stood up. 'Ikey,' my new pedigree fox-terrier, saw him and like a fool went for him. Nothing on earth would keep him off. Away went the leopard across the open with the dog after him, and we close behind. At the edge of the jungle the leopard turned and sprang at 'Ikey'. Somehow or other, to my great surprise, he missed, and the fool of a dog turned and went for the leopard, who disappeared into the jungle with the dog close behind. I swore and roared at 'Ikey' and finally to my surprise he came out again with the leopard after him. For some time the leopard watched us from about 100 yards off but he dare not spring with me there and it was all I could do to keep the dog from going back after him. All this time my wife was keeping the other dog 'Topsy' off and I told her to gallop off and call the dogs. To our great relief they followed. The leopard came out a little way, but dared not pass me into the open, and I did not leave till the dogs were well away."

Unfortunately my friend had no gun with him. He sat up next evening over a goat but the leopard did not show up.

Another instance of a leopard's boldness. Some years ago a leopard being reported in the hill here, I tied up a goat and sat up for it, but it did not appear. At dusk I had the goat untied and we went down the hill together, when I got on my pony, giving my rifle over to a chaprasi, the goat being led by another. I was riding a bit ahead along the road when the man leading the goat began shouting to me. On asking the cause he called out that the

leopard had tried to take the goat from between them. I rode back to where they were standing when he told me he had felt the hot breath of the leopard on the calves of his legs and turning suddenly he saw the leopard crouch. He pointed out to me an indistinct object on the road side about 10 yards off. Hardly believing a leopard would be so bold, I got off my pony, took the rifle and walked towards the object, when to my astonishment up jumped a leopard and raced off to the hill. I fired a snap shot but of course missed. He must have been watching the goat *and us* the whole time and seeing his dinner being walked off, made a bold attempt to get it from between the men.

Yet another instance.

Two sportsmen sat up over a goat one evening. At dusk the leopard came down and killed the goat. Both sportsmen wanting the first shot fired in a hurry and missed, the leopard went a short way up the rocks, stood and looked at them, they fired and missed again and it then disappeared. They got another goat, when down came the leopard a second time and killed it. It being almost dark now they again missed their shots. The leopard took not the slightest notice of the shots but calmly carried off the goat to its cave. I send you these accounts as they may be of interest to some of the members of our Society.

F. FIELD.

GAYA, BENGAL, 26*th April* 1906.

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## No. XIII.—THE OCCURRENCE OF THE SCORPION SPIDER (*PHRYNICHUS*) (KARSCH) IN THE SHEVAROY HILLS.

I wish to record the existence of *Phrynichus* in the Shevaroy Hills. This genus is known to occur in Ceylon, Western India and Siam, but apparently has not been previously notified in S. India. Several specimens have been found at different times at an altitude of 3,000—3,500 ft.; the most recent was obtained on April 14th. This specimen is apparently a young form of *Phrynichus cunatus* (Pocock) which is well-known in Ceylon. I shall be pleased to forward it to any expert in the *Pedipalpi* for further examination.

H. S. RIVINGTON, B. Sc.

CHETPUT, MADRAS, *April* 1906.

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## No. XIV.—THE BROWN WOOD OWL (*SYRNIUM INDRANI*).

The following notes on the nidification of *Syrnium indrani* may be of interest to some of our readers. I found a nest of the above bird in a deep shady nullah here at about 5,000 feet elevation on February 21, 1906. It contained two fresh eggs which measured 2·25″ × 1·81″. The nest was merely a hole scraped in the ground at the foot of some steep rocks and was placed behind some scanty bushes. The birds were not at all shy and watched us from such a short distance that there was no difficulty in identifying them, and it is a bird I know well. Thinking she might lay more I put in two fowl's

eggs we had brought (as I had known of the nest for some time before the above date) and she sat on these quite contentedly and actually hatched them out. When we saw them, the chicks were apparently a day old and the owl had provided two dead rats as suitable provision for them. Two days afterwards I went to see how they were getting on, but the rats, the chicks and the owls had all disappeared. I fancy the above sequence would fairly represent the progress of this jungle tragedy.

I afterwards found another nest in March. This was placed in the hollow of a fork of by no means a large tree standing on the edge of a shady nullah but not itself well shaded, it was about ten feet up. The egg was much smaller than the former ones, measuring only 1·94 × 1·69. I was attracted to this nest by the male owl calling during the day-time, a low double hoot, "tu-whoo" describes it very fairly. It seems from what I have now seen that the male constantly remains close by the nest, occasionally calling to his mate, a habit which I hope may lead to the detection of more nests next year.

S. L. WHYMPER.

NAINI TAL, *April* 1906.

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## No. XV.—HABITS OF THE TAPIR.

I was very interested in Colonel Ferris' note on the habits of the Tapir in captivity, more especially with what he wrote as to its curious habit of concealing its excrement, which recalled at once to my mind the account given in Wallace's travels on the Amazon of the South American species.

He there states that the excrement of the tapir is never seen, which is explained by the Indians as due to the fact that the animal always takes to water when obliged to meet a call of nature, further that when no water is available it will break off a branch of a tree using it as a rude tray and after strewing leaves over the top will carry it for a considerable distance until it finds a river or pool in which it can deposit it.

Perhaps some of our members in the Straits can give us some information as to the habits on this point of the Malayan species in the wild state?

Notes on the sense of modesty, which undoubtedly exists in many birds and animals, are often so curious and extraordinary that they are well worth recording.

L. C. H. YOUNG.

BOMBAY, 11*th May* 1906.

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## No. XVI.—OCCURRENCE OF *REMIZA* (*ÆGITHALUS*) *CORONATUS* IN KOHAT.

I am not aware if the occurrence of the Penduline tit—*Ægithalus coronatus*—within Indian limits has been previously recorded or not, but if not then I would wish to announce the fact of its discovery as a fairly common spring migrant in the Kohat district.

In April 1905, a party of strange tits was observed by me in Kohat, but unfortunately I failed to secure a specimen. I however recorded in my note-book a description of the bird, and trusted to meet with it the following year and to obtain specimens for identification. But early this year I was ordered away from Kohat, so I gave my friend Mr. C. H. T. Whitehead, 56th Infantry F. F., a description of the bird and asked him to keep a sharp look-out for it. I am glad to say he was most successful, meeting with several flocks and obtaining specimens. I am indebted to him for the identification and for the pair of skins, ♂ and ♀, which are now being sent to our Museum.

The specific name suits this little bird well. He is even more tit-like in his habits than "*Parus*" and seems to be as happy hunting the leaves and bark of his favourite trees upside down or hanging abdomen uppermost from the slenderest of leaf stems, as in the normal position of birds in trees. His note, which is constantly uttered when searching for food, is very similar to that of the "White-eye."

So far this rare species has only been noted on spring migration, the passage taking place in Kohat in April.

H. A. F. MAGRATH, MAJOR,
51st Sikhs F.F.

FORT LOCKHART, 18*th April* 1906.

[The occurrence of this tit in Sind was recorded in the last number of our Journal, page 244, by Mr. T. R. Bell, so that the above is not the first notice of its being found within Indian limits. Its occurrence however in Kohat and the notes on its habits are none the less interesting.—EDS.]

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## No. XVII.—FLOCKING OF KITES.

If I can trust my memory, not having the numbers with me in camp, twice during the past year notes have appeared in our Journal on the unusual flocking of kites. Perhaps a similar occurrence I witnessed yesterday and to-day at this place may throw light on the matter. The bungalow here is in a well wooded valley in a very small clearing. Yesterday morning I noticed some 70 to 100 ordinary kites (*Milvus govinda*) on the ground within 30 yards of the verandah and busy pecking up some food from an open bit of turf. On approaching the flock they rose and settled on a similar piece of ground on the other side of the bungalow. I could at first see nothing to attract them, there being only a few (not more than normal) black ants and a red bug or two about. However after a little search I found round the woody stems of some small plants dense masses of the shed wings of termites and turning these over I found the termites had gone into the soil, but could easily be routed out as there were many close to the surface. There had evidently been a flight the night before after a heavy downpour of rain. At first there were only kites but later a jungle crow (*Corvus macrorhynchus*) and a "Pharaoh's chicken" (*Neophron ginginianus*) and a few common mynas (*Acridotheres tristis*) and later there were six *Neophron* which kept all the others at a respectful distance.

This afternoon there was another flighting of termites, this time by daylight and the kites were busy taking them on the wing. There seemed to me to be more of them to-day and there were a few Brahminy kites (*Haliastur indus*) in addition. It was a pretty sight to see these birds twisting and turning to seize the termites in their claws. The latter were flying high as several of the kites were busy a good 150 feet up. The two kinds of kites were the only birds feeding on the termites to-day. As far as my observation goes it is unusual to find kites grubbing in the soil with their beaks and no doubt they prefer feeding on the wing as they did to-day.

I may mention here that kites find an easy livelihood around the silk cultivation centres in the Kollegal taluq of Coimbatore; they gather in large numbers to feed on the dead "silk worms" thrown out by the villagers.

C. E. C. FISCHER.

GEDDESAL, COIMBATORE DISTRICT, 13*th May* 1906.

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## No. XVIII.—NOTES ON THE "SHOT-BORER" IN BAMBOOS.

Having read the above in the last Journal, No. 1 of Vol. XVII, I presume to send these few lines in connection with these notes, as it would be of interest, perhaps to others, besides myself, to have a *scientific* opinion on what I am about to state.

The people of these parts—Kumaun—are fully aware of the attacks of the "Shot-Borer" on Bamboos, Ringals (snow-bamboo as called by some) and timber of the "Chir" or *Pinus longifolia* tree, by the same or a similar Borer; but according to them such attacks are *only* made on Bamboos, Ringals, or "Chir" trees that have been cut, or felled during moon-light periods, and *not* during dark night periods; by which is meant not *night* cutting, but during the *periods* of moon-light or darkness. What the *cause* of this *effect* is, if it is cause and effect, I cannot say, perhaps science can; but it is a *fact*, and I have a long and practical experience in all these three materials. If there is anything in it, it may be of value to larger users of them, to know, and have it explained?

NORMAN F. T. TROUP.

KAUSANIE, ALMORA, U. P., 22*nd May* 1906.

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## No. XIX.—BLACK PANTHERS.

In continuation of my note in the last Journal (page 234) on the black panthers in the Kolhapur collection and with reference to the controversy on the subject of the colour of the tongue and palate of black panthers, I send you a note on a black panther shot by Colonel Grantham of the 33rd Cavalry, on the 12th May 1906 in the Dajipur jungles of the Kolhapur State. The panther was a male aged about 10 years.

*Measurements.*

| | |
|---|---|
| Length taken on the spot between pegs ... | 6 feet 7 inches. |
| Height from point of shoulder to flat of pad ... | 2 „ 4 „ |
| Circumference of fore-arm ... ... ... | 10 „ |
| „ of neck ... ... ... ... | 1 foot 6½ „ |
| „ „ jowl ... ... ... ... | 1 „ 7½ „ |
| Girth behind shoulders ... ... ... ... | 2 feet 3½ „ |
| From root to tip of tail ... ... ... ... | 2 „ 10 „ |

*Colour.*

In open daylight, very dark brown approaching to black on head, back and upper parts of body ; somewhat lighter on belly, chest, inside of thighs and arms. The spots distinctly visible but not markedly peacock-eyed.

*Eyes.*—Normal colour.

*Tongue.*—Normal pink colour.

*Mouth.*—Roof, near the margins of gums and the sides of cheeks inside, pigmented, otherwise normal pink.

*Hairs of moustache.*—Black.

*Claws.*—Normal, white.

On careful dissection no trace of the usual rudimentary clavicles were found.

W. B. FERRIS, COLONEL.

THE RESIDENCY, KOLHAPUR, 29*th May* 1906.

## No. XX.—A REMARKABLE TREE.

In the Gundila valley of the North Coimbatore District there is a remarkable Champak (*Michelia champaca*) tree, which is held in veneration and worshipped by the local Sholagas (hill men). It is known by them as the Doddasampagai (big Champak). Owing to its sacred character the Sholagas demurred to my approaching it with boots on, and I had to get it taped by some of them. The girth at 10 feet (to avoid some large warty protuberances) is 50 feet. At a height of about 15 feet, the main trunk splits into 11 large branches, the least of which is about 6 feet in girth and running up to about 12 feet girth. These again split up into innumerable smaller branches. The highest twig I estimated to be 70 feet from the ground. Under its shade in September last I found the only specimens of that curious fern, *Ophioglossum reticulatum*, that I have so far found in these hills.

C. E. C. FISCHER.

GUNDILA, NORTH COIMBATORE, 1*st June* 1906.

## No. XXI.—HABITAT OF THE GREEN KEELBACK (*MACROPHISTHODON PLUMBICOLOR*).

Referring to the article on the common Indian snakes by Captain F. Wall, I.M.S., in Vol. XVII, No. 1 of the Journal, it may be of interest to record the occurrence of *Macrophisthodon plumbicolor* in the hills of North Coimbatore.

I have found immature specimens on three occasions. 1—In April 1905, a half-grown specimen in the Burgur hills in bamboo jungle devoid of grass at an elevation of 3,400 feet. 2—In April 1906, near Salamalai, elevation 3,000 feet, a small specimen on dry strong soil in scrub jungle devoid of grass. 3—In May 1906, one specimen about 10″ long at 4,100 feet in high timber forest, but near a grassy clearing. The hill men (Sholagas, etc.,) declare it to be poisonous and were amazed at my seizing the last noted specimen by the tail and holding it suspended. The peculiar flattening of the body referred to by Captain Wall was very striking not only when on the ground but even when held suspended in mid-air.

This morning when packing up on moving camp, I removed some loose newspaper sheets from a basket lid lying on the ground in a corner of the tent. I thought I saw a leaf in the angle, but, fortunately, the tent being somewhat dark, I was cautious and took it to the light when it turned out to be a coiled *Lachesis gramineus*, evidently a young one, as it taped only $17\frac{1}{10}$″, tail $2\frac{9}{10}$″ (elevation 2,700 ft.).

C. E. C. FISCHER.

LOKANHALLI, NORTH COIMBATORE, 3*rd June* 1906.

## No. XXII.—BIRD WEATHER REPORTERS.

I heard last week a prophesy about rainfall based on the habits of birds which might interest some of your readers. Last year the birds are said to have built their nests high up on the topmost branches of trees. This year they have built low down in the most sheltered parts, the inference drawn is that while last year they did not seek much protection, this season they expect the fall to be heavy. I give this for what it may be worth. Let us hope the little prophets will escape the fate of some of our weather reporters.

K. R. BOMANJI, I.C.S.

BIJAPUR, 10*th June* 1906.

## No. XXIII.—HOW TIGERS KILL THEIR PREY.

As this old question with apparently undiminished interest on the part of naturalists and sportsmen has again cropped up, perhaps the following remarks based on personal observation will aid in determining the above mooted question. From the several occasions on which I have witnessed the complete stalk and death of a buffalo at the jaws of a tiger, it would seem that there is no general rule that can be applied to the performance of these acts. I have seen a tiger stalk-in, standing up like a pointer, with tail stiff and one paw up, stand a second thus, and with 2 or 3 large strides, taken very rapidly, up to the buffalo, dip his head under the buffalo's chin, catch it by the throat and pin it to the ground without either forefeet being raised off the ground for purposes of assault. On the first occasion I saw this performance the tiger pinned the animal's head tightly to the ground, the tiger being down on his fore-paws which were stretched out before him, and his hind quarters

up in a standing position. The buffalo remained standing for several seconds, then fell over, and in so doing broke his own neck. I feel sure in many cases the animal's neck is broken in this way, by the fall of his own body, his neck being fixed rigidly to the ground. On other occasions the tiger stalks up and lies down concealed watching his prey for some minutes, then stands up slowly and charges in at the gallop, rearing up on his hind legs and putting one paw on the head or nose of the victim and the other on his shoulder takes a mouthful of neck and bears him to the ground.

Both methods are quite common, and which has been employed can be told from the marks on the victim and the prints on the sand.

Sometimes the tiger plays with his victim, but as the only occasion on which I witnessed this performance the tiger was not allowed to kill : the story can add nothing to our knowledge of how he kills. It may be interesting to add that when a tiger comes on a live buffalo suddenly, he generally gives a " whoof " and bolts. I can only explain this by his associating buffaloes with the presence of man.

The tiger sometimes kills his prey by a smashing blow on the head with his paw, but the only occasions on which I have known this done have been when the tiger did not intend to eat and had killed for pure devilment, on such occasions, when he has killed several buffaloes on one night, or has come along a path, given the buffalo a pat and walked right off, never intending to stay in the place. The above refers to animals which have been tied up and which the tiger can make tolerably sure of killing, and the circumstances are therefore different from those in which wild game is killed. In the latter case the prey is often moving, sometimes at full gallop and the tiger also is in rapid motion, claws therefore enter more into his scheme of attack in such cases than they do in the case of buffaloes, nevertheless I witnessed a tiger pull down a young swamp deer by the throat without using any claw. In the majority of cases, however, in " natural " kills the claws are used and it is not uncommon to shoot animals which have the long tearing claw marks of a tiger on them. On one occasion I shot a nilgai with two such brands on his rump and a large piece of meat torn out of his round. One can picture the mighty rush and the nilgai's great strength tearing out the hold. Tigers in concert will attack and hamstring bison, but this is exceptional. I have also noticed the unbusinesslike method several tigers have of killing their prey compared with a single animal, of which Mr. Selous makes mention as regards lions. I think this is due possibly to two causes. Firstly that several animals hunt their prey rather than trust to a stealthy stalk and a sudden surprise and attack and also that they may be conscious the animal cannot escape. This description also as regards the method in which lions drag their kill only requires to have the word tiger substituted for lion to make it an exact description of the tiger's method.

Perak is a long way from the Central Provinces and the conditions there are very different ; in differing somewhat therefore from Mr. F. O. B. Dennys as regards the habits of the tiger, it is quite possible that these habits are

actually different. I entirely disbelieve, however, both from what I have seen and from the indirect evidence of the dead body, that the tiger has any scientific and conscious method of breaking the animals' neck, he merely makes a furious onslaught on the neck which frequently gets broken by means of "unconscious" force.

I should like to add a word of caution regarding the belief that the neck is almost invariably broken, on the contrary it is more often not broken. I think this belief has arisen from the matter having been so often discussed in print and also the very cursory examination which often takes place resulting in a false verdict of a broken neck. From a very large number of kills which have been thoroughly examined, and excluding such cases in which the neck has been chewed through, I have found that not more than 40 per cent. of the animals' necks are broken. It would be interesting if other sportsmen who have made a study of this point would give their experiences.

A. A. DUNBAR BRANDER, I.F.S.,
Deputy Conservator of Forests.

BERAR, *May 27th*, 1906.

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## No. XXIV.—THE SENSE OF SMELL OF TIGERS.

One frequently reads in books on sport of the keen sense of smell possessed by tigers and the precautions which are necessary when hunting to prevent detection on this account. All the evidence, however, which I have been able to collect on this subject goes to show that the tiger's sense of smell is of a very low order, perhaps hardly equalling that of man. A tiger is frequently driven up to a man either on the ground or in a tree and over ground which has been thoroughly tainted with human smell without the tiger being in the least aware of the presence of his hidden foe. Most sportsmen who have shot tigers must have noticed this occur even when the wind was "all wrong" and under circumstances in which any other animal in the forest (panthers excepted) would have been aware of the presence of man. It cannot be argued that he is aware of man's presence, and only indifferent to it, as on hearing or catching sight of man the tiger frequently takes precautions accordingly. The same applies when stalking on foot. I have several times come on tiger in the forest which were quite unaware of my presence. Although within 40 yards and under circumstances in which had they possessed even moderate powers of smell they must have known of my approach.

Then again a tiger will approach his kill, and he frequently does this with the greatest caution and suspicion. But a man may be hidden within 20 yards without the tiger discovering him. Any one who has sat this distance over water to watch deer must have noticed how the deer discover his presence again and again even when the greatest precautions regarding "wind" have been made and which are usually entirely neglected when dealing with the tiger. The tiger has undoubtedly a very keen sense of sight and hearing and I feel sure that sportsmen, unaware how keen these senses are, have often attributed the

discovery of their presence to the sense of smell, because they have considered it incredible that the tiger could have seen or heard them. Some years ago I had the good fortune to procure a young tiger which I reared under the most natural circumstances and which used to run about loose in camp with the dogs. The following experiments were often repeated. His food, say a pig's leg, would be taken away from him and hung up so as to be some 7 feet off the ground, and the tiger led under it and past it he seemed to be quite unaware of its presence. Again when he had carried off his "joint" to the surrounding grass I have taken him off it and shifted the joint trailing it along the grass. The tiger would return to the exact spot where it had been and then proceed to hunt round in circles for it, he never ran up the scent and what is more significant never attempted to. Wild tigers find a shifted "kill" in exactly the same way if it is out of sight. I consider that these experiments prove that the tiger's sense of smell is less than that of man, and a tiger has failed to see me under circumstances which had they been reversed would have enabled a man endowed with ordinary powers of smell to discover the tiger.

Now on considering the above facts in relation to the tiger's character and habits, they are exactly what one would expect to find. He does not use his sense of smell nor does he require to possess this sense. His eyesight and hearing are of the very first order and it is on these that he depends for his food entirely. His method of hunting is to prowl about until he hears or sees an animal when he trusts to a stealthy approach and a sudden rush; he never hunts his prey except when accompanied by another tiger and then the hunt is of the nature of a drive when one tiger tries to frighten the deer over his companion already concealed. The fact of his quiet and slow method of questing shows that he depends on his ears and eyes to find and not on his nose. A wild dog, although carnivorous, has a very keen sense of smell, but he regularly hunts his prey by scent, so one naturally expects to find this to be the case. Deer also have a very keen sense of smell, and this is necessary to them for their very existence, as ears and nose are their chief protections against danger and attack. But again these reasons do not apply to the tiger as he has no danger or attack to guard against, and he is not afraid of anything in the forest and does not require to be continually on his guard; his fear even of man is a very limited fear and in no sense the same sort of fear that exists among deer.

It would appear, therefore, that the tiger does not require a keen sense of smell and that observed facts show that he is endowed with this only to a very limited extent.

A. A. DUNBAR BRANDER, I. F. S.

BULDANA, BERARS, *May 27th*, 1906.

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## No. XXV.—THE NESTING OF THE BLACK-CRESTED BAZA (*BAZA LOPHOTES*).

The following note on the nesting of *Baza lophotes* in the Goma Reserve may be of some interest to readers of our Journal.

My collector having told me a few days ago that he had come across two nests of *Baza lophotes* being built, I went yesterday to the nearest one reported (quite six miles distant) in order to see that my man was not mistaken in the identity of the birds, though I had little doubt on this score as I had previously paid him Re. 1 for each specimen of this species he brought in, and a Sonthal does not often make mistakes when money is to be had.

The nest was situated in a Sal tree at the side of the Government road running through the Forest (this is not a road that carries much traffic at any time of the year, less so now when heavy rains are on), at a height of about 25 feet or 30 feet from the ground resting on two smallish branches growing close to the trunk, in fact one side resting against the trunk. The nest from below looked like a small edition of the Common Kite's, being far from tidy, and the boy who went up said it was lined with leaves (?). The female bird did not stir until the boy was about four feet below the nest when she flew into an adjacent tree, to which on ascertaining there were three eggs I followed her, I had with me only a Winchester Saloon rifle. At first the bird would not let me get near but kept flying from tree to tree and back again towards the nest, in fact even making one or two very feeble half-hearted swoops at the boy who was coming down. Her cries, which were somewhat kite-like, soon brought the male on the scene, and as the female now settled on a high thinly foliaged tree, some 60 yards off, she gave me the opportunity of a longish shot and I dropped her, but the bird most unfortunately, or rather as it afterwards proved fortunately, got caught up by its wing and remained hanging high up and quite out of reach. In a short time the male came to the same tree, under which in the meantime I had concealed myself in the undergrowth, seeing the plight of its mate it soon flew down to the branch on which it hung comparatively close to where I stood, and he, needless to say, was promptly bagged. A second shot at the dead bird luckily caused it to drop as well and so I succeeded in securing the pair of these rather uncommon birds and their eggs.

The crest of this bird when excited stands quite erect and thrown decidedly forward, a most conspicuous feature when the bird is perched on a bare branch. The crops of these two birds were full of grass-hoppers and the remains of a brightly colored cicada with red underwings found in this forest, so it is evident they must at times feed on insects, though, if my memory serves me right, I believe I have also seen a small lizard taken from the crop of one of my specimens. The eggs are of the type that have already more than once been described in the Journal; mine are much stained with yellow, probably from the lining of the nest, if it was of leaves as the boy said.

As the other nest is a long way inside the forest I am sending my man to take it.

A. M. PRIMROSE.

MORNAI, T. E., TAMARHAT P. O. GAURIPUR, ASSAM,
*16th June* 1906.

## No. XXVI.—THE NESTING OF THE BLACK-BACKED FORKTAIL (*HENICURUS IMMACULATUS*).

(*Contributed by* JAMES MARTEN.)

On 15th May I found the nest of the Black-backed Forktail (*Henicurus immaculatus*) in the extreme northern limit of the Pakokku district in Upper Burma at an altitude of about 2,500 feet. It was the usual cup-shaped form, made of moss and strongly built on the vertical face of a recess in the bank of a stream, and protected from sun and rain. It was at a height of about 5 feet from the bed of the stream, which at that time of the year was nearly dry. There were two fresh eggs, along with one of a cuckoo, of a light blue ground colour with fine light brown dots, measuring 0·75″ × 0·63″.

I have always seen these birds in pairs and only along small rocky streams. They have a habit of flying ahead when one is walking along, and after having escorted one for perhaps half a mile they disappear into the forest and return to their starting point. They are rather shy birds.

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## No. XXVII.—THE LARVA OF THE FIREFLY.

On the 10th May I found the larva of the firefly under a rose tree. I cannot say whether it was feeding on the roots of the tree or on some other matter. It put me in mind of the larva of a beetle, which feeds on potatoes in Europe, only that it is more fleshy and the skin less chitinous. The colour is light ochreous, head and last segment darker. The head is small, so that it tapers to a point at each end. When moving it uses the last segment to push itself forward. I have kept it in a bottle with soil and roots of plants. I have not seen it feeding, but it has been growing and is still healthy. In the day time it keeps under the soil, but sometimes in the evening it comes out and shows a brilliant light.

When glowing it lifts the last segments high up, so that the light is not covered and when disturbed it bends them down so that little or no light is visible.

I hope to see it pupate and finally emerge.

P. GERHARDT.

KARLA, 28*th May* 1906.

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## No. XXVIII.—A WHALE NEAR BASSEIN (BOMBAY COAST).

On the 11th April 1906, a large whale was washed ashore near Bassein (Thana District), which from its size probably belonged to the species *Balaenopteria indica* (The great Indian Fin-whale). Unfortunately information was not obtained until some 14 days after, and then when a visit was paid it was too late to obtain any details as to the external characters, which accord-

ing to Blanford (Mammalia, page 567, Fauna of B. I.) are unknown. The rough measurements were :—

Length 63 feet.

Lower jaw 18 feet.

Length of fin 6 feet (this measurement is doubtful as parts had rotted away. Other measurements give 8 feet and 9 feet 7 inches as the length.)

Decomposition was too far advanced to obtain any more measurements.

The skeleton has since been visited and the following information obtained:

Length of skull 14' 4".

Breadth of skull 7' 6".

Ribs 11 pairs.

Length of rib 8' 6".

Vertebræ about 48 in number.

Length of Lower jaw 16'.

In view of the importance of obtaining full and correct information as to the external characters and measurements of these whales, it is to be hoped that our members residing near the coast will bear the matter in mind, and if another opportunity occurs (and this is not the first large whale which has been washed on our shores) some further information will be obtained. Mr. S M. Edwardes, I.C.S., and Mr. P. M. D. Sanderson kindly assisted in providing the above information.

W. S. MILLARD,
*Honorary Secretary*,
Bombay Natural History Society.

26th *June* 1906.

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## No. XXIX.—A FORTUNATE ESCAPE AND RECOVERY FROM COBRA BITE.

On the 23rd June 1906, at 11 a.m., a Muhammadan, aged 22, well built, well nourished, came to me at my office with a dead cobra, which measured 4' 3". He had the end joint of the little finger of his left hand tied up with a dirty rag.

The following facts were elicited:—On the previous day—22nd June—at about 5 p.m., the women and children in his house raised an outcry of "snake, snake" Rushing in he saw the snake's tail disappearing inside the room, and seized it, when the snake came round like a flash and seized the end joint of the little finger of his left hand. He instantly snatched the snake away with his right hand and dashed it on the ground and then killed it. He tied up his finger which was bleeding slightly. He got very little sleep during the night, as his arm up to the shoulder was very painful. In the morning, when he untied the rag, he found one fang of the cobra broken off, and sticking in his finger. He threw it away, so could not show it to me. On examining his finger I found that there was a tear—or rather an incised puncture—about half an inch from the end of the finger on the outer side. The finger had been crushed on some former occasion and consequently the skin, where the wound had healed, was very hard, almost bone-like to the touch.

Most fortunately for the man it was on this horny surface that the tooth had struck, and this, together with the promptness with which the snake was snatched away, no doubt saved the man's life. There was considerable tenderness of the spot to the touch when I examined it. The man complained of not seeing properly, also of drowsiness. Things looked big, he said. On examining his eyes I found that the pupil did not contract to the light or expand when shaded from the light. His pulse was full. I foolishly omitted to note the number of beats per minute.

Examining the cobra I found the left fang broken off short. The right fang was entire. On cutting down to the poison glands I found the left gland full of poison, and the right gland nearly empty. The man had not noticed any poison scattered about his hand or elsewhere. There must have been some ejected from the right fang, and this was no doubt unnoticed in the natural confusion of the moment and afterwards.

R. W. BURTON, CAPTAIN,
SECUNDERABAD, 24*th June* 1906. (Indian Army).

## No. XXX.—AN UNUSUAL DISPLACEMENT OF THE HEART IN A WHISTLING TEAL.

The specimen which forms the subject of this note was sent to Mr. Phipson in November 1904 by Mr. W. Fisher, I.F.S., who shot the bird near Palghar. In a letter he thus describes what he found: "I was cutting it, and cut the left side of the breast, and first thought it must be a cyst or other growth. Then I noticed that the two arteries from it passed in between the 'merrythought" and the main bone. I then opened the bird and there was no heart inside."

Unfortunately, owing to lack of a convenient bottle and scarcity of spirit,—his own whisky being the only preservative he had available, Mr. Fisher sent only the pectoral muscles and not the breast-bone. The specimen, which is a very remarkable one, is thus deprived of much of its value from the scientific point of view.

On receiving the specimen from Mr. Phipson, I at once wrote to Mr. Fisher to ask for the breast-bone, but unfortunately it had been thrown out. He, however, assured me that the breast-bone was "normally formed and both sides alike. There was no open split and I do not think a closed one. The arteries passed round the front of the breast-bone and through the aperture to the inside where they connected with the lungs on the inner side of the backbone."

On examination of the specimen, I was sure the case was one of *ectopia cordis* such as one sees examples of, occasionally, in human embryos. To explain how the heart came to be where it is, one must hark back to a very early period of the existence of the bird, while it was still a chick in the egg. On making a transverse section through a very young chick in the egg, one sees a solid rod like portion in the centre of the section called the notocord, and above and below this, a canal, the upper smaller one representing the future spinal canal, and the lower larger one the thoracic cavity. Now, if we have succeeded in seeing this young chick in a sufficiently early stage of develop-

ment, we will find that these cavities are formed by an uprising of the edges of a furrow, which edges growing steadily, ultimately coalesce in the middle line and form a closed tube inside which the various body-organs are produced Now should the edges of this groove be arrested during development, they may not meet in front, and in these circumstances, one or other of the contained organs may escape. This is what must have happened in the case of this teal, and it was for this reason that I was so anxious to secure the breast-bone, for doubtless there would have been found evidence of the existence of a fissure at an early period of life The reason why Mr. Fisher did not notice this is probably because the original bony cleft was filled in by the subsequent formation of cartilage or fibrous membrane.

Believing that the specimen showed a rare condition, I took it home with me last winter and submitted it to Dr. D. J. Cunningham, Professor of Anatomy in Edinburgh University. He was much interested in the condition, and asked his senior demonstrator to describe it, and the following is taken from his account published in the Journal of Anatomy and Physiology (Vol XL., p. 303):—

"The specimen as it came under my observation consisted of a fleshy mass about 2½ inches long, 1 inch wide, and ½ inch thick, consisting principally of the great pectoral muscle, and some incisions had been made which subdivided the specimen. In the very centre of the muscular mass was an oval cavity measuring ¾ of an inch in length by ½ inch wide, and lying in this hollow was a structure which there was no difficulty in recognising as a well-formed avian heart. No fibrous pericardium was present, but the walls enclosing the cavity were smooth and polished in character, and the surface of the heart was apparently covered by a smooth epicardium. The heart itself appeared to be perfectly normal, and from its anterior end gave off the great vessels, which, however, had been cut short and could not be traced. As the sternum was not present, I had no opportunity of examining its condition."

The specimen, which is hardly suitable for the Society's museum, has been presented to the Anatomical Museum of the University of Edinburgh, where any one may examine it for himself. The condition is undoubtedly a rare one, and we must thank Mr. Fisher for having sent it for examination. It is interesting to note that the bird flew just as well as an ordinary normal teal.

Mr. Fisher says: "The bird with several others flew strongly and for his kind, fast; they circled about some five minutes before coming in my direction when I dropped a couple."

This is an example of the wonderful powers of adaptation nature shows, in cases of deformity and arrested development, for, at first sight, one would say it was impossible for a heart to perform its proper functions embedded in the breast muscles, and exposed to injury from external violence.

W. B. BANNERMAN, Lt.-Col., I.M.S.

Parel Research Laboratory,
Bombay, *June*, 1906.

## No. XXXI.—ON THE INDIAN SPECIES OF BEAN-GOOSE.

In his very interesting article on certain species of Bean-Geese in the last number of our Journal Mr. Eugene Oates has made some remarks which seem to call for a reply from me.

His suggestions that I mistook specimens of the Small White-fronted Goose (*Anser erythropus*) for the Pink-footed Goose (*Anser brachyrhynchus*) of course requires no answer, as Mr. Oates would have seen had he re-read his own article, for in this (p. 44, line 5) he quotes me as writing "nail black." Mr. Oates knows the Dwarf Goose (*A. erythropus*) never has this. It is rather like accusing a man of mistaking a Blackbird for a Jay. Mr. Oates has, however, shewn that all my birds but one were probably not *brachyrhynchus*, but at the same time I am quite positive as to their belonging to the section of Bean-Goose, which have brilliant pink on the bills and equally brilliant pink feet.

It is true that my descriptions of the bills of my birds omitted any mention of the black which was at the base of the bill. The reason for this was that when my notes were written it was generally supposed that a pink-billed Bean-Goose was to be found in India, and the key to this bird was that it had a *black nail to the bill* and *no black bars* on the head. Given these two characteristics the bird was a Bean-Goose, and as there was practically very little literature on the subject and that little all referred to *brachyrhynchus* as our Indian form, I accepted mine as being of the species and merely mentioned what might be considered the defining points, *viz.* the pink colouration of the bill combined with the black nail. That my description was sufficient to endorse my finding, is shewn by Mr. Oates himself in his "Manual of the Game-birds of India" (Vol. II, p. 67), in which he notes on my description of the supposed *brachyrhynchus* "his remarks and measurements fully sustain this identification of the species," thus shewing that at that time he considered it ample for the purpose of identification and laid no stress on the absence of mention of black at the base of the bill.

As a matter of fact, thanks to Mr. Oates' further researches, I cannot but conclude that the identifications of all my birds, except the Cachar one, was wrong after all, for though the bill agrees in colouration with that of *brachyrhynchus*, it is far too big for that bird, and I now consider that the bird shot by Mr. Moore in Dibrugarh and the two obtained by my men in the same district are all *Anser middendorffi* and my notes on these must now be read as referring to this species and not to *brachyrhynchus*. As regards the goose shot by my collector in Cachar, this must, I think, still stand as *brachyrhynchus* for the bill at front only measured 1·6″ and is much too small for that of *middendorffi*.

I cannot agree with Mr. Oates' remarks as to the constancy of the size of the bill in the various species of Bean Geese and am afraid that as bigger series are obtained we shall get a greater variation in dimensions; he already allows half an inch variation in the larger species and there is the full half-inch difference between the specimens of Middendorff's goose shot in the Irawaddy and that

obtained by Radde on the Tunka River. The British Museum had a wretched collection of goose-skins when I last saw it in 1903, and though it may have more skins by now, I fancy it is still in want of many more before one can consider it in any way representative and big enough to allow of final deductions being drawn from it.

M. Alpheraky's book is a fine one, but even this appears to me to be, in great part, more of a ground work for future ornithologists to work on than a definite final opinion on the differentiations of the known species of geese he treats of.

It would assist myself and other field ornithologists much if Mr. Oates would give us a *key* to the Bean-geese. By merely reading his article, interesting though it is, it is quite impossible for us to differentiate between the species, as I find his measurements overlap constantly.

E. C. STUART BAKER.

SHILLONG, ASSAM,
*5th July* 1906.

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## No. XXXII.—THE BREEDING OF THE BENGAL FLORICAN (*SYPHEOTIS BENGALENSIS*).

There is so little known concerning the breeding of this grand bird that I am very glad now to be in a position to record a certain amount of information on the subject.

In the five years I lived in the Dibrugarh District of Assam, in spite of the offer of good rewards for the eggs of this bird, most unfortunately only two were obtained the whole time I was there and these were found for me by a Mikir Shikari in Sadiya, left by him *in situ* and taken by me fearfully hard set on the 3rd June 1904. These eggs were laid in an extensive patch of sun grass which had been considerably fed over by buffaloes, and was consequently neither very high nor very dense, and was intersected in every direction by buffalo paths. I heard of two other clutches being seen whilst I was in this district, one of which was said to have been seen in July, the other in March.

In the early part of February this year in the course of conversation with a native gentleman it was mentioned that vast numbers of florican bred in his district, one in Western Assam, and, in consequence of this information, he arranged to depute for me some twenty or thirty men to try and obtain a series of the eggs. In spite however, of the large number of men employed on the work and the huge extent of country covered, the total number of eggs procured was only twenty-four, of which one was smashed before reaching me.

The men put on to hunt for the nests declared that they were started in the work too late, as the birds bred late in February, March and early April. One man who began his search earlier than the rest was the most successful and got a pair on the last day of February and another on the 25th March and others in April, at the end of which month several other men began work. Clutches were obtained on the 5th, 7th (two), 9th (two), and 11th. Nearly all

these were hard set. Then scattered pairs were obtained up to the 5th June, all hard set except the two latest pairs which were quite fresh and were probably second layings.

In every case the eggs were laid on the ground in the centre of patches of sun grass or *Uloo* grass, generally of considerable size, far from human habitation and almost invariably surrounded by dense jungles.

The nest is very hard to find, as the hen bird is very cute, and unless taken very much unawares never rises until she has run some distance from the nest, seldom less than 50 to 100 yards, so that after putting up the parent bird it is a labour of some time and difficulty to find the eggs.

My Indian friend, who was so good as to look after the shikaries for me, gives a very interesting account of this bird's habits, which is well worth quoting. He writes: "A florican lays only two eggs a year in the breeding season (April and May). Dense forests infested with ferocious animals, scarcely trodden by men, are the places where eggs are laid on the ground. The bird takes great precaution to conceal her eggs and you can hardly find any eggs within a quarter of a mile from the place where a florican is seen. She creeps through the forest unobserved to a great distance to lay her eggs. A very careful and extensive search is required to discover them."

In shape the eggs are typically very regular ovals, the ends being equal. They vary considerably in the proportion of the length to the breadth, but otherwise remarkably little in shape, though a few eggs are somewhat pointed at one end and, in two or three instances, they are pointed at both ends. In many cases the extremes of variation are found in a pair laid by the same bird.

The colour is exceptionally constant, unlike that of the eggs of *Syphesoti aurita* (The Lesser Florican), which varies very much.

The ground is olive-green, in some rather brighter, in some rather more brown. The markings consist of small freckles, splashes and blotches, generally longitudinal, of brown and purple brown, rather more profuse at the larger end of the eggs than elsewhere, but nowhere very numerous. In some, these markings are all reduced to freckles and may then be very numerous and are also, in such cases, *very* indefinite.

In no eggs are the markings very bold.

The average of twenty-seven eggs which I have seen is 2·41″ × 1·75″ and the largest measured 2·76″ in length and 1·85″ in breadth and the smallest 2·28″ and 1·67″.

When fresh the large majority of eggs are decidedly a bright green olive-green, but very soon after being blown the eggs become pale and in a year or two become an olive-brown, in which brown is distinctly the dominant colour. The gloss, also, which is very highly developed in newly taken eggs, fades much with time, but years after they still retain a very large proportion of this. Although two seems to be the invariable number laid, I once heard of four eggs being seen in a clutch; but these were not taken and the authentication is not beyond all doubt.

From the above notes it will be seen that when bird protection advances a little further in this Province, the period during which the florican will have to be protected will be from the 1st March to the 1st September or 1st October.

There is no doubt that the florican is polygamous and, courtship only lasting a few days, once the eggs are laid the cock bird takes no more interest in that particular hen, but goes off on the chance of having his addresses received elsewhere. For this reason little harm is done if cock birds are shot up to the end of March, and it would be a most excellent thing if, for some few years to come, cock birds were allowed to be shot from 1st October to 1st April and hen birds protected throughout the year.

E. C. STUART BAKER.

SHILLONG, ASSAM, *5th July* 1906.

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## No. XXXIII.—THE PLUMAGE OF THE COCK PURPLE HONEYSUCKER (*ARACHNECTHRA ASIATICA*.) A QUERY?

I recently came upon the following passage on page 370 of Vol. I. of Jerdon's *Birds of India*, anent the cock purple Honeysucker (*Arachnecthra asiatica*):—"After breeding the fine purple garb is doffed, all except a long stripe from the chin to the vent, in which state it is the *currucaria* of authors, and Col. Sykes was quite right in stating that this was not the livery of the young bird. He, however, unaware of the change of plumage, considered it to be a distinct species. It has the upper parts dull olive-green; beneath bright yellow; shoulders and central stripe beneath, brilliant glossy violet; wings and tail glossy, dusky or black."

This passage considerably surprised me, as I have always been under the impression that the cock never loses his purple plumage when once he has assumed it.

Looking him up in Oates's "*Birds*" in the *Fauna of British India* series, I found no mention of this doffing of the purple livery. On the contrary Oates states that it is the young male which has the broad stripe from the chin to the abdomen.

Since this coincides with my ideas it would have settled the question for me had I not happened to come across the following passage in Finn's *Birds of Calcutta*, second edition, page 63:—"The purple cock apparently thinks his wedding garment too expensive to be worn the whole year round; for, after the nesting season, he doffs it, retaining only a purple streak from chin to stomach as a mark of his sex. . . . I well remember one bird which came to the museum compound after breeding to change his plumage; he kept very much to two or three trees, singing, apparently, from one particular twig, and even when in undress he kept up his song."

This seems to be a most circumstantial account of the alleged change in plumage; yet I cannot help thinking that Mr. Finn must have made a mistake. In Madras, where I was last stationed, *A. asiatica* is by no means common, but *A. lotenia* is, and I feel pretty certain that this latter species does not

doff its purple plumage when once it has assumed it. I must have seen dozens of purple cocks during every month of the year. Although the purple Honey-sucker visits Lahore (where I am now stationed) in great numbers in the hot weather, it only stays to breed, and will leave us in September. I am therefore, not likely, for some time to come, to be able to settle the matter from personal observation. Can any of the members of the Society give information on the subject?

D. DEWAR (I. C. S.).

LAHORE, *4th July* 1906.

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## No. XXXIV.—SOME NOTES ON *HETEROCERA*.

Perhaps the greatest charm in the study of Entomology lies in the number of opportunities offered to the observer, be he savant or tyro, of adding something new to our knowledge of this subject.

It is therefore with the hope of being able, though a mere tyro, of providing a crumb of novelty that I venture to narrate the following incidents in the life history of probably most moths.

While quartered during the years 1904 and 1905 in the Mussooree Hills, I reared from the egg large numbers of that handsome moth *Acteas selene* and also collected among others several cocoons of *Antheræa roylei* and *Caligula simla*. All these three species have an expanse of from $5\frac{1}{2}$" to 7". Their cocoons however differ widely in structure; those of *A. selene* being of close texture, impervious to light and having a single envelope; those of *C. simla* being loosely, though strongly, woven and having the appearance of a roughly made, fine-meshed net, while those of *A. roylei* have a double envelope and are woven of the toughest possible silk. My cocoons numbering some 250, I kept suspended in rows across the muslin curtains of a little room set apart as a workshop.

During 1904 I was content to allow the moths to escape from their cocoons unobserved and to then kill and set them without further ado. The following year, however, curiosity prompted me to try and discover how such an apparently ill-adapted creature as a moth contrived to break through the tough walls of its cocoon without injury. I enquired of two eminent naturalists of my acquaintance, one a well-known member of the Linnæan Society, and was told that the process was not exactly known but that it was believed the imago exuded some secretion which dissolved the silken wall of its prison. In the first week of September last year several moths hatched without my being present at the moment. One day, however, while engaged in carpentering, my attention was drawn by a very audible scratching to one of the *A. selene* cocoons suspended before the window in front of me. It was moving spasmodically and I commenced to watch it carefully. The scratching was regular and persistent and after 10 minutes or so I noticed two tiny points projecting through the apex of the cocoon.

Presently as the silk became more and more worn I was able to see the struggling imago through it and it became evident that the exit was being

effected by means of 2 sharp spurs seemingly attached to the shoulders of the imago and which projected just above the level of its head. With a deliberate backwards and forwards and rotary motion of its whole body the imago, after resting at intervals for a minute or so, had succeeded in completely fretting through the apex of the cocoon and in a few more seconds was trailing its abnormally long and unweildy body up the muslin curtain. It was interesting to notice how that as the abdomen, which at the moment of exit was nearly twice its ultimate length, gradually contracted, so the wings slowly expanded, till at the end of an hour the insect had attained its normal proportions.

I subsequently observed the process of exit some score of times as did also my wife and a brother officer who was my guest at the time. In every case was the process the same. The spurs, which are very hard and sharp, are straight and are attached to the base of vein of the forewing on the upper side. Owing to the hunched position of the imago just prior to its exit and to the rudimentary condition of the wings, the spurs naturally project just sufficiently above the level of the head to enable the imago, as it presses upwards with its legs against the apex of the cocoon, to exert the necessary amount of force without any pressure being brought to bear upon its head and the delicate antennæ.

As the wings expand so the position of the spurs, which are, by the way, of a dark chestnut colour and about 1-32nd of an inch long, alters, till in the perfect imago they can only be found by probing the dense plumage on the upper side of the base of the forewing with a sharp point. I am unable to state definitely whether the spurs remain attached throughout the whole life of the imago or become detached and fall off when the insect has become fairly launched upon its aërial career. None of the specimens in my collection were allowed to do more than flutter across the window of my little workshop.

It is also most interesting to note that I observed the imagines of both *A. roylei* and *C. simla* employ precisely the same means of escape as those of *A. se'eue*, the spurs in all three being identical. The two former, however, invariably emerged between nightfall and midnight, while the latter did so by day between the hours of 10 a.m. and 2 p.m. and the whole process never lasted less than 10 and rarely more than 20 minutes. I consider it very probable that all cocoon-spinning *Heterocera* effect their release in the same manner, and will be much interested to know whether any other members of the Society have made similar observations with other species.

H. W. KETTLEWELL, LIEUT.,
85th King's L. I.

FYZABAD, 20*th July* 1906.

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## No. XXXV.—PARASITES IN SPARROW HAWKS.

I should be much obliged if some member of our Society could give me some information about worms in hawks.

On the 19th of May, I caught a sparrow hawk which died five days subsequently. It was fed daily on three fresh sparrows, flies were very bad, but

though the majority of sparrows were given immediately on being killed, two were kept a few hours in the shade before feeding time.

On the second day the hawk went off in condition unaccountably and died on the 5th day. On opening the crop I found 12 or 15 worms, about 1½ inches long of a transparent pink colour, very like those sometimes seen in horse droppings and I believe are known in dogs as round worms.

1. Could these worms have been brought by flies into the food or are they more likely to have come in the water the meat was dipped into before feeding?

2. Is it possible that they could have incubated and grown in two days when the falling off in condition was first noticed by me or is it more likely they were in the hawk when caught? She was in apparently perfect condition both round and heavy.

The symptoms during the three days she was ill were—

1. Excessive thinness followed by weakness in the legs at times; she could not stand up for 5 or 10 minutes; then a little strength would appear to return.
2. A fixed stare in the eyes and disinclination to move the head from a set position, even though the body was turned.
3. No appetite.
4. Food in the crop remained there many hours longer than it should under ordinary circumstances in a healthy bird.
5. No pellet was cast on two occasions after castings had been given.
6. Droppings were not as frequent as they should have been, but colour and consistency quite healthy.
7. On two occasions I thought I felt something foreign in the crop and neck, which did not feel like meat undigested which no doubt was a small collection of these worms, but at that time I had no suspicion of the cause of the illness and did not know that hawks suffered from worms.

J. S. BOGLE, CAPT.,
Q. O. Corps of Guides.

BUNJI, KASHMIR, 26*th May* 1906.

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## No. XXXVI.—CANNIBALISM AMONGST PANTHERS AND TIGERS.

The two following cases of, to my mind, undoubted cannibalism by the large cats may be of interest:—

On 5th April last, I was out after panthers about 40 miles S. E. of Hyderabad. A wood-cutter came in and reported he had seen a panther on his kill, a goat, in some big rocks. We went out and got on to the ground shortly after 4 p.m. and were pointed out a large mass of square boulders within which a marker then reported the panther asleep.

I got round on to the flat top of one of these and looking down a crevice could plainly make out the form of a panther lying on his left side about 12 feet below. I got a clear shot at him and thought I had killed him instantaneously as he never turned a hair. After throwing down bits of rock and

making quite certain he *was* dead, I sent a man down noting at the time that this panther had apparently a nice taste in high kills. On hauling him up by means of a puggari we found he had the distinct punctures of big teeth in his throat and in addition the lower part of the throat was torn out and eaten and he was also disembowelled—from his state he had evidently been killed early the previous night. He was a small adult male and would measure rather over 6 feet.

On looking about on the top of the boulders we found the jaw bones and stomach of a goat. Below there was a narrow passage between the rock leading to where the dead panther was found and in this was the *distinct* track of a panther *entering and leaving*.

What had evidently happened was that the dead panther had been surprised on his kill and in a dying state had fallen down between the rocks. His murderer having finished off the goat got down to his body and had a good square feed off him.

There was a low rocky ridge about 300 yards off across a little rice cultivated valley in which I thought the slayer might be lying, so about 5-30 p.m. I got into a small tree commanding the route any animal coming back to the big rocks must take.

I further picketed a kid close to me. About 6 p.m. I thought some animal was on the move from the restlessness of some crows in the rocky ridge and I suddenly caught sight of a panther, who had evidently just left some rocks at the foot of the ridge, about 250 yards off, coming straight towards me across a dry rice field. He was rather below the slight rise on which my kid was and I could not see it nor had the latter ever uttered a sound. I let him come quietly on just as I expected, and when he topped the little rise about 30 yards from me he suddenly spotted the kid and was stalking slowly up when I dropped him about 3 yards from it, which then saw him for the first time. He was a short but very thick set male panther, measuring 6'-6" between uprights—he was not scarred or marked but he had one of the big teeth in his lower jaw broken off quite short recently. I am certain he was returning to his kill, the dead panther, and when shot he was about 15 yards in a straight line from where it lay. My old shikari said he had known no case of this sort with panthers previously.

For my second case, a tiger, I will quote from a letter written to me from a shooting camp in the Bandara District, C. P., in May 1904, which I had just left. The first part of the letter describes a successful tiger beat and shoot and I will quote from there: "There lay the most magnificent beast—the biggest and heaviest G. J. has ever seen, and he has seen a good few,—heavy, hard and fit as he could be and with hardly a sound tooth in his head, all the big teeth being broken off quite short. It took some twelve men to move him out and when they did I got two photos of him and was just taking a third when a most fearful din rose from down below where the rest of the beaters were drinking; 'Sher—Sher ata', and yells and shouts. There *was* a

scatter; I threw away my camera, seized my rifle and did the best time on record to the tree, and the men oiled up the cliffs in no time. There was nothing left in that old nullah but the huge carcass of that tiger with cameras and chaguls and all sorts of gear strewn round him. We had hardly got into the tree when a man came back shouting 'Morgayahai, purrahai' and we thought a man was killed. G. J. was just rushing down to the rescue when they shouted 'Sher morgaya' and we went right down to the water utterly incapable of understanding what could have happened.

"There lying in the water 20 yards from the kill was a fine young tigress, evidently killed by this old monster and partly eaten by him too. The old brute was much bitten and clawed about. She had evidently been strangled over the kill and just managed to get to the water while the old brute finished his dinner and proceeded to eat her. He measured 9'-8" as he fell. We found a smooth bore round lead bullet in his forearm which must have been there for years."

I may say that G. J. mentioned above is a very well-known big game shikari in the Central Provinces and not the man to make any mistake as to the facts of this case of cannibalism.

This same big tiger has bothered us a good bit previously with his kills, as we could find no teeth marks on them, due to his teeth being all broken off.

TRIMULGHERRY, DECCAN, 23*rd May* 1906. L. B. MONTRESOR, CAPT., R.F.A.

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## No. XXXVII.—THE NESTING OF THE CRESTED HONEY BUZZARD (*PERNIS CRISTATUS*).

The Crested Honey Buzzard (*Pernis cristatus*) has, I believe, always been credited with sufficient self-respect and energy to build its own nest and lay therein. That they do not always carry out the full contract is proved by the following instance. A pair of these birds had been under observation of my friend, Mr. N. L. Hervey, and myself for some weeks and had laboriously completed a very nice nest high up on a Tamarind tree in a bungalow compound. Fifty yards away in a Sissoo tree was a nest of the Shikra (*Astur badius*) from which we removed two eggs on April 23rd. To our surprise and for no apparent reason, on May 5th the Honey Buzzard suddenly deserted her own capacious home and transferred her head-quarters to the deserted nest of the Shikra, piling in her furniture, in the shape of green leaves and additional sticks with a feverish haste, which was in marked contrast to the leisurely manner in which she and her mate had built their own nest. On the following day she laid a particularly handsome egg but to our lasting sorrow a severe cyclone visited the district on the next day and it was blown from the nest.

Since sending in the above the Shikra has returned to her original nest and has laid two eggs. The Honey Buzzards, presumably the same individuals, have built again in the same compound. We are now anxiously awaiting the next move.

SAMASTIPUR, T. S. RAILWAY, 14*th June* 1906. H. N. COLTART.

## No. XXXVIII.—THE SAND WASP (*SPHEX LOBATUS*).

With reference to the notes made on page 680 of the B. N. H. Journal Vol. XVI, about *Sphex lobatus*, I was very interested in watching one of these sand wasps a few days ago. It ran about on the ground for about ten minutes on this occasion. As soon as the sand wasp disappeared underground a large field-cricket (*Brachytrupes achatinus*) came out of another hole and commenced to make off, but *Sphex lobatus* seemed to become aware of this immediately and was out and on to it before it had gone two feet away. The wasp then gripped the cricket at the junction of the thorax and head while seated on its back and stung it under the thorax which made the cricket quite helpless. The wasp then proceeded to lay its eggs maintaining the same grip, but shifting its tail up near the cricket's head. I turned the cricket over twice but the wasp deliberately turned it back again and gripped it as first before continuing to lay its eggs. After a couple of minutes the wasp left the cricket and ran back to the hole when it suddenly stopped and began to dig out a hole into which it disappeared, and did not appear again for about three minutes when it came out and closed the hole so arranging the sand that it was impossible to see that the ground had been disturbed in any way. I dug up the hole but lost it and could find nothing. A little later I watched another wasp of the same species. It removed some sand and went back to the cricket which it gripped by the antennæ and dragged it along towards the hole with the help of its legs and wings.

This was apparently done to avoid injuring the cricket. Before it actually reached the hole I took the cricket away as I was afraid I would not be able to find it again. The wasp was in a great state of mind and spent sometime looking for it. The cricket came to life again very soon after. I have had it now for three days and so far it appears none the worse for its inoculation. I also watched a small wasp treat a spider in exactly the same way but I do not know the name of the wasp.

C. B. BEADNELL.

VELLORE, N. ARCOT DISTRICT, 17*th June* 1906.

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## No. XXXIX—NESTING OF THE IBIS-BILL (*IBIDORHYNCHUS STRUTHERSI*) AND THE COMMON SANDPIPER (*TOTANUS HYPOLEUCUS*).

On May 5, 1906, I found the Ibis-bill (*Ibidorhynchus struthersi*) breeding—on the Bhaghirthi river—at about 8,000 feet. I got three clutches of eggs (four in each), there being, so far as I could make out, only three pairs of birds there. The nests, composed of small stones, were hollowed out and placed on sand and shingle among boulders and were very like a large nest of the Spur-winged Plover. I found two of the nests by watching the birds, but the first one I found by taking back the tracks of a bird that was crouching and running along in this manner and at once flew back when flushed. I had

to trace the tracks back well over a hundred yards before I came to a well trampled spot and the eggs were at the side of it.

I sat down some way off to watch and the bird returned in about five minutes (the eggs were very hard set) running almost straight to the nest and stood over it bobbing her head like a plover. She then sat down alongside the eggs, not actually on them, and this seems to be a habit of theirs as I saw another bird act in the same way when returning to its nest. The eggs in the different clutches vary a good deal in size, but the largest are 1·95 × 1·45 and are shaped very like a Whimbrel's eggs. The ground colour is greenish-grey and they are spotted more or less all over but chiefly at the larger end with reddish-brown and pale purple, in colour and marking they are not unlike some Tern's eggs. All the clutches were very hard set and indeed one would have hatched in a very few days. I was overjoyed at getting them, as I do not think they have been recorded before.

While hunting for these eggs I also found a fresh clutch of the Common Sandpiper (*Totanus hypoleucus*) in quite a neat little nest of twigs and pine needles under a boulder. I am not aware if this nest has been recorded from Indian limits before, though, of course, it breeds freely in Kashmir.

CAMP, JEOLIKOTE, U.P., S. L. WHYMPER.
*May* 10, 1906.

[The Society has curiously enough just received an egg of *Ibidorhynchus struthersi* from Lieut. F. M. Bailey of the British Trade Agency, Gyantse, who writes :—

"The nest was situated on a stony island in the middle of the river here (13,000 feet). The nest was made of small flat stones about ½ inch in diameter, forming a perfectly smooth and flat surface. I unfortunately did not measure the nest. The eggs, four in number, were laid with their points inward. This nest was taken on 9th June when the eggs were hard set. On the same day I saw two birds with two young ones each. On my approaching, the young birds lay among the stones with their necks stretched out flat on the ground while the old bird endeavoured to draw me off in another direction, uttering loud cries. The young when crouching among the stones were very difficult to see, and lay so still that they allowed themselves to be picked up before showing any signs of life. The other three eggs were accidentally broken, so I have not attempted to blow the remaining one."

The egg which Lieut. Bailey has so kindly sent with those of other valuable Tibetan breeding birds, is 52 millimeters by 39. It is very hard set, but I hope to be able to make some kind of specimen of it.

Among the others are two eggs of *Tetraogallus tibetanus*, the Tibetan Snow-cock, the nidification of which was not known at the time of Hume and Marshall's "Game Birds of India."

H. MACNAGHTEN,
*Hony. Secy., Birds' Eggs Section,*
22*nd August* 1906, *Bo. Nat. History Society.*]

# PROCEEDINGS

## OF THE MEETING HELD ON 28TH JUNE 1906.

A meeting of the members of the Bombay Natural History Society took place at the Society's Rooms on Thursday, Lieut.-Col. W. B. Bannerman, I.M.S., presiding.

### NEW MEMBERS.

The election of the following 81 new members since last meeting was duly announced :—

Lieut.-Col. H. Thomson, I.M.S. (Madras) ; Lieut.-Col. C. F. Willis, I.M.S. (Satara); Capt. G. McPherson, I.M.S. (Godhra, Panch Mahals); Lieut. T. B. Fletcher, R.N., F.E.S. (Ceylon); Mr. C. W. E. Cotton, I.C.S. (Vellore); Mr. H. F. Salt, R.H.A. (Meerut); Mr. T. H. Mann (England) ; Mrs. O. S. Mawson (Bombay); Major A. S. Buckle, R.F.A. (Karachi) ; Dr. J. D. Gimlette (Singapore) ; Mr. H. H. Marshall (Mandalay) ; the Honorary Secretary, 58th Battery, R.A. Mess (Ahmednagar) ; the Hon'ble Mr. C. S. Bayley, C.S.I., I.C.S. (Hyderabad, Deccan); Major the Hon'ble D. Forbes-Sempill (Nowshera, Punjab); Mr. H. J. Davies (Yenangyaung, Upper Burma); Mr. W. A. Cave (Colombo, Ceylon) ; Mr. A. H. Sparling (Aligarh); Mr. F. P. Young (Sangli, S.M.C.) ; Mr. M. H. Oakes (Gonda Dist.); Lieut. F. H. James (Santa Cruz); Capt. L. T. R. Hutchinson, I.M.S. (Bombay); Mr. G. Ostermayer (Bombay); Lieut. R. B. M. Wood (Bhamo, Upper Burma); Mr. R. N. Parker (Rawal Pindi) ; Mr. A. H. Hammond (Bombay); the Hon'ble James W. Best (Balaghat, C. P.); Mr. J. Wein (Bombay); Mr. G. Bettoni (Bombay); Mr. H. R. Greaves (Bombay); Mr H. Jackson, I.F.S. (Naini Tal); Capt. R. S. Pottinger (Kolhapur); Mr. H. Kelsal Slater, F.G.S. (Bangalore); Mr. O. Allen Harker (Dhulia, Khandesh); Lieut. J. F. Mackenzie, R.A.M.C. (Meerut); Lieut. E. W. C. Bradfield, I.M.S. (Bombay) ; Professor K. Burnett (Hyderabad, Deccan); Capt. F. H. G. Hutchinson, I.M.S. (Belgaum); the Hon'ble Major Hugh Daly, C.S.I. (Indore, C I.); Mr. Lionel Newcombe (Coorg, S. India); Capt. A. Murphy, I.M.S. (Bombay); Major J. W. Dwane (Ranikhet) ; the Honorary Secretary, United Service Library (Poona) ; Rev. Trevor Bomford, C.M.S. (Tarn Taran, Amritsar District, Punjab); Lieut. A. H. Proctor, I.M.S. (Amritsar, Punjab); Mr. Fred. Canning, I.F.S. (Bahraich, Oudh); Major H. Wigram (Srinagar, Kashmir); Mr. A. P. Percival, I.F.S. (Balaghat, C. P.) ; the Hon'ble Mr. J. M. Douie, C.S.I., I.C.S. (Lahore); Mr. W. B. Wilson (Calicut, Malabar Coast); Mr. John Whitehead, I.F.S. (Pilibhitt, U.P.); Lieut. G. A. Panter (Sitapur); the Mess President, 1st Royal Sussex Regiment (Umballa); Kumar Shree Vijayadevji of Dharampur (Dharampur); the Director of Agriculture, Madras (Madras); Capt. S. H. L. Abbott, I.M.S. (England); Mr. W. B. Cotton, I.C.S. (Bombay) ; Lieut. A. C. Ingram, I.M.S. (Dthala, Aden Hinterland); Mr. A. K. Weld Downing (Coonoor) ; Lieut. C. H. Peto (Mhow, C. I.); Mr. W. Greer, I.C.S. (Ahmednagar); Mr. N. Ramsay (Dunneedaw, Rangoon) ; Mr. S. P. Williams (Meiktila, Burma) ; Mr. H. Nunn, I.C.S. (Khandwa, C. P.); Mr. C. F. Bell, I.F.S. (Amraoti, Berar); Major F. Lee (Poona); Mr. A. G. Hamilton (Insein, Rangoon) ; Mr. J. B. S. Thubron

(Nasik); Mr. E. Kynaston (Yatiyantota, Ceylon); Major P. C. Elliott-Lockhart (Mardan, N. W. F. Provinces); Mr. E. M. Burn (Secunderabad); Dr. J. N. Kilner, M.B. (Chinpina, Adra, Bengal); Mr. C. J. Irwin, I.C.S. (Seoni Chappara, C. P.); Mr. F. C. Coventry (Seoni-Chappara, C. P.); Lieut. L. S. Fenton (Bombay); Rev. Canon J. H. Beck, M. A. (Ahmedabad); Mr. R. G. Gordon, I.C.S. (Ahmedabad); Mr. W. L. Crawford (Saklaspur, Hassan); Mr. W. Stonor (Nagasamudram P. O.); Lieut. R. B. Phillimore, R.E. (Taunggvi, S. Shan States, Burma); Mr. A. Butterworth, I.C.S. (Madras); Lieut. G. P. Cosens, (Lucknow).

## CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary, Mr. W. S. Millard, acknowledged receipt of the following contributions since the last meeting :—

| Contribution. | Description. | Contributor. |
|---|---|---|
| 1 Chukor Partridge* (alive) | *Caccabis chucar* ..... | Mr. G. Ostermayer. |
| Some specimens of Manganese Ore from C. P. | ..... | Mr. T. W. Birkett. |
| 1 Woolly Hare ..... | *Lepus oiostolus* ..... | Col. A. E. Ward. |
| 1 Indian House-Crow (partial albino). | *Corrus splendens* ..... ..... | Rev. L. Kraig, S.J. |
| 1 Barn Owl..... ..... .. ..... | *Strix flammea*..... | Mr. R. G. Webb. |
| Some Scorpions from Lanowli. | ..... | Col. T. S. Weir, I.M.S. |
| 1 Phoorsa juv. (alive) ..... | *Echis carinata* ..... | Mr. C Beadon. |
| 1 Snake (alive) ..... | *Lycodon sp.* ..... ..... | Mrs. C. Hudson. |
| 1 Nilgai skin and skull..... | *Boselaphus camelaphus*..... | Maj. P. Kilkelly, I.M.S. |
| 1 Palni Laughing Trush ... | *Trochalopterum fairbanki*.. | Rev. W. Howard Campbell. |
| 1 Cricket..... ... | *Schizodactylis monstrosa* ... | Mr. H. W. Kettlewell. |
| 1 Snake (juv.) ..... | *Gongylophis conicus* ..... | Capt. G. McPherson, I.M.S. |
| 3 Snakes from Kodaikanal. | ..... | Rev. W. Howard Campbell. |
| 3 Squirrel skins from Siam | *Sciurus sp.* ..... | Mr. W. S. Palmer. |
| 1 Skull of the Indian Bush-rat. | *Golunda ellioti* ..... | Rev. F. Dreckmann, S.J. |
| 1 Tit..... | *Remiza coronata*..... | Maj. H. A. Magrath. |
| 1 Chameleon, sundry Lizards and Spiders from Aden Hinterland. | *C. calcarifer* ..... | Lieut. H. R. Watson. |
| 8 Eggs of the Burmese House Crow. | *Corvus insolens* ..... | Maj. J. Elgee. |
| 1 Snake skin ..... | *Zamenis mucosus*..... | Dr. E. H. Hunt. |
| 1 Large Cuckoo Shrike... .. | *Graucalis macii* ..... | Capt. R. Burton. |
| 4 Seesee Partridges ..... | *Ammoperdix bonhami* ..... | Mr. H. Seaburne May, R.E. |
| Some Geological specimens from Poona. | ..... | Prof. A. B. Kotewal. |
| 1 Lizard ..... | *Lygosoma guentheri* ..... | Dr. E. H. Hunt. |
| 1 Chameleon (alive)..... | *Chameleo calcaratus* ..... | Mr. P. J. Tomkin. |
| Nest and 2 eggs of the White-bellied Shortwing | *Brachypteryx albiventris*... | Rev. Howard Campbell. |
| 5 Eggs of the Himalayan Jay. | *Garrulus bispecularis* ..... | Col. C. L. Wilson, R.A. |
| 2 Eggs of the Spotted Dove. | *Turtur suratensis*..... | |
| 2 Eggs of the Black-breasted Kalij Pheasant. | *Gennæus horsfieldii* ..... ... | |
| 3 Eggs of the Puddy Crake | *Amaurornis fuscus*..... | |
| 1 Egg of the Common Snipe and some other Birds' Eggs ... | *Gallinago cœlestis* ..... ..... | |

* Forwarded to the Victoria Gardens.

Minor contributions from Mr. H. R. Watson, Mr. A. J. Agabeg, Mr. C. Grenville Rollo, Mr. J. A. Jeffries.

## CONTRIBUTIONS TO THE LIBRARY.

Agricultural Research Institute, Pusa, Bulletin (an outbreak of Cotton Pests in the Punjab, 1905).

The Indian Forester, Vol. XXXII, Nos. 3 and 4.

Records of the Geological Survey of India, Vol. XXXIII, Parts 2 and 3.

The Agricultural Journal of India, Vol. I, Part II.

Memoirs of the Department of Agriculture in India, No. 1, Vol. I.

Entomological Series, Vol. I, No. 1. The Bombay Locusts, by H. Maxwell Lefroy.

Transactions of the Entomological Society of London, 1905.

Memoirs of the Asiatic Society of Bengal, Vol. I., No. 10.

Spolia Zeylanica, Vol. III., Part XII.

Journal and Proceedings of the Asiatic Society of Bengal, Vol. I., Nos. 8, 9, and 10, and extra number, 1905, Vol. II, Nos. 1, 2 and 3, 1906.

The Decennial Publications, Colors and Color patterns of Coleoptera.

Description Geologique de l'Ile d'Amben.

Annals of the Royal Botanic Gardens, Peradeniya.

Catalogue of the Indian decapod Crustacea in the collection of the Indian Museum.

Annual Report of the Smithsonian Institution, 1904.

Annual Report of the Board of Scientific Advice for India for 1904-05.

The Agricultural Ledger, 1905, No. 6.

## ALTERATION TO RULE V.

The Committee notified that in future Rule V. will read as follows:—"Any member may, on payment of Rs. 200, become a Life member, and will thereafter be exempt from any further subscriptions."

## EXHIBITS.

Mr. Comber exhibited a small collection of mammals from Japan that has been presented to the Society by the Trustees of the British Museum in exchange for various contributions from the Society's collections. It consists of 17 specimens of squirrels, mice, voles and bats from the collections lately presented to the British Museum by the Duke of Bedford, who has employed a special collector to investigate the fauna of Eastern Asia. Mr. Comber explained that although these specimens are from a part of Asia that is outside the strict field of the Society's work, they are not only a useful object lesson to members as to how such specimens should be made up nicely, but are particularly interesting as showing how the practically European, and even English, fauna extends to the furthest parts of the Palæarctic region, as the squirrel, represented by two specimens, proves to be not even specifically distinct from the common English species, though it has been honoured with sub-specific rank. As another similarly allied form, or sub-species, has been recorded by

Gray from Tibet, it behoves members of the Society, who may have the opportunity to collect in Kashmir, Darjeeling or in Northern Burma beyond Bhamo, to look out for such forms. In the same way the *Micromys* of Japan is hardly distinct from the English Harvest Mouse, while the Red Vole of the British Isles is closely allied to the species of *Evolomys*. Corresponding forms may at any time be expected to be found in the Himalayas and other parts that come within the Palæarctic area.

## A WHALE AT BASSEIN.

The Honorary Secretary said since their last meeting, a whale measuring some 63 feet in length, had been washed ashore near Bassein (Thana District), but unfortunately the first notice he received was from a newspaper account and from a letter from a Mr. Dias some fourteen days after the event. Although a visit was paid to the carcass at once, it was too decomposed to obtain any information of value as to the general external characters. This was greatly to be regretted since the external characters of the great Indian Fin-whale (*Balænoptera indica*)—to which species, from its size, this appeared to belong—were absolutely unknown to science. If the Collector of the District had only informed the Society in time, this information might have been obtained, but although a local official had visited it on the first day, it was only to ascertain, according to orders, if there was any treasure in its stomach! It was to be hoped that if an animal of this description was found on our shores in future (and this is not the first occurrence of this whale on the Bombay shores) some of the members of the Society would be able to obtain the information desired.

## WILD DOGS.

The Honorary Secretary asked members—particularly those residing in the Central Provinces, United Provinces and Madras Presidency—to try and obtain for them one or two good skins and skulls of Wild Dogs. He mentioned that the Natural History Museum, South Kensington, had requested our Society to try and obtain a specimen for mounting in their galleries. It would, of course, be desirable that correct measurements (as many as possible) of the animal should also be supplied, but no elaborate preparation of the skin is necessary. Open from breast bone to vent and turn inside out and dry, leaving the feet attached.

## PAPERS READ.

The following papers were then read:—

1. A new Tortoise from Travancore, by G. A. Boulenger, F.R.S.
2. A note on *Podoces pleskei*, Zarudney, by R. Bowdler Sharpe, LL.D.
3. On the Tenthredinidæ and parasitic Hymenoptera collected by Major C. G. Nurse in Kashmir, by P. Cameron.
4. Some hints for beginners on collecting and preserving Natural History specimens (Fishes), by E. Comber, F.Z.S.
5. Flowering Season and Climate, by Rev. E. Blatter, S.J.
6. The Kashmir Termite, *Termopsis wroughtoni*, by J. Desneux.

7. The Snake and its Natural Foes, by Capt. F. Wall, I.M.S., C.M.Z.S.
8. The Larva of the Firefly, by P. Gerhardt.
9. A singular position of the heart (*Ectopia cordis*) of a Whistling Teal, by Col. W. B. Bannerman, I.M.S.

## PROCEEDINGS

### OF THE MEETING HELD ON THURSDAY, THE 16*th August* 1906.

A meeting of the members of the Bombay Natural History Society took place at the Society's Rooms on Thursday, Lt.-Col. W. B. Bannerman, I.M.S., presiding.

### NEW MEMBERS.

The election of the following 27 new members since the last meeting was duly announced :—

Capt. W. B. Greig (Bombay) ; Major W. C. C. Leslie (Chakrata) ; Mr. A. Combi (Poona) ; Mr. R. E. Gibson, I.C.S. (Hyderabad, Sind) ; Capt. F. C. Rogers, I.M.S. (Mooltan) ; Mr. H. J. C. Turner, F.G.S. (Fyzabad) ; Mr. C. A. King (Coonoor P. O. Nilgiris) ; Capt. A. E. Wood, R.A.M.C. (Fyzabad) ; Mr. J. E. Powell (Gaya, Bengal) ; Mr. Guy P. Boys (Allahabad) ; Mr. T. B. Copeland, I.C.S. (Oghi, Hazara Dist., N.W.F.P.) ; Mr. R. T. F. Kirk, I.C.S. (Ahemadnagar) ; Surg.-General G. Bomford, C.I.E., I.M.S. (Simla) ; Mr. H. R. Holmes (Balaghat C.P.) ; Mrs. L. G. M. Barkley (Sunugalla, Ceylon) ; Mr. James Green (Wallington, Surrey, England) ; Mr. G. S. P. Percival (Ramnad, Madura Dist., Madras Presidency) ; Mr. W. V. Weston (Gonatea, Sainthea, E. I. Ry.) ; Lieut.-Col. T. C. F. Somerville (Shwebo, Burma) ; Mrs. G. B. Adamson (Bombay) ; Mr. A. T. Weston (Papun, L. Burma) ; The Mess President, 1st Battalion, 10th Gurkhas (Maymyo, Burma) ; Major L. G. Oliver (Thayetmyo, Burma) ; Prof. D. J. Dr. Capra (Intra, Italy) ; Monsieur A. Polovtsoff (Bombay) ; Mr. H. C. Macnee (Bombay) ; and Mr. Sutherland Orr (Madras).

### CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary, Mr. W. S. Millard, acknowledged receipt of the following :—

| Contribution. | Description. | Contributor. |
|---|---|---|
| 1 Phoorsa (juv.) from Saugor, C. P. | *Echis carinata* ..... | Lt. C. I. Brierley, I.M.S. |
| 16 Rats from Nasik..... | ..... | Mr. E. Comber, F.Z.S. |
| 1 Viper from Kodaikanal... | *Trimeresurus striatus* ..... | Rev. Howard Campbell. |
| 1 Lizard from Kodaikanal. | *Salea anamalayana* ..... | |
| 1 Cobra, juv. (alive) from Bombay. | *Naia tripudians*..... | Mr. Dn. Joss. |
| 56 Bird skins (nineteen species new to our collection) from Burma. | ..... | Mr. K. C. Macdonald. |
| 90 Eggs and 8 skins of birds from Persian Gulf. | ..... | Major P. Z. Cox, C.I.E., F.Z.S. |

| Contribution. | Description. | Contributor. |
|---|---|---|
| 1 Indian monitor (juv.) from Panch Mahals. | *Varanus bengalensis* ..... | Mr. E. Marston. |
| 2 Ground snakes (alive) from Karli (Deccan). | *Tropidonotus plumbicolor*... | Mr. P. Gerhardt. |
| 1 Snake (alive) from Multan. | *Eryx johnii* (*juv.*) ..... | Major O. A. Smith. |
| 4 Crocodiles' eggs from Kolhapur. | *Crocodilus palustris* ..... | Capt. R. S. Pottinger. |
| 1 Snake from Poona..... | *Lycodon aulicus*..... | Capt. G. McPherson, I.M.S. |
| 10 Birds' skins from Cachar. | ..... | Mr. A. M. Primrose. |
| 1 Lizard from Muscat ..... | *Eumeces schneideri* ..... | Major P. Z. Cox, C.I.E., F.Z.S. |
| 1 Snake from Loilem, S. Shan States. | *Coluber* (*Ablabes*) *porphyraceus*. | Mr. S. E. F. Jenkins. |
| Birds' eggs from Kashmir | ..... | Col. A. E. Ward. |
| A collection of birds' eggs from Assam. | ..... | Mr. E. C. Stuart Baker. |
| 1 Snake from Bhopal, C. I. | *Tropidonotus piscator* ..... | H. H. Mahomed Nasrulla Khan. |
| 2 Sooty Gulls from Astola Island, Persian Gulf. | *Larus hemprichi* ..... | Major P. Z. Cox, C.I.E., F.Z.S. |
| 2 Large-crested Terns from Astola Island, Persian Gulf. | *Sterna bergii* ..... | |
| 1 Indian Monitor (alive) from Multan. | *Varanus bengalensis* ..... | Major O. A. Smith. |
| 1 Indian Monitor (juv.) from Ahmedabad. | *Varanus bengalensis* ..... | Mrs. Duff. |
| 13 Skins of mouse-hare, rats, &c., from Chamba, Punjab. | ..... | Major G. S. Rodon. |
| A number of rats (alive), (six species from the Konkan, West India). | ..... | Capt. W. G. Liston, I.M.S. |

Minor contributions from Mr. F. A. Reddie, Mrs. Joyce, Lieut. H. H. Smith, Mr. F. Priestley, and Col. C. L. Wilson, R.A.

## CONTRIBUTIONS TO THE LIBRARY.

Lepidoptera Indica, Part 74, by F. Moore, D.S.C., presented by H. H. the Maharaja of Mysore.

The Indian Field Shikar Book, 3rd Edition, presented by Mr. W. S. Burke.

Indian Forester, Vol. XXXII, Nos. 5 and 6.

Memoirs of the Asiatic Society of Bengal.

A Descriptive List of the Sea Snakes in the Indian Museum, by Capt. F. Wall, I.M.S., C.M.Z.S.

Fauna of British India, Rhynchota, Vol. III. (Purchased.)

Memoirs of the Geological Survey of India, Palæontologia Indica, Series XV., Vol. V., Memoir No. 1.

Records of the Geological Survey of India, Vol. XXXIII, Part 4, 1906.

Records of the Geological Survey of India, Vol. XXXIV., Part 1, 1906.

Spolia Zeylanica, Vol. IV., Part XIII.

The Agricultural Journal of India, Vol. I., Part III.

Fourmis de l'Himalaya, par Aug. Forel.

Ficus Elastica, Forest Bulletin No. 4, 1906.

Annual Report of the Department of Land Records in the Bombay Presidency for 1904-05.

Ethnographic Notes in Southern India by Edgar Thurston. Presented by the Author.

## A NATURAL HISTORY SOCIETY IN BOMBAY 50 YEARS AGO.

Mr. Comber then asked permission to be allowed to say a few words about a paragraph that appeared in the *Bombay Gazette* of 9th July last under the heading of "Fifty Years Ago," regarding the formation of a Natural History Society in Bombay in the year 1859. He reminded the meeting that the present Society was formed in September 1883, but from the extract that was printed in the *Bombay Gazette* it would appear that there had been a previous Natural History Society in existence in Bombay as its foundation was definitely alluded to and a list of members given, numbering 25. Mr. Comber then read the extract, from which it appeared that the original society was more of the nature of a purely field naturalists' club than a society of working naturalists with a museum and premises on a more or less elaborate scale and a journal that is practically unique as the production of a purely amateur club.

The Society of 1859 appeared to have mainly devoted its attention to excursions and subsequent dinners when "all manner of curious things" were exhibited and discussed.

Mr Comber enquired whether any of the older members present had any recollection of this former society, as it apparently was short-lived and no records of it seem to remain.

## EXHIBITS.

A small collection of otoliths or the earbones of fishes, amongst which were those of the Pomfret, Indian Salmon, Stonefish, Ladyfish, Surmai, &c., presented by Mrs. Joyce, was exhibited.

## PAPERS READ.

The following papers were then read :—

1. Some historical notes on the development of the complete Flora of the Bombay Presidency, by Rev. E. Blatter, S.J.
2. Note on the Breeding of the Russel's Viper (*Vipera russelli*) in captivity, by Lieut.-Col. W. B. Bannerman, I.M.S.
3. Pelicans breeding in India, by C. E. Rhenius.
4. Some notes on Heterocera, by Lieut. H. W. Kettlewell.

H. Grönvold del.

J. Green Chromo lith.

3/4

THE PERSIAN GROUND-CHOUGH.

Podoces pleskei.

JOURNAL
OF THE
BOMBAY
Natural History Society.

Vol. XVII. BOMBAY. No. 3.

# A NOTE ON
# *PODOCES PLESKEI*, Zarudny.

By

R. Bowdler Sharpe, LL.D., etc.,

Assistant Keeper, Department of Zoology, British Museum.

(With a Plate.)

(*Read before the Bombay Natural History Society on 28th June* 1906.)

Through the kindness of the officers of the Bombay Natural History Society, I have just received a specimen of a very rare bird which was not represented in the British Museum. It is an example of *Podoces pleskei*, a species of Desert-Chough, described by Mr. Zarudny, the well-known Russian traveller, in the "Annuaire" of the St. Petersburg Museum, 1896, pp. xii—xviii.

In the British Museum are the types of three species of the genus *Podoces*, *viz.*, *P. biddulphi*, *P. hendersoni* and *P. humilis*, all of them described by Mr. Allan Hume. Of the other species, *P. panderi*, we have now seven specimens.

Having, therefore, representatives of all the known species before me, I am able to modify my "key to the species" of *Podoces* given by me in the "Catalogue of Birds" (Vol. III, p. 150) as follows:—

1. Crown of head blue-black. 2.
— No black on crown. 3.

2. A cheek patch of black ; tail-feathers white, with black shafts to centre ones. ... ... ... ... ... *biddulphi.*
— No black on cheeks, which are like the throat and fore-neck ; tail-feathers entirely blue-black. ... *hendersoni.*

3. Size larger ; wing 4·8—5·0 ; no white on tail ; wings blue-black, with broad white tips to wing-coverts and secondaries. 4.
— Size smaller ; wing 3·5 ; outer tail-feathers mostly white ; central feathers brown ; wings brown. ... *humilis.*

4. Upper parts lavender-grey ; a broad black patch on lower throat ; underneath light pinkish. ... ... *panderi.*
— Upper parts pale cinnamon ; small triangular patch of black on the lower throat ; under parts pale cinnamon like the back... ... ... ... ... *pleskei.*

*Podoces pleskei* holds an intermediate position between the black-headed species of the genus, *P. biddulphi* and *P. hendersoni*, being of a similar cinnamon colour, but it is distinguished by the black patch on the lower throat. This patch is smaller than in *P. panderi*, and appears to be more longitudinal and triangular, whereas in *P. panderi* it is broader and reaches across the top of the fore-neck. In colour, however, *P. panderi* is quite different from *P. pleskei*, being a light lavender-grey above and pink below, whereas *P. pleskei* is cinnamon above and below.

The specimen examined by me was procured by Captain J. W. Watson, I.M.S , at Kain, in Eastern Persia, in December 1903.

[Regarding the habits of this specimen Capt. J. W. Watson, I. M. S., has supplied the following notes :—

"I shot the fawn-coloured Chough in a nullah with small bushes in it in January. The nullah was in the middle of a desert in Kain; the place, Mahomedabad. We turned a lot of hares out of this nullah and were shooting them, getting over a dozen, I believe, and these birds kept flying in front of us in pairs. I must have seen about eight of them, and after the shoot was over I went back and shot the specimen."

Again on 27th June 1906, Capt. Watson writes: "I happened to pass the place in which I shot the specimen of the Ground-Chough. I noticed a pair of them flying and hopping about, but, as they evidently were breeding, I did not shoot one. I was on the march and a very short search for their nest was unsuccessful. I think this bird will always be found in the same or similar places, *viz.*, in strips of bushy jungle which run across the plain between Tighab and Kalata Yusuff in Kain, north of Birjand. The birds run along the ground and occasionally perch on the *Asafœtida* plants, but I cannot say whether the latter are the attraction to them although there are a number of the plants on this desert. The bushes are Tamarisk and full of hares."—Eds.].

1. Crown of head blue-black. 2.
— No black on crown. 3.

2. A cheek patch of black ; tail-feathers white, with black shafts to centre ones. ... ... ... ... ... *biddulphi.*
— No black on cheeks, which are like the throat and fore-neck ; tail-feathers entirely blue-black. ... *hendersoni.*

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4. Upper parts lavender-grey ; a broad black patch on lower throat ; underneath light pinkish. ... ... *panderi.*
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[Regarding the habits of this specimen Capt. J. W. Watson, I. M. S., has supplied the following notes :—

"I shot the fawn-coloured Chough in a nullah with small bushes in it in January. The nullah was in the middle of a desert in Kain; the place, Mahomedabad. We turned a lot of hares out of this nullah and were shooting them, getting over a dozen, I believe, and these birds kept flying in front of us in pairs. I must have seen about eight of them, and after the shoot was over I went back and shot the specimen."

Again on 27th June 1906, Capt. Watson writes: "I happened to pass the place in which I shot the specimen of the Ground-Chough. I noticed a pair of them flying and hopping about, but, as they evidently were breeding, I did not shoot one. I was on the march and a very short search for their nest was unsuccessful. I think this bird will always be found in the same or similar places, *viz.*, in strips of bushy jungle which run across the plain between Tighab and Kalata Yusuff in Kain, north of Birjand. The birds run along the ground and occasionally perch on the *Asafœtida* plants, but I cannot say whether the latter are the attraction to them although there are a number of the plants on this desert. The bushes are Tamarisk and full of hares."—Eds.].

# ON A NEW SPECIES OF GREY DUCK (*POLIONETTA HARINGTONI*) FROM BURMA.

By Eugene W. Oates.

(*Read before the Bombay Natural History Society on the 13th December* 1906.)

Captain H. H. Harington has been for some time past re-arranging the large series of Ducks in the Museum of Natural History, South Kensington, and he has drawn my attention to the difference which exists between the Grey Duck of India, or Spot-bill, and the Grey Duck of Burma.

There certainly is a very constant and well-marked difference between the two birds, and I therefore propose to separate the eastern species by the name of

POLIONETTA HARINGTONI, n. sp.

Similar to *P. pœcilorhyncha*, the Spot-bill or Grey Duck of India, but constantly wanting the orange coloured patches which adorn the base of the upper mandible of that species. The bill is, moreover, much smaller, measuring two inches from the point of the forehead to the tip of the nail, against two and-a-quarter inches in *P. pœcilorhyncha*.

There are now five specimens of this new bird in the Museum, but they are all from the Shan States. Captain Harington, however, distinctly recollects that the Grey Ducks he shot on the Irrawaddy had the base of the bill entirely black, and were similar to the Grey Ducks that he got in the Shan States.

The distribution of the two species will thus be:—

*P. pœcilorhyncha*, the Indian Peninsula, Assam, Sylhet, Cachar and Manipur.

*P. haringtoni*, the valley of the Irrawaddy river and the Shan States. Major Evans informs me that he has shot Grey Duck near Toungoo, at Tandawgyi on the Pegu river, and at Thatone. There can be little doubt but that they were *P. haringtoni*.

The Chinese Grey Duck, *P. zonorhyncha*, has occurred several times in Assam, and I have lately acquired for my collection two specimens shot in that province and recorded in the Society's journal.

The characters by which the Indian, Burmese and Chinese Grey Ducks can be recognised may be briefly summarised thus :—

*P. pœcilorhyncha*, the Indian species, has two large orange patches at the base of the upper mandible; the whole lower plumage marked with distinct round spots; the speculum almost invariably of a metallic green; a double band of black and white above and below the speculum; the outer web of the two long secondaries next the speculum entirely white.

*P. haringtoni*, the Burmese species, differs in no respect from the Indian species, except that it entirely wants the orange patches on the base of the upper mandible, and has a shorter bill.

*P. zonorhyncha*, the Chinese species, also wants the orange patches at the base of the upper mandible; the whole lower plumage is brown, each feather with a paler margin, and there is not a trace of spots; the speculum is almost invariably of a metallic blue; the white portion of the double band above and below the speculum is very narrow and sometimes almost absent; the outer web of the two long secondaries next the speculum are mostly black, the white being of small extent and confined to the outer margin of the web.

It may not be unnecessary to point out that all these three species have a large portion of the tip of the bill of an orange colour. The term "Spot-bill" has been applied to the Grey Duck of India, not on account of this orange tip, but because of the orange patches at the base of the upper mandible. Consequently, the term "Spot-bill" should not be applied to the Burmese species, as is often done by sportsmen in Burma.

# A NEW TORTOISE FROM TRAVANCORE.

By

G. A. Boulenger, F.R.S.

(With 2 Plates.)

(*Read before the Bombay Natural History Society on 28th June* 1906.)

Shortly after leaving India, Mr. H. S. Ferguson drew my attention to a Tortoise which occurs near Trivandrum, along with the well-known *Testudo elegans*, and which agrees with it in the absence of a nuchal shield. A shell which he brought me about a year ago indicated a species more nearly allied to the Burmese-Siamese *T. elongata*. I requested Major Dawson, Mr. Ferguson's successor at the Trivandrum Museum, to procure complete specimens, and through his kindness I have now received two living adult individuals, from which, together with the shell above mentioned, I have drawn up the following description :—

## Testudo travancorica.

Shell much depressed once and two-fifths to once and three-fifths as long as deep, with flattish or feebly convex vertebral region; anterior and posterior margins very distinctly reverted, slightly serrated; shields concentrically striated; nuchal absent; supracaudal undivided, incurved or not; first vertebral shield a little broader than long, the others much broader than long and as broad as or broader than the costals. Plastron large truncate anteriorly, deeply notched posteriorly; suture between the pectoral shields shorter than, but at least three-fourths the length of, that between the humerals; suture between the gulars as long as or shorter than that between the pectorals; anals forming a very short suture; axillary and inguinal moderate. Head moderate; a pair of large præfrontal shields, followed by a much larger frontal, which is broader than long; beak feebly hooked, tricuspid. Anterior face of fore limb with large, unequal-sized imbricate scales; no enlarged tubercles on the thighs; tail ending in a claw-like horny tubercle.

Carapace olive or reddish-brown above, the shields with a yellowish central area surrounded by black blotches, which may extend over the greater part of their surface; plastron yellowish, with small black blotches. Head yellowish, tinged with orange; limbs olive, the large scales yellowish; iris dark-brown.

Length of shell 290 millimetres.

This new species may be said to be intermediate between *Testudo elongata*, Blyth., which inhabits Bengal, Burma, and Siam, and *T. forsteni*, Schleg. and Müll., from Celebes and Gilolo, being on the whole nearer to the latter, from which it is distinguished by the greater extent of the median suture between the pectoral shields of the plastron, whilst it differs from the former in the lesser extent of that suture, in the absence of a nuchal shield, and in the much larger frontal shield.

Mr. Ferguson informs me that this Tortoise is very common in the Travancore hills between 500 and 1,000 feet altitude, but not higher, so far as he can remember.

# ACTA ET AGENDA

BY THE

# BOMBAY BOTANISTS.

By

E. Blatter, S. J.

(*Read before the Bombay Natural History Society on 16th August* 1906.)

Did it ever strike you when perusing a Flora on Indian plants, through how many hands each flower had passed and how often nearly all of them had changed their specific, and not seldom their generic names, till, finally, they had to be satisfied with the name they had been given when first discovered by a botanist? W. Gray[1] gives an example, *viz.*, *Cissampelos pareira*, L., a common climbing plant of the Konkan and Kanara jungles, which has been described under 18 different names by various collectors, and *Allophylus cobbe*, Bl. possesses, according to Hooker's "Flora of British India," no less than 30 synonyms. It is evident that under such circumstances the identification of a plant took a good deal of time, just on account of the many authorities which had to be consulted before one was able to find the right description; and Gray is not quite wrong when he says: "Indian botanists have much to answer for; they have in this way not only introduced confusion into the old and well defined genera, but they have also unnecessarily created new groups and subdivisions which are of no practical value."[2] He then continues blaming our old botanists with regard to other points, and, as it seems, not without reason. I think, however, that we could advance as many reasons in their defence. Is it, for instance, not quite natural that in such a big country as India, where a great number of naturalists were working at the same time and in different parts of the vast area, many were ignorant of the work done by others and, for this reason, selected the names for the plants they had found from their own Latin or Greek vocabulary? There arises at least one advantage from the whole list of synonyms: the names of those will not be forgotten so easily who under the

1. Dr. W. Gray: "The Botany of the Bombay Presidency," in the Bombay Gazetteer, Vol. XXV, p. 311.

2. Dr. H. Gray, l. c., p. 312.

burning rays of the Indian sun spent their leisure hours and very often their life in a noble scientific pursuit. In the same way we have a condensed history of Indian Botany in the names of the plants themselves, in the generic as well as in the specific ones. In many circles, however, this kind of nomenclature is very ill-favoured; they prefer a Greek name, though it does not, very often, on account of its being unintelligible, or having an obscure origin, give any more information as to the character of the plant, than *v.g. Woodfordia, Osbeckia*, etc. We are not of opinion that every one who, without knowing it, discovered a new plant, should be immortalized by a specific or so much as a generic plant name, but nobody will object to honouring a well-merited naturalist by calling a flower after his name.

Some twenty years back an Indian botanist wrote: "When the botany of this Presidency and its dependencies shall have been fully worked out, and sufficient materials collected, it is to be hoped that some person may be found competent to undertake the task of preparing on a new and enlarged scale, a comprehensive scientific guide to the Bombay Flora." That time, which Gray was speaking of, has come, and we are going to see very soon the completion of Cooke's volumes, a long desired and comprehensive guide to the Flora of the Presidency. In order to give due honour to those able and enthusiastic men whose hard labours are bearing valuable fruit in our days, I consider it appropriate to make a short inquiry into the development of the new Flora. After this, I think, it will not be out of place to ask ourselves: What has been achieved up to the present day, and what will be our programme for the future, in order to keep up the good repute of the disciples of the "Scientia amabilis" in India?[1]

During the first half of the XVI century the physician Cristobal da Costa came all the way from Portugal to make his botanical observations in India. His notes were made use of by C. Clusius in his "Exoticorum libri decem."[2] Henry van Rheede, the Dutch Governor of

[1]. The following historical notes when not taken from the original, have been borrowed chiefly from "A Memoir on the Indian Surveys," by Cl. R. Markham, London, 1878. Very useful was also K. R. Kirtikar's "Progress in Natural History during the last Century," delivered before the Science Section of the Bombay Branch of the Royal Asiatic Society on the 19th January 1905.

[2]. C. Clusius: "Exoticorum libri decem," (Antwerp 1563, and Rome 1605). C. Clusius (the Latin for Charles de L'Ecluse) was born at Arras (1526) and died as Professor of Botany at Leyden (1609).

Malabar, undertook the famous "Hortus Malabaricus." The plants collected by Brahmans between 1674 and 1676, were sent to Cochin, where the missionary Mathæus made the drawings. Hermann van Doulp, the Secretary to Government at Cochin, translated the descriptions of the plants from the Malayalim into Latin. Up to 1703, 12 volumes, with 794 plates appeared at Amsterdam. A commentary on this first great Indian work on plants by Buchanan Hamilton is contained in the "Transactions of the Linnæan Society."[1]

William Roxburgh, born at Underwood in Scotland, proceeded to India in the medical service of the East India Company. In the early part of his career his attention was confined to the peninsula, as he was stationed at Samulcottah from the year 1781, where he paid particular attention to the cultivation of pepper. Into the plantations, established for this purpose, he introduced the coffee, cinnamon, nutmeg, annatto, bread-fruit tree, sappan-wood tree, and mulberry. His valuable papers on the cultivation of rice, sugar, and pepper were published in Dalrymple's "Oriental Repository." He knew and corresponded with John Kœnig of Courland (in the service of the Danish Government), a pupil of Linnæus, who first gave an impulse to scientific botany.[2] Roxburgh made large collections of plants in the Carnatic, but he had the misfortune to lose them all, with his books and papers, in an inundation at Injeram. He, however, recommenced making a fresh collection, and the Court of Directors sent him out a present of botanical books. In the autumn of 1793 he was appointed superintendent of the botanic garden in Calcutta which had been established by Colonel Kyd. His superintendence extended to 1814, and few men have laboured with greater zeal, assiduity, and success, though he had very indifferent health. During one of his voyages Dr. Carey, the celebrated missionary and orientalist, took charge of the garden and published Roxburgh's Catalogue of the contents of the botanic garden. Of the 3,505 species described, 1,510 were named by Roxburgh. Between 1795 and 1816 his "Plants of the Coast of Coromandel," in 3 vols., folio, with 300 coloured engravings were published by the East India Company. The general descriptive work of the plants of India called "Flora Indica" was not published for many years

[1]. Transactions of the Linnæan Society, Vol. XIII, XIV, XV.

[2]. Kœnig's Herbarium and MSS. are in the British Museum.

after his death[1]. In 1814 he went home and died at Edinburgh on 10th April 1815.

After Roxburgh's departure, Nathaniel Wallich (formerly Nathan Wolff) was the leading Indian botanist. He was a Dane, born at Copenhagen on 28th of January 1787. As surgeon of the Danish settlement of Serampore he was taken prisoner when that place was captured by the English. But he was soon transferred from the prison to the Government gardens at Calcutta, 1815. During the years of his superintendence he added enormously to the collections. After a botanical excursion to Nepal he started the publication of his "Tentamen Floræ Nepalensis illustratæ." When he went to England in 1828 he was able to take along with him a huge collection of plants, owing to the fact, that he had employed a great number of collectors in various parts of India. Wallich's original herbarium, which was presented in 1832 to the Linnæan Society by the East India Company, contains about 7,000 species and is a standard work of reference.[2] During his stay in England Wallich finished his "Plantæ Asiaticæ Rariores" in 3 vols, folio, containing 300 coloured plates. It was published by the East India Company between 1830 and 1832. In 1833 we find Wallich in India again, resuming his labours with unremitting zeal; but ill-health obliged him to go home in 1847, where he died in 1854.

One of the leading Bengal botanists was William Griffith, born at Ham Common (Surrey). As assistant surgeon he accompanied Wallich to Assam; he explored the tracts near the Mishmi mountains between Sudiya and Ava, made a journey from Assam to Ava, and down the Irawadi to Rangoon, traversed 400 miles of the Bhutan country, joined the Army of the Indus in a scientific capacity, went from Kabul to Khurasan and succumbed finally to the fatigues and sicknesses due to exposure during his long and restless journeys on the 9th February 1845. "Dr. Griffith," says Markham, "was unquestionably the most learned botanist and acute investigator of the many that India can boast of. The various papers communicated to the Linnæan Society of London

[1]. An edition was commenced to be published at Serampore, by Carey, with additions by Wallich, the first volume in 1820, and the second in 1824. A complete edition, in 3 vols., was published by Roxburgh's son, in 1832, but without Wallich's additions.

The "Hortus Bengalensis" is a list of all the plants described in Roxburgh's "Flora Indica," arranged according to the Linnæan system with vernacular names, habit, time of flowering, and references to the plates in Van Rheede's "Hortus Malabaricus."

[2]. A set of Wallich's Herbarium is at Kew.

and other publications are models of scientific research, and his drawings, microscopic analyses and descriptions of plants and their organs, made chiefly during his travels, always in hot and often in malarious regions, and preserved at the Royal Gardens of Kew, are evidences of astonishing industry and great knowledge."[1] His intention was to prepare a general scientific Flora of India. For this purpose he collected, in the course of twelve years, 2,500 species from the Khasia hills, 2,000 from Tenasserim, 1,000 from Assam, 1,200 from the Mishmi country, 1,700 from Bhutan, 1,200 from the Naga hills, 1,000 from the neighbourhood of Calcutta, and, besides, a great number from the Malay peninsula and Borneo.[2]

When the East India Company's botanic garden at Saharunpur had been established, Dr. Forbes Royle was made the first superintendent. In this capacity he was enabled to form a great collection of plants and to make observations on other departments of natural history. On his return to England he published his great work, entitled "Illustrations of the Botany and other Branches of the Natural History of the Himalayan Mountains." (London, 2 vols., 4to, 1839).[2] He was appointed lecturer on Materia Medica at King's College in London and died in 1858.

We must not forget in this place to mention the name of a young French naturalist, *viz.*, Victor Jacquemont, who was sent out to India by the "Muséum d'Histoire Naturelle" in 1828. His travels from Calcutta to Delhi, Cashmere, and Bombay are described in his journal, which comprises 3 volumes folio, whilst the 4th volume contains the description of the collections. The 2nd volume of the "Atlas" contains, besides many zoological drawings, 180 plates, showing plants of different parts of India.[3] Jacquemont had a mind to travel from Bom-

[1] For the fruits of these labours we are indebted to T. McClelland, who published in Calcutta, between 1847 and 1854, 5 volumes 8vo. with a 4to. volume of illustrations: "Posthumous papers bequeathed to the H. E. I. C., and printed by order of the Government of Bengal; being journals of travels by the late William Griffith, Esq., arranged by John McClelland, M.D."

"Dr. Hooker in 1858 rescued 12 or 14 waggon loads of chests of dried plants from the cellars of the India House, consisting chiefly of Griffith's, Helfer's, and Falconer's collections, and arranged and distributed them to the principal museums in Europe and America." (Markham.)

[2] Royle's further publications were—

"On the Antiquity of Hindoo Medicine."

"Essays on the Productive Resources of India." London, 1840.

"The Fibrous Plants of India." London, 1845.

"A Manual of Materia Medica and Therapeutics." London, 1847.

[3] Victor Jacquemont: "Voyage dans l'Inde pendant les années 1828 a 1832." Paris, 1841.

bay to the Cape Comorin and then to explore the coast of Coromandel, but he became a victim of his untiring zeal, succumbing in Bombay to the fatigues and the effects of the tropical climate on the 7th December 1832.

The most eminent botanist of the Madras Presidency at that time was Dr. Robert Wight, of the Madras Medical Service (born at Milton in Scotland on the 6th July 1796). As Director of the Botanic Garden at Madras he published, together with George Arnold Walker-Arnott, the "Prodromus Floræ Peninsulæ Indiæ Orientalis," (Madras, Calcutta, and London), comprising 2 volumes. This is, in Hooker's opinion, the most able and valuable contribution to Indian botany that has ever appeared. Later on there appeared the "Icones Plantarum Indiæ Orientalis" with 2,101 plates, and "Spicilegium Neilgherrense." In 1831 already he had published "Illustrations of Indian Botany" with 40 plates. Many papers besides appeared in the "Madras Journal of Science" and the "Calcutta Journal of Natural History." His enormous collections of plants, chiefly from the hill districts, were presented to the Herbarium of the Royal Gardens of Kew. Wight died in 1872.

Leschenault de la Tour, who accompanied Baudin on his voyage to the Moluccas, Java, and Sumatra, appears to have been appointed director of the botanic garden at Pondicherry. He investigated some of the southern provinces of the Peninsula, but the plants he collected are chiefly from the Neilgherries, and are principally published by De Candolle in his "Prodromus Systematis Naturalis Regni Vegetabilis." The Flora of the Neilgherries was also explored by George Gardener, the director of the botanic garden at Peradeniya in Ceylon.

In 1828 John Graham, a native of Dumfriesshire, arrived in India. As Deputy Postmaster-General he devoted his moments of leisure to botanical explorations. In 1839 he was able to publish his "Catalogue of the Plants growing in Bombay and its Vicinity." "Considering the means of communication," says Cooke, "that existed at that time, for there were no railways, and travelling was difficult and tedious, one cannot help being struck with admiration at the number of plants brought together in this catalogue, all of which were, as Mr. Graham states, personally examined either by himself or by Mr. Nimmo, and most of which were correctly named." It is much to be regretted that he died at the early age of 34, on the 28th May 1839, at Khandala.

Graham was the first to attempt a local flora of Bombay. That he succeeded in so high a degree, he owed to the work done by those never tiring pioneers who had, years before, explored other parts of Hindustan and occasionally also Western India; and I am sure there has not been a single Bombay botanist up to the present day who could dispense with the old classics of Indian Botany. Local floras are cropping up everywhere at present to our great delight, and, no doubt, many a hard hour they must have caused their authors, but nevertheless I feel convinced those florists are the first to admit how much they are indebted to their famous predecessors.

Joseph Dalton Hooker, born on the 30th June 1817 at Halesworth in Suffolk, forsook the practice of his medical profession for the more fascinating pursuit in which his father, Sir William Jackson Hooker, has so greatly distinguished himself. In 1839, on the occasion of the fitting out of the expedition to the Antarctic Ocean under Sir James Ross, Hooker was appointed assistant surgeon on board the *Erebus*; but his real object was to investigate the botany of the district through which the expedition passed. The result was the publication of the "Flora Antarctica" in which Hooker has not only figured and described a large number of new plants, but by comparison of the species obtained in this voyage with those of other parts of the world, has succeeded in advancing greatly our knowledge of the laws which govern the distribution of plants over the surface of our globe. After having investigated the plants of temperate and cold climates, he could not rest till he had seen those of tropical countries. His choice lay between the Andes and the Himalayas, and it fortunately fell upon the latter (1848). His route lay through districts not under British superintendence, and his adventures, therefore, were numerous and his position occasionally even, dangerous, having been for some time kept prisoner by the presiding governor of a district in the Sikkim-Himalaya. In 1852 he returned to England, and published his "Himalayan Journals," in two volumes. They are one of the most readable contributions to scientific travelling during the last century. His first volume of a large work, entitled "Flora Indica," gives a more perfect idea of his scientific labours and affords the best evidence of the industry and intelligence displayed during his three years' peregrinations in the Sikkim and Nepal Himalayas. When Hooker in company with Thomas Thomson wanted to publish the "Flora Indica" the Court of Directors refused

to promote this great national work, though strongly memorialized by the British Association ; yet the first volume appeared in 1855.

In 1872 the Secretary of State for India in Council, the Duke of Argyll, gave instructions for a flora of British India to be prepared under the supervision of Joseph Hooker. The gigantic work, consisting of seven volumes, was completed in 1897.

Of the more recent floras on Bombay and Sind plants I must mention " Practical Remarks on the Plants of Sind " published by J. E. Stocks in 1848 ; " The Bombay Flora or short descriptions of all the indigenous plants " by Nicholaus A. Dalzell and Alexander Gibson, (Bombay, 1861 ) ; a " Catalogue of the Economic Products of the Presidency of Bombay, " compiled by Assistant Surgeon Birdwood, (Bombay, 1862). The botanical volume of the Gazetter of the Bombay Presidency (Vol. XXV, 1886) contains " Useful Plants of the Bombay Presidency" by J. C. Lisboa, " Botany of the Bombay Presidency" by W. Gray, and a " List of Gujarat Trees " from materials supplied by G. H. D. Wilson and J. G. McRae. The year 1894 brought us the " Systematic List of the Trees, Shrubs, and Woody Climbers of the Bombay Presidency " by W. A. Talbot.[1] The want of a forest handbook led to the preparation of this work, the same want which induced Beddome to write his " Flora Sylvatica " of Madras, Sulpiz Kurz to publish the " Forest Flora of British Burma," and D. Brandis to complete the " Forest Flora of North-West and Central India, " which had been commenced by J. Linsay Stewart.

A good deal of work and an indispensable one for the writer of a flora, especially if he is far away from the country whose plants he is going to describe, has been done by various collectors in different parts of the Presidency. Stocks collected plants in Sind, Schmidt in Kanara, Law in Bombay, Dalzell in the Konkan, Sykes and Gibson in the Deccan. It would be unjust not to mention here the work done by G. M. Woodrow. His continued explorations of our country and his extensive knowledge of plants enabled him to publish a nearly complete catalogue of the " Flora of Western India. "[2]

These are the men who by their labours directly or indirectly influenced the development of a scientific flora of the Bombay Presidency. It was a slow but uninterrupted progress, occupying a time

[1] A new enlarged edition appeared in 1902.

[2] In the Journal of the Bombay Natural History Society, Vols. XI, XII, XIII.

of over 250 years. What is now the result with regard to our botanical knowledge of Bombay? We know, in the first place, what plants are growing in this country and, though the present flora is not an exhaustive one, there is "every reason," says Cooke, "that the plants which still remain undiscovered are few." This fact of our knowledge gives us a clue for ascertaining whether our flora is poor or rich, whether it is poorer or richer than those of other parts of India, of other countries in Asia, etc.; it shows us what plants prevail, whether the woody or herbaceous, perennial or annual, evergreen or deciduous ones; we know what orders there occur, and how the occurring orders are represented with regard to the number of genera and species; we have greater facility to find out, which plants are endemic and which are not, and where the latter ones occur beyond the boundaries of our area, and are, thus, able to make conjectures as to the possible centre from which the non-endemic plants began to migrate, till, finally, they settled down also in our country.

We have, besides, full descriptions of each plant, which provide us with plenty of information as to the peculiarities of the outer morphological form of the tropical plant. These, again, are extremely suggestive for the botanist, to trace the various relations existing between a certain plant-form and its special surroundings, *viz.*, soil, humidity, rainfall, moisture, clouds, temperature, etc., especially if he knows from other sources, that the same plant strives as well in another geographical position, though under entirely different conditions.

The flowering time is mentioned by Cooke in most cases, and the notes on the occurrence of the single plants allow us to form a rough idea of their distribution in the Presidency. It is not the author's fault, that so much information is not met with in his "Flora" which is so eagerly looked for in floristic volumes by the botanist, and especially in floras on tropical countries, *e.g.* about sprouting, defoliation, fruiting, habit, etc. But to write a flora is not to write a novel; imagination is of no value where definite notes on a scientific subject are not available to the compiler.

Some time ago I spoke to a gentleman who is not a professional botanist, but has a fair knowledge of our flora. He was so grieved because all the plants had been already named, and as he was not capable of working in plant physiology, and, besides, found cryptogamic botany too difficult, he told me, that he did not know how to find

an object for his natural interest in the study of the vegetable kingdom I think this gentleman is only a type of a great class, who would with pleasure devote all the leisure time that could be spared from their necessary duties to their beloved science if they only knew in what way, if they were shown a field of labour. To do this is not so very difficult. There are many botanical fields in the Bombay Presidency which have not been cultivated as yet or only to a small extent, and I do not hesitate to say, that the work, which is still to be done, is of greater interest and of greater importance than which has been done up to now: I mean the solutions of all those questions which are called now-a-days collectively " plant-geography " in its widest sense. It is not in the least my intention to detract in any way from the merits of the work accomplished by generations. I only want to say that the enumeration, identification, and description of plants is not the final end of botanical inquiry, but only a necessary step towards higher and more important results.

Some years back I had the opportunity to speak to some well known botanists at the South Kensington Museum. From their conversation I could gather how much they regretted that with regard to plant-geography scarcely any attempt had been made in India. A short perusal of the botanical literature shows that the sketches of this kind are very few.

Perhaps one of the oldest is that by M. G. da Silva, giving observations on the vegetation of Goa.[1] Dr. Forbes Royle was the first to attempt to show the characteristic features of the geographical distribution of the plants of Northern India taking into consideration elevation and climate and the flora of the adjoining countries. In the same paper he made interesting remarks on the vegetation of some Indian lakes.[2] The preliminary essay to the first volume of the " Flora Indica" is well known. Cleghorn published an article " On the sand-binding plants of the Madras beach,"[3] and D. Brandis wrote an account on the distribution of the forests in India, for the " Geographical Magazine," illustrated by a tinted map showing the amount of rainfall in the

[1] Manoel Galvão da Silva: Observações sobre a historia natural de Goa, (worked out in 1780, edited and published in 1862 by J. H. da Cunha Rivara).

[2] Forbes Royle: " General observations on the geographical distribution of the Flora of India, and remarks on the vegetation of its lakes," in " Report of the 16th meeting of the British Association, XV., p. 74." (1846).

[3] In the London Journal of Botany, VIII. (1858).

different regions.[1] W. Gray was the first to give a detailed account of the distribution of our indigenous natural orders throughout the Presidency of Bombay with some general considerations on the flora as a whole. In the "Forest Flora of British Burma" we find a short description of the distribution of forests in that Province. Kurz distinguishes "mixed" forests, "upper" and "lower mixed" forests. There exist, besides, some plant-geographical papers by David Prain[2] and C. B. Clarke [3] and a very recent general paper on the Indian flora by Jos. Hooker.[4] Also our Journal contains some valuable contributions. Th. Cooke wrote some notes on H. M. Birdwood's "Catalogue of the Hill Flora of Matheran and Mahableshwar"[5]; Woodrow described the "Plants of a Bombay Swamp"[6]; and G. A. Gammie examined "The trees and shrubs of the Lonavla and Karla groves."[7] The latest and most interesting contribution received is from W. A. Talbot: "The distribution of the forest flora of the Bombay Presidency and Sind."[8] He distinguishes an evergreen forest flora of Malabar, which shows a distinct Malayan affinity, a dry deciduous flora of the Deccan with a predomination of African elements, and the flora of the Konkan and the Western Ghats, which shows a mixture of dry deciduous and evergreen forest.

How eagerly the naturalists in Europe are waiting for papers of this kind, may be seen from a remark made by Engler, the greatest living authority in botany, on an article which appeared in the Journal of the Botanical Survey of India (I, 1894): "Considering," he says, "the scarcity of descriptions of the plant-formations in India, also notes like G. Woodrow's, 'on a journey from Haveri to Kumta,' are of a certain value." [9]).

If anybody in the Presidency is able to respond to the wishes and expectations of our Western colleagues, it is certainly the Bombay Natural History Society. We have our members scattered all over the country, many stationary for a longer or shorter time, others

[1] "Ocean Highways," October 1873, p. 200.
[2] In his "Botanical Notes and Papers", 1901.
[3] In the Journal of the Linnæan Society of London, Vol. XXXV.
[4] It is printed in the Gazetteer of the Indian Empire (descr. vol.)
[5] Journal of the Bombay Natural Hist. Soc., Vol. X., p. 394-440.
[6] Vol. XI., p. 88; XI., p. 335.
[7] Vol. XV., p. 279.
[8] In the "Indian Forester, 1906, Vol. XXXII., Nos. 1, 2, 3.
[9] Engler: Die Entwicklung der Pflanzengeographie in den letzten hundert Jahren u weitere Aufgaben derselben, Berlin 1899.

leading a more nomadic life. A few of them are professional botanists, the greatest part are not allowed by circumstances to make the science they like so much their profession; but all, without exception, are capable of doing valuable work.

The following remarks are not intended to be a treatise on plant-geography; they are only short hints directed to those who are, on the one hand, ready to contribute towards the completion of an important scientific work, but, on the other, do not exactly know how to begin.

The Bombay Natural History Society wants to ascertain—

(1) the exact distribution of the single phanerogamic species in the Presidency. Cooke in his notes on the habitat of the plants adhered, as he says himself, "to the main divisions that Dalzell and Gibson seem to have worked to, *viz.*, Konkan, Deccan, Gujarat, Southern Maharatta Country and Sind, as being the most convenient to follow." Kanara, on account of its possessing plants which solely occur within its area, has been kept separate. All these geographical divisions, however, are vast areas, and within these areas the conditions for the development of plant life is very often so varied, that we must not suppose that a certain plant which was found in one place, is necessarily spread over the whole area. Very often, besides, we do not even know to what main divisions many plants are confined. A detailed account of their distribution is, therefore, very desirable. For this purpose the Bombay Natural History Society requests of her members to send specimens from all parts of the Presidency. Identified specimens are, of course, preferred; but if this should be impossible, a minute description of the flower added to the specimen will be sufficient. We hope, thus, to complete at the same time our herbarium, which as yet contains only the plants presented by Woodrow. They represent about half of our phanerogamic flora, and the absence of the rest is badly felt by those who want to use the collection for reference. Of the plants growing in Kathiawar, Cutch, and especially in Sind, we have only a small number of specimens, though, perhaps, the Sind flora is the most interesting feature in the vegetation of the Presidency. Those who are willing to collect specimens, are requested not to mount them, but to put them simply between two sheets of paper; newspapers serve the purpose very well. A note saying whether the plant is common or not in a given place, is very useful.

(2) In order to give a valuable plant-geographical description of our country we must know a good deal more of the cryptogamic

flora than we do at present. The Ferns, we may say, are pretty well known, but about their distribution we have still to learn very much. The same may be applied to the Club mosses. For the rest (Mosses, Liverworts, Algæ, Fungi, Lichens) we know almost nothing. K. R. Kirtikar, as far as I know, is the only one who has contributed to our Journal some papers on this branch of botany.

A few notes on the collecting of cellular cryptogams might not be superfluous.

In collecting Mosses less care is required than is bestowed on flowering plants. It is not necessary that Mosses should be laid out and pressed. It will suffice to preserve the specimens in small paper bags, and to mark outside the locality and the date when gathered. There should be added, whether the Moss was found on a tree, on a rock, or on the soft ground. The same holds good for Lichens. As to the collecting of Fungi and Algæ I quote from the "Instructions for Collectors" issued by the British Museum, as I am not able to give more concise and clear directions.

"Hard woody Fungi need no special preparation, beyond keeping them in a dry place. Most of these are found growing on trunks of trees; but when a terrestrial one is met with, it should be dug up with care, since sometimes such forms spring from underground tuberous bodies. It is not possible to make satisfactory specimens of soft Fungi, such as Agarics and Phalloideæ, in any but a dry climate. Much the best plan in any damp climate is to preserve them in fairly strong spirit or in formalin diluted with from five to ten parts of water. A note of the colours should be made on the ticket; and, if possible, in the case of an Agaric, the colour of the spores should be observed. This is best done by cutting off the pileus, and placing it for several hours, say overnight, on a sheet of paper; and the spores cast during that period will be found to have deposited a map of the gills on the paper. The colour may then be noted; and if possible the spore-cast should be preserved by painting a thin film of gum on the reverse side of the paper, which should be thin. The pileus should be placed where there is no draught while casting its spores. In the case of Phalloideæ, young and mature specimens should be obtained when possible. Leaf Fungi are best preserved by pressing and drying, and the name of the host-plant should be noted, or if unknown then a specimen should be taken for identification. Mycetc-

zoa should be dried, and carefully preserved from crushing by fixing them in chip-boxes."

"In collecting sea-weeds, the best kind of receptacle is an ordinary sponge-bag. A stout stick with a chisel end is most convenient, and a cotton bag in a landing-net ring at the other end of it is useful in recovering detached floating specimens. In preparing sea-weed for the herbarium, great care must be taken in spreading each specimen with a small camel's hair brush on a paper mount inserted below it while floating in a basin. The specimen should then be dried in the ordinary way; but a layer of muslin should be placed over the sheets of specimens to prevent their adhering to the upper sheet of drying-paper. In preserving minute Phyto-plankton, marine Diatoms, and the like, a fluid preparation is best. Either chromic acid 0·25 per cent. solution or platinic chloride 0·5 per cent. solution is excellent as a fixing and preserving fluid; but where minute calcareous organisms are involved, formalin (5 per cent.) gives good results for them as well as for all the other kinds, and is to be recommended for general use. Minute fresh-water Algæ are well preserved in carbolic acid (about 1 per cent.), or in camphor water, or weak spirit where these are not to be obtained. Such submerged plants as *Myriophyllum*, *Utricularia*, *Nymphæa*, *Nuphar*, and *Nitella* should be squeezed, and after the water has stood for some time the upper part may be decanted and the sediment preserved. Scrapings from moist and dripping rocks yield good result."

It is very desirable that of each species at least two specimens should be sent to the Bombay Natural History Society's museum, because we want to keep one for our museum, whilst the rest will be sent to Europe or to the Cryptogamic Botanist of the Botanical Survey of India for identification.

The Bombay Natural History Society would, besides, like to get answers to the following questions:—

(3) When do the plants begin to flower, when do they cease? Though the flowering time is given of almost all the plants in Cooke's "Flora," it will be very useful to have more data on this point, in order to arrive at exact results with regard to the flowering season in the tropics. The flowering season of the individuals of the same species is, no doubt, different at different places of the Presidency, at different elevations, in different soil, at different degrees of moisture and temperature, and in different illumination.

(4) When do the woody plants (shrubs and trees) begin to sprout and when do the herbaceous plants make their first appearance?

(5) When do deciduous woody plants begin to shed their leaves? During what period are they without leaves?

(6) How long does the ripening of the fruits last, and how long do they remain on the plant after the ripening?

(7) Do all the branches of the woody plants bear flowers at the same time? Is there any law in the seeming irregularity.

(8) Which plants grow only in one kind of soil? Which prefer one kind to another one? And which are indifferent to any kind of soil?

(9) Which plants grow near the sea—

(*a*) on the sandy sea-shore?

(*b*) on rocky ground?

(*c*) in salt-water creeks and backwaters, which are subject to the tides and action of salt water?

(*d*) in salt swamps?

(*e*) in the forests near the coast and on the banks of tidal rivers, still affected by the salt water?

(*f*) along the banks of creeks in alluvial soil, which is not directly influenced by the salt water, being above high-water mark?

(10) Which plants form the dune forests?

(11) Which plants grow on the banks of rivers, nalas, water-courses, and which in river beds? Here it is essential to give the physical characters of the bed, whether it is rocky, sandy, or muddy.

(12) Which are the plants of the evergreen forests?

(*a*) Immediately covering the soil there are seedlings mixed with shrubs, undershrubs, and herbaceous species.

(*b*) In the next zone there are small or medium-sized evergreen trees 50-75 feet high.

(*c*) Then there follow great evergreen trees mixed sometimes with deciduous trees, often 150 feet above the ground.

(*d*) Climbing and epiphytic plants.[1]

(13) Which plants grow in the deciduous forests[2]?

[1] Cf. W. A. Talbot, "The distribution of the Forest Flora of the Bombay Presidency—Sind," in the "Indian Forester," Vol. XXXII., No. 2, p. 56.

[2] Cf. W. A. Talbot, *l. c.* No. 3, p. 126, 131, 133.

(14) Which plants grow in moist deciduous forests?

(15) Which plants grow in dry deciduous forests?

(16) Which plants are found on sandy soil, (sandy sea-shore excluded)?

(17) Which plants are found on rocks, walls, stony ground?

(18) Which plants grow in waste places, on rubbish, near houses, villages, on garden paths, roads, etc.

(19) Which are the plants growing in swampy places which are not affected by salt water?

(20) Which plants grow in moist, damp places, *e. g.* on the margins of the tanks?

(21) Which plants grow in cultivated ground and gardens?

(22) Which plants are found in lakes, tanks, wells, ditches and flowing water?

(23) Which plants surround the lakes?

(24) Which plants are found growing in the pasture grounds?

(25) At what elevation do certain plants occur?

(26) Extremely welcome are botanical descriptions of smaller areas giving *e. g.* the aspect of the vegetation of a valley, a ravine, a hill, a swamp, a mangrove forest, etc., entering into the detailed description of the respective flora, even if the area dealt with should not occupy more than an acre.

(27) It is, besides, very useful to know the aspect of a bigger or smaller area at different seasons of the year. In a description of this kind we must find named the plants which are flowering, those which show foliage, and those which are devoid of flowers and leaves, etc.

These are the points which the Bombay Natural History Society expects to be answered by her members. The questions are short and comparatively few; but the complete answers will not be given in one year and not in ten years; they will occupy a long time and demand some labour of all those who intend to contribute materials towards a useful and scientific discussion of the plant-geographical features of the Bombay Presidency.

# ON THE PARASITIC HYMENOPTERA COLLECTED BY MAJOR C. G. NURSE IN THE BOMBAY PRESIDENCY.

By P. Cameron.

To make this paper more complete I have added, as an appendix, a list of the Parasitic Hymenoptera described previously from the Bombay Presidency. As will be seen, the catalogue is not an extensive one.

### Bethylinæ.

*Dissepyris pallidinervis*, sp. nov.

Black, the scape, pedicle of antennæ, mandibles, palpi, legs, tegulæ, the 1st abdominal segment, the 2nd broadly laterally, at the base, more narrowly in the middle and the apical segment more obscurely, red; fore wings slightly but distinctly smoky, the hinder clear hyaline, the apices not ciliated; the stigma, parastigma and nervures pale, the radius darker coloured at the apex. Head opaque, more shining at and behind the ocelli, finely closely shagreened, almost punctured and bearing small, shallow scattered punctures. Eyes large; the temples one-fourth of their length; malar space about as long as the temples, shorter than the pedicle of antennæ. There is no distinct keel between the antennæ; ocelli in a triangle, the hinder separated from each other by a distinctly less distance than they are from the eyes. Terminal tooth of mandibles long, gradually narrowed. Occiput transverse. Pronotum not quite so long as the head behind the antennæ; aciculated, sparsely punctured, the punctures distinctly larger than those on the head; the punctures on the head are still larger. Metanotum irregularly, closely obliquely striated; it bears 5 keels in the middle; the central is stout, straight; the inner 2 converge and become weaker, more irregular towards the apex; the outer are stronger and curve roundly, broadly inwardly at the apex; they are more widely separated from the 2nd than that is from the central; there is an indistinct longitudinal furrow on the inner side of the outer bordering keel. Pro- and mesopleuræ finely, the metapleuræ more strongly and regularly obliquely striated. The pubescence on the legs is longish, white and moderately dense. The 2nd discoidal cellule has the apical and lower nervures faint compared with the upper basal. The radius is not much longer than the stigma and parastigma united; the transverse median nervure is roundly curved; its lower part being opposite the apex of the transverse basal; it has not the upper and lower parts straight, oblique and sharply angled where the lower abscissa leaves the upper, as shown in Kieffer's figure of *D. rufipes* (also from Bombay)—Ann. d. l. Soc. Scient. de Bruxelles, XXIX, pl. 1, f 12. The apices of tarsal joints are armed with stiff longish spines; the tibiæ not spinose, the hinder shorter than the tarsi, the metatarsus below thickly covered with stiff hair; it is distinctly shorter than the following 2 joints united. The sides of the metanotum at th apex above bear a short blunt tubercle, before the terminal curve. ♀.

Length 6 mm.

Deesa.

Antennal scape as long as the following 2 joints united; thick; the 2nd about 3 times longer than thick, as is also the last. Allied to *D. rufipes*, Kief., from Malabar.

CHALCIDIDÆ.

*Chalcididing.*

*Cœlochalcis carinigena*, sp. nov.

Black, densely covered with long white pubescence, the apex of the 4 anterior tibiæ and the greater part of the tarsi rufo-testaceous; wings clear hyaline the nervures black.

♂ Length 4 mm.

Deesa. January.

Head, pronotum, mesonotum and scutellum rugosely punctured. Cheeks clearly longer than the eyes, keeled on the outer and inner sides; the inner keel indistinct on the top. Scutellum large, narrowed towards the apex; the apical teeth large, as long as wide, irregular. Metanotum with 3 areæ; the central of almost equal width, extending from the base to the apex; the lateral areæ wider, widened in the middle, the basal part rounded, the apical straight, oblique. Propleuræ rugosely punctured; mesopleuræ with the basal half smooth, finely, widely longitudinally striated; metapleuræ rugosely punctured with some round, separated punctures at the base. Basal segment of abdomen strongly closely aciculated, bare, the others punctured, densely pilose. Legs densely covered with short, white pubescence.

The apex of the scutellum is more distinctly bidentate than it is in *C. carinifrons*, Cam. (also from Deesa), which has also the legs red for the greater part.

*Euchalcis trichiocephala*, sp. nov.

Black; the legs, except the forecoxæ, red; the antennæ red, the apical joint black, the preceding 2 joints infuscated, the head, especially below, thickly covered with longish silvery white pubescence; wings hyaline, the nervures black. ♀.

Length 5 mm.

Deesa. January.

Front and vertex irregularly punctured. Malar space distinctly longer than the eyes, which converge slightly above. Temples obsolete; the eyes behind projecting beyond the occiput, which is narrowed laterally. Mandibles reddish in the middle. Pro- and mesonotum rugosely punctured. Scutellar teeth stout narrowed towards the apex; the space between wider than long. Metanotum with a central area which is slightly narrowed towards the base, the apex nded; in the centre are 2 indistinct transverse keels; at the sides, at the , are 3 areæ, of which the central is much the larger; the inner is 4-angled, quely narrowed at the base, the 2nd is wider than long; its apex is dilated to e middle; below, next to the central, is a large area, longer than wide

and of equal width ; the sides of the segment have the upper half dilated, the top projecting upwards into a blunt tooth, its lower edge also slightly projecting. Propleuræ covered with deep, round, clearly separated punctures ; the base of mesopleuræ smooth, the base bordered by a row of round foveæ, its apex by a crenulated furrow ; the rest of the pleuræ rugosely punctured-reticulated. Abdomen smooth, shining ; the basal half bare, the apical thickly covered with silvery pubescence. Sheaths of ovipositor distinctly projecting, broad. Hind femora distinctly dilated near the top, the apex of the dilated part with an oblique slope.

*Antrocephalus varipilosis*, sp. nov.

Black, covered with silvery pubescence ; the apex of the 4 anterior femora and the 4 front tarsi dull red, the hind femora red ; the apical third of their tibiæ of a duller red ; the tibiæ at the base behind suffused with red ; wings hyaline, slightly infuscated at the apex ; the nervures black. ♂.

Length 5 mm.

Deesa. October.

Head and thorax strongly, closely punctured Scutellar teeth short, broad, inconspicuous. Post-scutellum about twice longer than wide, hollowed, with broad margins. Areola on metanotum extending from the base to the apex, slightly narrowed at the apex, the upper two-thirds hollowed, the lower third rugosely punctured ; the sides are distinctly margined ; above is a small triangular area ; the metapleuræ thickly covered with longish silvery pubescence. Underside of femora with a white hair fringe ; their basal half black below. Flagellum of antennæ opaque, covered with white down ; the scape shining, bare, narrowed at the apex. The silvery hair on the sides of the abdomen is mixed with golden. Tegulæ testaceous.

*Oncochalcis nursei*, sp. nov.

Black, shining, with the following parts pallid yellow : the apex of the 4 anterior femora, more broadly below than above, an irregularly oval mark on the apex of the hinder femora on the outerside, the 4 anterior tibiæ, the posterior on the outer side, the 4 anterior tarsi and the tegulæ ; the hinder tarsi rufous ; wings hyaline, the nervures black ; the temples, sides of face, apex of scutellum and the metapleuræ densely covered with long, silvery pubescence. ♀

Length 5 mm.

Abu.

Flagellum opaque, covered with a white pubescence ; the antennæ are inserted shortly above the lower edge of the eyes. Front at the sides strongly, closely punctured, the punctures running into each other ; the vertex less strongly punctured. The plate in the centre of the face, large, shining, broad below becoming gradually, roundly narrowed above, bordered by an obscurely crenulated furrow ; the lower border with shallow, not very distinct punctures. Basal half of mandibles closely punctured, the apical smooth and bro[ad]

Clypeus broadly depressed, the apical margin raised. Propleuræ shagreened, the fore margin raised; the smooth base of mesopleuræ with 4 foveæ, of which the 3rd is the larger and more irregular, the part below covered with round, not very deep, punctures, the middle with a broad striated band, widest above, the rest smooth, shining; metapleuræ rugosely punctured. Pro-mesonotum and scutellum strongly punctured; the pronotum more closely than the rest. Metanotum coarsely reticulated; on the basal half of the metapleuræ, on the inner edge, is a curved oblique area, fully 4 times longer than wide and curved, roundly inwardly on the innerside; the sides are broadly rounded, without projections. Basal segment of abdomen shining, the sides weakly punctured; the others are strongly punctured, except at the base and apex. On the hind femora are 7 large, clearly separated teeth (the basal more widely separated than the others) and 3 smaller, closely pressed apical. Hind coxæ smooth and shining above, shagreened and pilose below. The areola is about twice longer than wide, rounded and narrowed at the base, transverse at the apex.

This species may be known from *marginata*, Cam. and *decesæ*, Cam. by the pale, not bright lemon-yellow colour of the legs and tegulæ. The ♀ may be separated thus:—

*a*. Middle of face without a smooth, shining, clearly defined plate; temples very short, underside of hind femora thickly covered with silvery pubescence ..... *decesæ*, Cam.

*b*. Middle of face with a large, clearly defined smooth plate, temples not very short.

legs bright lemon-yellow, clypeus raised in the centre; areola obliquely, sharply narrowed at the base ..... *marginata*, Cam.

legs whitish yellow; clypeus broadly depressed; areola bluntly rounded at the base ..... *nursei*, Cam.

*Chalcis megaspila*, sp. nov.

Black, the tegulæ and the legs, except the coxæ, trochanters, the femoral teeth and a large mark, longer than wide, on the middle of the outerside of the hind femora; the mark is slightly oblique, extends to the basal fourth and has the base rounded; they have 12 minute black teeth, the basal less distinct and widely separated; wings hyaline, the nervures black. ♀.

Length nearly 5 mm.

Abu.

Orbits, face and clypeus densely covered with longish white pubescence; closely rugosely punctured, the face more coarsely than the rest; clypeus smooth, except for a row of weak punctures in the middle; the labrum smooth, its sides raised. Mandibles closely rugose, smoother towards the apex. Temples distinct, moderately wide. Pro-mesonotum and scutellum closely rugosely punctured, the scutellum more coarsely than the rest, the apex broadly bidene, the lobes brownish. Metanotum deeply reticulated; the reticulations in ws; there is no areola; the sides broadly rounded; roundly dilated below. al segment smooth, shining, bare, the others closely, strongly punctured and to ckly covered with white hair. The 3 lower teeth on the femora are smaller,

blunter and more widely separated than the others. Upper half of propleuræ shagreened, irregularly punctured; the lower smooth. Base of mesopleuræ smooth; the apex stoutly, closely striated. Metapleuræ strongly rugosely punctured. The apex of the hind coxæ and the hind trochanters are rufescent.

This species agrees with *C. ornatipes*, Cam., from Kashmir in having the coxæ yellow, with a distinct black spot; the spot in *ornatipes* is smaller and is in the middle, not on the outer edge, and the pubescence has a golden tinge.

EVANIIDÆ.

*Gasteruption rotundicolle*, sp. nov.

Black, the basal half of mesonotum, the mesopleuræ except at the sutures the mesosternum, the greater part of the metapleuræ and of the metanotum, red; the base of the 4 anterior tibiæ and tarsi and a band near the base of the hinder tibiæ, much broader below than above, white; the apex of the 1st and the 2nd abdominal segments, dull rufous; wings hyaline, the nervures black. Prothorax long, longer than the mesothorax, cylindrical, not much widened towards the apex, aciculated. ♂.

Length 12 mm.

Deesa. January.

Antennæ black; the pedicle fully twice longer than wide; the 3rd joint slightly shorter than the 4th, about as long as the scape. Eyes bare; the ocelli in a triangle; the posterior placed behind the eyes, separated from them by about the same distance as they are from each other. Temples long, two-thirds of the length of the eyes; obliquely narrowed; the occiput transverse. Middle of clypeus at the apex, with a semicircular depression; the apex fringed with golden hair. Basal half of mesonotum in the middle irregularly transversely striated; the apical irregularly reticulated. Scutellum somewhat strongly, but not closely punctured. Metanotum transversely reticulated, a smooth, shining keel down its centre. Propleuræ closely rugosely punctured, more finely below than above, the middle irregularly reticulated; the meso closely rugose; below the middle coarsely aciculated; the apex crenulated, the upper half with a row of round foveæ; the metapleuræ irregularly reticulated at the base and apex, the middle closely rugose. Hind coxæ closely striated; about 4 times longer than thick. Basal abscissa of radius as long as the 2nd or nearly so. The pubescence is dense and silvery.

This species comes near to *G. orientale*, Cam., which is also from Deesa; the 2 may be separated, as regards the males, thus:—

Eyes hairy, pedicle of antennæ not much longer than wide, mesonotum and scutellum entirely red; prothorax shorter than mesothorax, thick ..... *orientale*.

Eyes bare; pedicle of antennæ more than twice longer than wide; mesonotum at apical half and scutellum black; prothorax as long as mesothorax, slender ..... *rotundicolle*.

*Gasteruption abuense*, sp. nov.

Black; the apices of the 2nd and 3rd abdominal segments broadly ferruginous; the base and outer side of the tibiæ and the base of the tarsi broad. 2

white ; the mandibles, except the teeth, rufous ; wings hyaline, the nervures and stigma black ; the head and thorax densely covered with silvery pubescence, calcaria minute, hardly as long as the width of the apex of tibiæ. Collar as long as the temples, densely covered with longish white pile ; finely rugose, a stout keel down its centre. Occiput transverse, margined ; it is not quite so wide as the length of the temples ; ocelli in a curve, the hinder separated from each other by a distinctly greater distance than they are from the eyes—by more than the length of the antennal scape. Basal 2 joints of antennal flagellum united, as long as the 3rd, which is longer (but not much) than the 4th. Mesonotum opaque, covered with white pubescence ; the puncturation is distinct ; the punctures clearly separated ; the apex is flat in the centre. Scutellum sparsely punctured laterally, the centre opaque, almost impunctate ; the basal furrow is transverse, narrow, but distinct. Median segment closely, rugosely punctured; towards the apex it bears round, separated punctures. Pleuræ alutaceous, densely covered with silvery pubescence. Parapsidal furrows narrow, oblique. Pleuræ alutaceous, densely covered with silvery pubescence. ♀.

Length 11-12 mm. ; terebra 7 mm.

Abu.

The hind legs are unfortunately absent.

*Evania deesaensis*, sp. nov.

Black ; the antennal scape, the first joint of flagellum, the 2nd and base of 3rd rufo-testaceous ; the fore legs testaceous, the middle femora and trochanters almost fuscous ; wings hyaline, the nervures and stigma testaceous, the stigma darker coloured than the nervures. Face strongly obliquely striated, the striæ stout, clearly separated, converging towards the middle of the face below ; the upper part of the face being quite smooth. Sternal process Y-shaped ; the apical forks straight, oblique. ♂.

Length 4 mm.

Deesa. February.

Eyes parallel ; the upper inner orbits bordered by 2 longitudinal striæ, of which the outer is the more distinct. Ocelli in a curve ; the hinder separated from each other by almost double the distance they are from the eyes. The antennal pedicle and the following joint together are as long as the scape ; the 3rd is distinctly shorter than the 2nd and about the same length as the 4th. Apex of pronotum transverse, with the sides rounded. Parapsidal furrows deep, converging towards the apex; the space between them covered with round, distinct, clearly separated punctures ; the outer edge of the mesonotum bordered by a narrow keel ; inside this is a stouter keel, which unites with the parapsidal furrows, forming a triangular area. Scutellum rugosely punctured. Median segment regularly, closely reticulated. Propleuræ filled up with 3 rows of punctures. Upper half of mesopleuræ smooth, shining ; the lower half filled with round, not very clearly separated punctures. Abdominal petiole not longer than the metanotum, stoutly, sharply, longitudinally striated.

Mandibles dark rufous, the teeth black at the apex. Palpi testaceous. Hind coxæ sparsely punctured in the middle. Calcaria testaceous, the longer, hinder, two-thirds of the length of the metatarsus. Radial cellule short, wide, the apical abscissa of the radius nearly as long as the basal 2 united. Transverse median nervure interstitial, as is also the recurrent; but the latter is angled before uniting with the transverse cubital. The hinder trochanters are almost half the length of the femora. Body and limbs (but especially the apex of metanotum) covered with a white pile. Malar space nearly as long as the 2nd joint of the flagellum—not half the length of the eyes. Temples wide, very little narrowed.

BRACONIDÆ.

*Braconinæ.*

*Iphiaulax spilocephalus*, sp. nov.

Reddish testaceous, the antennæ, head above the antennæ, and hind tarsi, except at base, black; the face, mandibles, except at apex and a line on the upper inner orbits, interrupted, or at least narrowed in the middle, pale-yellowish testaceous; wings yellowish hyaline to the top of the transverse basal nervure, fuscous beyond, hyaline in the 1st cubital cellule, extreme base of radial, small cloud in front of the recurrent nervure and a narrower one bordering the 2nd transverse cubital nervure. Abdomen ovate, as long as the thorax and broader than it; there is no area on the base of the 2nd abdominal segment, which is, as is also the 3rd, closely, longitudinally striated; the 4th and 5th closely, strongly punctured, the apical smooth; the middle lobe of 1st closely striated, the middle striæ stronger, more clearly separate and pale golden in tint; the lateral furrows wide, the inner part obscurely striated. Suturiform articulation wide, deep, crenulated, as is also the 2nd furrow; the apical are distinct, smooth. Head, thorax and base of abdomen densely covered with longish pale pubescence. Stigma ochreous yellow, black at the base. ♀ & ♂.

Deesa. April to October.

A variable species in size; a ♀ is 10 mm. long, with the ovipositor 4 mm.; another is 8; and a ♂ is only 7 mm. The species comes close to *I. elizeus*, Cam., from which it may be readily separated thus:—

A broad continuous line on the upper inner orbits and the face ivory white; abdomen long, narrow; apex of hind tibiæ and base of tarsi black ..... *elizeus*, Cam.

A narrow short interrupted or narrowed line on the upper inner orbits; abdomen short, broad, ovate; apex of hind tarsi not black ..... *spilocephalus*, Cam.

*Chelonina.*

*Chelonus indicus*, sp. nov.

Black, the abdomen immaculate, the apex of the 4 anterior femora (the middle narrowly), their tibiæ and tarsi, a broad band on the hind tibiæ commencing near the base and extending shortly beyond the middle, the basal three-fourths of the hinder metatarsus and the spurs, whitish testaceous; wings hyaline, a broad fuscous cloud in the middle filling the radial and basal 2

cubital cellules; the stigma and nervures fuscous; the basal nervures paler than the others, the stigma darker in front. ♀.

Length 5 mm.

Ferozepore. March (Major C. G. Nurse).

Middle of mandibles rufous. Clypeus shining, closely distinctly punctured; its apical half depressed; it is clearly separated from the face; the rest of the head closely rugosely punctured, more or less striated; the sides of the vertex with distinct curved striæ. Thorax closely rugose; the middle of mesonotum irregularly longitudinally reticulated, striated, weakly at the base, more strongly at the apex. Median segment longitudinally reticulated; deeply and strongly on the apical slope, which has, on the sides above, a stout triangular tooth. Abdomen with the basal half strongly, closely, irregularly, longitudinally striated, the striæ becoming gradually weaker; the apex is alutaceous, covered densely with a close white pile. Antennæ over 30-jointed; the apex is broken off. Palpi blackish, fuscous towards the apex. The punctuation on the lower part of the mesopleuræ is coarse and runs into reticulations.

*Microgasterinæ.*

*Pseudapanteles leptothecus*, sp. nov.

Black, densely covered with short white pubescence, shining, the apex of anterior femora broadly, their tibiæ and tarsi, the basal third of the middle tibiæ, the middle tarsi and the basal third of the hind tibiæ, testaceous; the spurs paler; wings very clear hyaline, almost lacteous, the costa, stigma and nervures almost white. ♀

Length 4·5 mm.; terebra 2 mm.

Deesa. January.

Scutellum large, longer than wide, narrowed towards the apex, shining, smooth, glabrous. Postscutellum longer than wide, bordered by 2 stout keels, which hardly converge at the base. Metanotum smooth, shining, glabrous; the apical slope with an indistinct pyriform depression. First abdominal segment almost square, depressed in the middle at the base; the other segments are wider than long, transverse, smooth and shining; the apical is covered with white pubescence. Sheath of ovipositor broad, narrowed at the base. Pterostigma large, widest in the middle, the basal slope rounded, the apical straight, oblique. Pleural furrow wide, deep, covered with white pubescence which gives it a striated appearance.

This species belongs to the genus *Pseudapanteles*, Ashm, which, however, is not recognised as valid by Szépligeti, who sinks it in *Apanteles*, (Hal.) al Cf. Genera Ins. Braconidæ, p. 105.

*Agathidæ.*

*Disophrys laticeps*, sp. nov.

Luteous, the antennæ, except the scape above, black, wings fuscous, the base to the middle of the transverse basal nervure and a cloud, gradually narrowed

posteriorly, between the base of the stigma and the apex of the areolet, yellowish-hyaline; the areolet square, of equal width; the hind wing fuscous, the basal third yellowish-hyaline; stigma pale luteous. ♂.

Length 8 mm.

Abu. June.

Head as wide as the thorax; the temples roundly narrowed, the occiput roundly incised; frontal laminæ stout. Areola large, obliquely narrowed towards the base and apex; the apical part the larger; its knees not so stout; on either side of its base is a large, triangular area, its apex at the middle of the areola; from the apex a keel runs obliquely to unite with the keel bordering the outer edge of the metanotum. Pro- and mesothorax punctured, the pleuræ more closely than the upper surface; the basal half of the mesonotum has 2 parallel furrows down the middle. Pleural furrow oblique, weakly crenulated, straight. Basal segment of abdomen large, triangular, longer than it is wide at the apex; the large wide central part of equal width, separated by furrows.

This is a broader, stouter species than usual; the abdomen is also wider, broader and more sessile at the base, it differing also in being clearly trilobate there. There is no stump on the 2nd transverse cubital nervure, but it is thickened in front. The lateral keels on the front are stout, high. The hind coxæ can hardly be called "short" as they are by Szépligeti (Gen. Ins. Brac. 124), for *Disophrys*, being more than twice longer than wide and reaching to the apex of the 1st abdominal segment. Hind claws simple.

ICHNEUMONIDÆ.

*Tryphoninæ.*

*Metopius pulchripes*, sp. nov.

Black; the head in front below the antennæ, the upper inner orbits to the anterior ocellus, the line obliquely narrowed above, mandibles, except the teeth, palpi, a broad line on the apical half of the pronotum, the basal lateral edges of the scutellum, a broad line on its apex, including the lateral teeth, post-scutellum, tubercles, base of mesopleuræ to near the middle, a spot on the sides of metanotum to near the top of apical slope, basal half of 1st abdominal segment, basal third of 2nd, the 3rd from near the middle, the 4th from shortly behind the middle, the base of the band trilobate, the lateral lobes larger than the central; a band, half the size, on the apex of the 5th, its middle broadly, squarely narrowed; narrow bands on the apical two, similar bands on the ventral segments; and the 4 front legs, bright lemon-yellow; the hind coxæ black, the trochanters and apex of femora narrowly yellow, the rest of the legs bright red. Wings hyaline, the apex of the radial and the 3rd cubital cellule smoky; the stigma testaceous, the nervures black; the antennal scape yellow, the flagellum brown, darker above. ♂.

Length 13 mm.

Abu. September.

Front and vertex closely finely punctured, striated above the antennæ; the face is more strongly punctured, especially in the centre; in front sparsely, behind the

eyes more thickly covered with longer white pubescence. Pro- and mesothorax strongly, closely punctured, the mesonotum more strongly than the pleuræ; these are densely covered with white pubescence. Scutellum punctured like the mesonotum; its basal depression deep, with 3 stout keels. Post-scutellum smooth, depressed in the middle at the base. Metanotum closely, rugosely punctured; its centre with 2 curved keels, converging at the apex, on the top of the apical slope; there is an indistinct keel between them at the base. Abdominal segments, except the apex of the 1st, strongly closely punctured.

This is a *Metopius*, s. str., the head being as wide as the thorax; and the 2nd joint of the maxillary palpi is greatly swollen.

*M. rufus*, Cam. (also from Abu), may be known by the rufous head and thorax.

*Ophioninæ.*

*Campoplex nursei*, sp. nov.

Black, a narrow short line on the lower side of the 2nd abdominal segment at the apex, and the following, except irregularly above, rufous, the 4th and 6th with the top black mark larger than on the others; the forelegs, except for a broad line on the base of the femora, the apex of the middle femora, their tibiæ and tarsi and the hind tibiæ except for a small black spot and a slightly larger mark on their apex, pale whitish yellow, as are also all the calcaria; mandibles, except the teeth and the palpi pale yellow; wings clear hyaline, the nervures and stigma pale yellow; the areolet large, the nervures almost touching in the middle; the recurrent nervure received in the middle. ♀.

Length 12 mm.; terebra 1 mm.

Abu.

Sides of front, face, clypeus, mandibles, and outer orbits densely covered with long silvery pubescence. Face and clypeus closely, rugosely punctured; the front and vertex much more sparsely punctured. Thorax more strongly punctured than the face; on the apex of the mesonotum the puncturation runs into reticulation, and there is a striated space before the scutellum, which is roundly convex and strongly, closely punctured, more or less striated. The puncturation on the metanotum is close, more or less transversely striated; there is a weak curved transverse keel at the base, but no area; the base of the metanotum is more finely punctured than the rest. Except at the base the propleuræ are closely strongly striated; the mesopleuræ more strongly punctured than the mesonotum, the punctures too are more clearly separated; behind the middle is a strongly striated band, the apex itself being smooth; the metapleuræ are more closely, finely punctured, smoother behind the spiracles.

Characteristic of this species are the yellow hind tibiæ.

*Tarytia*, gen. nov.

Wings without an areolet, the recurrent nervure received on the outerside of the transverse cubital, almost interstitial. Parallel nervure broken shortly above the middle; transverse median nervure interstitial, apical nervures in hind wings entirely absent. Clypeus not separated from the face, its apex

broadly rounded. The mandibular teeth large, of equal size, diverging. Metanotum irregularly areolated in the middle, the areola open at the apex; the spiracles small, oval. First abdominal segment clearly longer than the second; the post-petiole distinctly nodose. Ovipositor longish. Claws simple. Hind spurs long, nearly as long as the 2nd tarsal joint. Antennæ long, longer than the abdomen. Malar space distinct, not furrowed. Hind coxæ stout, about two-and-a-half times longer than thick; basal joint of hind tarsi nearly as long as the following 3 united. Eyes large, parallel, not incised.

In the arrangement of Szépligeti this genus would come near *Agrypon*, Foer. (Gen. Ins., Ichn Ophion., p. 6). The 2 may be separated thus:—

Spurs short; clypeus pointed, 2nd abdominal segment longer than the 1st... *Agrypon.*

Spurs long, clypeus broadly rounded, 2nd abdominal segment shorter than the 1st... *Tarytia.*

*Tarytia basimacula*, sp. nov.

Rufo-testaceous, the head yellow, a triangular mark covering the ocelli, the base of the 1st abdominal segment, and a broad stripe down the centre of the basal half of the 2nd black; the apical segments infuscated; legs coloured like the body but paler; mesonotum with 2 broad yellowish lines; wings hyaline, the nervures and stigma dark testaceous. ♀.

Length 8 mm.; terebra 2 mm.

Deesa. October.

Face and base of clypeus closely punctured, the apex of clypeus smooth. Front and vertex closely punctured, more strongly than the face; above each antenna is a longish deep fovea, the 2 distinctly separated by a broad keel. Eyes large; they have a greenish hue and do not converge above or below. Ocelli large, glassy, pale coloured, placed in a triangle; the hinder separated from each other by a greater distance than they are from the eyes. Mesonotum closely punctured. Scutellum roundly convex. Metanotum rugosely punctured; the apical slope strongly transversely striated. Pleuræ closely distinctly punctured; the base of the meso- and metapleuræ with a large irregular orange-yellow mark. Post petiole aciculated; the 2nd dorsal segment closely, distinctly, longitudinally striated; the base of the 3rd more weakly striated. The transverse keels on the metanotum are indistinct.

*Tarytia nigromaculata*, sp. nov.

Yellowish testaceous; the sides of mesonotum and the back of abdomen rufous; the head and the parts bordering the black line on the mesonotum lemon-yellow; the ocellar region, 2 broad lines on the middle of front, a large mark, narrowed above, on the middle of occiput, a broad line on the basal two-thirds of the mesonotum, the hollows at the wings, a broad mark, contracted near the base rounded at the apex, on the basal third of the metanotum in the centre, the base of the 1st abdominal segment, more than the basal half of the 2nd and the base of the 3rd, black. Four front legs pale yellow; the hinder rufous, the tibiæ and tarsi darker coloured than the femora, the coxæ and

trochanters pale yellow, a fuscous band near the base of hind tibiæ, a darker band on the apex of tibiæ; the tarsi infuscated. Wings hyaline, the stigma pallid testaceous, darker round the edges, the nervures paler; antennæ dark brown; the scape yellow, black above. ♂.

Length 7 mm.

Deesa. October.

Face and clypeus finely and closely punctured; the front and vertex somewhat more strongly punctured; the former raised in the middle, this part being rufous. Mesonotum and scutellum closely, strongly punctured; the scutellum with a rounded slope from the base to the apex. The metanotum is more strongly punctured; the posterior median area, *i.e.*, the apical two-thirds is closely strongly striated. Pleuræ, if anything, more strongly punctured than the mesonotum, the punctuation becoming stronger towards the apex. Abdomen smooth; the 2nd segment finely, closely, longitudinally striated.

*Tarytia flavo-orbitalis*, sp. nov.

Rufo-testaceous; the face, clypeus, orbits, mandibles, except at apex and 2 lines on mesonotum, pale lemon-yellow; the ocellar region slightly, the 1st segment above, except at the apex, the 2nd, base of 3rd and a slight spot on the apical 2, black; antennæ fuscous-black; the scape yellowish. Legs pale testaceous, almost white at the base. Wings hyaline, the nervures and stigma testaceous. ♀.

Length 8 mm.; terebra 3 mm.

Deesa. October.

Face closely punctured, the clypeus only very sparsely punctured; the front and vertex more strongly punctured; the hollows bordering the broad central keel striated; keel is broadened above. Mesonotum strongly, but not very closely punctured; the scutellum is almost smooth. On the metanotum is a small petiolar area; the areola is wide, bulges out roundly on the basal half; the posterior median area is not so wide and is slightly narrowed at the top and bottom; there is an indistinct keel on either side of the apex. Post-petiole finely and closely, the 2nd segment more strongly and as closely striated.

*Tarytia cariniscutis*, sp. nov.

Testaceous? (the specimen is discoloured), a broad line on the basal half of the 2nd abdominal segment above, the basal half of the 3rd, the black extended down the sides, and similar marks on the apical two, black; antennæ fuscous, lighter coloured below, the scape yellow. Wings clear hyaline, the stigma and nervures pale testaceous. ♂.

Length 8 mm.

Deesa. July.

The head unfortunately has got crushed; the face and clypeus are closely punctured. Thorax closely, but not strongly punctured; the propleuræ smooth. Scutellum closely punctured; keeled laterally to near the middle; the keel

highest at the base. Petiolar area distinct, triangular, the keels broad, uniting at the apex into one; areola wide, roundly narrowed at the base, slightly narrowed towards the apex, it extends to shortly below the middle; the keels then bulge out slightly and run to the apex, this widened apical part being shorter than the upper, which is weakly and sparsely striated, the lower, strongly and closely transversely striated. The 2nd segment above is finely, closely, the base of the 3rd more weakly striated. Genital valves broad, long, largely projecting.

May be known from the other species by the scutellum being keeled beyond the base and by the large, distinctly defined petiolar area.

This species also differs from the others in having distinct parapsidal furrows.

*Zaporus? argenteopilosus*, sp. nov.

Black, densely covered with longish silvery pubescence, the antennal scape except for a line above, mandibles, except at apex, palpi, the 2nd and 3rd abdominal segments at the sides, the others entirely and the legs except the coxæ and trochanters, rufous; the 4 anterior legs of a paler colour; tegulæ yellowish; wings hyaline, the stigma and nervures black. ♀.

Length 9 mm.; terebra 2 mm.

Deesa. June.

Head closely, somewhat strongly punctured, as is also the thorax; the pubescence on the base of scutellum and on the sides of metathorax longer and denser than elsewhere. Scutellum prominent, roundly convex; the post-scutellum densely covered with silvery pubescence. Abdomen smooth, shining, the 2nd segment faintly aciculated. Base of hind femora and tibiæ and apex of tibiæ black.

The metanotum is distinctly areolated; the areola large, longer than wide, closed at base and apex; the base transverse in the middle, with the sides oblique; the apex is roundly turned inwardly: there are 2 large lateral areæ, the apical the larger; the apical slope is keeled round the edges; spiracles oval, about twice longer than wide. Post-petiole distinctly dilated. Recurrent nervure received distinctly beyond the transverse cubital which is longish; the transverse median nervure interstitial; the apical nervures in hind wings obsolete, the transverse median nervure unbroken. Claws with at least 3 longish spines. Clypeus not separated from face; its apex rounded. Mandibles large, the upper tooth longer and sharper than the lower. Labrum projecting, broad. Radial cellule long; narrowed at base and apex, widely, indistinctly angled at the transverse cubital nervure. Abdomen dilately laterally on the apical half.

This may not be a *Zaporus*; it comes nearest to that genus in the Foersterian-Ashmeadian systems.

*Nototrachus flavo-orbitalis*, sp. nov.

Head and thorax rufous, the face, except in the centre above, the orbits broadly all round, a line on the sides of mesonotum, dilated roundly, inwardly at the base, scutellum, except the basal slope and more narrowly at the apex, a

line on the lower part of propleuræ, dilated at the apex, a small, triangular mark below the tegulæ, a larger one in the middle below, a still larger, triangular mark below the hind wings and the apical half of metanotum, the spot narrowly dilated in the middle above, yellow; the ocellar region and the front broadly—the mark broadest above, a mark on the base of propleuræ in the middle, the scutellar depression and keels, the lower sides broadly, a spot covering the spiracles on metanotum and the abdomen, except the basal half of 1st segment (which is dull red), black. Four front legs rufo-fulvous, the coxæ yellow; the hind legs black, the coxæ rufous, the femora largely rufous. Wings hyaline, iridescent, not much longer than the head and thorax united: the stigma and nervures black. Antennæ black, the scape rufous below. ♂.

Length 9 mm.

Deesa. February.

Face closely, the clypeus sparsely punctured; the latter broadly black above, narrowed below to a point which is bidentate; the black central part of front strongly, transversely striated and keeled down the middle, the sides punctured. Vertex sparsely punctured laterally and between the ocelli. Mesonotum reticulated, the base in the centre finely, minutely punctured, the sides transversely striated; the outer edges with large, clearly separated punctures. Scutellum coarsely punctured; the lateral keels black, distinct. Base of metanotum bordered by a transverse keel, smooth, with 2 keels in the middle; the rest reticulated and thickly covered with longish white pubescence. Propluræ smooth at the base, the apex above punctured, the rest stoutly, longitudinally striated. Mesopleuræ rugosely punctured; more or less reticulated, the top stoutly striated at the base, smooth at the apex; the apex with stout striæ. Metapleuræ reticulated. Abdomen at least 3 times longer than the thorax, very smooth and shining.

*Pimplinæ.*

*Xanthopimpla maculifrons*, sp. nov.

Luteous, the abdomen largely marked with rufous; the mesonotum with 3 rufous stripes, an elongated triangular spot covering the ocelli, an irregular spot, broader than long, on the sides of metanotum at the base, 2 spots on the 1st to 5th abdominal segments and 2 larger, more oval, spots on the 7th, black; wings hyaline, the nervures and stigma black, the latter testaceous at the base; areolet small, triangular, almost appendiculated, the recurrent nervure received shortly beyond the middle. ♀.

Length 11; terebra 2 mm.

Deesa. June.

Areola large, 6-angled, the lateral angles at the middle; the apex transverse; it is longer than it is wide at the apex; tooth-bearing area large, 4-angled slightly narrowed on the innerside. Face strongly, but not very closely punctured; a longish depression, widest below, in its centre. Clypeal foveæ large, deep. Thorax smooth; the parapsidal furrows narrow, extending to the middle. First abdominal segment about one-fourth longer than it is

wide at the apex; the keels reach to the middle; the 2nd to 5th segments strongly punctured; the 3rd to 5th closely and regularly; the 2nd with the punctures larger and sparser and with a smooth space down the middle. Antennæ blackish above, brownish below on the flagellum, yellow on the scape Apical third of hind tibiæ with short rufous spines, the lower part with more than the upper. Ovipositor as long as the basal 3 joints of the hind tarsi united.

*Xanthopimpla nursei*, sp. nov.

Luteous, tinged with rufous, the head pale lemon-yellow, with a black mark covering the ocelli and extending below close to the antennæ, the mark becoming narrowed below; 2 large oval marks on the centre of mesonotum on the lateral lobes, a spot on the depression behind the tegulæ, 2 oblique, ovate marks on the base of mesonotum, an irregular stripe across the middle of 1st abdominal segment, its centre narrowed and irregular, transverse marks on the 2nd to 5th, those on the 4th and 5th broader and more regular; and 2 large irregularly ovate marks on the 7th, black. Antennæ brownish black above. Wings hyaline, the stigma and nervures black. Ovipositor as long as the basal, 4 joints of the hind tarsi united. ♀.

Length 12 mm., terebra 2 mm.

Parapsidal furrows deep; indicated on the basal slope only. Areola large, 6-angled, narrowed at the base, as long as it is wide in the middle, before it begins to narrow; the lateral areæ not much narrowed on the innerside. Except at the base of the mesonotum in the middle, where it is weakly punctured, the whole of the thorax is smooth and shining; the mesonotum is thickly covered with whitish pubescence. Face closely, strongly punctured, the sides more weakly than the centre; the clypeus is not separated from it. Labrum long, gradually narrowed to a point. First abdominal segment impunctate; the 2nd at the base and middle smooth, the rest strongly punctured, the punctures clearly separated; the 2nd to 5th are closely, strongly punctured, except at the raised apices; the transverse furrow on the apex of the 2nd is wider and with the punctures larger and deeper. Basal slope of 1st segment strongly keeled on either side. Areolet small, triangular, almost appendiculated.

The middle of the face above and on the sides is bordered by shallow furrows; the face is as long as broad. Scutellar keels distinct from the base to the apex; higher at the base than at the apex. The 1st abdominal segment is one-half longer than it is wide at the apex. Apex of tibiæ with 2 rows of short spines.

The orange colour may be owing to discolouration.

CRYPTINÆ.

*Cratocryptus rufipes*, sp. nov.

Black; the eye orbits on the innerside and below, the line on the lower part dilated above, a squarish mark in the centre of the face, clypeus, basal half of mandibles, the dilated basal part of pronotum, a line on the propleuræ, at the base below, tegulæ, scutellum, the sides of metanotum at the apex broadly, the mark extending narrowly on to the pleuræ a large, irregularly oval mark

on the base of the mesopleuræ in the centre, a triangular mark under the hind wings, and the apices of the basal 2 abdominal segments broadly and of the others more narrowly, pale yellow. Legs red, the 4 anterior coxæ and trochanters distinctly, their tibiæ and tarsi less distinctly tinged with yellow; the hind knees, apex of hind tibiæ and the tarsi, black. Wings hyaline, the stigma and nervures black, the areolet small, almost square. ♀.

Length 7; terebra nearly 2 mm.

Deesa. October.

Antennæ longer than the body, thickened towards the apex; joints 9-13 for the greater part white. Middle of front below the ocelli coarsely irregularly reticulated-striated; the part immediately below the ocelli stoutly, obliquely striated; there is a smooth line in the middle of the punctured part, which is narrowed roundly below and does not reach to the antennæ. Face and clypeus strongly, closely punctured and covered with white pubescence. Pro- and mesothorax strongly closely punctured, more or less reticulated; the middle of scutellum, except at the base and the apex, broadly impunctate. Base of metanotum strongly punctured, the punctures clearly separated, the sides between the keels stoutly obliquely striated, more or less reticulated, the central part smooth at the base, the rest with large, separated punctures, the apical slope closely, distinctly reticulated; areola deep, shining, wider than long. Pleuræ and sternum opaque, closely, regularly, distinctly, but not coarsely punctured. Basal 2 segments of abdomen closely, somewhat strongly punctured, the 3rd more finely punctured, the others smooth. The metanotal teeth are not prominent.

The genus *Cratocryptus*, Cam. was described in the Journ. St. Branch Roy. As. Soc. 1905, p. 142, on a species from Borneo. It may be separated from that here described thus:—

Mesopleuræ immaculate, middle of face black, metanotal spines distinct, hind tarsi white ..... *maculiceps* Cam.

Mesopleuræ with a large yellow mark; middle of face yellow, metanotal spines indistinct, hind tarsi black..... *rufipes*, n. sp.

*Melcha nursei*, sp. nov.

Ferruginous, a line on the inner orbits, the base of pronotum, post-petiole, the 4th and following segments of the abdomen above, white; the antennal scape red, the flagellum black, with joints 9-11 white; legs coloured like the thorax; the 4 anterior tibiæ white behind; the posterior knees, tibiæ and tarsi black; the basal fourth of the tibiæ white; wings hyaline, the stigma and nervures black, the former with a white spot at the base. ♀.

Length 8-10 mm.; terebra 2 mm.

Deesa. February to December.

Face and clypeus closely, somewhat strongly punctured; the front irregularly obliquely striated above, the striæ running into reticulations; there is a stout keel down the middle; ocellar region rugosely punctured; the orbits are sparsely punctured. Mandibular teeth black. Palpi pale testaceous. Mesonotum closely, strongly punctured; faintly striated along the furrows; the

scutellum faintly striated. Base of metanotum finely irregularly striated behind the keel; the rest of the metanotum closely, strongly reticulated. Pro- and mesopleuræ closely, rugosely punctured; there is an oblique keel above the middle of the former. Metapleuræ closely rugosely punctured at the base; the apex stoutly obliquely striated, the striæ intertwining. Base of post-petiole strongly, but not closely punctured; it has an oblique furrow on either side; the apex is much more sparsely punctured, smooth in the middle; the 2nd, 3rd and 4th segments are closely, strongly punctured.

A variable species as regards size; the hinder femora may be infuscated towards the apex.

*Friona octobalteata*, sp. nov.

Black; the face, clypeus, basal half of mandibles, orbits, except the upper half of the outer, palpi, base of prothorax, scutellar keels, scutellums, the pleuræ below the hind wings broadly, the apical slope of metanotum with an A-shaped mark of the same length projecting backwards from its centre behind, tegulæ, tubercles, the base of the 1st abdominal segment to near the middle and the apices of all the segments broadly, pale yellow. Legs yellow, tinged with fulvous; the 4 anterior tarsi darker; the hind coxæ, trochanters and femora rufous, their tibiæ dark fuscous, broadly testaceous at the base, hind tarsi black, the apex of the 1st, the 2nd, 3rd and base of 4th joints black, white. Wings clear hyaline, the nervures and stigma black, the latter with a white spot at the base. ♂.

Length 11 mm.

Deesa. October (Major Nurse).

A stout keel runs down from the ocelli, the part bordering the ocelli stoutly, obliquely striated. Raised central part of face closely, rugosely punctured. Pro- and mesothorax smooth and shining. Metanotum, except at the base behind the keel, irregularly, transversely, rugosely striated. There is a striated band in the centre of the propleuræ; the meso-, as usual, closely, longitudinally striated; the meta- closely rugose, except at the base above. Areolet longer than wide along the radius; the recurrent nervure is received at the base of the apical third; the transverse median received behind the transverse basal.

*Ichneumoninæ.*

*Fileanta rufipes*, sp. nov.

Black; a broad line, narrowed above and below, on the upper inner orbits, a line on the apical half of the pronotum, scutellum, a narrow line on the apex of post-scutellum, a line, dilated laterally, on the apex of the 1st abdominal segment, a somewhat broader one on the 2nd and 3rd and the whole of the apical 2, yellow; the legs red, the apex of the hind tibiæ and the hind tarsi, black, the 4 front tarsi infuscated; wings hyaline, very slightly tinged with fulvous on the basal half; the stigma and nervures black, antennæ black, the 10th to 16th joints white; the other joints infuscated below. ♀.

Length 11-12 mm.

Deesa. June.

Face and upper part of clypeus strongly punctured, the punctures clearly separated; the depressed apex of the clypeus with a row of large deep punctures, the smooth sides at the apex with some smaller punctures. Front and vertex punctured closely, but not so coarsely as the face. Sides of clypeus at the apex laterally, and the mandibles, except at the apex, rufous; the clypeal foveæ large and deep. Palpi pale testaceous. Pro- and mesothorax closely punctured, the scutellum is not so closely punctures. Median segment strongly, irregularly punctured; the areola with the top slightly, roundly curved downwards; the apex much more deeply curved upwards; the sides slightly bulging outwardly; the inside stoutly, irregularly, longitudinally striated, the striæ intertwining; posterior median area strongly, transversely striated, the striæ running into each other; the lateral areæ stoutly, irregularly reticulated. Apex of 1st and the 2nd and 3rd abdominal segments closely punctured; the base of post-scutellum with scattered punctures; there is a curved closely finely punctured furrow on the base of the gastracœli. The stump on the disco-cubital nervure is minute, on the recurrent nervure it is longer; the transverse median nervure is interstitial.

The sides of the apex of metanotum above are slightly marked with rufous, the basal part of the 1st abdominal segment is largely rufous.

*Eutanyacra alboannulata*, sp. nov.

Black, the face, clypeus, basal half of mandibles, palpi, a line on the lower third of the inner orbits, a line on pronotum, not reaching to the base, widest at the apex, tegulæ, scutellums, a broad line on the apex of the 5th abdominal segment, a broader one on the 6th, almost the whole of the 7th and the tubercles, whitish-yellow; the apex of the 1st abdominal segment—the line broadest in the middle—and the whole of the 2nd and 3rd red; the legs red; the 4 anterior largely marked with yellow, their coxæ and trochanters yellow; the hind coxæ marked with yellow on the outer, with black on the inner side; the apex of the hind tibiæ broadly—more than the fourth—and their tarsi, except at the base, black. Antennæ black above, the scape yellowish below, the base of flagellum reddish brown below; the middle with a broad yellowish white band. ♂.

Length 11 mm.

Abu.

Face and clypeus closely strongly punctured, thickly covered (as is also the base of mandibles) with white pubescence; the front and vertex are more closely punctured; they are not so densely pilose. Pro- and mesothorax closely regularly punctured, shortly pilose. Scutellum roundly raised, more sparsely punctured than the mesonotum. Base of metanotum smooth and shining in the middle at the base, this part roundly narrowed towards the apex; the areola open at the base, transverse at the apex, slightly roundly narrowed towards the base, about as long as wide; it has a few irregular striæ; the lateral areæ are confluent; the rest of the segment is closely, rugosely punctured; the spiracles are large, wide, oval, about 3 times longer than wide; the keels rufous. Recurrent nervure received near the base of the apical fourth of the areolet.

Post-petiole closely, sharply, longitudinally striated; the 2nd and 3rd segments closely punctured; gastracœli shallow, smooth and transverse at the apex. Aedigus large, black, closely punctured and densely covered with black pubescence, longest on the apex below; looked at from the sides the upper (and larger) part is straight and oblique, the lower rounded; the 7th ventral segment is broad at the base, the narrowed apical (and large) part becomes gradually narrowed to a bluntly rounded point.

The following is a list of the described species from the Bombay Presidency :—

*Bethylinæ.*

*Mesitus indicus*, Kieffer, Bull. d. l. Soc. d. Hist. Nat. d. Metz, XII, 89. Bombay (Biro).

*Epyris montanus*, Kief., l.c., 89, Matheran. 800 m. (Biro).

„ *indicus*, „ „ 90 „ „ „

„ *conjunctus*, „ „ 90 Bombay, Malabar.

„ *feai*, „ „ Ann. d. Mus. di Stor. Nat. di Genova, XLI. 408.

*Epyris conjunctus*, Kief.

This species has been taken at Deesa by Major Nurse.

*Propristocera percurrens*, Kief., Bull. d. l. Soc. d. Hist. Nat. d. Metz, III, 97, Matheran. 800 m.

*Propristocera levicollis*, Kief., l.c., 98. Matheran. 800 m.

*Diapriidæ.*

*Trichopria indica*, Kief., l.c., 103, Matheran. 800 m.

CHALCIDIDÆ.

*Leucospisinæ.*

*Leucospis petiola*, Fab.

This species is, there can be no doubt, identical with *atra*, Fab. and *guzeratensis*, West. Cf. Schletterer, Berl. Ent. Zeit. XXXV, 224. It varies greatly in size and colouration. It may be entirely black, or with only a short line on the pronotum; or it may be largely marked with yellow. In one example are the following yellow markings:—the underside of the scape, a broad transverse line, narrowed at the sides on the base of pronotum, 2 lines, widened in the middle, on its apex, a line on the sides of mesonotum at the tegulæ, the apical half of scutellum, the mark deeply, irregularly incised in the middle at the base, an ovalish spot on the lower side of the propleuræ, a broad oblique line below the hind wings, a longish conical mark on the base of the hind coxæ, 2 conical spots, almost united at the base, near the base of the 1st abdominal segment, a narrow line at the base of the 2nd segment, a conspicuous line on the base of the 3rd, transverse and obliquely sloped at the apex, the base dilated at the middle; the apex of the 4 anterior femora, the tibiæ and base of tarsi behind, a large conical mark on the base of the hind coxæ above, a line on the base of the femora, broadly irregularly dilated to the apex below and the upperside of the hind tibiæ. The base of the

abdomen may be entirely black, or it may be largely ferruginous as in *petiolata*. The coxæ may be black, or almost entirely ferruginous.

Deesa. July and August.

*L. petiolata* has been taken by Mr. G. A. J. Rothney at Barrackpore, where he has also taken *L. semirufa*, Wlk.

*Chalcidinæ.*

*Chalcis responsator*, Walker, Trans. Ent. Soc., 1862, 355.
Deesa. March to August. Probably a common Indian species.
*Chalcis eccentrica*, Cameron, Manchr. Mem. xli, 1897, 39.
Bombay.
*Oncochalcis deesensis*, Cam., Zeit. f. Hymen. ii. Dipt., 1905, 285.
Deesa.
*Ozycorypus pilosellus*, Cam., The Entomologist, 1904, 110.
Deesa.
*Antrocephalus fascicornis*, Walker, Notes on Chalcidæ, 43.
Bombay.
*A. tarsalis*, Walk., l.c., 44.
Bombay.
*A. divisicornis*, Walk., 44.
Bombay.
*A. ornatipennis*, Cam., Journ., Bomb. Nat. Hist. Soc., 1900, 439.
Deesa.

*Torymina.*

*Ecdamua indica*, Walker, Notes on Chalcidiæ, 55.
Bombay.

EVANIIDÆ.

*Gasteruption orientale*, Cam., Manchr. Memoirs, 1888, 19.
Deesa. January to August.

BRACONIDÆ.

*Iphiaulax elizeus*, Cam., The Ent., 1905, 107.
Deesa. October to February.
*Bracon deesensis*, Cam., Journ., Bomb. Nat. Hist. Soc. 1900, 433.
*Vipio smenus*, Cam., The Ent., 1905, 107.
Deesa. March to August.
*Lisitheria nigricornis*, Cam., The Ent., 1904, 306.
Deesa.

ICHNEUMONIDÆ.

*Metopius rufus*, Cam., Zeit. f Hym. ii. Dipt., 1905, 281.
Abu.
*Exochus appendiculatus*, Cam., Journ., Bomb. Nat. Hist. Soc., 1900, 430.
Deesa.
*Lissonota xanthoria*, Cam., l.c., 426.
Deesa.
*Stictocryptus testaceus*, Cam., Zeit. f. Hym. in Dipt., 906.
Deesa. September.

# A FEW WORDS IN REPLY TO MR. E. W. OATES' PAPER ON THE SPECIES OF BEAN-GEESE.

(*Printed for Monsieur S. Alpheraky at St. Petersburg, 8th July* 1906.)

Mr. Eugene W. Oates has, in the journal of the "Bombay Natural History Society" (April 23, 1906), published a paper on the species of Bean-Geese with a plate of drawings of their bills and a postscript, containing a very severe criticism of my book "The Geese of Europe and Asia".

The Author says that I have by this work "*rendered the study of these birds more difficult in future*". How far Mr. Oates is right in this his opinion I shall try to shew in the following lines.

I shall speak of the species in the order Mr. Oates has placed them.

1. ANSER ARVENSIS, Brehm. (Bill, fig. 1).

To begin with, Mr. Oates seems astonished at the great size of the bill as represented by Mr. Frohawk on the plate which accompanies his paper. Had Mr. Oates read what I have said about this Goose in my book, he would have seen that considerably larger bills in this species are by no means of rare occurrence.

Mr. Oates acknowledges that this Goose is the Bean-Goose proper of Great Britain, and I am glad, that in this case at least he agrees with what I have said on the subject in my work, and what I knew to be the case some four or five years ago.

I well remember that I had then written to Mr. F. W. Frohawk asking him to have the kindness to settle, by a careful comparison of British-killed specimens of Bean-Geese, the conclusion I had arrived at theoretically; that is, that *it could not be* the *Melanonyx segetum*, but the much bigger *Melanonyx arvensis*, that was the common Bean-Goose of the British Isles.

At the same time I had sent Mr. Frohawk the details I had worked out to surely discriminate between the two species. This Mr. Frohawk most obligingly did, and proved practically that my theoretical conclusions were correct.

That things stood so, can easily be seen from two papers (with illustrations of the bills) by Mr. Frohawk; one in the "Field", the other in the "Zoologist". I do not think that Mr. Oates could have arrived at the same conclusion by himself, since he clearly says that he has never even seen the skin of a *segetum*. Now to decide such a question, not knowing thoroughly both these Geese, and this in numbers too, is, to my belief, an absolute impossibility.

The Author further says: "Mr. Alpheraky would have us call the species the "Yellow-billed Bean-Goose", but I do not think that many persons will care to follow him in this." This, at all events, is an unmerited reproach, as never even had the intention of inventing a new English name for this Goose, but simply adopted the one proposed for this species by Mr. Frohawk in one of his above-mentioned writings. I find, however, that the name "Yellow-billed Bean-Goose" is by far a better one than, for example, the one Mr. Oates has found out for the next species, calling it the "European Bean-Goose,"

since, besides *Melanonyx segetum*, there are several other Bean-Geese in Europe, and to call one of them "European" seems not to have been a "happy thought" after all.

2. ANSER SEGETUM, Gmel. (Bill. fig. 2).

Mr. Oates, never having seen a skin of this species, knows it only from Naumann's and Mr. Frohawk's descriptions. I regret that he has not paid more attention to what I have said about it in my book, for, surely, he would have found there some details that he could not have found in either of the above-named authors' writings.

3. ANSER BRACHYRHYNCHUS, Baillon (Bill. fig. 3).

This common Goose in England seems to have been but very superficially examined by Mr. Oates, for, as we shall see it latter on, speaking of the so-called *Melanonyx oatesi*, the Author has apparently quite overlooked the most important of its specific characters.

On the other hand Mr. Oates does well in following my example, *i.e.*, in expelling this species from the list of Indian Birds.

4. ANSER NEGLECTUS, Sushkin (Bill. fig. 4).

Mr. Oates thinks that this Goose may frequent some parts of India in winter,—once more an opinion that has been previously expressed in my book. But it is true that his reasons for thinking so are widely different from mine, as I did not, nor could know, that this Goose had been obtained by the late H. Seebohm on the Yenissei river; a fact of great interest by itself. My conclusion about this Goose probably occurring in India during the winter months was based on the fact of its having been found wintering in Persia by Mr. N. Zarudny.

5. ANSER MIDDENDORFFI, Severtz. (Bill. fig. 5).

That this Goose has been met with in India is a very interesting fact, though one that was easy to foresee. The extremely small weight of the specimen mentioned by Mr. Oates, and its very small bill tend to show that it was a very young bird.

That Severtzoff's name "*middendorffi*" is to be kept for this Goose, instead of "*sibiricus*" as proposed by me, has been proved by Count Salvadori in the "Ibis" of 1905, and I at once accepted this correction ("Ibis," 1906, April), although, I here once more repeat, Severtzoff made the description of *middendorffi* after typical *arvenses*, and he also has made a complete set of blunders respecting its geographical distribution.

6. ANSER MENTALIS, Oates (Bill. fig. 6).

Mr. Oates expresses his doubts as to the Mandshurian specimen, quoted in my book, belonging to his *mentalis*. But it is as true a *mentalis* as is the typical specimen at the British Museum. That Stejneger's bird, obtained on Bering Island, is likewise a true *mentalis*, has been pointed out to Mr. Frohawk by me about four years ago, and (if I remember right, as I think I do *), Mr. Frohawk

* I am writing these lines in the country, where I have neither my book on Geese with me, nor my correspondence with Mr. Frohawk concerning the different Goose-questions.

then took my letter to Mr. Oates at the British Museum, where both these gentlemen compared the type of *mentalis* with Stejneger's drawing of the bill of the Bering Island bird, and decided that I was right in this identification.

Still, although I am sure that the bill figured by Mr. Stejneger represents *mentalis*, I cannot recognise, as Mr. Oates evidently does, in Mr. Stejneger's description of the two other specimens from the same locality the *mentalis*, and I think that, most probably, both of them belonged to *middendorffi*.

Mr. Oates further says, that I have not devoted a single line to his original description of *mentalis*, and s. o. But I really think that I have said in my book everything that is to be found in Mr. Oates' original description.

That the white chin is of absolutely no value as a specific character in the Bean-Geese, as also *now* thinks the Author, I have clearly shewn in several places of my book.

I also believe having said that, personally, I do not think *mentalis* is anything but a huge-billed geographical race of *segetum* (or *serrirostris*, which is only the Eastern form of *segetum*), but that the question is not to be settled before a sufficient number of specimens of this Goose can be carefully studied. I also have given in my book all the pros and cons of the question, and if ever it is proved that *mentalis* is really a separate species, I shall be the first to confess my error and to acknowledge the fact.

7. ANSER SERRIROSTRIS, Swinhoe (Bill. fig. 7).

Contrarily to Mr. Oates' statement, this Goose is not only known from Swinhoe's description, but from the writings of several authors. It is true that Taczanowski, Przevalsky, Schrenck, Maak, etc., have spoken of it under the name of *A. segetum*, but all these *segetum* from Eastern Siberia and China are most decidedly *serrirostris*, as is confirmed by the specimens in the Zoological Museum of St. Petersburg and other skins from the extreme East of Asia I have had the opportunity of studying.

In all these specimens the light parts of the bill have been noted (by the collectors) as yellow or orange-colour, not in a single instance as pink or flesh-colour.

Still, if Mr. Oates had really paid a little more attention to the book he so severely condemns, he would have seen that I have mentioned three specimens of *serrirostris* from the Anadyr river, in which the bills had the light parts flesh-colour in life (but they are yellow now in the dry skins*).

I do not wish to say anything more about this Goose, as it shall soon be done by Mr. Buturlin, who has had the opportunity, last summer, of studying and collecting this Goose in its breeding grounds, and this too in considerable numbers. It is better to wait for what Mr. Buturlin has to tell us about the bird from personal observation than to continue to discuss the question over only a few dry skins at our disposal.

* Mr. Oates' plate represents the colour of the *serrirostris* bill of the same tint as are those of *brachyrhynchus* and *neglectus*, but we know that it could not have been copied from a freshly-killed specimen.

8. ANSER OATESI, Rickett (Bill. fig. 8).

When I first saw Mr. Rickett's description of this so-called distinct species, I at once understood that something was wrong about it. "Similar in size and plumage to *A. brachyrhynchus*, but with a much larger bill and white chin" is a very vague way of describing a Goose of this difficult group. And so it proved to be the case.

At the time I was preparing my book I could not *guess* that another entire skin of the bird had reached the British Museum, as Mr. Oates tells us the fact only now, and that is why I placed the name as synonym to *Melanonyx neglectus* with two "??". Well, now that we know from Mr. Oates' paper and from the drawing of the bill on his plate what this Goose surely is, we shall simply change its position, transferring it to the synonyma of *Mel. segetum*, leaving out the two now unnecessary "??". The only thing that could have saved *Melanonyx oatesi*, would have been the fact of its really having the plumage "*similar to that of brachyrhynchus*" which would necessitate *ashy-grey upper wing-coverts*, as this last species has them, and which are its most important specific feature. Now Mr. Oates, who has examined this entire skin of the supposed new species of Goose, does not say a word about the colour of its upper wing-coverts, which would have at once settled the question of the validity or not of *Mel. oatesi*.

The bill on Mr. Oates' plate represents a typical, though somewhat heavy-billed specimen of *Mel. segetum* which, at the same time is not, as Mr. Oates supposes, about the same size as *arvensis*, but a much smaller bird.

I have seen both species freshly killed, lying side by side, and could always surely distinguish them by the difference in size at a distance, not even having to look at the differently-formed bills. But what Mr. Oates seems to have completely overlooked, is that *brachyrhynchus* had so very pale ashy-grey wing-coverts, or he would not have found that Mr. Rickett's short description, containing the "similarity" of plumage with *brachyrhynchus* was sufficient. As however, in scientific matter prudence is of the greatest importance, I here declare that, in case this Goose (*oatesi*) has really the wing-coverts ashy-grey (a highly improbable thing) it must belong to a separate species from *segetum*, though with exactly the same bill as in this last.

And now I come to ask the impartial reader to decide if I am as guilty, as Mr. Oates will have it, of having "*rendered the study of the Geese more difficult in future*" by my book on the "Geese of Europe and Asia." Excepting the two facts:—that *neglectus* has been found by Seebohm on the Yenissei, and that *middendorffi* has been obtained in India, which were not known to me, I fail to find a single statement in Mr. Oates' paper that has not found its place in my work.

## POSTSCRIPT.

Mr. Oates considers all the species of Geese he deals with in his paper, under the heading "The Bean-Geese," as a separate group of the sub-family *Anserina*. This is quite obvious, and in this he is perfectly right. But why

then does he not accept the scientific name *Melanonyx*, proposed for these birds by Mr. Buturlin ? I think that a word about the reasons of his not accepting the genus *Melanonyx* would have proved of interest to systematists. My idea is, that Mr. Oates does not give us his reasons, simply because such do not exist.

# ON BEAN-GEESE

BY

S. A. BUTURLIN, F.M.B.O.U.

In No. 1, Vol. XVII of the "Journal of the Bombay Natural History Society," Mr. Eugene W. Oates has published an interesting paper on the species of Bean-Geese, with a coloured plate, stating, that his paper may be defective in some respects from lack of material and information. Having not long ago devoted considerable pains to a study of this difficult group in the field and cabinet, may I be permitted to add here some notes on it?

Mr. Oates figures (Fig. 7) and describes the bill of *Anser serrirostris*, Swinh. as being *pinkish-red* on its pale parts. Now, I have shot *A. serrirostris*—indeed scores and scores of it—in the valley of Kolyma, N. E. Siberia, from their first arrival, 22nd May 1905 (fully three weeks before the fathom-thick ice of the great river began to move) to 23rd September, when cold, snow and ice drove the last one away to milder climates. I have seen numbers of them alive caught by natives when moulting, and always recorded the colours on the spot. They all have the pale preapical band of the bill yellow (shades of chrome-yellow), as they were quite correctly figured in Mr. Alphéraky's work "The Geese of Europe and Asia" (London, Rowland Ward, 1905, pl. 23.) In the case of some of the birds, shot through the head or upper part of neck, this colour changes to pink, sometimes so soon as about an hour after death. This fact may account for Swinhoe's statement (Swinhoe's papers are duly recorded by Mr. Alphéraky).

I may add that among *A. serrirostris*, as among other Bean-Geese, some few specimens have some white on the chin. It is plainly an individual feature, having nothing to do with age or sex. The bird is rightly considered by Mr. Alphéraky as a subspecies of *A. segetum* Gm. as intermediate specimens occur, with bills about 60—63 m/m. (2·37-2·48 inch) long and 34 m/m. (1·35 inch) high at base, and depth of lower mandible about 9·5-10·5 m/m. (0·37-0·41 inch). Such specimens, when unsexed, can be identified only from the labels (locality).

*Anser carneirostris*, Buturlin.—This is another local race of *A. segetum* differing not in form, as *A. serrirostris*, but in colouring of bill. While the typical form (and eastern heavily billed race) has legs and pale parts of bill chrome-yellow (not uncommonly somewhat orange tinged), *A.*

*carneirostris* has only the legs of the said colouring, and the band of the bill is pinkish flesh-coloured. The head is also somewhat darker. The bird breeds on Novaja Zemlia (where *A. neglectus* and *A. arvensis* also breed, but no typical *A. segetum*) and it was lastly procured on migration in Ufa Government (west of Ural range).

*Anser middendorffi*, Severtz—A specimen of this eastern or Middendorff's race of Common Bean-Goose is said to have been obtained at Myitkyina on the Irrawaddy, a ♂ with wing 18 inch, bill 2·75 inch, with traces of golden fulvous on head. It is scarcely doubtful that this Myitkyina bird is a typical *A. arvensis*, Brehm. Adult males of *A. arvensis* not uncommonly have bills longer than 2·75 (70 m/m), and wings much longer than 18 inch. Such specimens I met with, not only on Novaja Zemlia, but in the western half of Russia also (lake Ilmen, Novgorod Government). But never have I seen an adult bird (with the yellow on the bill developed) (♂ or even ♀) of the eastern bird (*A. middendorffi*, Auct.) with culmen shorter than 73 m/m (2·87 inch.), and the males ordinarily have it much longer, and wing longer than 18·5 inch. I may add, that the breeding range of typical *A. arvensis* includes Central Siberia, where (as also in Turkestan) *A. middendorffi*, auctorum, does not occur. Shades of head-feathering have no diagnostic value.

As to the name of the eastern race (or perhaps quite a good species) Mr. Oates states "Mr. Alphéraky has bestowed a new name on this goose *on the ground that we do not know to which species* of Bean-Goose Severtzoff's name *A. middendorffi* applies." It is almost unnecessary to say that Mr. Alphéraky says nothing of the kind. Every careful reader of Mr. Alphéraky's capital work can see (p. 105), that this author studied all the Bean-Geese of Severtzov's collection, including the types of *A. middendorffi*, and found them all to be ordinary *A. arvensis*. I may add, that this was only to be expected, as no one has ever met with true Middendorff's Bean-Goose (*i.e.* with the bird described and figured by the great voyager) in Turkestan. Seeing that "*A. middendorffi*" of Severtzov is a plain synonym of *A. arvensis*, Mr. Alphéraky had only one course left: to give a new name (*sibiricus*) to the East-Siberian bird, *A. grandis* of Middendorff (nec Pall), *A. middendorffi* of authors (nec Severtzov!). If the late Dr. Severtzov, in giving a new name to his Turkestan specimens of *A. arvensis*, acted under a false impression that they were identical with East-Siberian

birds figured by Middendorff, this error in judgment does not alter the facts which are easily ascertained by a study of the original specimens. Thus *A. sibiricus*, Alphéraky, is the only correct name for this eastern bird.

*Anser oatesi*, Rickett.—This bird was described in 1901 from one unsexed specimen as being similar to *A. brachyrhynchus*, but with much larger bill (and white chin, as often is the case in this group). Now Mr. Oates (Fig. 8) figures its bill yellow, as Mr. Rickett "has a recollection that the pale part of the bill was yellow in life." Later another specimen (sex not stated) was sent to the British Museum, but all that is said by Mr. Oates about it is that it has wing 17·2 inch (as against 16·4 of the first) and bill 2·5 inch (against 2·3). Mr. Oates thinks that this bird requires no further description, and though its bill resembles that of *A. segetum*, being somewhat longer and higher, the length of wing, in Mr. Oates's opinion, will suffice to separate the two species.

As to myself, though somewhat acquainted with Bean-Geese in general, *A. oatesi* after this description rests as mysterious as ever. First of all, a recollection of the colours of birds one has shot once or twice several years ago, is ordinarily somewhat a vague thing. Then, it is not quite clear, why the bird was compared, not with *A. segetum*, but with *A. brachyrhynchus*, if its bill* was yellow-ringed as in *A. segetum*. Further, as *A. brachyrhynchus* differs strongly from *A. segetum* in some details of feather-colouring, it would be interesting to know, to which of them Mr. Rickett's specimen is nearer. In *A. brachyrhynchus* the upper wing coverts on primaries and (larger series) on secondaries are light lavender grey; in *A. segetum* the primary coverts are dark lavender grey, in contrast with brownish larger secondary coverts.

Further still, the length of wing—being 16·4—17·2 inches in two unsexed specimens—cannot suffice to separate these birds from *A. segetum*. Mr. Oates freely admits that he has never seen *A. segetum*. I have seen and shot them on Kolguev Island, and still have some specimens (from Kolguev and Pechora) in my private collection; and can state, that adult specimens have wings from 410 m/m (16·15 inch) upwards.

Last but not least: differences between *A. oatesi* and *A. serrirostris* surely deserve further description. Not a word is devoted to this

* And legs also? Surely its legs "require further description," as many other points.

point. The bill figured in Mr. Oates's paper (Fig. 8) as that of *A. oatesi* is, however, plainly that of *A. serrirostris*. Among females *A. serrirostris*, collected by me in Kolyma's valley, several have bills point by point identical with the figure 8 of Mr. Oates's plate, and no longer wings. As *A. serrirostris* was first described from China, and in several of my Kolyma birds I found on dissection old iron shot of Chinese shooters, it is only to be expected, that Fohkien birds belong to this species, being small individuals of it.

As to the first specimen, its bill is somewhat small *for a fully adult* specimen of *A. serrirostris*. But, then, it is here the place to state, that eastern specimens of true *A. segetum* also visit China, as pointed out by Mr. Alphéraky.

As to myself, I am by no means *quite* sure, that the so called *A. oatesi* has a yellow bill and is consequently identical with the eastern race of *A. segetum* (= *serrirostris*). After all it may turn out, that my *A. carneirostris* goes as far east as China to pass the winter, and having a pinkish-banded bill, (though orange-yellow legs,) could be described as similar to *A. brachyrhynchus*, but with a larger bill. In this case the name *oatesi* must stand, having priority ("*carneirostris*" was published 13th April 1901). But fuller description of the existing two specimens is needed.

Mr. Oates devotes some space to a criticism of Mr. Alphéraky's work on Geese, stating that it is only a Monograph of Russian Geese, that information given is from Russian sources, that full synonymy is not given, etc. As a matter of fact, in Mr. Alphéraky's work all species and subspecies of all true Geese (subfam. *Anserinæ*) of the Old World are fully treated of; full synonymy is given (though references—very rich indeed—are mostly devoted to works having something new or noteworthy in them: the author thought it was of no use to follow the much abused system of endless copying from the Catalogue of British Museum, etc., of long lists of papers, if even nothing more than a "*nomen nudum*" of a species can be found there).

Mr. Alphéraky, knowing well most European languages, utilised for his work all valuable information that is to be found in works of most European, Indian, and American ornithologists. If he *adds* to it also all information from "Russian sources" how can this addition detract from the value of his work? Surely it is a somewhat peculiar point of view,—the more so as out of twenty-two species of Geese treated in the

work above named, only two do not breed in the Russian Empire, and only nine do breed in Europe or Asia outside of Russian limits.

Mr. Alphéraky's "Geese of Europe or Asia" is till now the *only* work that gives means to discriminate, without a large library, between all species and subspecies of Old World Geese. For instance, though differences between such sharply distinct species as *A. segetum* and *A. arvensis* were justly pointed out more than half a century ago by the greatest ornithologist of all lands, Naumann,—these birds were nearly always confounded together, especially in England. Mr. Oates himself (1899, "A Manual of the Game Birds of India," II, p. 74-75) treats them both under one name "*A. fabalis.*" And only Mr. Alphéraky, after fifty years of confusion, rediscovered their distinctness. Mr. Frohawk's papers on these birds, mentioned by Mr. Oates, are *confessedly* only results of Mr. Alphéraky's investigations (cf "The Field," 1902, No.-2597).

WESENBERG, ESTHONIA, RUSSIA,
16*th August* 1906.

# A NEW KRAIT FROM OUDH (*BUNGARUS WALLI*).

By

Captain F. Wall, I.M.S., C.M.Z.S.

(With a Plate.)

(*Read before the Bombay Natural History Society on 24th January* 1907.)

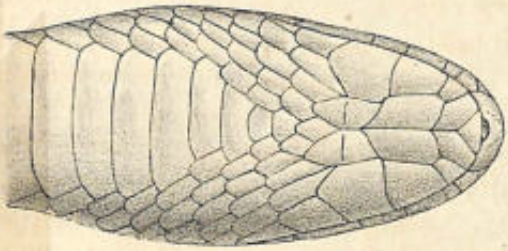
Our Indian fauna has just been enriched by a remarkably handsome and large Krait which I have had the good fortune to discover in Fyzabad.

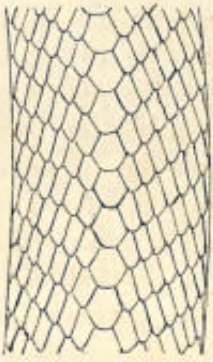
Fyzabad, I may mention, seems to offer peculiar attractions to the Common Krait (*B. candidus*) which I have never known nearly so abundant in any other locality. Since the 17th of June this year (the day before the rains broke) up to the date of writing (August 29th), I have had 47 of this species brought in to me!

On August 6th I had a small Krait brought me in the morning, which attracted my attention at once by its colouration and markings. A closer investigation showed me that there were several other peculiarities which convinced me the species was one new to science. At the Club in the afternoon I was pursued by an urchin who produced another specimen which, to my satisfaction, I found to exactly accord with the morning one, and after getting home while dressing for dinner the same boy brought me a third, identical in the peculiarities first noted. Thus in one day I acquired three specimens of a snake hitherto unknown! I may mention that the day's bag exceeded 100 snakes of all kinds! These three Kraits were all small.

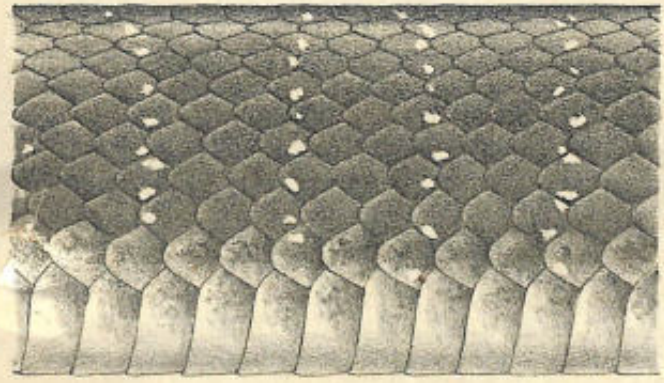
Since this I have obtained 8 of the same species, and though I believe it a breach of ethics for any naturalist to call a species after himself, the fact that this is the first new snake I have discovered in 11½ years' hard collecting, may be pleaded as sufficient excuse for commemorating the event and attaching my own name to it.

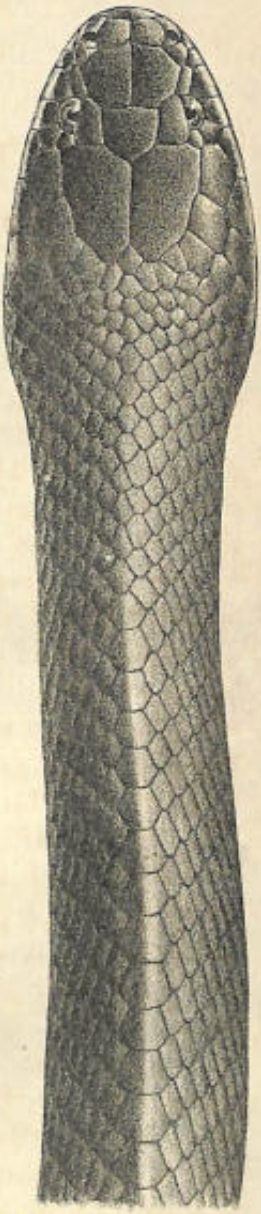
*Description. Rostral*, broader than high, touches 6 shields, the sutures made with the internasals are twice those made with the 1st labials, and two-thirds those with the anterior nasals. *Internasals*, a pair; the suture between them rather less than half the suture between the prœfrontal fellows, three-quarters the internaso-prœfrontal suture. *Prœfrontals*, a pair; the suture between them about twice the prœfronto-frontal suture; each touches the internasal, postnasal, præocular, supraocular, and frontal. *Frontal*, touches 6 shields, of which the





*a.*





J. Green del et lith.

NEW INDIAN SNAKE.

Bungarus walli.

parietal sutures being rather the largest, and the prœfrontal rather the smallest. Length about half the parietals. *Supraoculars*, breadth about three-fifths the breadth of frontal, length about three-fourths frontal. *Nasals*, divided; touching the 1st and 2nd supralabials *Prœocular*, one.

*Eye*, jet black, in life, not revealing the pupillary shape. *Postoculars*, two. *Temporal*, one anterior, touching the 5th and 6th supralabials. *Supralabials*, 7; the 2nd unusually narrow, decidedly more so than any other in the series; the 3rd and 4th touching the eye. *Anterior sublinguals*, rather longer than posterior. *Posterior sublinguals*, touch the 4th only of the infralabial series. *Infralabials*, 4; the 4th largest, nearly twice the breadth of the posterior sublinguals, and in contact with 2 scales behind; the suture between the first about half the suture between the anterior sublinguals. *Scales*, 2 heads lengths behind head 19, midbody 17, 2 heads lengths before vent 17. Vertebral row considerably enlarged, at midbody the breadth exceeding the length of a scale. Last row fairly enlarged. *Ventrals*, 203. *Anal*, entire. *Subcaudals*, 55, all entire. *Configuration*, the body is decidedly compressed. *Colour*, black with a greyish tinge. Body striped with a series of close-set white arches, which are about equidistant, fading anteriorly and composed of a chain of white dots. The head is black above, the upper lip yellow, fading to white at the margin. No trace of prœocular white spot. Belly rather a yellowish white, unspotted. Mottled plumbeous beneath the tail. This description is taken from a large adult. The other specimens agree in every respect with the following exceptions :—

| Sex. | Length. | Scales. | | | Ventrals. | Subcaudals. | Rostral. |
|---|---|---|---|---|---|---|---|
| | | 2 Heads lengths behind head. | Midbody. | 2 Heads lengths before vent. | | | |
| ♂♂♂♀♀♀♀♀ | 1′ 7¼″ | 17 | 17 | 17 | 202 | 54 | Height exceeds breadth. |
| | 1′ 6″ | 17 | 17 | 17 | 198 | 52 | Ditto. |
| | 1′ 3½″ | 17 | 17 | 17 | 198 | 52 | Ditto. |
| | 4′ 4″ | 19 | 17 | 17 | 203 | 55 | Ditto. |
| | 2′ 8″ | 19 | 17 | 17 | 204 | 53 | Ditto. |
| | 3′ 5¾″ | 19 | 17 | 17 | 207 | 55 | Ditto. |
| | 4′ 11¾″ | 19 | 19 | 17 | 202 | 51 | Ditto. |
| | 1′ 7¾″ | 17 | 17 | 17 | 203 | 52 | Ditto. |

*Identification.* The family resemblance of the members of this group is very striking and no single species presents a greater number, or more pronounced distinguishing characters than this new species, not even *B. fasciatus.* It is probably more nearly allied to *B. sindanus* than others of the genus. *B. sindanus* is the only other of the genus that has its scales in 17 rows.* From *sindanus* this species differs in the following ways :—(1) the length of the frontal is about half the parietals (in *sindanus* about two-thirds) ; (2) the 2nd supralabial is remarkably narrow, decidedly more so than the adjacent supralabials (in *sindanus* the first four supralabials are equally broad ; (3) the vertebrals are broader, thus in midbody they are distinctly broader than long ; in *sindanus* they are longer than broad ; Mr. Green has taken great pains to show this accurately, by making tracings from the types of each, which are shown side by side in the accompanying Plate, that marked "*a*" is *sindanus* ; (4) the ventrals—198 to 207—are fewer (in *sindanus* they are 220 to 237) ; (5) colour—the white arches are finer, and not arranged in pairs (in *sindanus* they are decidedly broader, less interrupted, and disposed in pairs) ; there is no white prœocular spot, (whereas in *sindanus* a more or less distinct spot is present); the tail is mottled beneath at the tip (in *sindanus* it is pure white) ; (6) the distinctly compressed body is remarkable, and is not seen in any of the other Kraits. Points 1, 2, 5 and 6 enumerated above as typical of *sindanus* are the same in *sindanus* and *candidus*, so that in these respects *walli* also differs from *candidus.* The three young specimens were all obtained by the same urchin on the 6th of August, who says whilst digging he disturbed a whole nest of young snakes some inches below the soil. The objection to this story is that they came in at considerable intervals during the day, the first at about 11 a.m., the second at about 6 p.m., and the third at about 7-30 p.m. The large adult was said to have been found some four feet high in a big tree.

For those who may find my statement of over 100 snakes in one day hard to credit I would point out that I have been generous in the matter of rewards this rains, and that just now the whole country is

* I am aware that Mr. Boulenger (Catalogue of Snakes in the British Museum, Vol. III. p. 349) says in his description of *B. candidus*, the rows are rarely 17 ; but this was written at a time when a specimen in the British Museum collection with 17 rows was included with this species, but was subsequently recognised by him as distinct, and exalted to the rank of a species under the name *B. sindanus*. I believe there is no instance of *B. candidus* known with 17 rows of scales.

flooded for miles. Across the river, where there are patches of ground here and there not submerged, creatures have congregated in swarms, including such large beasts as wild pig and nilghai. A private in the regiment here, who had been out shooting on islands left in the flood, told me on that day that these places were crawling with snakes, and he brought me 17 in support of his statement.

From my waking moments when I was dimly conscious from the buzz of subdued conversation in my verandah that snakes were awaiting me, up till 8 o'clock when I retired to dinner, fresh arrivals bearing snakes alive and dead made their appearance almost every five minutes in the day, and although "the bank broke, and the shutters were up" at about 4 p.m., still they came. It was the red-letter day of my life, and no miner striking the richest reef could experience a greater degree of enthusiastic joy than was elicited from me the entire day. At intervals I emerged to interview those waiting, and the scene was a remarkable one. Boys of all sizes and men were to be seen bearing specimens of every size, in every stage of vitality, and in every manner. Here a solitary little specimen with its head bashed to pulp borne by a brat, nearly as diminutive, there one of formidable proportions in the hands of a man, liking the job none too well, but attracted by "*bakshish*". Here a batch of half-a-dozen tied into a bundle with grass or rags, the proceeds of a partnership including two or three urchins, there another partnership with a collection of 15 corpses jammed into an empty kippered herring tin. Here a small collection in the rose of a watering pot, stopped up with a plug of mud, evidently imprisoned with some degree of life, judging from the disappointment manifested by the partnership concerned when the three occupants were shaken out dead; there an active six-footer liberated from a cloth on to the floor by some impatient fellow in order to wrest my attention from less worthy objects. Here a wriggling object, suspended from a bamboo, held at the remotest distance from the bearer, there again, others more or less alive, attached by their bodies to lengths of grass, rush or strips hastily ripped from clothing, and displaying an activity commensurate in the first place, with the extent of their injuries, and in the second with the amount of stimulation meted out by small boys treading violently on their tails in order to warrant the eager announcement "*jeta hai, Sahib,*" and merit the major reward. The spectacle will linger vividly in my memory all my life.

# SOME NEW ASIAN SNAKES.

By

Captain F. Wall, I.M.S., C.M.Z.S.

(With 2 Plates.)

(*Read before the Bombay Natural History Society on 24th Jan.* 1907.)

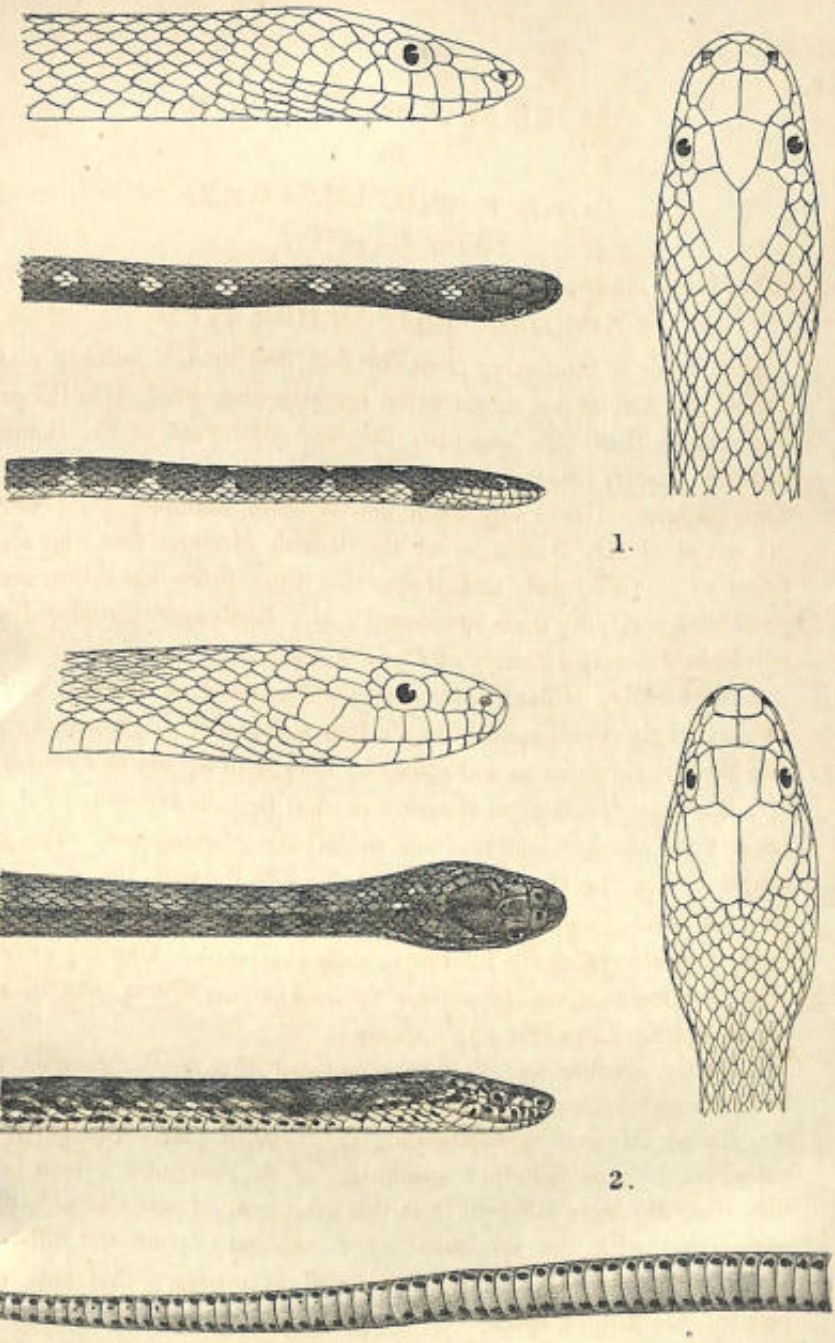
## *LYCODON FLAVOMACULATUS.*

This snake is interesting from the fact that though hitherto undescribed it is not, as one might infer, recently discovered. On the contrary more than one specimen has been preserved in the Bombay Natural History Society's collection for several years labelled as *Lycodon jara*. It was only when one of these examples came under the notice of Mr. Boulenger at the British Museum that this identification was disputed, and since this time there has been much perplexity regarding these specimens. Mr. Boulenger considered the one he saw merely a variety of *Lycodon aulicus*.

Last year Mr. Millard sent me two specimens to identify, and I unhesitatingly pronounced them colour *varieties* of *L. jara*, being led into the same error as he and others by the key to the genus *Lycodon* in Mr. Boulenger's catalogue of snakes in the British Museum (Vol. I., pp. 348-9) which could lead one to no other conclusion. The description, too, in that work accorded perfectly with the specimens referred to me, except in colour, a point I deem of little importance in itself, and always vastly inferior to scale characters. One has only to refer, for instance, to *L. aulicus* to see how multiform may be the colour and markings of a single species.

Recently another fine living example of this species reached the Society's rooms from Mrs. C. Hudson, of Dharwar, and this I took to the British Museum for identification. With Mr. Boulenger I examined the type and other specimens of *L. jara*, and agreed with him that they were different from this specimen. I was also able by a comparison with the specimens of *L. aulicus* to point out differences between them and this specimen, and to convince that authority that this is a distinct species.

From *L. aulicus* it differs thus :—(1) the ventrals are not angulate; (2) the nasals touch only one supralabial (the 1st), whereas these shields in *aulicus* almost always touch the 2nd also; (3) the minute posterior nasal; (4) colour.



J. Green del. et lith.

NEW INDIAN SNAKES.

1. Lycodon flavomaculatus. 2. Tropidonotus xenura.

From *jara* the most obvious difference lies in its very distinctive colouring. In addition to this, however, is the fact that in *flavomaculatus* the postnasal shield is very small, decidedly smaller than in *jara*.

The scale characters of the two appear to me otherwise identical. I have now examined 6 specimens of *L. flavomaculatus*, which exactly agree. Five of these belong to the Bombay Natural History's collection and were obtained from Sangli (S. Maratha District), Kirkee, Poona, Nasik, and Dharwar, all places on the Western Ghats inside the Bombay Presidency. The 6th example was in the Fyzabad Museum until recently, but has now been presented to the British Museum. There is no record of habitat.

*Description.—Rostral* in contact with 6 shields, the sutures made with the anterior nasals being twice those made with the internasals. *Internasals*, a pair; the dividing suture about two-thirds that between the præfrontal fellows, subequal to the internaso-præfrontal suture. *Præfrontals*, a pair; the dividing suture about one-third greater than the præfronto-frontal suture; in contact with the internasal, loreal, præocular, supraocular, and frontal. *Frontal*, in contact with 6 shields, all sutures subequal, or the supraocular rather longest; length about one-third greater than supraocular; breadth about twice supra-oculars. *Nasals*, in contact with one supralabial only (the first). *Loreal*, one, twice as long as high; in contact with internasal; not entering eye. *Præocular*, one; not touching frontal. *Postoculars*, two. *Temporals*, two; the lower in contact with 6th and 7th supralabials (sometimes 5th also). *Supralabials*, 9; the 3rd, 4th and 5th touch the eye. *Infralabials*, the 6th is the largest of the series, twice as broad as the posterior sublinguals, and in contact with 3 scales behind; the 5th and 6th touch the posterior sublinguals; suture between the 1st $\frac{3}{4}$ or subequal to the suture between the anterior sublinguals. Ventrals not angulate, 165 to 182. *Anal*, divided. *Subcaudals*, 53 to 62 pairs. *Scales*, 2 heads lengths from head 17; midbody 17; 2 heads lengths before vent 15. Smooth. *Colour*, glistening jet black, with a series of buttercup yellow roundish vertebral spots, opposite which whitish bars descend and broaden to form a reticulation in the flanks. The vertebral spots involve about 2 scales, and the intervals 4 or 5. No occipital collar. Head black with white lips. Under parts pearly white. The living specimen after being put into spirit lost its brilliant yellow in about three days, the spots being then as white as the flank bars. It was $13\frac{3}{4}$

inches in length, and all the other specimens I have seen are of about the same dimensions.

This is the second new Lycodon I have had the honour of describing within a year, and the total number of species now known to inhabit our Indian territory amounts to 11.

Without wishing to commit myself too positively I think the following characters, if found co-existing, will identify the Lycodon group—

(1) Scales in midbody in 19 or 17 rows.

(2) Scales two headslengths before vent 2 rows less than in midbody.

(3) Pupil vertical.*

(4) Three labials touching the eye.†

Key to the Species of Lycodon.

A.—NO LOREAL.

(*a*) Labials 8 ..... *mackinnoni.*

(*b*) Labials 9 ..... *atropurpureus.*

B.—ONE LOREAL WHICH DOES NOT TOUCH THE INTERNASAL.

(*a*) Scales in midbody 17.

° Labials 8 ..... *fasciatus.*

°° Labials 9 ..... *travancoricus.*

(*b*) Scale in midbody 19.

° Labials 8 ..... *gammiei.*

°° Labials 9 ..... *carinatus.*

C.—ONE LOREAL WHICH TOUCHES THE INTERNASAL—

(*a*) Labials 8 ..... *striatus.*

(*b*) Labials 9

° Nasals touch 1st and 2nd labials; præocular usually touches frontal ..... *aulicus.*

°° Nasals touch 1st labial only; præocular does not touch frontal

o Brown with a pair of white spots on each scale... *jara.*

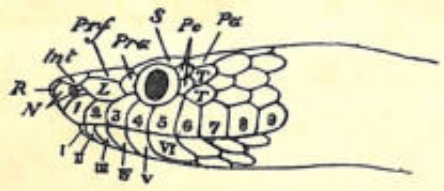
oo Black with vertebral series of yellow spots ..... *flavomaculatus.*

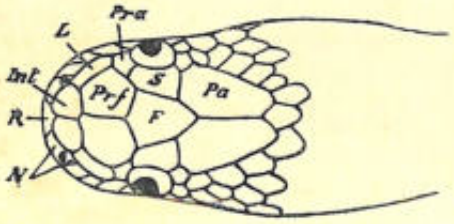
D.—LOREALS TWO. ..... *anamallensis.*

* The pupil can never be discerned in the Lycodons during life, but the earliest *post mortem* change to be observed which may be revealed in a couple of hours, or even less, is a steadily increasing opacity of the lens, whereby the shape of the pupil becomes obvious. Immersion in spirit brings about the same change more rapidly.

During life, or in a freshly killed specimen, this jet-black condition of the eye added to points 1 and 2 given above will suffice to declare the genus, for in all other snakes with the same optical peculiarity, the scales at a point 2 heads lengths before the vent, are disposed in the same number of rows as in midbody.

† Except *L. atropurpureus* in which the 4th and 5th only touch the eye. This taken with the first 3 conditions enumerated will suffice to distinguish it from all our other Indian snakes.




F. Frontal.
L. Loreal.
I. Internasals.
N. Nasals.
Pa. Parietals.
Pra. Praeocular.
Prf. Praefrontals.
Po. Postoculars.
R. Rostral.
S. Supraocular.
T. Temporals.
1-9 Supralabials.
I-VI. Infralabials.

LYCODON FLAVOMACULATUS (X3).

The following scheme should assist the identification of the species, —in fact I think is even preferable to that usually adopted in a key.

| Subcaudals. | Rows of scales mid-body. | Loreals. | Loreal touching internasal. | Supralabials.* | Supralabials touching the eye. | Ventrals angulate. | Anal. | Supralabials touching nasal. | Preocular touching frontal. | Name of Species. |
|---|---|---|---|---|---|---|---|---|---|---|
| All entire .. | 19 | 1 | No. | 9 | 3rd, 4th & 5th. | Yes. | 1 | 1st & 2nd. | No. | *carinatus.* |
| All paired .. | 19 | 1 | No. | 8 | Do. | Yes. | 1 | 1st & 2nd. | No. | *gammiei.* |
| Do. .. | 17 | 2 | Yes. | 9 | Do. | Yes. | 1 | 1st. | Yes. | *anamallensis.* |
| Do. .. | 17 | 0 | — | 8 | Do. | Yes. | 2 | 1st. | No. | *mackinnoni.* |
| Do. .. | 17 | 0 | — | 9 | 4th & 5th. | Yes. | 1 | .... | No. | *atropurpureus.* |
| Do. .. | 17 | 1 | No. | 8 | 3rd, 4th & 5th. | Yes. | 1 | 1st & 2nd. | No. | *fasciatus.* |
| All paired or some entire. | 17 | 1 | No. | 9 | Do. | Yes. | 1 | 1st & 2nd usually. | Usually. | *travancoricus.* |
| All paired .. | 17 | 1 | Yes | 9 | Do. | Yes. | 1 or 2 | 1st & 2nd usually. | Usually. | *anticus.* |
| Do. .. | 17 | 1 | Yes. | 8 | Do. | No. | 2 | 1st & 2nd. | No. | *striatus.* |
| Do. .. | 17 | 1 | Yes. | 9 | Do. | No. | 2 | 1st. | No. | *flavomăculatus.*† |
| Do. .. | 17 | 1 | Yes. | 9—10 | Do. | No. | 2 | 1st. | No. | *jara.*† |

Here I may remark that many people appear to expect a key to direct them unerringly in every case to the object of their enquiry, but the disciple of Darwin on a little reflection must see how impossible it is to fulfil such expectations, for it is only through variation that the evolution doctrine can be accepted. Whether the variation is retrograde —a reversion to an ancestral type,—or progressive—a

* A caution must here be offered to the novice, to count these shields very carefully. It is very easy to omit counting the last, and to prevent this the mouth should be well opened to show the extreme limit of the gape. Again it is often easy to overlook the contact of the 3rd with the eye, and it will be seen by a glance at the scheme how either of these mistakes will misdirect the enquirer.

† A most critical examination of these two species side by side reveals to me no other shield difference but that already referred to in connection with the postnasal. Recourse had better be had therefore to colour only. In *flavomaculatus* the jet black ground with the white flank bars, and reticulation, and the brilliant yellow vertebral spots are very striking and characteristic. In *jara* the ground colour is brown, and each scale has a pair of small whitish (Theobald says yellow) spots at its apex. It is doubtful whether habitat will help in discriminating between the two; for although the only authentic localities where *flavomaculatus* has been met with are confined to a moderately elevated region in the Bombay Presidency, the fact that there was a specimen in the Fyzabad Museum, though its habitat is known, suggests a wider distribution. *Jara* has been met with in Malabar, the Anamally Hills, Sikkim, Himalayas, Ganjam, Calcutta, Pegu and recently the Bombay Natural History Society has acquired its first specimen, the habitat being Tindaria (Kurseong) on the Darjeeling-Himalayan Railway.

deviation towards a new type, the effect is the same, and certain individuals must occur which depart in some way or other from the accepted normal type. This being so, any key however well constructed will fail to correctly indicate certain individual specimens. In framing keys one endeavours to select characters which are found to be most stable in individuals of the same species, so as to minimise the chances of misleading.

TROPIDONOTUS XENURA, *spec. nov.*

The habitat of this very interesting snake is not recorded. That it belongs to this genus I have little doubt, though it differs from all the other known species (80 in number) European, Asian, African, Australian and American in having the subcaudals entire. The entire anal too is a character only as yet known in one other of the many Asian species, *viz.*, *T. pealii*. Another very unusual feature about this snake is in connection with the supracaudals. These scales in snakes where the subcaudals are in pairs are arranged in even rows. I know of no exception to this rule. On the other hand in snakes such as the genera *Bungarus*, *Aspidura*, *Achalinus*, etc., where the subcaudals are entire, the supracaudals are arranged in odd rows, and even in those snakes where a combination of entire and divided subcaudals exist, as *Bungarus bungaroides*, *Naia bungarus*, *Ancistrodon acutus*, etc., I have always found the supracaudals arranged in odd rows corresponding to the entire subcaudals, and even rows corresponding to the divided subcaudals. In this snake however the supracaudals are arranged in even rows though the subcaudals are entire.

*Description—Rostral*, in contact with 6 shields, of which the anterior nasals form larger sutures than the internasals. *Internasals*, a pair; the suture between them subequal to that between the præfrontal fellows, subequal to the internaso-præfrontal suture. *Præfrontals*, a pair; the suture between them subequal to the præfronto-frontal suture; in contact with internasal, postnasal, loreal, præocular, supraocular, and frontal. *Frontal*, touches 6 shields, of which the supraocular sutures are longest and about $\frac{1}{3}$ longer than those formed with the parietals. *Supraocular*, length subequal to frontal; breadth $\frac{1}{3}$ frontal. *Nasals*, divided; in contact with 1st and 2nd supralabials. *Loreal*, rather longer than high. *Præocular*, one; not touching frontal. Eye, pupil uncertain. *Postoculars*, 3. *Temporals*, 2; the lower touching the 7th

and 8th supralabials. *Supralabials*, 9, the 4th, 5th and 6th touching the eye. *Anterior sublinguals*, much smaller than posterior. *Posterior sublinguals*, touch the 5th and 6th infralabials. *Infralabials*, 6. The 5th and 6th largest, and subequal. The 6th broader than the posterior sublinguals. *Scales*, 2 heads lengths behind head 19; midbody 19; 2 heads lengths before vent 17. All strongly keeled except the last row anteriorly. *Ventrals*, 162, not angulate. *Anal*, entire. *Subcaudals*, entire, 25 counted but the tail is very incomplete. *Colour*, blackish-brown with whitish spots mottling in the flank. Many labials bordered posteriorly with blackish-brown. Belly with a pair of roundish lateral blackish-brown spots on each ventral.

TROPIDONOTUS BAILEYI, *spec. nov.*

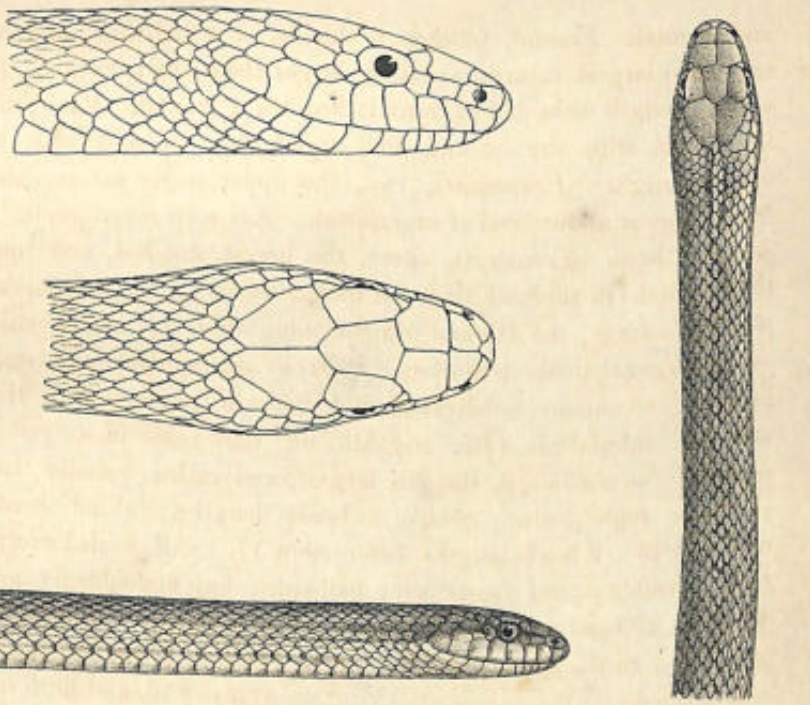
Of this snake Lieut. F. M. Bailey has sent me two specimens. One I take to be an adult and measures about 2 feet 6 inches; the other appears to be a hatchling, as the navel is very obvious. It measures 11½ inches. Both were obtained in Thibet at an altitude believed to be about 14,000 feet. This is a very remarkable elevation at which to find snakes living. The only other instance, of which I am aware, where a snake has been captured at an approximate altitude is that reported by Dr. H. Gadow * who found a rattlesnake (*Crotalus triseriatus*) in the mountains of Mexico at height of 12,500 feet. Mr. Bailey was informed by the natives, one of whom he sent to procure these specimens, that they live in the sides of a hot spring, and are never found as far as half a mile distant. They are reported not to enter the water, and can be obtained in winter and summer alike. It appears to be common. Both specimens were captured about the 15th May this year. I believe it is unusual for the young of snakes to hatch in the spring in temperate climates, as this appears to have done, the autumn is the season when the eggs are deposited, and young born.

*Description.—Rostral*, touches 6 shields, of which the anterior nasals make much the largest sutures, 4 or 5 times the length of the internasals, which are much the shortest. *Internasals*, a pair; the suture between them ⅔ to ¾ that between the præfrontal follows; ⅔ to ¾ the internaso-præfrontal suture. *Præfrontals*, a pair; the suture between them ¼ greater than the præfronto-frontal suture; in contact with internasal, postnasal, loreal, præocular, supraocular,

* Proc. Zool. Soc., London, June 1905, p. 226.

and frontal. *Frontal*, touches 6 shields, of which the supraoculars make the largest sutures, about $\frac{1}{3}$ larger than the parietals. *Supraocular*, length subequal to frontal; breadth $\frac{3}{4}$ frontal. *Nasal*, divided. in contact with the 1st and 2nd supralabials. *Loreal*, one, length exceeds height. *Præoculars*, two, the upper larger not touching the frontal, lower above level of supralabials. *Eye* with round pupil. *Postoculars*, three. *Temporals*, three, the lowest smallest, and touching the 6th and 7th supralabials; the median touching the 7th supralabial. *Supralabials*, 8; the 4th and 5th touching the eye. *Anterior sublinguals*, larger than the posterior. *Posterior sublinguals*, quite separated, in some specimens subdivided into two, in contact with the 5th and 6th infralabials (4th and 5th on right side in larger specimens). *Infralabials*, 6, the 6th largest, and rather broader than the posterior sublinguals. *Scales*, 2 heads lengths, behind head 19; midbody 19; 2 heads lengths before vent 17. All keeled except last row. Double apical facets very indistinct, but undoubtedly present. *Ventrals*, 203 and 204; not angulate. *Anal*, divided. *Subcaudals*, 111 and 108. In the adult 103rd to 106th, 108th to 110th are entire, the rest divided; in the young 23rd to 25th, 81st to 85th and 88th to 90th are entire, the rest paired. *Colour*, olive green, with five series of indistinct spots dorsally, most pronounced in the forebody, and in the young specimen fading behind, except the vertebral series which remains quite evident. Last 3 rows with dusky mesial lines and the last row bordered above and below with whitish. A dusky postocular streak, and dusky posterior edges to the labials. Belly bluish-grey, each ventral black basally. The young specimen is darker than the adult, and the body is very depressed.

Since writing the above I have received more than 20 more specimens of this species from the same source which agree with the above. Ventrals vary from 201 to 221. The subcaudals from 91 to 111.



J. Green del. et lith.

NEW SNAKE FROM THIBET.

Tropidonotus baileyi.

# A NEW SPECIES OF INDIAN WAX-PRODUCING BEE.

By

Major C. G. Nurse, Indian Army.

About two years ago Mr. J. H. Burkill, Reporter on Economic Products to the Government of India, sent me for identification some specimens belonging to two species of Dammar-bees. One species proved to be the common *Melipona iridipennis*, the other is smaller than any described Indian species, and I propose to name it after Mr. A. M. F. Caccia, of the Indian Forest Department, who obtained the specimens. The delay which has taken place in the publication of the description is owing to my manuscript having been somehow mislaid since I left India.

Melipona cacciæ, n. sp.

Smooth and shining; a well marked carina between the antennæ. Head and thorax brownish-black; abdomen dark red, especially dark towards the apex, where it is almost black in some specimens, mandibles, scape of the antennæ, tegulæ and tarsi light red; flagellum of antennæ and tibiæ darker red; clypeus and front with short grey pubescence: thorax and abdomen with a little sparse pubescence of the same colour: wings clear, hyaline and iridescent.

*Length.*—2—2·25 mm.

*Habitat.*— Hoshangabad, Central Provinces.

# ESTUARY FISHING,

## SOME REMARKS ON ITS DECADENCE, AS AN INDUSTRY, IN THE KONKAN, WESTERN INDIA.

BY

W. A. WALLINGER.

(*Read before the Bombay Natural History Society on 4th October 1906.*)

The average District Officer, who has his regular and ever increasing amount of work to do in this country, finds himself with very little spare time for the detailed study of any Natural History subject. I have seen it somewhat thoughtlessly stated, in a responsible newspaper, that these Officers ought, in consequence of the opportunities and time at their disposal, to contribute more than they do at present to scientific knowledge. The conception of the writer as to the amount of "spare time" available is, it is to be feared, in a vast majority of cases, only too inaccurate. It is necessary to make these few preliminary remarks in justice to myself, for while no energy has been spared to try to arrive at impartial truths, I am bound to admit that I have not been able to spare the time necessary to make this paper sufficiently exhaustive and accurate to be, in the strict sense of the term, of scientific value. Nevertheless there are some leading *facts*—and facts are always of some value—in connection with estuarine fish and estuary fishing on the coast in the immediate vicinity of the enormous Bombay Market, which, after three years experience and attention, seem worth recording—if only as a basis for further investigation. I feel the more emboldened to address this Society on a subject which has been of peculiar interest to me, in that many of the deductions arrived at are, to a great extent, supported by the writing of such an eminent ichthyologist as Dr. Day. I can only hope, in the absence of a better exponent, that I may have sufficient ability to state the case, as it appears to me, with enough care, judgment and moderation to carry some little conviction. My object is to raise interest in fish preservation in the true ultimate interests of an enormous class of men, and of the consumer. It is necessary to disabuse many, of the unfortunately popular idea that, as the fishing industry has gone on for generations, there is nothing to stop it now. This is a very dangerous standpoint to take up. Fishes require conservation and the thoughtful and educated consideration of man, not, it is true, so urgently as the trees and forests of the country, but even more urgently, I submit, than its fauna.

It is better, more politic and infinitely safer, even in the absence of direct evidence to the contrary, to assume that harm is being done, than to quietly rest contented under existing conditions. I have a feeling that some very eminent authority must have expounded this more or less elementary hypothesis, but I have not been able to locate it. That there is to-day an enormously interesting and profitable field for further enquiry into the subject of the life history of the large species of Indian estuary and fresh water fishes cannot be

questioned. The little that is actually known suffices to show this. The life history of such well known and valuable edible fish as the Salmon and Sea-trout in Europe, is, thanks to the minute enquiry of such men as Dr. Frank Buckland and others, a matter of common knowledge amongst pisciculturists.

Day—that wonderful authority on Indian fish—devoted his time and inexhaustible energies more, as an ichthyologist, to the matter of a careful identification and geographical distribution of the species, than to a study of their habits which was not within the province of his finest work. His "Report on the Fresh Water Fisheries of the Indian Empire" published in 1873, however, contains a masterful appeal, on ample data, in favour of fish legislation, submitted under the orders of the Secretary of State for India to the Madras Government.

Thomas' fascinating work "The Rod in India" undoubtedly contains—when we look to the fundamental character of the work, which was intended mainly as a guide to anglers—a very considerable amount of accurate information. The copy of his official report written in 1870 and quoted in Chapter XXV shows how earnestly he strove to impress the importance of guarding the fishing industry.

Dr. Gunther's "Introduction to the Study of Fishes" published in 1880 contains a purely scientific nomenclature.

*I.—The primâ facie case.*

Before entering into specific instances of the harm done, and before indicating the precise species which appear to me to have suffered, it is not only desirable, but strictly relevant, to consider the subject from a broader standpoint. Is it *likely* that the ignorant "Koli" and "Agri" fishermen on the Bombay Coast, if not elsewhere, have done harm? Do these poor ignorant people consider the life history of fish, and having done so, is there any indication of their having combined in the cause of preservation? That such consideration and combination is absolutely necessary, I shall presently show. It must be evident to members of this scientific society that very little intelligence and forethought can have been brought to bear by a class of men who have not only been handicapped by gross ignorance for generations, but by a desire to make the most out of the creeks to which they unfortunately turn their undivided attention during the rains, for the reason that at this time of the year sea-fishing is all but impossible. In other words, therefore, unless there have been natural obstacles, of which we are not aware, the chance, *primâ facie*, of harm having been done is as great here as it has been found to be in other parts of the world, where the fishing, for sporting as well as for industrial purposes, is, as we shall presently find, often protected by a special and elaborate legislature.

One has only to wander amongst the Konkan Creeks to learn from the older residents that the decrease of the fish supply—of some species more particularly—is getting more and more pronounced. The universal nature of this outcry may be considered enough to warrant a more detailed examination

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into the true condition of things. It may as well be admitted at once, and at this stage, that it is because I have failed so signally to catch fish on my rod and line that I originally felt impelled, as it were, to go into this matter somewhat more closely. With me the subject is, it may possibly be thought by some, a trifle delicate. In any case there is no advantage in dilating on it.

We have next to see how far this *primâ facie* case is actually supported, not only by the universal nature of the outcry, already given prominence to, but by a somewhat detailed and impartial examination of (1) the precise methods of destruction adopted and by (2) as complete an examination of the species of fish that are known to stock these waters as is possible.

*II.—Various Methods adopted in taking Creek Fish in Kolaba.*

I find that there are as many as 14 common types of nets used in Kolaba, all with a local nomenclature. There are three kinds of night and day lines, and three traps, making a grand total of 20 implements! Of this total, however, in so far as the creeks are concerned, we need only refer to and describe the following nets. The traps will be referred to generally, and the night lines may safely be ignored. It is necessary to enter into a close study of some of the nets, however, in order to correctly appreciate the truth of the preliminary conclusion which has been arrived at, and in order to make my description still clearer, I have had small working models prepared for the inspection of the members. Thanks to the great kindness of Col. Bannerman, I. M. S., (the well-known Plague expert) and of Dr. Rowland (also of the Plague Research Laboratory) I am enabled to publish photographs of some of these models, as well as of one or two of the nets in use. These illustrations will, I feel sure, render my descriptions clearer, and far more interesting than they could otherwise have been.

Photo A.

*(a) Stake Nets.*

1. *Bhoksi* (भोकसा).— This stake net, as used on this coast, is, without exception, the most comprehensively destructive arrangement conceivable. The net resembles a truncated cone, with an oval entrance. This entrance between stakes varies from 5½′ to 33′ according to the size of the water to be dealt with. Thus a net with an entrance 5½′ would be nearly 20 feet in length and with an entrance of 33′ it has a length of close on 135 feet or, say, 45 yards.

Its depth varies in like manner with the nature of the water. A net of 19′ entrance was, I found, 26′ deep, so that the largest are said, with reason, to attain 40′. The net is sunk down the stake by heavy weights known as "Walia" (वालिया) so that the bottom lies touching the mud, while the top is as close to the surface of the water as possible. As the stakes get covered with barnacles very quickly, there is a special device to prevent its sticking on the way down known as "Khora". The net is entirely worked by the tide and is taken in a little before slack water. In the making of these nets regular rules are laid down, as regards the number of the meshes at the entrance. The largest have 750, which figure is adhered to, to the end. The mesh at the entrance would be, in this case, nearly 6″ in diameter. But the point is that those at the end of the largest net are no larger, thanks to the expertness of the makers, than those at the end of the smallest. In fact at the apex the nets often resemble a mass of knots *so closely tied together that it is no easy matter for the in-rushing water to escape.* The various gradations of mesh which go to form "Bhoksi" have a regular set of names starting with "Moor" and ending with "Khola." The illustration shows 2 horizontal bars; they had to be inserted to support the model, but are not actually used as the two vertical stakes are driven firmly into the bed of the Creek. (*See* Photo **A.**)

(*b*) *Large Wall Nets.*

Photo B.

2. "Para" (पेरा).—A long wall net used by a class of "Kolis" called "Dalai" during the rains at sea and at no inconsiderable risk to themselves. There are not many "Kolis" who indulge in this sporting occupation; when they do, the "Matchva" selected is manned by about 20 men, each one being allotted a given position from which he is not permitted to move.

This net when used in the Creek is a true draw-net (Seine). It requires at least three men, and often six to eight men, with boats, are employed, according to size. The net is only 8′ in width or depth; but a large one often measures 180 yards in length. The meshes are here again barely ½″ in diameter.

Floats are fixed at very short intervals to make the top of the net rigid, and at either end of the net there are bamboo poles 8 feet in length. Often the bottom of the net has small pieces of lead attached as sinkers; but this is not

apparently considered indispensable. The net is brought round in a huge circle to the shore, and often results, owing to the size of the mesh, in enormous catches of fry.

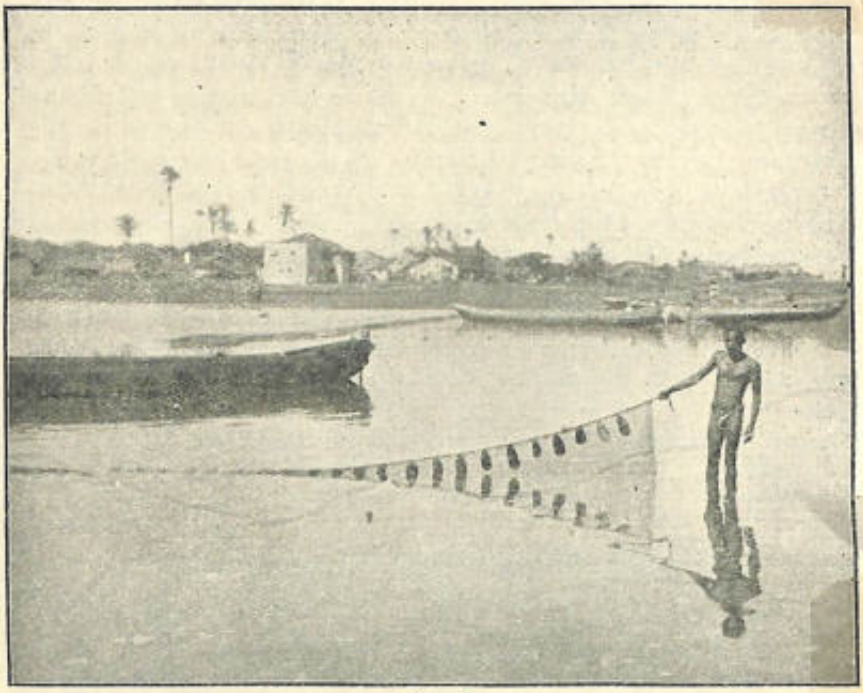


Photo C

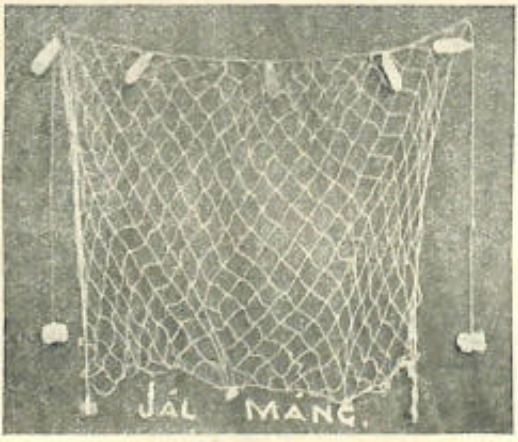



Photo D.

The above photo conveys an idea of this net in use. It will be noticed that the side stakes have been discarded, owing probably to the shallowness of the water (*See* Photos **B** & **C.**)

3. "Jal" (जाळ).— This drift or trammel net is of great length when used at sea. It is attached at one end to a boat which is permitted to drift without let or

hindrance and is taken in about every 2 hours. In these circumstances, it is a net with a large 6″ to 9″ mesh.

When used in the Creek the two ends of this net require to be anchored. The larger ones are 165′ in length and at every 5½ feet (or 1 "Wamb") a float, called "Bhendi," is required. Along the bottom, stones are fixed as sinkers. The net is about 10 feet in depth and has meshes which vary from 2″ to 6″ according to size, and it is interesting to note that the weight of stones along the bottom is regulated in accordance with the nature of the fish the owner wishes to try to secure. If he is intent more particularly on "Rawas" or Bamin *(Polynemus plebeius)*, the stones are of less weight, so that the net makes a floating wall near the surface. If intent on "Jetara" or Nair fish *(Lates calcarifer)*, etc., the wall is made to sink to the bottom. Owing to the greater size of the mesh, this is the least destructive of the nets used on this coast. (*See* Photo **D**.)

4. "*Pagta*" (पागटा.) Exactly similar to "Jal", but on a smaller scale and used in practically the same way at low tide only. The maximum measurements are :—

Length 100 feet.
Depth 9½ "
Size of mesh ½″—1″

(*c*) *Small Miscellaneous Nets.*

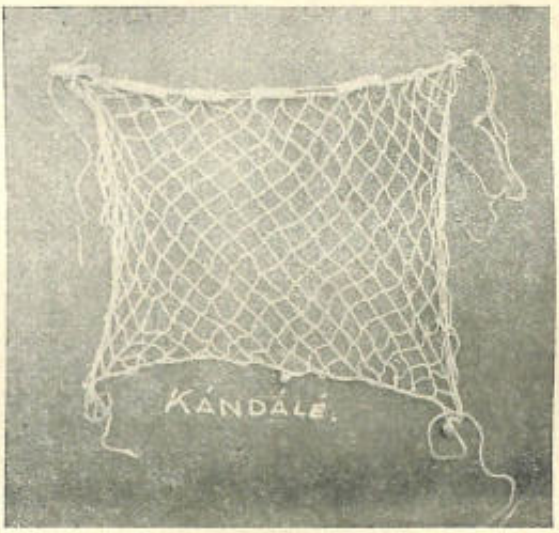



Photo **E**.

5. "*Kandala*" *or* "*Vaura*" (कांडाला—वौरा.) Used more in the Thana District. It is practically a repetition of "Para" on a *very* small scale. The twine used is barely thicker than ordinary thread and the meshes are proportionately minute. (*See* Photo **E**.)

6. "*Asu*" (आसु). Practically an ordinary English landing net without its handle, of similarly fine make, used in small pools of water to extract misguided fry.

7. "*Zila*" (झीला). The same as the last but with a handle.

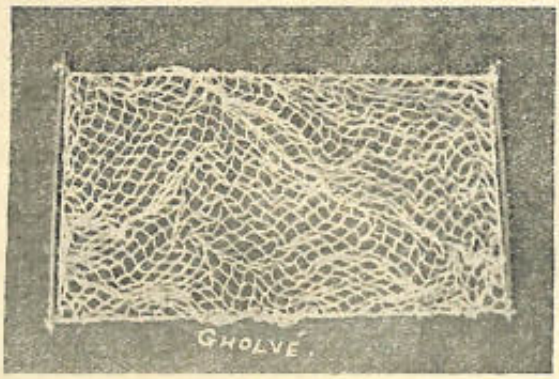



Photo F.

8. "*Gholwa*" (घोलवा). The common draw net used by 2 men usually about 10′ in length with bamboos at either end and a depth of as much as 12′ to prevent the escape of fish when the net is suddenly lifted out. The meshes are usually very small, seldom exceeding $\frac{1}{2}$″. (*See* Photo **F**.)

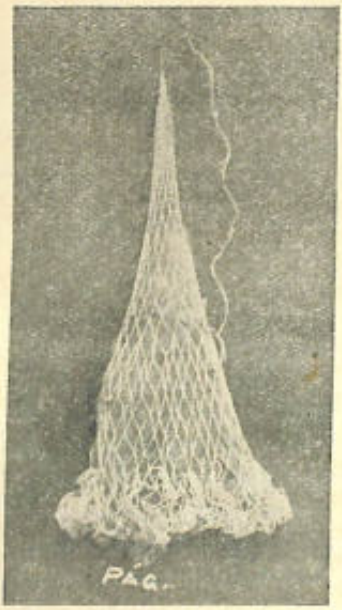



Photo G.

9. "*Pag*" (पाग). The well-known circular cast net with lead sinkers, in the use of which the native is so expert. The mesh never exceeds $\frac{3}{4}$".

The outward appearance, particularly of the stake nets just described, is well known to all who are familiar with the Bombay coast. But this familiarity conveys no conception of the extent to which these stake nets are actually used. There are, for instance, usually three and often five lines of stakes for the use of the "Bhoksi" net, from the mouth of the Revdanda Creek at Korlai to the entrance of Ramraj Creek, a distance of 3 miles and 3 furlongs, so that the entrance to this Creek—one of the finest in the Konkan—may be said to be effectively barred. Now, it is a peculiar and unfortunate thing with migratory fish—as indeed it is with many wild animals in the case of paths—that a majority take a more or less definite line in ascending and

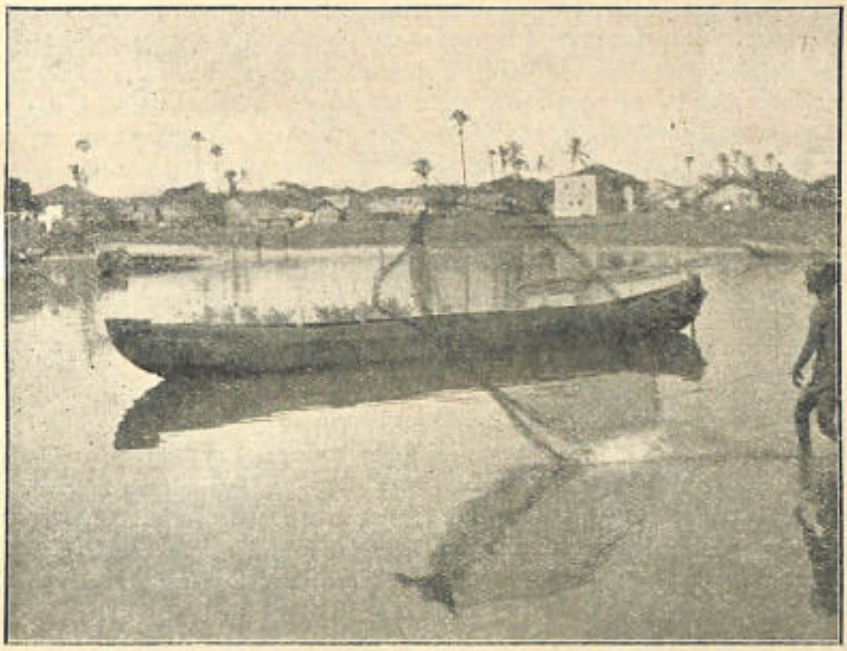


Photo H.

descending a Creek. This line is not always at the deepest point, nor is it always across, as one might think, the shortest cut. But the particular line which the majority of fish prefer to take, for reasons best known to themselves in a broad Creek, is perfectly well known to the local fishermen, and it is towards these points that they naturally concentrate their energies. The "Kolis" are very zealous in the matter of the retention of positions for staking the Creek's length within their village limits. These positions have been recognized among them from time immemorial, and the right, I find, is almost invariably hereditary. The owner is at liberty, however, to sell his

position, one of which, in the Revdanda Creek, realises within my knowledge only Rs. 30 to 40 for 8 months' right to use the "Bhoksi". This low price alone shows how poor the fishing has become, particularly when it is recollected that about 100 yards of splendid water is covered. (*See* photos **G** & **H.**)

*III.—Specific instance of decay.*

1. The Savitri river rising in the vicinity of the Mahableshwar Range and flowing through the Mahad Taluka and Janjira territory, empties itself into the sea at Bankot. This river or Creek is tidal as far as Mahad, 30 miles from its mouth, and there is evidence to show that the fishing industry along its banks was, at one time, of considerable importance. There are, to start with, several fishing settlements along its length to-day, terminating in the one at Dasgaon. Being, as I have said, very interested in the question of estuary fishing, I made enquiries as to the state of the Creek in this respect, and very soon learnt that, from a fisherman's standpoint, this enormous stretch of water is now, let us call it, a "Paradise Lost". One has only to turn to the settlement at Dasgaon itself, to see that the families have almost abandoned fishing and taken up cultivation instead. I learnt that the decrease in the fish supply has become more and more apparent during the last 8 or 10 years. There are, to the best of my knowledge, 2 factors alone which have contributed to the bringing about of this deplorable result. The first of these is the reckless netting with meshes small enough to catch fry an inch in length (I have, alas! seen them of this length at Dasgaon) which has gone on no doubt unchecked for generations, and the second is perhaps the partial silting up, more particularly of the mouth of the Creek, brought about by the almost complete denudation of the hills along its entire length. This latter cause, however, cannot be said, I think, to play a very important part in the diminution complained of, in so far as true migratory fish are concerned, for the reason that Shepherd's steamers are still just able to get into Bankot at high tide, and where they go large fish can follow.* Here we, therefore, have an instance of partial extermination of all kinds of fish on a scale large enough to warrant especial attention, while making all allowance for possible misrepresentation and consequent error in deduction on my part.

2. I have now to refer to the decrease of several species of fish in every Creek of the Kolaba District, and the remarks probably apply to the Konkan generally, if not to the coast of Western India as a whole. There are several species of fish which, as far as is known, never leave the Creeks at all, and there are many which habitually ascend (*a*) either at certain times of the year or (*b*) with more or less regularity all the year round. In my list of fishes, later on, I have made an effort to differentiate broadly between migratory and resident fish, helped by the best local knowledge procurable. In this former class is to be included the fish "Bamin" (*Polynemus plebeius*) rendered more

* *Note.*—Shepherd's steamers have, I hear, quite recently ceased going into Bankot, the bar being considered no longer safe.

famous as a sporting fish, than he ever was, by the writings of Mr. Gadsden to this Society.

But there is one other almost equally well known sporting fish, "The Cock up" or "Nair" (*Lates calcarifer*), a fly taker, and many more which have, unfortunately for themselves, to ascend the Creeks in order to spawn. Next to the Pomphret and Bamin well known locally as Rawas—(रावस) ) the "Nair fish" are rightly esteemed the finest eating of any fish along the coast. The enquiries made certainly tend to show that the numbers of these migratory fish are decreasing. I need hardly say that they are comparatively seldom caught in the Bankot Creek. The reason for this decrease is again, I believe, not very far to seek, if any reliance whatsoever is to be placed on the testimony of fishermen, and on the observations I have myself been able to make from time to time. Like the Salmon, these estuary fish ascend the various Creeks not only in order to spawn, but in regular and ordinary pursuit of their food, which consists to a great extent of the fish locally known as "Sheg" (a kind of Mullet) and "Noit" (*Boleopthalmus boddaerti*). The process of spawning in almost all instances is stated to take place with, I think, accuracy between June and August, when, be it noted, the native fishermen, in their hundreds, unable to put to sea, concentrate all their energies on estuary fishing.

In times of flood, when nature points to additional safety, the larger fish are no doubt able to, and do, to some extent avoid the vast array of trapping engines already mentioned: for that enormous numbers of fry are caught and destroyed, is merely a matter of fact. I have personally identified the fry of a large number of these migratory fish taken in the Alibag and Revdanda Creeks and have, in fact, 20 specimens before you secured in these Creeks alone, and I have repeatedly seen the little things caught in the higher reaches during the last 3 touring seasons.

Now, it has already been demonstrated that *the size of the mesh, which is the all-important factor*, depends, in the Konkan Creeks, more on the expertness of the maker than on any other recognised factor. In a word, the meshes are as small as it is found possible to make them. If we follow this statement to its conclusion, we shall find that on every one of these nets of the "Bhoksi" pattern being drawn twice in 24 hours (except during about eight days in each month), they invariably contain a mass of little fry which have, to all intents and purposes, been needlessly and heedlessly slaughtered. If the catch is a satisfactory one (the matter depends a good deal on the state of the market), the drowned fry are now cast away, not in tens and twenties, but in their thousands. Without taking too sentimental or too alarming a view of the position, the simple facts stare us in the face that (*a*) there are scores, nay hundreds, of nets of various kinds with minute meshes on every Creek of any length, (*b*) that the process of slaughter described with the flow or stream net takes place, with the regularity of clock work, twice in 24 hours, day after day, and (*c*) that albeit, at other times of the year, Creek stake fishing is

not so extensively resorted to as in the rains, it nevertheless does proceed uninterruptedly for 12 months. The wonder, therefore, is that there are, after all these years, any fish left all. I have already shown that in one Creek, within my knowledge, the diminution appeared to me to be very considerable and that in others, notwithstanding the well known prolific character of fish, there is a decided diminution, which must moreover be proceeding in geometrical progression. There is a spot on the Revdanda Creek, about 6 miles below the Taluka Town of Roha, which was once and is even now famous for "Rawas" and "Jetara" ("Bamin" and "Nair" fish). I visited this spot three times at the right moments in order to see them on the feed, a procedure which, when they are plentiful, is, we find in "Thomas' Rod," a remarkable sight. On one of these three occasions my wife and I saw two fish. We caught nothing, and further comment seems hardly necessary. It will not surprise some of my listeners here and readers hereafter, when I state that almost everywhere the "Kolis" of Kolaba, when approached on the topic, have a pleasing method of transferring all responsibility in the growing failure of the supply from their own immediate shoulders to that of their Creator, and that in some aggravated examples they do not scruple to hold the "British Raj" itself responsible for this evil! The process of reasoning in both cases may, in the circumstances, be said to be more than usually obscure.

*IV.—Catalogue of Creek Fish.*

I have been at some pains to try to ascertain the precise species that live in the Konkan Creeks, as far as can be said, permanently, and those that visit them only from time to time. In this matter, much assistance has naturally been secured from Day's Fishes of India, kindly lent to me by our Society, as also from Mr. Sinclair's excellent local article in the Kolaba Gazetteer, which if not exhaustive, I beg leave to refer to in respectful and appreciative terms. It was not my original intention to try to give a *complete* list of fish, but as my interest in the subject deepened, I have devoted more and more time to try to make it so. A complete list is hardly necessary perhaps for my present purposes, in that what is desired is a list of the larger edible fish, on the sustained supply of which, the creek fishing industry—not to mention the consumer—is actually dependent. Nor is it necessary to enter into a minute scientific definition of each of the specimens I have before you. They have been identified, and what is wanted is information regarding them, showing more particularly what I have been able to learn as to their suitability as food, and the size they attain when mature. For, after all, these are the only two factors of importance from the fishing industrial standpoint. My list of the large fish is, it is believed, almost complete and that of the smaller may be three quarters so. Some day I hope to make both absolutely complete. As a matter of fact, both the large and the small fish are almost all edible and some are most highly esteemed. As many as twelve species are commonly found at the dinner tables of the European residents of Bombay; the several varieties of *Mugil* and *Polynemus* are perhaps the most highly esteemed. My statement

of the weight or size of the various fish, when mature, varies in some cases from that given by Day. Usually the difference is not great, and where it is so, it is to be hoped, that it may not be considered very presumptuous on my part to deviate from so great an authority. Weights must vary, after all, in various localities, under varying conditions. As to the question of the precise habits of any species, it has not been possible for me to learn much. I find that in the fundamental questions as to whether a given fish in the list is strictly migratory or practically resident, that my independent information fortunately agrees, in the main, with Dr. Day.

Perhaps the most remarkable and striking thing about this list is the very large variety of large migratory and resident fish, which our Konkan estuaries are shown to hold. It contains as many as 8 separate species which are locally known to grow to over 40 lbs. and I have already said that this list is not quite complete. There are 8 species which attain 6 lbs. and over. This catalogue of fish capable of growing to a great size, if given the opportunity, cannot but be looked upon with satisfaction. It means that the estuaries can be kept filled—aye to over-flowing—with sizable fish, with reasonable forethought, in a surprisingly short space of time. Some of the migratory fish appear to ascend the Creeks for the sole object of spawning. At any rate, their stay is of very short duration, and is usually restricted to the month of July.

Others, it has already been shown, ascend and descend with considerable regularity irrespective of the operation of spawning. It is conceded, as an undoubted fact, that large fish when about to spawn will seek, by instinct, small water in order, as Thomas aptly says, "to suit the puny strength of their tiny fry." Thus it is that during the rains the rice fields bordering on the creeks are considered by these poor misguided, but helpless creatures, as the very thing for their requirements. They little realise the complete nature of the trap in which they have securely left their progeny. The bamboo cruives at the outlet of practically every rice field are so well known that I have not even considered it necessary to prepare a model. I cannot help adding here, what will be evident presently, that the use of this form of fixed engines was prevented by legislation, in parts of England, as long ago as the 15th century. How the natives of this country can be so short sighted as to permit this dreadful folly to-day, passes all comprehension. Thus, not only are the fry which escape into, and are hatched in the Creek itself slaughtered, but those in their natural breeding grounds. The presence of great numbers of fry of the larger fish, in the larger waters of the Creeks themselves is capable, it appears to me, of a perfectly logical and simple explanation. Many a large female with her mate ready to spawn is not able, at present, to make her passage up to the shallows without obstruction. If they both successfully evade the various fixed engines set for their capture they can often have but little time to carefully select their ground for the operation. And thus it is that the ground chosen, being often unsuitable, the fry are washed down into the main creek at spring tides or during the frequent heavy floods, and are killed there instead.

V.—*Protective Legislation.*

It appears to me of great interest and significance to follow, for a few moments, the course of legislation in the matter of fish, in England, Scotland and Wales, without troubling about the rest of Europe. In fact, my feeling is that, by doing so the objective value of this paper may perchance be increased. I must express my great indebtedness to the Bombay Branch of the Royal Asiatic Society for having lent me the necessary books of reference. It may surprise some members present— as it did me—to hear that a penalty for taking salmon from "the Nativity of our Lady unto St. Martins day" was fixed as early as the 13th year of Edward I. reign. Thereafter I find that—

(1) The use of large nets fastened to stakes, anchors or boats across rivers and estuaries (*the very thing that is done so extensively in the Konkan to-day*) was prohibited by 2 Henry VI., 1423, as being "a cause of as great and more destruction of the brood and fry of fish as be the weirs, kydels, or any other engines." Such nets were therefore only permitted to be pulled by hand in the 15th century throughout, as far as I can ascertain, the United Kingdom.

(2) A very elaborate Act was issued by Queen Elizabeth, called "an Act for the preservation of spawn and fry of fish" which applied "to England, Wales, Berwick, and the marches thereof." It forbade the taking of salmon and trout out of season, regulated the length at which fish might be killed, the size of the mesh and of each net, the kind of net that might be used, with suitable penalties.

(3) The earliest mention of an Act to protect those fishes which were recognised to go into estuaries to spawn (besides salmon) was passed in James I, 1605. It prohibited the setting up of any new wear along the seashore or in any haven, harbour, or creek, or within 5 miles of the mouth of any creek, the use of any draw or drag net under 3" mesh within the same limits.

(4) With the same objects in view, George I. passed an Act in 1714 increasing, however, the size of the mesh to 3½" and forbidding the use of one net behind the other even though of legal mesh—(we have seen that there are unlimited rows of nets in the Kolaba Creeks, without moreover any restriction as to size of mesh).

There were repeated amendments of these Acts all through the following reigns, for instance.

(5) The Salmon Fishery Act of 1861, Vic. C. IX., amended the laws relating to the salmon fisheries in England only, and prohibited all poisoning of waters, fishing with lights and spears, using fish roe as bait, using a net with a mesh of less than 2" from knot to knot, placing fixed engines in a river, a fishing wear without a free gap, the taking of unseasonable salmon the young of salmon, the wilful disturbing of any spawning bed (such as the Konkan rice fields) and any attempt to catch salmon when spawning. This act also fixed

an annual closed season and a weekly closed season ("between the hour of 12 of the clock at noon on Saturday and the hour of 6 of the clock on Monday morning").

Thus the estuaries and rivers of the United Kingdom may be said to have been protected by legislation, centuries ago.

(6) It was little thought that the advance of civilization in the special form of immensely destructive engines—a form which it is recognized that civilization often has, unfortunately, a tendency to take—would ever render it necessary for mankind to move in the interest of the fisheries at sea. For, it must be recollected that, except in the case of some species of deep-water sea fish, the spawn of almost all varieties, unlike those in the estuaries and rivers of the world, float. Thus, it came to be considered—quite rightly—and could be considered at present as regards the sea fisheries of India—quite rightly—that no special protective measures were necessary. It was the introduction of the steam-trawler on the coast of England and elsewhere that rapidly caused a revolution in the fishing industry which threatened to do enormous harm.

(*a*) In 1883 Hull and Grimsby "included 20 steam and about 1,000 sailing trawlers"; seven years later (1900) the number of steamers had increased to no less than 869, while the number of sailing trawlers had fallen to 4.

(*b*) The Encyclopædia Britannica contains, under the head "Fisheries," a most excellent article. The history of sea-fish legislation may be said to have started with a commission given to Messrs. Buckland and Walpole in 1878 to "enquire into the alleged destruction of the spawn and fry of sea fish, especially by the use of the beam-trawl and ground seine", but it was the Royal Commission of 1883 which "resulted in the institution of fishery statistics" for the United Kingdom.

(*c*) In 1886 a Fishery Department of the Board of Trade was organized under the Salmon and Fresh-water Fisheries Act of that year.

(*d*) Practically the whole coast line of England and Wales has now been divided into local fisheries districts, to which the Acts of 1888, 1891 or 1894 are made applicable, as local circumstances require.

(*e*) I have not been able to ascertain what the results of the International Conference of Representatives of North Sea Powers at Christiania in 1901 (?) were.

The latter portion of the above short historical reference to this subject is included merely in order to try and show, that, even where the conditions, as at sea, are so clearly and wonderfully favourable to uninterrupted propagation, it was nevertheless found ultimately necessary, not only in the British Isles, but

in many parts of Europe and America, to devise means to husband the fishing resources in the true interests of the industry. "*Security* for the labourer" says Jeremy Bentham; "*security* for the fruits of labour; such is the benefit of laws; and it is an inestimable benefit."

Thus there seem to me reasonable grounds to assume that if there were a true "public opinion" in this country, the present condition under which estuary fishing is conducted, would not be tolerated for long. If the educated natives of India would give this matter their thoughtful consideration, and use their influence rightly, they might do much good.

## LIST OF FISH TAKEN IN, AND AT THE MOUTH OF, THE KOLABA CREEK AND CLASSIFIED ACCORDING TO THEIR SIZE AND HABITS.

| Vernacular (Marathi) Name of fish when Small. | Medium. | Large. | Locally said to attain | Size given by Day. | Scientific Name. | English Name. | Remarks. |
|---|---|---|---|---|---|---|---|
| | | | lbs. | | Resident Large. | | |
| Godir .. | Godir ... | Godir ... | 15 | 1′ | *Batrachus gangeue.* | | |
| Kharwad .. | Kharwad .. | Kharwad ... | 15 | 18″ long | *Chrysochirus dotaia*... ... .. | ..... | Said to spawn in May. |
| Chevna ... | ..... | Shingali ... | 8 | Not given. | *Arius falcarius.* | | |
| Sheg ... | Bhadwi .. | Doil ... | 8 | Not given. | *Mugil da—mugil?* ... ... ... | Mullet. | |
| Gangur ... | Gangur ... | Thoda ... | 6 | 3′ | *mugil oeur.* | | |
| Waras ... | Waras ... | Waras .. | 4 | Not given. | *Megalops cyprinoides** ... .. | ..... | Both resident and migratory. |
| Murdi .. | Murdi ... | Murdi ... | 3 | 1′ | *Sillago sihama* ... ... .. | "Lady fish" or "Madras Whiting." | |
| | | | | | Resident Small. | | |
| Salpa ... | Salpa ... | Salpa ... | 2 | Not given. | *Mugil borneensis.* | | |
| Khargota ... | Kargota .. | Khargota | ½ | 12″ | *Therapon jarbua.* | | |
| Nivta ... | Nivta .. | Nivta ... | ... .. | Not given | *Bol ophthalmus boddaerti.* | | |
| Kharba .. | Kharba | Kharba ... | ..... | 6″ | *Gobius ocellatus.* | | |
| Kaleta ... | Kaleta ... | Kaleta ... | ..... | Not given. | *Gobioides* (sic) ... ... ... | ..... | The absence mainly of barbels seems to indicate a new species. |
| | | | | | Migratory Large. | | |
| Gobra ... | Gobra ... | Gobra ... | 90 | Not given. | *Serranus gilberti* .. ... ... | ..... | This is a rock fish addicted to shallow water. |
| Ch | ha | Dara .. | 168 | Not given. | *Polynemus tetradactylus* ... ... | ... ... | Buchanan gives 320 lbs. |
| Jhitara ... | Guri ... | Khajura ... | 110 | 200 lbs. | *Lates calcarifer* ... ... ... | "Noir fish" or "Cock-up." | |
| Ghold | aume. | Gholmasa... | 100 | 'Several feet" | *Sciena sina.* | | |

* This fish acclimatizes well to fresh water, and is a good fly-taker. An experiment is actually being conducted to see whether this species will stand the higher altitudes of the Deccan.

| Vernacular (Marathi) Name of fish when | | | Locally said to attain | Size given by Day. | Scientific Name. | English Name. | Remarks. |
|---|---|---|---|---|---|---|---|
| Small. | Medium. | Large. | | | | | |
| | | | lbs. | | MIGRATORY LARGE—*contd.* | | |
| Tamb ... | Tamb ... | Tamb ... | 100 | 1′ or more. | *Lutjanus johnii.* | | |
| Toli ... | Tolka ... | Tol ... | 56 | 2′ or more. | *Belone strongylura.* | | |
| | Rawas | | 50 | Not given. | *Polynemus plebeius.* | "Bamin" | |
| Bandi ... | Nalbi ... | Nalba ... | 42 | No given. | *Caranx gripinnis.* | | |
| Nalbi ... | Dangul ... | Dangul ... | 28 | 22″ | *Trachynotus russellii.* | | |
| Khewa | | Kolra ... | 10 | Not given. | *Pristipoma argenteum.* | | |
| Kalamb ... | Kalamb ... | Kalamb ... | 6 | 3′ | *Plotosus canius* | | |
| Shatira ... | Shatira | Shatira ... | 5 | Not given. | *Platycephalus scaber* ... ... | ..... | "Crocodile fishes." |
| Rhepti | | Shivra ... | 3 | Do. | *Pseudorhombus javanicus.* | | |
| Wara ... | Warra ... | Warra ... | 3 | 1′ | *Scatophagus argus* | | |
| Surgutta ... | Surgutta ... | Surgutta ... | 3 | 4′-½″ | *Equula brevirostris* ... ... | ..... | Given by Day as 4½ only. It grows to over a foot and the specimen available is over 6″ in length. |
| Gomeri ... | Gomeri ... | Gomeri ... | 2 | 1′ | *Sciena carutta.* | | |
| Shendwa ... | Shendwa ... | Shendwa ... | 2 | 6″ | *Polynemus heptadactylus.* | | |
| | | | | | MIGRATORY SMALL. | | |
| ..... | Pelkati ... | ..... | 1½ | 2′ | *Engraulis taty.* | | |
| ..... | Tailkati ... | ..... | 1 | 1½′ | ,, *mystax* | | |
| ..... | Wakti ... | ..... | ¼ | 16″ | *Trichiurus savala.* | | |
| ..... | Muig n ... | ..... | ..... | 7″ | *Gerres lucidus.* | | |
| ..... | Mandel ... | ..... | 9″ | 7″ | *Coilia dussumieri.* | | |
| ..... | Kachak ... | ..... | 6″ | 6″ | *Ambassis commersonii.* | | |
| ..... | Bhituri ... | ..... | 5″ | 4″ | *Clupea lile* ... ... ... ... | ..... | A very gregarious species. |
| ..... | Datridhumne | ..... | ½ lbs. | 2½″ | *Odaxthus argenteus* | | |
| ..... | Tali ... | ..... | ..... | Not given. | *Hemiramphus georgii.* | | |

# PROTECTIVE LEGISLATION FOR INDIAN FISHERIES.

By

E. Comber.

The interesting paper on the Estuarine Fisheries of the Konkan that we have had contributed by Mr. Wallinger tempts me to rescue from what is probably, by this time, well nigh oblivion, an article that appeared in the *Field* of 2nd and 9th May 1903 over the initials "W. M." on the Inland Fisheries of India, in the hopes that by doing so it may possibly give the nail another tap on the head towards driving it home, and assist thereby in forcing the Government of India to realise its duties to the industries of the country by seriously undertaking the very needful legislation for the protection of one that is of the most importance to the population as a whole.

Let me admit that I am entirely ignorant of the identity of the author of this article; but I believe that all who read it will admit that he at any rate had studied, and thoroughly understood, his subject. That it is nearly forty years since Dr. Day was specially deputed to draw up a scheme with a view to instituting special and necessary legislation for the better protection of the fisheries of the country, is surely proof enough that what was recognised as of sufficient importance then has not yet been done in even an unsatisfactory and tentative manner.

It is to be sincerely hoped that whenever Government are aroused to take in hand this question they will be able to see their way to do so in a more complete and satisfactory manner than was the case with the so-called "Game Laws," which are now nominally in force, and was also the case when the Fisheries Act of 1897 was made law.

## THE INLAND FISHERIES OF INDIA.

### I.—Destructive Agencies.

There are few problems of greater interest and importance awaiting treatment in India at the present time than the question of the inland fisheries of that country. This problem found no place on Lord Curzon's published list of questions demanding early treatment, but there is reason to hope that the further experience of India which the Viceroy has now gained will have convinced him of the necessity of moving in the matter. It is true that already Lord Curzon has performed three times his allotted task, and that there yet remain for him many serious and far-reaching reforms. But, on the other hand, it may be urged that the question of the fisheries is far more important than has hitherto been recognised, and that the need for early action in the matter is very real. For more than thirty years the question has been merely nibbled at by the Indian Government, and throughout that time a marked progressive deterioration in the fish supply of Indian waters has been noted by competent observers. Yet it is the case that very little of a practical nature has been done during all that time. If the question

is to be shelved until such time as some future Viceroy may care to take it up there is no saying what immense permanent injury may not be done to Indian fisheries. The question, indeed, is one which no longer admits of further delay, and it is particularly desirable that it be dealt with by Lord Curzon himself, for the present Viceroy's splendid administration in the East has been largely due to his unique power of getting things done, of pushing papers through the secretariats and of inspiring even the most routine ridden of subordinates with something of his own strenuous enthusiasm. There is reason to believe that, once Lord Curzon took the matter in hand, a few practical and commonsense measures would take the place of thirty years of apathy and indecision.

So long ago as 1869 Dr. Day, the author of the standard work on Indian fishes, was placed on special duty for the purpose of drawing up a scheme for the better protection of Indian fisheries. Two years later he issued a report dealing with the protection of fish in the Nort-West Provinces, in which he strongly advocated the introduction of a Fisheries Act. But this report and recommendation shared the fate which so frequently befalls similar documents in India, and for years nothing whatever was done in the matter. By 1888 the question had again forced its way to the front, and was considered by the agricultural conference assembled at Delhi in that year. Various proposals, including one or two draft schemes of legislation, had been put forward by local administrations in the years immediately preceding, and these were duly considered by the Delhi conference. The members unanimously recommended that—(*a*) the use of dynamite or other explosives for the destruction of fish should be prohibited; (*b*) poison should also be prohibited; (*c*) fish ladders should be provided on weirs or other river works; (*d*) fixed obstructions and engines in rivers should be regulated; (*e*) stock pools should be protected. The members of the conference differed as to the expediency of regulating the size of the mesh of nets, and also as to prohibiting or regulating the baling out of rivers or streams for the purpose of catching fish. But the labours of this conference were, for the time at least, largely in vain. Five years elapsed before even a draft Fisheries Bill was prepared by the Government of India, and it was nine years after the conference and twenty-eight years after Government had deputed Dr. Day to report on the matter before a Fisheries Act was eventually passed into law. This Act was very far from being what all competent experts would have liked to see it. It prohibited the use of poison and dynamite in rivers, but practically left everything else to local administrations, to whom power was given to frame such minor rules under the Act as might seem necessary. No machinery was introduced for the proper working of the Act. It was nobody's business in particular to see that its provisions, scanty as they were, were carried out. It was even left to the discretion of local governments whether they should adopt it at all. The result of legislation of this sort may be imagined. It was something rather worse than useless. It has not stayed in the slightest degree the

process of wholesale destruction of fish in Indian rivers, but the fact of its having become law means, apparently, that the question is looked upon as closed by responsible authorities, and when this attitude is assumed it is difficult indeed to get anything done. The Act has, indeed, been practically inoperative throughout its brief existence. It has proved a mere dead letter. Inquiries recently made elicited the facts that in some provinces of India it had not been adopted at all, that in others it was nominally in force, but that nothing else had been done, in others it was in force, but no subsidiary rules had been drawn up, while in the one or two cases where rules did exist they were chiefly of a local character, and not of general application to the rivers of the province. In many cases district authorities were even ignorant of the existence of a Fisheries Act.

Such is the position to-day as regards the protective measures so far adopted by the Government of India. It may be of interest to recount briefly the evils from which Indian fresh water fisheries chiefly suffer and then to indicate the most desirable remedies. Dynamite and poison are apparently deemed the most destructive agencies by the Government, since they alone are expressly prohibited by the Act of 1897. It is very doubtful whether they really come first, but they are, at any rate, most potent causes of the depletion of many Indian rivers. Dynamite is largely used in India, as elsewhere, in railway construction work, for road making in hilly districts, for clearing sites, and so on. It is unfortunate that the labourers usually employed on work of this sort, and who thus have extensive opportunities for the theft of high explosives, should generally be hill-men whose homes are on the banks of some of the chief spawning and breeding waters in Northern India. There is little doubt that engineers and others responsible for construction work have been very lax in the past in the matter of safeguarding their explosives, but there is every reason to believe that the leakage is no longer so great as it was. Still enormous damage has been done in some rivers by the use of explosives, notably in those tributaries of the Indus in the neighbourhood of Attock. Twenty years ago these streams were renowned for the head of fish they contained. To-day, and for years past, they are practically empty. It is probable, though, that poison does far more damage than dynamite and kindred substances in the matter of fish destruction. It is far more easily obtained, in the first place, and requires no skilled knowledge to use. Every bazaar will have on sale substances which can be used only too successfully for poisoning fish. An enormous amount of damage, indeed, is done in many hill streams by a poison which costs nothing, inasmuch as it grows on the banks of the streams which are to be operated on. A decoction of the leaves of a certain shrub which is common enough in the Himalayan valleys is very frequently used for poisoning all the fish in an extensive pool. At certain periods of the year the fish ascend the rivers very much in the same manner as salmon. In the event of there being insufficient water to unable them to get past some natural obstruction thousands of fish will congregate in the pool. Such an

accumulation is the chance which the fish poisoner waits for. He lowers into the head of the pool his earthenware pot containing a decoction of poisonous leaves, and then all that is necessary is to wade into the shallows at the end of the pool and gather up the sickened and stupified fish which the current floats down to him. It will readily be understood that when this sort of operation is being carried on at a score of different points on a hill stream it is a matter for wonder, not that there should be a decrease in fish, but rather that any should remain.

But perhaps even more destructive than the poisoner is the native who works on the actual spawning grounds and nurseries for young fry. These are petty streams in the little side valleys of the hills. The largest fish may be seen forcing their way through the shallowest of water in order to reach some quiet pool with shelving bank, which instinct tells them is the most desirable spawning ground. These spawning fish, when the water is low and clear, are generally secured by the men waiting for that purpose, either by netting, clubbing, spearing, or poisoning. Some manage to escape, and may accomplish the spawning operation successfully and even get back safely to the main stream if a good spate happens to occur opportunely. To get back when the stream is low and clear is almost impossible, for such small streams are frequently dammed for either irrigation or power purposes. In each case the water is compelled to pass through a narrow channel, and in this will be placed a series of nets or large baskets, which render the passage of any fish, large or small, out of the question. In baskets such as these myriads of immature fry are captured incalculable damage being thus done to the fishery To those who have not seen the actual operations in progress the elaborate methods of the professional fish slaughterer will appear almost incredible. It is a very frequent practice, for instance, to turn aside a stream altogether from its natural course in order to leave all the fish below a certain point high and dry or confined in petty pools, whence they are readily taken out. Not merely fish and fry are thus captured, but millions of eggs are left out of the water, and so never come to maturity.

Another method of fish destruction is usually employed against the mahseer. As is well known, this grand fish prefers the rocky rivers and streams at or near the foot of the hills, and at one period of the year he ascends the rivers in large numbers. With the coming of autumn, however, he begins to fall down the streams towards the plains. Some fish, though what proportion is not clear, are found far down in the sluggish water well away from the hills, but a large number remain to hibernate in the deep, rocky pools just within the hills. The term "hibernate" is used advisedly, as there is no doubt that, as a rule, these fish pass the winter months at the bottom of these pools in a more or less unconscious condition. The water at such times is usually very clear, and shoals of monster mahseer may easily be seen from some vantage point high above the stream. They lie close to the bottom, and even when watched for hours, do not appear to move. A boat passing over them they

heed not, even a stone does not move them. Such fish readily fall a prey to the professional fishermen. They are too heavy, as a rule, for such nets as he possesses, so that, if neither dynamite or poison are employed, the most approved method in such cases is clubbing. A gang of men enter the water and drive the fish to the shallows above or below the pool. Here, the river being at its lowest, it is a simple matter to knock the fish over with clubs. It was by these methods that one of the best reaches in the Poonch, most famous of Indian rivers, was almost completely denuded of fish a few winters ago, so much so, indeed, that even the native administration of Kashmir was at length compelled to take measures to preserve the few remaining fish.

Such are a few of the methods of destruction adopted. The result of those methods is every day becoming more apparent. The decrease in the fresh water fish supply, which was noticed thirty years ago by such authorities as Day and Thomas, has continued to become more marked until now from almost every part of India the same story is forthcoming. Famous rivers well nigh destitute of fish, fewer fish on sale in the markets, higher prices for those offered. And looking to the methods employed, and which have been briefly described, can there be any wonder that the supply so steadily diminished? It may be said that from time immemorial the natives of India have been accustomed to catch their fish in the manner indicated. This looks plausible enough at first, but will not stand examination. The principal breeding grounds for the river fish of Northern India are the streams within the hills. Now, before the roads and railways which we constructed had opened out Upper India, there were probably few places more difficult to get to than the small side valleys of the Himalaya. Consequently, the profession of fisherman hardly existed within the hills in those days. Men killed large numbers of fish, no doubt, by the primitive and expensive methods already described; but there was no outside market for these, and consequently only an occasional slaughter was necessary in order to supply the scanty local demand. But to-day all this is changed. Roads and railways have brought many of the breeding grounds within easy reach of lucrative markets. Fish are caught during a winter's day, a dozen miles or so by camel brings them to the railway, and in six hours they can be on sale in the bazaars of Lahore or Amritsar. The demand for fish is increasing too. Whether this is due to an increased standard or comfort in living which some observers have remarked, or whether the spread of the ubiquitous Bengali—a fish-eater *par excellence*—is responsible for this it is difficult to say. But the fact remains that the high prices offering tempt men to pursue the business of fish slaughter ever further and further afield. Gangs now not infrequently exploit streams far remote from their own homes, greatly to the annoyance of the local natives. Some of the streams near Rawal Pindi were thus cleared of fish a few years ago by a horde of professional netters from Jhelum. Similarly, the streams in the native state of Sirmur, near to Simla, were for years

annually invaded by some scores of netsmen from the Kangra valley until the taking over of the waters in question by a private concern compelled these men to return to their homes. These are but a few instances of what has been going on for years in many parts of India, especially Northern India. From almost everywhere the same reports come regarding the marked decrease in the stock of fish and the very much increased activity of the professional fish slaughterer.

### II.—Protective Agencies.

Many years ago the Government of India deliberately recorded its opinion "that the importance of maintaining to the fullest extent one of the most considerable food supplies of the country was so great as to justify legislation." After long years that pronouncement has been followed up by the promised legislation. Is it sufficient ? and has "one of the most considerable food supplies of the country" been "maintained to the fullest extent ?" These are questions which deserve to be fully and carefully considered, and to which unfortunately, only one answer is possible, and that most decidedly in the negative. The legislation has mainly been ineffective because it has never really been given a fair chance. When salmon laws came first into operation in this country they were found to be ineffective because there was no machinery to work them and put them into force. And it was not until the Government of the day had at last recognised that legislation alone, without machinery to put into force, was perfectly useless, that the salmon laws afforded any protection whatever to the fish. It ought to be obvious enough that any legislation so handicapped must altogether fail in its object. Of what use, for instance, would elaborate laws regulating factories, steam generators, and explosives be if there existed no machinery whatever to enforce them. Or, to adopt an Indian parallel, what sort of an income would the Government monopoly of salt and opium bring in if there were no preventive service? The matter is surely plain enough. The good, though belated, intentions of the Government of India, as indicated in the Fisheries Act of 1897, have almost entirely failed to be realised simply because it has been nobody's business to set that Act in motion. The already overworked district officers have no time to study fishery questions. Local administrations have been apathetic because to a large extent ignorant of the evils which have been going on, and because, too, they have had at hand no one competent to give them expert advice on the subject. In a word, what is necessary is the appointment of a fisheries inspector, whose business it will be to carefully examine into the causes of the very marked depletion in the fresh water fish supply, and advise Government as to the remedial methods to be adopted.

Now, this proposition, simple and obvious though it appears, is one which has not as yet been received with much enthusiasm in official quarters. It is true that inspectors of fisheries have been found to be necessary by practically every civilised country in the world. But in India, no doubt rightly enough, there is always somewhat of a disinclination to create any new agency which may

perhaps, in time prove oppressive to the people. The example of the working of the forest laws is often quoted as a case in point. There is apparently a fear that the creation of any machinery, however modest, for efficiently working the Fishery Act would mean the letting loose on the people of a horde of rapacious native underlings, eager, like most of their kind, for extortion and blackmail, and ever ready in the perpetration of every description of petty tyranny and oppression. But these fears are surely either altogether unfounded or very much exaggerated. It would be possible to protect Indian fisheries to a very large extent without an army of native assistants. It has already been pointed out that it is the greater accessibility of the rivers to the markets, thus leading to an enormously greater drain upon their fish life, which is largely answerable for the depletion now so largely prevalent. It is not, therefore, absolutely necessary to patrol the banks of every river by means of armies of watchers. If only the markets themselves are carefully watched they will readily afford a great deal of information. They will tell us, for instance, whether fish have been poisoned, whether fry, immature, or spawning fish are being killed whether the close times, if any, are being observed, and so on. By watching the great markets in this way it will soon be possible to see where and by whom the regulations considered necessary locally are being broken. And in the framing of these local regulations the fishery inspector would naturally be consulted by the local authorities. He would carefully examine into the conditions on the spot, diagnosing the disease from which the river was suffering, and prescribing an appropriate remedy. The use of dynamite or poison might be indicated; he would take steps to discover the culprits and procure their conviction. The absence of all but large fish from a stream which ought to maintain a good stock of fry and smaller fish would evidently point to fixed obstructions, the use of illegally small mesh nets, and so on. In extreme cases he might even advise that the most drastic section of the Act be put in force, and all taking of fish be prohibited for a prolonged period. A system of licensing fishermen, such licenses costing merely a nominal amount, might also be introduced with advantage. Questions of acclimatisation, of spawning times, and other fish problems still to a large extent undecided might be systematically taken up, and an enormous amount of most valuable evidence thus accumulated. All this might be done at a very trifling cost, but the benefits to be derived from a common-sense fishery policy in India would be immense—so great, indeed, that the question surely deserves greater and more sympathetic attention than has hitherto been bestowed on it.

Let any one take a population map of India. He will then be able to see at a glance that the broad belt of fertile plains running parallel to the Himalaya and on either bank of the Ganges constitute some of the most densely-populated districts in India. Immediately north of this heavily-peopled tract lies a very thinly populated zone of hill country, the lower spurs and valleys of the Himalaya. Now, at the present moment the few inhabitants

of this latter tract are, to a large extent, destroying the fish food of the millions in the plains beyond. Many of the principal edible fishes ascend the rivers for spawning purposes, and it is within the hills, or in the country immediately at their feet, that the greater part of the damage to fresh water fisheries is done. A thousand fry wantonly slaughtered here for the sake of a copper or two or a few handfuls of rice means the loss of many thousands of potential full-sized fish to the netsmen in the plains below. It is not sought to in any way restrict or curtail the supply of fish to the people of India, but rather to enormously increase it by taking a few obvious precautions. By slightly curbing the very savage and primitive method of the fish slaughterer within the hills it will be possible to increase the eventual yield of the nets in the plains below a thousandfold Fish is a very favourite article of food with the natives of India. It is, indeed, of perhaps more widespread use in that country than any other substance. The staple foods of the people vary greatly. In one part rice is universally used, in another wheat flour, in a third millets or pulses. But fish is everywhere eaten when it can be obtained.

Consequently, any measures which seem to hold out even a promise of increasing this very important food supply surely deserve the fullest consideration. Hitherto in this paper the rivers of Northern India have been chiefly referred to. But there is a great opening for future fish supplies in the intelligent stocking of the numerous storage tanks which have been constructed of late years as famine relief works. In a very interesting account Mr. Thomas has shown what extraordinarily favourable results may be obtained from even small stocking schemes, such is the reproductiveness and quickness in arriving at maturity of certain species of Indian fish. By judiciously stocking some of the more promising of these tanks a very large stock of fish might be created. But to carry out work of this sort intelligently and systematically some special machinery and some uniformity of plan is required. It is a task which might well be undertaken by an Indian inspector of fisheries.

It has sometimes been said that the cry for the better protection of Indian fisheries is a mere selfish cry raised by, and in the interests of, a limited number of English anglers. There could not be a greater error. The interests of the angler and of the legitimate netsman are identical. The recreation of the one and the livelihood of the other are both being seriously affected by the wholesale fish slaughter going on continually in the hill streams—the nurseries and breeding grounds of many species. The sporting point of view may be ignored, for it is insignificant when compared with the economic aspect of the question, an aspect which has hardly as yet been afforded serious consideration by Government. Meanwhile, every year sees the general condition of Indian rivers growing worse, and it is earnestly to be hoped that the question will be thoroughly gone into before Lord Curzon's term of office expires.

W. M.

# THE MOTHS OF INDIA.

## SUPPLEMENTARY PAPER TO THE VOLUMES IN "THE FAUNA OF BRITISH INDIA."

## SERIES III, PART III.

By

Sir George Hampson, Bart., F.Z.S., F.E.S.

*(Continued from page 478 of this Volume.)*

Sub-family Erastrianæ.

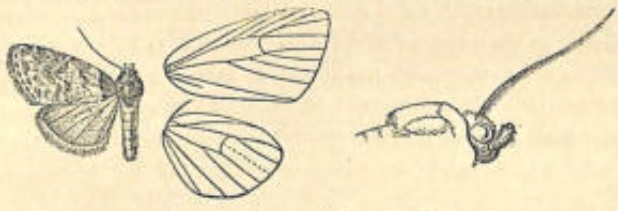
Genus Neachrostia, nov.

Type *N. brunneiplaga*.

Proboscis fully developed; palpi upturned to vertex of head, thickly scaled; the third joint short; frons smooth, rounded; antennæ of male ciliated; metathorax with recumbent crest; abdomen without crests. Forewing with vein 3 from well before angle of cell; 4·5 from angle; 6 from upper angle; 7·8 stalked shortly in female; 9 absent; 10·11 from cell. Hindwing with veins 3·4 coincident; 5 almost obsolete from middle of discocellulars; 6·7 shortly stalked; 8 anastomosing with the cell near base only.

2098. *a*. Neachrostia brunneiplaga, Swinh., A. M. N. H. (7), xv., p. 500 (1905).

♂. Head and thorax brown almost entirely suffused on dorsum with black and tinged with grey; palpi black except at tips; abdomen pale brown irrorated with fuscous. Forewing pale ochreous brown irrorated with rufous; the basal area black bounded by a waved line; the antemedial area with a glaucous tinge; the antemedial line represented by a black striga from costa and brown striæ in and below cell; a medial line, black towards costa, then brown, incurved in submedian interspace; a small black discoidal lunule; a black patch on costa from middle to near apex, slightly tinged with grey; an indistinct postmedial line excurved at middle and incurved in submedian interspace and with traces of another waved line beyond it; some faint diffused fuscous subterminal patches; a terminal series of black striæ; cilia irrorated with black. Hindwing pale brown with a faint fuscous tinge; cilia ochreous at base; the underside pale irrorated with fuscous, a black discoidal spot and diffused curved postmedial line.



*Neachrostia brunneiplaga*. ♂ ¾.

♀. Forewing with the antemedial area pale ochreous

*Habitat*.—Assam, Khasis. *Exp*. 18 mill.

2101. *d.* NARANGA MACROPLAGA, n. sp.

♀. Head and thorax ochreous white with an olive tinge; palpi fuscous except towards tips; fore tarsi ringed with fuscous; abdomen white slightly tinged with fuscous, the crest on basal segment black. Forewing pale ochreous, sometimes tinged with olive and with slight fuscous irroration; subbasal line represented by a slight oblique striga from costa; some fuscous scales on inner area before the antemedial line which is obsolescent on costal area and highly angled on median nervure, then defined by whitish on inner side and waved, defining an olive patch extending from cell to inner margin defined above by black scales and on outer side by the postmedial line which is obsolescent towards costa, inwardly oblique to vein 4, then excurved, defined by whitish on outer side; an oblique diffused fuscous fascia from termen below apex; a terminal series of black points. Hindwing pale suffused with fuscous; cilia white with a fuscous line through them.

*Habitat.*—CEYLON (de Mowbray). *Exp.* 20 mill. Type in B. M.

Genus RIVULA insert *Motina*, Wlk., XXVII., 12 (1863). Type *æqualis*.

2103. *c.* RIVULA CYANEPUNCTA, n. sp.

♂. Head and thorax red-brown, the patagia with some purple scales and metathorax with white spot; tarsi banded with black; abdomen fuscous brown. Forewing rufous with an olive tinge with series of silvery purplish points and striæ; a point at base of costa and a short streak below the cell; an antemedial series of points and striæ oblique below costa angled inwards in cell, then oblique to vein 1 and with a point further from base on inner margin; the reniform represented by a rather T-shaped mark on its upper and inner sides and some points on its outer; a postmedial series of points and striæ very strongly bent outwards below costa and angled inwards in discal and submedian folds; an irregular subterminal series of points and small white spot on costa. Hindwing fuscous, the cilia pale rufous; the underside with the inner half whitish, a slight discoidal lunule and curved postmedial line.

*Habitat.*—BHUTAN (Dudgeon). *Exp.* 24 mill. Type in B. M.

2106. *a.* RIVULA *barbipennis* insert *Motina* ÆQUALIS, Wlk., XXVII., 12 (1853), which has precedence.

2106. *b.* RIVULA NIVEIPUNCTA Swinh. A. M. N. H. (7), xv. p. 154 (1905).

♂. Legs of male normal.

Head and thorax reddish brown, the metathorax with white spot; abdomen fuscous brown, the anal tuft ochreous white. Forewing reddish brown; subbasal white points on costa and below cell; an antemedial series of points angled inwards in cell and submedian fold; reniform represented by a white lunule with series of points beyond it; a postmedial series of white points bent outwards below costa, excurved to vein 4, then strongly incurved; some white points on costa towards apex; a subterminal series of white points. Hindwing whitish, the inner and terminal areas strongly suffused with brown; the underside whitish, the costal and terminal areas irrorated with brown, a slight discoidal lunule and curved postmedial line.

*Habitat.*—Bhutan, Assam, Khasis; Ceylon, Puttalam, Haputale; Singapore. *Exp.* 16 mill.

2106. *c.* Rivula furcifera, n. sp.

♂. Pale ochreous; palpi brown at sides, the fringe of hind tibiæ brown at tips. Forewing with red brown patch from cell to inner margin extending from base to near termen and conjoined to a spot in middle of cell and oblique discocellular band extending to costa; a subbasal brown point, some slight marks on costa and a diffused patch of scales on terminal area below apex. Hindwing suffused with fuscous brown.

*Habitat.*—Ceylon, Pundaloya (Green). *Exp.* 24 mill. Type in B. M.

2106. *d.* Rivula plumipes, n. sp.

♂. Tibiæ fringed with long hair, the hind tibiæ with immense tufts of hair, black on inner side, and meeting large tufts of long black scales from medial segments of abdomen below; thorax with tufts of ochreous and black hair from below base of wings; hindwing with the inner margin fringed with long hair.

Head and tegulæ grey; thorax red-brown; abdomen ochreous. Forewing grey-brown suffused with red-brown on inner half; the grey area with a purplish tinge and slight dark irroration, the inner margin with some fulvous at middle; black points in cell near base and before middle; an antemedial series of very short black streaks, acutely angled on median nervure; a large brown discoidal ocellus with two black spots on it, the upper one larger, and some black points on its outer edge; a postmedial series of very short black streaks, very strongly bent outwards below costa, then very oblique, incurved below vein 4; an apical black spot and terminal series of points. Hindwing fuscous brown, the hair on inner margin ochreous; the underside paler with dark irroration, a slight discoidal lunule.

*Habitat.*—Ceylon, Maskeliya (J. Pole). *Exp.* 26 mill. Type in B. M.

2133. *a.* Eublemma alstoni, n. sp.

♂. Forewing with the termen strongly excurved at middle and excised above and below middle; hindwing with the termen excurved at middle and excised at submedian fold.

Black; abdomen with some whitish on basal segment. Forewing with traces of black antemedial line with slight whitish mark on it above vein 1; an indistinct black medial line oblique from costa to median nervure, then incurved; traces of a postmedial line with diffused white patch on it from costa to vein 7, a white point beyond it at vein 4, and angled inwards at submedian fold; a diffused white mark on apical part of costa; a black terminal line. Hindwing slightly mixed with grey especially on costal area and disk; traces of waved ante- and postmedial lines; a black terminal line.

*Habitat.*—Ceylon, Maskeliya (Alston). *Exp.* 24 mill. Type in B. M.

2136. *a.* Zagira bipars, n. sp.

♂. Head and thorax fuscous, the scales tipped with grey, the head with some ochreous; thorax ochreous; abdomen dorsally fuscous; pectus, legs and

ventral surface of abdomen fuscous mixed with ochreous. Forewing with the costal area broadly ochreous from inner margin near base to subterminal line, irrorated with fuscous and becoming fuscous at costa; the rest of wing deep black to postmedial line, then fuscous black; postmedial line pale, incurved, from the costal ochreous area to inner margin; a black streak below extremity of the pale costal area and two small triangular marks on its outer edge; a slight greyish subterminal line, incurved below vein 4; some ochreous point on terminal half of costa and a terminal series. Hindwing with the basal area deep black; an irregularly waved medial line with greyish suffusion before and beyond it; the terminal area fuscous black; a sinuous postmedial series of greyish ochreous points, the one in discal fold placed on a small black mark; a terminal series of ochreous points. Underside of forewing with the basal half of costal area suffused with ochreous and with dark discoidal lunule, an oblique subterminal series of whitish points; hindwing with the basal half suffused with whitish, a dark discoidal spot and line from it to inner margin; a sinuous subterminal series of white points.

♀. Thorax and costal area of forewing tinged with pale rufous.

*Habitat.*—Assam, Khasis; N. Kanara, Karwar (T. R. Bell). *Exp.* 36 mill. Type in B. M.

2139. *b.* Zurobata albiscripta insert (syn.) *Agabra spotha*, Swinh. Cat. Het. Mus. Oxon. II., p. 37, pl. 1, f. 16. Nilgiris.

2139. *a.* Zurobata decorata, Swinh. A. M. N. H. (7), xi., p. 505 (1903).

Head and thorax white mixed with some fuscous especially on palpi and fore tibiæ; a spot on frons and basal joint of antennæ orange; abdomen white, the dorsal surface red-brown except first two segments. Forewing red-brown, some purplish grey with black points on it at base of costa; an antemedial white band with a black lunule on it below the cell, angled outwards and produced to streaks on subcostal and median nervures and with a fine oblique streak from its outer edge in cell to upper angle of cell, a fine discoidal line connecting the ends of streaks; postmedial line oblique and white from costa to vein 6, then indistinct and inwardly oblique; a fine white subterminal line slightly excurved below costa and strongly at middle, the area beyond it suffused with white from below apex and vein 5; a fine white line at base of cilia which are white at apex and vein 5. Hindwing red brown; the base white; a fine oblique sinuous white line from lower angle of cell to inner margin forking in end of cell; a subterminal white line angled outwards to termen at vein 5.

*Habitat.*—Bhutan; Siam, Muek-Lek. *Exp.* 20 mill.

2145 Corgatha costinotalis del. *Capn. des minor.*

2145. *a.* Corgatha minor, Moore Lep. Ceyl. III. p. 212. pl. 174, f. 11.

♂. Bright red-brown; palpi black at tips; vertex of head white. Forewing with white subbasal, antemedial, postmedial and apical spots with the costa between them black and two white points on it towards apex; traces of a waved antemedial line; a black discoidal point; an indistinct curved postmedial

series of points; a series of black points in the inter spaces just before termen, and a terminal series of striæ on veins. Hindwing with small black discoidal spot; an indistinct curved postmedial series of points; a series of black points just before termen and a terminal series of striæ on the veins.

*Habitat.*—CEYLON; BORNEO, Sarawak. *Exp.* 18 mill.

2145. *b*. CORGATHA ATRIFALCIS, n. sp.

Hindwing falcate, the termen angled at middle; hindwing with the termen rounded.

♀. Pale brownish ochreous slightly irrorated with black. Forewing with the costal edge blackish towards base; an antemedial black point just above median nervure and one on discocellulars; two oblique medial lines from cell to inner margin filled in with fuscous; two oblique postmedial lines from vein 6 to inner margin filled in with fuscous; a double series of obscure fuscous subterminal spots; a series of fuscous points just before termen; the cilia of lobe black; the point just before it white and black. Hindwing with double oblique medial line, the inner strong, black; an indistinct double subterminal line, slightly excurved at discal fold; a series of fuscous points just before termen.

*Habitat.*—CEYLON, Wattegama (Mackwood). *Exp.* 30 mill. Type in B. M.

2145. *c*. CORGATHA DIPLOCHORDA, n. sp.

♀. Pale brownish slightly irrorated with black; head and tegulæ fulvous. Forewing with antemedial black point in cell and three on discocellulars; a double oblique medial line from cell to inner margin; a double oblique postmedial line from vein 5 to inner margin; an indistinct double subterminal series of fuscous spots; a series of black points just before termen, the terminal area tinged with rufous. Hindwing with black point at lower angle of cell; a double oblique postmedial line; a double subterminal line slightly excurved at middle; a series of black points before termen; both wings with fine terminal line.

*Habitat.*—ASSAM, Khasis. *Exp.* 24 mill. Type in B. M.

2145. *d*. CORGATHA TRICHOGYIA, n. sp.

♂. Femora and tibiæ fringed with hair, the mid and hind tibiæ with extremely long hair.

Purplish red-brown; palpi and frons black; antennæ with some white on basal half of shaft above; legs ochreous. Forewing with subbasal, antemedial and medial black spots on costa; antemedial points on median nervure and vein 1; a large discoidal spot; some pale points on costa towards apex; a terminal series of black points. Hindwing with black discoidal point; traces of a curved postmedial series of white points; a terminal series of black points.

*Habitat.*—CEYLON; Pundaloya (Green). *Exp.* 18 mill. Type in B. M.

2146. *c*. CORGATHA ALBIVERTEX, n. sp.

♂. Red-brown; palpi and frons blackish; vertex of head pure white; metathorax and segmental bands on abdomen blackish. Forewing irrorated

with black; waved black antemedial, indistinct medial, postmedial and subterminal lines, the postmedial bent outwards from below costa to vein 4 and slightly angled inwards in discal fold; a discoidal point and a terminal series. Hindwing irrorated with black; traces of an antemedial line; a discoidal point; a postmedial minutely dentate line angled outwards at vein 4; a subterminal waved line and a terminal series of points.

*Habitat.*—Ceylon, Puttalam, Matéle (Pole). *Exp.* 20 mill. Type in B. M.

1407. *d.* Tolpia melanosticta, n. sp.

♂. Head and thorax grey mixed with fuscous; palpi blackish except at tips; tarsi banded with black; abdomen fuscous. Forewing grey-white irrorated with fuscous; subbasal line strong, black, oblique from costa to submedian fold; antemedial line double, waved, with black patches on outer side at costa and submedian folds; an indistinct medial line on costal and inner areas with black mark beyond it on costa; a small elliptical white discoidal spot defined by black; the terminal area with three very ill-defined waved lines crossed by two short black streaks in discal fold, the upper rather nearer termen, and two small black marks in submedian fold; a terminal series of black points. Hindwing fuscous brown; the underside greyish with discoidal bar and curved postmedial line.

*Habitat.*—Madras, Palnis (Campbell). *Exp.* 20 mill. Type in B. M.

1407. *e.* Tolpia leucopis, n. sp.

Head, thorax and abdomen dull brown; tarsi with pale rings; tegulæ darker. Forewing pale brown suffused and irrorated with dark-brown; subbasal line represented by a black point on costa; ante- and postmedial lines waved, with black points at costa; a small whitish discoidal spot defined by black; the terminal area rather darker with ill-defined sinuous whitish subterminal line; a terminal series of black points. Hindwing pale fuscous; the underside with discoidal spot.

*Habitat.*—Punjab, Dharmsala (Hocking); Assam, Margherita (Doherty); Madras, Palnis, Kodai Kanel (Campbell); Ceylon, Hambantota (Pole). *Exp.* 12 mill. Type in B. M.

1407. *f.* Tolpia myops, n. sp.

♀. Head and thorax red-brown; abdomen pale brown with the dorsal crest at base black. Forewing red-brown more or less strongly suffused with fuscous; the subbasal, ante-medial, postmedial and subterminal waved lines very obscure and diffused; a small white discoidal spot surrounded by black scales; a terminal series of black points. Hindwing yellowish white suffused with brown or fuscous towards termen; the underside with discoidal spot and interrupted diffused postmedial line.

*Habitat.*—Ceylon, Puttalam, Bogawantalawa (Pole). *Exp.* 18 mill. Type in B. M.

1407. *g.* Tolpia plumbifusa, n. sp.

♀. Head and thorax leaden fuscous; abdomen fuscous. Forewing leaden fuscous sparsely irrorated with black, ill-defined antemedial, medial and

postmedial rufous bands; antindistinct subterminal line angled outwards at vein 7 and excurved at middle. Hindwing pale fuscous.

The specimen from Sikhim is reddish-brown, the head and tegulæ dark; forewing with the leaden fuscous suffusion confined to the basal costal area, the medial and terminal areas.

*Habitat.*—SIKHIM (Pilcher); CEYLON, Maskeliya (Pole). *Exp.* 14 mill. Type in B. M.

1407. *h*. TOLPIA BILINEATA, n. sp.

Head, thorax and abdomen brownish tinged with fuscous; abdomen with black basal crest. Forewing pale brownish suffused and irrorated with fuscous; the ante-, the inner medial and postmedial areas more or less distinctly paler; subbasal line dark, from costa to submedian fold; antemedial line dark angled outwards on median nervure; postmedial line curved from costa to submedian fold where it is angled inwards, then oblique to inner margin; a small whitish lunule at lower angle of cell with dark points beyond it; an ill-defined sinuous grey subterminal line defined by fuscous suffusion on each side; a terminal series of dark striæ. Hindwing pale yellowish more or less strongly tinged with brown on terminal area; the underside with black discoidal spot.

*Habitat.*—CEYLON, Maskeliya (Pole), W. Haputale, Horton Plains (Mackwood). *Exp.* 16-18 mill. Type in B. M.

1407. *i*. TOLPIA BIPARS, n. sp.

Palpi ochreous, black at sides; head and thorax white, antennæ black; tegulæ ochreous; patagia with leaden grey patches; legs black and grey; abdomen ochreous dorsally suffused with fuscous. Forewing with the basal area white irrorated with a few brown scales; a black-edged leaden grey patch at base of costa; a curved black line bounding the basal area with a broad leaden grey band beyond it extending to the red-brown medial line; the terminal half leaden grey and white with waved rufous postmedial line and indistinct sinuous subterminal line; a few large black scales on the rufous lines. Hindwing yellowish white suffused with fuscous brown, especially towards termen; the underside with discoidal spot and traces of postmedial line on costal area.

*Habitat.*—CEYLON, Bogawantalawa (Pole). *Exp.* 14 mill. Type in B. M.

2161. *a*. MICRÆSCHUS ATRICINCTA, n. sp.

♂. Head, thorax and abdomen pale brown slightly tinged with crimson; vertex of head and base of shaft of antennæ white. Forewing pale brownish flesh colour irrorated with crimson and a few dark scales; the costal and terminal areas black, expanding at apex; antemedial line crimson with a white point at costa, waved, a slight discoidal point; postmedial line crimson with black points at the veins and white point at costa, dentate, obliquely excurved from costa to vein 4, then strongly incurved, some white points beyond it on costa; cilia orange. Hindwing pale brownish flesh colour irrorated with crimson and a few dark scales; a discoidal crimson lunule and curved waved postmedial line; terminal black band; cilia orange. Underside greyish.

*Habitat.*—CEYLON, Maskeliya (Pole). *Exp.* 16 mill. Type in B. M.

2162 *a*. MICRÆSCHUS OINISTIS, n. sp.

♂. Head, thorax and abdomen vinous red and whitish; shaft of antennæ and a band between their bases white. Forewing whitish tinged with vinous red and irrorated with fuscous; an indistinct antemedial line from cell to inner margin; an oblique line from costa to lower angle of cell; a diffused blackish discoidal spot; traces of a postmedial line excurved from costa to vein 4, then incurved; the terminal area slightly darker with traces of a pale waved subterminal line; some dark points on termen. Hindwing purplish red; the postmedial line represented by a white bar on inner margin; cilia whitish at tips.

*Habitat.*—CEYLON, Kandy (Pole), Yatiyantota (Green). *Exp.* 14 mill. Type in B. M.

2164. *c*. MICRÆSCHUS PURPURASCENS, n. sp.

♂. Deep purplish pink; palpi, frons and forelegs brown; vertex of head and shaft of antennæ above pure white; ventral surface of abdomen and anal tuft yellow. Forewing with traces of an antemedial line; an indistinct postmedial line very oblique from costa, excurved to vein 4, then incurved, the area between the lines rather darker; the costa except at base and between the lines white. Hindwing with postmedial line oblique from costa to vein 3, then incurved, the area beyond it rather paler; both wings with the termen and cilia orange yellow.

*Habitat.*—CEYLON, Kandy (Pole). *Exp.* 16 mill. *Type* in B. M.

2164. *d*. MICRÆSCHUS POLIORHODA, n. sp.

Head, thorax and abdomen grey mixed with purplish crimson, the vertex of head pure white. Forewing grey irrorated with purplish pink; some ochreous points on costa; traces of a pink antemedial line; a slight dark discoidal lunule; a faint medial line from lower angle of cell to inner margin; a minutely waved postmedial line oblique from costa to vein 6, incurved below vein 4 and excurved at vein 1; traces of a subterminal line; termen purplish pink; cilia yellow. Hindwing grey irrorated with purplish pink; a small black discoidal lunule; a rather diffused postmedial line defined by whitish on outer side; an indistinct minutely waved grey subterminal line; termen purplish pink; cilia yellow.

*Habitat.*—CEYLON, Gampola (Mackwood), Kandy (Pole). *Exp.* 14 mill. Type in B. M.

STICTOPTERINÆ.

2298. *a*. GYRTONA NAMA, Swinh., A. M. N. H. (7), vii., p. 492 (1900).

♀. Head and thorax red-brown and black with a few white scales; a white stripe on frons and vertex of head; tibiæ and tarsi fuscous ringed with white; abdomen fuscous, the anal tuft ochreous at sides. Forewing dark purplish grey with numerous waved lines; a more distinct medial line angled in and below cell; the tufts of scales below middle of cell dark; the reniform defined by tufts of white and dark scales; the postmedial line distinct, double, strongly bent outwards below costa and below vein 4 very oblique, two black marks and white lunules on it below costa followed by an apical white

V-shaped mark and with a white spot beyond it at vein 5 ; some white points on costa towards apex and a terminal series ; cilia chequered rufous and black. Hindwing dark brown, the interspaces of basal half hyaline ; cilia pale with a brown line at base.

*Habitat.*—Assam, Jaintia Hills. *Exp.* 30 mill.

Sarrothripinæ.

2222. *a.* Blenina aquisoides, Swinh., A. M. N. H. (7), xv., p. 156 (1905).

Head brown, the vertex white ; thorax brown mixed with white, the tegulæ brown at base white at tips ; tarsi with white rings ; abdomen brown, the ventral surface whitish. Forewing white suffused with dark brown except on basal and apical areas ; the medial area suffused with purplish fuscous irrorated with irridiscent scales except on costal area ; subbasal line represented by a dark striga from costa ; traces of oblique antemedial and medial lines from cell to inner margin ; postmedial line slightly waved, oblique from costa to vein 6, excurved to vein 3, then inwardly oblique ; some black points on costa towards apex ; an ill-defined irregularly dentate subterminal line, angled outwards at vein 7 and excurved at middle ; termen brown ; cilia chequered white and brown. Hindwing pale brown, the costal area whitish, the underside whitish tinged with brown, especially on the veins and terminal area.

*Habitat.*—Assam, Khasis. *Exp.* 32 mill.

2223. *a.* Blenina fumosa, Swinh., A. M. N. H. (7), xv., p. 157 (1905).

♀. Head and thorax dull sap-green suffused with brown, tegulæ black at base and with brown medial line ; abdomen dull brown. Forewing pale purplish brown largely suffused with sap-green and irrorated with blue-black scales, the medial area suffused with black ; an indistinct waved subbasal line from costa to vein 1 ; an indistinct oblique antemedial line, waved below the cell ; postmedial line indistinct, waved, slightly bent outwards below costa and angled inwards in submedian fold, where there are two slight oblique black streaks beyond it ; subterminal line indistinct, minutely waved, slightly angled outward at vein 7 and excurved at middle, then angled inwards and with short black streak beyond it. Hindwing blackish brown with oblique sinuous pale postmedial band ; termen at middle pale rufous with some black points on it ; cilia pale rufous with fuscous line through them. Underside of both wings pale rufous, the basal half suffused with fuscous, the terminal half with black, a sinuous ochreous brown postmedial band.

*Habitat.*— Assam, Khasis. *Exp.* 46 mill.

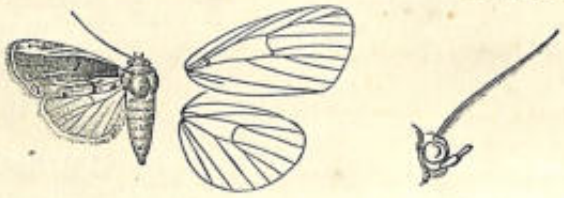
Genus Apothripa, nov.

Type *A. iphida.*

Palpi upturned, the 2nd joint not reaching vertex of head, the 3rd moderate ; antennæ of male ciliated. Forewing with veins 3, 4 stalked, 5 from above angle of cell ; 6 from just below upper angle ; 7, 8, 9, 10 stalked ; 11 from cell. Hindwing with veins 3, 4 stalked ; 5 from angle of cell ; 6, 7 from upper angle ; 8 anastomosing with the cell to middle.

2236. *c.* APOTHRIPA IPHIDA, Swinh., A. M. N. H. (7), vii., p. 490 (1901).

♂. Head and thorax rufous mixed with white; pectus, legs and abdomen whitish. Forewing purplish red tinged with fuscous towards base; the costal area whitish, tinged with olive except towards base; the inner area whitish to beyond middle; a white spot at base of costa; a dark subbasal spot on inner margin; the antemedial line indistinct on costal half, oblique from costa to median nervure where it is angled; a dark discoidal lunule; the postmedial line very oblique towards costa, then indistinct, below vein 3 white and acutely angled inwards in submedian fold, a dark spot on its inner side at inner margin; an indistinct subterminal line. Hindwing white, the veins and terminal area tinged with brown.



*Apothripa iphida.* ♂ ¾

*Habitat.*—ASSAM, Jaintia Hills. *Exp.* 24 mill.

2249. *b.* DILOPHOTHRIPA LOBATA, n. sp.

♂. Hindwing with the tuft below costa thin and whitish, the tornus with large rounded tuft of cilia forming a lobe, but no tuft on upperside.

Head and thorax dark brown mixed with grey; abdomen whitish tinged with reddish brown. Forewing grey suffused with reddish brown; an oblique whitish band on costal half between the subbasal and antemedial lines, the costal half beyond the latter suffused with fuscous; subbasal line oblique, waved, whitish from costa to submedian fold; antemedial line very slightly waved, oblique from costa to below cell, then erect, defined by grey on outer side; two obliquely placed black points on discocellulars; postmedial line minutely dentate, oblique from costa to vein 7, slightly incurved in discal fold and strongly below vein 3, defined by grey on inner side; a grey subterminal line angled outwards at vein 7 and excurved at middle; a terminal series of black points defined by grey. Hindwing brown with a reddish tinge, the tuft at tornus fuscous at tips.

*Habitat.*—KHASIS. *Exp.* 18 mill. Type in B. M.

2449. *c.* DILOPHOTHRIPA ALOPHA, n. sp.

♂. Hindwing with thick brown pencil of hair below costa, the cilia at tornus slightly thickened but not lobed.

Head and thorax dark brown mixed with grey; abdomen whitish tinged with brown. Forewing whitish suffused with fuscous grey, leaving an oblique whitish band on costal half between the subbasal and antemedial lines, the costal half beyond the latter fuscous; an obliquely excurved slightly waved sub-basal line, with a fuscous patch before it at base; antemedial line slightly awved, oblique from costa to below cell, then erect; two obliquely placed black points beyond it in submedian interspace and two on discocellulars; postmedial line minutely dentate, oblique from costa to vein 7, slightly incurved

dentate subterminal line angled inwards above vein 7, bent inwards between veins 6 and 4 and below vein 3; a terminal series of black points. Hindwing yellowish white, the inner half suffused with pale red.

*Habitat.*—Khasis. *Exp.* 40 mill.

2334. *a.* CAREA DIONE, Swinh., A. M. N. H. (7), xv., p. 159 (1905).

Head and thorax purple brown, the vertex of head, tegulæ and patagia suffused with dark olive green; pectus and legs pale; abdomen pale purplish brown, the ventral surface whitish. Forewing pale purplish brown suffused with olive green, especially at base, on medial area from costa to vein 2 and on apical area; oblique olive lines from costa before middle to middle of inner margin and from vein 6 beyond middle to inner margin towards tornus; cilia rufous except towards tornus. Hindwing whitish tinged with pale red the inner area slightly with fuscous.

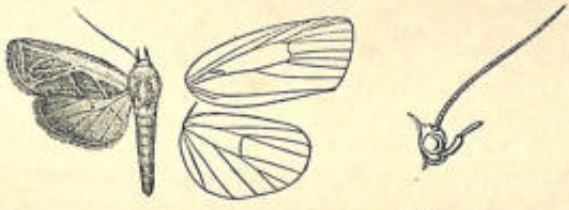
*Habitat.*—ASSAM, Khasis. *Exp.* ♂ 38, ♀ 40 mill.

Genus PLAGIOGRAPTA, nov.

Palpi upturned, slended, the 2nd joint reaching vertex of head, the 3rd long; antennæ of male almost simple; tibiæ with the spurs long; abdomen long and slender. Forewing long and narrow; veins 3 and 5 from near angle of cell; 6, 7 from upper angle; 8, 9, 10 stalked from before angle; 11 from cell; the retinaculum bar-shaped. Hindwing with veins 3, 4 on a long stalk; 5 from angle of cell; 6, 7 from upper angle; 8 anastomosing with cell to middle.

2342. *a.* PLAGIOGRAPTA MACRODONTA, n. sp.

Head, tegulæ and front of thorax white, the rest of thorax and abdomen grey-brown. Forewing grey-brown; a broad white fascia from base through the cell, its edges rather irregular, a very oblique antemedial white line from it to inner margin; a white streak on median nervure continued to termen above tornus and giving off an oblique medial line to inner margin and a streak on vein 3 to termen joined by oblique streaks from upper angle of cell and costa beyond middle crossing a streak from upper angle of cell to apex; a fine subterminal white line straight from costa to vein 3, then bent inwards to the streak running to above tornus. Hindwing fuscous brown.



*Plagiograpta macrodonta.* ♂ ¾

*Habitat.*—CANARA, Malmani (T. R. Bell). *Exp.* 24 mill. Type in B. M.

CATOCALINÆ.

2516 *a.* OPHIUSA PALLESCENS, Wlk., Journ. Linn Soc., VII., p. 179 (1864).

*Lagoptera violetta.* Pag. Abh. Senck. Ges. 1897, p. 449, pl. 20, f. 13.

Head grey-brown; thorax pale grey; abdomen pale ochreous, the ventral surface tinged with red-brown. Forewing pale violaceous grey irrorated with

black, the costal edge brownish ; an indistinct highly sinuous antemedial brown line ; orbicular represented by a black point ; reniform small, dark brown, produced to an oblique point above ; an indistinct oblique medial shade beyond the cell bent inwards to costa and outwards to inner margin ; postmedial line indistinct, waved, excurved from costa to vein 6, then oblique and bent outwards to inner margin ; an indistinct minutely waved subterminal whitish line, excurved below costa and at middle, stronger towards inner margin, with a dark brown patch before it between vein 7 and 5 and some brown suffusion beyond it from below apex to vein 3 ; a subterminal series of black points. Hindwing ochreous whitish, the inner area brownish ochreous, the termen whiter ; a black subterminal band with waved edges, very broad towards costa, narrowing to a point and indistinct towards tornus ; terminal area tinged and irrorated with brown towards tornus. Underside of forewing with black discoidal bar and postmedial line with diffused black beyond it except towards costa ; hindwing ochreous brownish with slight dark irroration, an indistinct dentate postmedial line on costal half and series of black points just before termen.

*Habitat.*—Khasis ; Singapore ; Borneo, Kuching, Sarawak. *Exp.* 90 mill.

2348. *a.* Cetola rubricosta, n. sp.

♂. Antennæ bipectinate with moderate branches, the apical part serrate. Head purplish rufous ; antennæ ochreous ; tegulæ and thorax black brown ; patagia ochreous suffused in parts with purplish rufous ; pectus and legs purplish rufous ; abdomen ochreous ; the dorsal crests on basal segments blackish, the medial segments subdorsally and ventral surface suffused with purplish rufous. Forewing ochreous ; the base slightly tinged with pink ; the costal area and upper part of cell suffused with purplish red to near apex towards which it becomes much darker and with some black streaks below costa, an indistinct highly dentate subbasal black line from costa to submedian fold ; an indistinct double antemedial line from cell to inner margin, angled outwards in submedian fold and inwards on vein 1 ; the inner margin tinged with olive except towards base ; orbicular and reniform whitish tinged with purplish pink and defined by blackish above, the former rather elongate elliptical, the latter somewhat bilobed below and with some olive suffusion below it and in lower part of cell before and between orbicular ; postmedial line indistinct, pale, strongly bent outwards below costa and oblique below vein 4, angled inwards in submedian fold to the antemedial line, some white points beyond it on costa ; an oblique olive shade from termen below apex interrupted by two whitish streaks with some dark scales on them ; an oblique olive shade from termen at vein 4 to submedian fold with some slight whitish and dark subterminal mark on it ; a slight double olive lunule at termen. Hindwing semi-hyaline white ; the apex and vein 7 towards termen tinged with purple brown ; the inner area and cilia ochreous ; a terminal series of slight ochreous points.

*Habitat.*—Ceylon ; N. Central Province (Alston). *Exp.* 46 mill.

2526. *a.* HYPÆTRA RUINOSA, Swinh., A. M. N. H. (7), XV., p. 159 (1905).

Head and thorax dark red-brown, slightly irrorated with ochreous; pectus pale; tarsi with ochreous rings; abdomen fuscous brown, the crest at base rufous, the ventral surface whitish. Forewing rufous more or less suffused with purplish fuscous, especially on basal and terminal areas; subbasal line black-brown, waved, from costa to submedian fold; antemedial line indistinct except at costa, oblique, waved; traces of an obliquely curved, waved medial line; postmedial line strongly angled outwards below costa, strongly incurved between veins 6 and 4 and with black-brown patch in its sinus, then oblique waved, forming a small spot below vein 3 and double below vein 2; subterminal line minutely and irregularly waved, forming a series of small spots; some ochreous points on costa towards apex; a fine waved terminal line with series of ochreous points in the interspaces. Hindwing dark brown; an oblique double postmedial line, more prominent and filled in with rufous above and below submedian fold; cilia with two white patches near apex and one near tornus; the underside fuscous brown with obliquely curved medial line with some black spots on it.

*Habitat.*—ANDAMANS; SINGAPORE; BORNEO, Kuching. *Exp.* 42-48 mill.

MOMINÆ.

P. 435. MOMA GRACILIS, Swinh. Cat. Het. Mus. Oxon. II., p. 101, pl. iii. f1.=M. CAVILLATOR, Wlk., from Mexico, not India.

PLUSIANÆ.

2672. PLUSIA *labifera* insert *Apamea* SELECTA, Wlk. XXXII, p. 646, which has precedence.

NOCTUINÆ.

P. 354.—Under DINUMMA insert (syn.) *Ortheaga*, Wlk., XXXIII, p. 927 (1865). Type *combusta*.

2167. *a.* DINUMMA COMBUSTA, Wlk., XXXIII, p. 928 (1865).

Head and thorax fuscous brown irrorated with grey; pectus, legs and abdomen grey tinged with fuscous, the dorsal crests blackish. Forewing pale red-brown slightly suffused and irrorated with fuscous, the patch at base of costa and medial area hardly darker; an oblique waved antemedial line; a slight dark discoidal mark; postmedial line slightly waved, oblique from costa to vein 5 where it is angled, then inwardly oblique; traces of a pale subterminal line incurved to costa; small black spots before termen at veins 6 and with slight metallic blue points above and below them. Hindwing pale us brown; a fine pale line at base of cilia.

*Habitat.*—CEYLON, Uva 600; JAVA. *Exp.* 26-34 mill.

2193. *b.* HEMODES IRRETITA, Swinh., A. M. N. H. (7), XV., p. 155 (1905).

Head and tegulæ purplish red; thorax yellow and fiery red mixed; abdomen yellow suffused with fiery red at base, purplish red towards extremity; pectus, legs and ventral surface of abdomen yellow. Forewing orange irrorated with red-brown; the costal area purplish red; some silver scales below base of costa; the lines arising from just below costa, red irrorated with silvery

scales, the antemedial and medial lines incurved to costa, the postmedial line double, the outer line without silver scales, oblique from costa to vein 6 and slightly incurved at discal and submedian fold; subterminal line with more prominent silver striæ on it, defined by fiery red on inner side incurved to costa and produced to minute dark streaks on the veins; a series of fine black lunules just before termen and a fine waved terminal line; cilia purplish red. Hindwing orange irrorated with red-brown; the antemedial and postmedial lines irrorated with silver scales, arising from below costa, the former obliquely curved, the latter double, waved, the outer line without silver scales; subterminal line with more prominent silver spots, defined by fiery red on inner side and produced to short streaks on the veins on outer; a series of fine black lunules just before termen and a fine waved terminal line. Underside yellow, the forewing except inner area and the costal and terminal areas of hindwing suffused with red.

*Habitat.*—ASSAM, Khasis; SINGAPORE. *Exp.* 32 mill.

2421. *Polydesma* VETUSTA belongs to HOMOPTERA, Sect III.

2432. POLYDESMA BIFORMIS.

*Larva* 1·3"—1·5". Head glabrous, red; body black irrorated with white and covered with grey hair; a very broad dorsal white stripe interrupted at 5th, 7th, 11th and 12th somites by thick tufts of buff-colored hair; a series of red lateral tubercles with a narrow white stripe below them with fine crenulate red line on its upper edge; prolegs all present, reddish; when mature the buff hairs become black and there are grey lines on the dorsal stripe. Forms a cocoon among leaves (W. H. Campbell).

2432. *a.* POLYDESMA PRASINA, Swinh., A. M. N. H. (7)., xii, p. 99 (1903).

♀. Head and thorax bright apple-green mixed with a few brown scales; antennæ brown with pale ridges of scale above; palpi brown; the extremities of 2nd and 3rd joints pale; pectus and legs pale and brown, fore femora and tibiæ with tufts of green hair, the tarsi ringed with white; abdomen ochreous white irrorated with brown, the dorsal crests green, the anal tuft fulvous. Forewing bright apple green; an irregular triangular brown subbasal patch on costa extending to submedian fold; a rather indistinct waved antemedial line angled inwards on median nervure; orbicular a small round whitish spot reniform indistinctly defined by white; an irregular triangular brown patch o. middle of costa; an irregularly waved postmedial line with a diffused waved band of brown scaling before it from vein 5 to inner margin; a minute waved subterminal line, incurved from costa to vein 4, then oblique and ?ted inwards on veins 2 and 1, a large patch of diffused dark scaling beyond ?ne apical area, some subterminal marks and a small patch in submedian fold; a waved terminal line; cilia brown mixed with green. Hindwing fuscous, the inner area paler, a subterminal and series of slight white mark cilia ochreous white with a dark line through them; the underside pale suffused and irrorated with fuscous, a slight discoidal lunule and diffused postmedial and subterminal bands.

at discal fold and strongly below vein 3 ; a grey subterminal line defined on each side by fuscous, angled outwards at vein 7 and excurved at middle ; a terminal series of black points. Hindwing grey suffused with brown.

*Habitat.*—TENASSERIM, Mergui (Doherty). *Exp.* 20 mill. Type in B. M.

2249. *d.* DILOPHOTHRIPA BRACHYTORNA, n. sp.

♂. Hindwing with thin whitish pencil of hair below costa, the cilia slightly thickened at tornus but not lobed.

Head and thorax fuscous brown slightly mixed with grey ; abdomen pale brown. Forewing fuscous brown mixed with grey ; an oblique minutely waved subbasal line, defined by grey on inner side ; the antemedial line obliquely curved, slightly waved and defined by grey on outer side ; two obliquely placed black points beyond it in submedian interspace and two on discocellulars ; postmedial line minutely dentate, oblique from costa to vein 7, slightly incurved at discal fold and strongly below vein 3, defined by grey on inner side ; subterminal line grey, somewhat dentate, angled outwards at vein 7 and excurved at middle, a terminal series of black points. Hindwing grey-brown.

*Habitat.*—CANARA, Karwar (T. R. Bell). *Exp.* 18 mill. Type in B. M.

2253. SARROTHRIPA POLIOPHÆA, n. n.

*Sarrothripa nolalella*, Hmpsn. Moths., Ind., II., p. 388 (nec Wlk.).

*Habitat.*—ASSAM, Khasis ; BOMBAY, N. Canara ; CEYLON, Dickoya,

ACONTIANÆ.

2186. *e.* METAPTYA ENDOPLAGA, n. sp.

♂. Head and thorax whitish tinged with pale brown and slightly irrorated with fuscous ; palpi behind and sides of frons blackish ; metathoracic crest tipped with blackish ; fore tarsi blackish with pale rings ; abdomen white dorsally tinged with brown. Forewing white tinged with rufous and slightly irrorated with fuscous ; a blackish patch on the lobe of inner margin ; traces of a curved antemedial line ; two faint discoidal points ; postmedial line rather diffused, brown defined by whitish on outer side, excurved from costa to vein 4, then incurved ; subterminal line represented by a series of dark points, excurved below costa and at middle, then incurved ; some dark points on costa towards apex. Hindwing brownish white with slight dark postmedial line ending in a black point on inner margin, the terminal area suffused with fuscous.

*Habitat.*—MADRAS, Bellary, Ramandrug, 3000′ (Campbell). *Exp.* 22 mill. Type in B. M.

Under *Pseudocalpe* insert. *Type.*

ARCYOPHORA, Guen. Noct. II. p. 378 (1852), which has precedence ... ... ... ... ... *longivalvis.*

*Setoctena*, Wllgrn. Wien. Ent. Mon., VII., p. 144 (1863)... *ledereri.*

*Euxestis*, Led. Hor. Soc. Ent. Ross., VI., p. 88 (1869) ... *mesogona.*

2655. *a.* ARCYOPHORA BOTHROPHORA, n. sp.

♂. Antennæ with long bristles and cilia ; forewing on underside with fan of scales at upper angle of cell ; veins 6·7 somewhat approximated and forming ridges with a narrow groove between them for half their length.

Head and thorax brown tinged with purplish fuscous; pectus, legs and abdomen pale ochreous, the fore legs tinged with fuscous. Forewing reddish brown suffused with purplish fuscous; an oblique rufous antemedial line with ill-defined dark spot on its outer side in cell, and outwardly defined by blackish towards inner margin; a slight obliquely curved rufous postmedial line defined by blackish on inner side; a punctiform blackish subterminal line, slightly angled outwards at vein 7 and incurved at discal and submedian folds; cilia dark-brown with slight whitish tips. Hindwing ochreous white, the veins and terminal area tinged with brown.

*Habitat.*—CEYLON, Uva, 3500′ (Alston). *Exp.* 22 mill. Type in B. M.

1510. EARIAS CHROMATARIA.

*Larva* dark slate grey with dull white dorsal line obsolete towards head and anal somite; a sublateral whitish line from 1st to 5th and 10th to 12th somites; the 2nd to 11th somites with subdorsal transverse orange oblong patches each bearing two black spots on their upper edge and one black spot on their lower. Head and legs fiery. Food plant the rolled up young leaves of *Salix babylonica*.

*Pupa* in a close fitting cocoon with conical projection at anterior end where it opens for moth to emerge, formed of brown cilia (Dudgeon).

2211. *a.* LABANDA VIRIDALIS, Swinh., A. M. N. H. (7), xv., p. 156 (1905).

Head and thorax sap-green mixed with fuscous, tegulæ with tufts of ochreous white hair below; pectus and legs brownish white, the apex with tufts of ochreous hair, the tarsi fuscous banded with ochreous; abdomen whitish thickly irrorated with fuscous, greenish towards extremity, the dorsal crests dark, of male very long and slender. Forewing sap-green irrorated with white and a few black scales; the basal area, the middle of costal area, the postmedial area to vein 4 and the apical part of costal area suffused with black; subbasal line waved, from costa to submedian fold, on a diffused green band; an oblique waved antemedial line with some white between it and the dark basal area; a prominent black discoidal lunule; postmedial line minutely dentate, oblique from costa to vein 4, then inwardly oblique and angled inwards in submedian fold; some white points on costa towards apex; subterminal line oblique from costa to termen below apex and defined by white above, a small dentate black mark below vein 7 and larger mark below 6, then interrupted, waved and angled inwards in submedian fold; a terminal series of blackish points; cilia chequered fuscous and brownish. Hindwing dull brown.

*Habitat.*—ASSAM, Khasis; MALACCA, Dinding I. *Exp.* 28-32 mill.

2328. *a.* TYMPANISTES FLAVESCENS, Swinh., A. M. N. H. (7), xv., p. 158 (1905).

♂. Head and thorax ochreous tinged with olive brown; abdomen pale red, the ventral surface whitish. Forewing ochreous irrorated with pale red, the costal area greenish irrorated with fuscous; an ill-defined antemedial line oblique from costa to median nervure when it is angled, terminating at submedian fold; a discoidal point; a dentate postmedial line, bent outwards below costa, angled inwards in discal fold and incurved between veins 4 and 1; a

*Habitat.*—Assam, Jaintia Hills. *Exp.* 44 mill.

2450. *b.* Melipotis ankara, Swinh., A. M. N. H. (7), vi, p. 311.

♀. Ochreous grey irrorated with fuscous. Forewing with waved antemedial dark line; a discoidal lunule with spot on costa just before it; a waved postmedial line bent outwards from below costa to vein 4 and arising from a costal spot; a diffused sinuous subterminal band with a large black spot just beyond it on costa and a small spot at vein 4; a fine crenulate terminal line. Hindwing ochreous white; the basal area tinged with fuscous; a narrow medial fuscous band and a broad terminal band.

*Habitat.*—Quetta. *Exp.* 40 mill.

P. 481. Under Catephia insert Idicara, Wlk. Journ. Linn. Soc. VIII, p. 172 (1864) for Sect. I. C.

2465. Catephia *Thicophora* insert *Idicara* olivacea, Walk. Journ. Linn. Soc. VII., p. 172, which has precedence.

Ceylon; Borneo.

2544*a*. Bocula erota, Swinh., A. M. N. H. (7), vii., p. 496 (1901).

♀. Head and thorax pale rufous; abdomen fuscous. Forewing pale rufous; an indistinct oblique waved antemedial line, an incurved medial line; a small black discoidal spot, an indistinct minutely dentate postmedial line angled outwards at vein 7 and above 1; the terminal area black, its inner edge oblique towards apex, then excised, then angled inwards on vein 7, then curved to tornus. Hindwing black-brown. Underside suffused with black; hindwing with discoidal spot; both wings with some pale points on termen.

*Habitat.*—Andamans, Port Blair. *Exp.* 36 mill.

2546. *b.* Bocula plecopteridia, n. sp.

♂. Antennæ ciliated; abdomen normal.

Red-brown; palpi tinged with fuscous. Forewing with dark brown antemedial point on costa, a small medial spot and a postmedial lunule with faint traces of the rufous subterminal line arising from it, excurved between veins 6 and 4, then incurved. Hindwing with traces of rufous and dark brown subterminal line towards tornus; the underside greyer with indistinct medial and sinuous postmedial lines.

*Habitat.*—Bombay (Davidson). *Exp.* 30 mill. Type in B. M.

2563 *a*. Acantholipis crenelata, n. sp.

♂. Palpi with large tuft of hair on 2nd joint above; frons with large tuft; [illegible]biæ with thick fringes of hair, the hind tarsi fringed with long hair above; fusc[illegible]s with the cilia highly crenulate; forewing with the termen angled at vein [illegible]; hindwing on underside clothed with androconia between veins 7 and 2.

Head and thorax bright rufous; palpi and frontal tuft dark brown; abdomen brown tinged with rufous, the ventral surface and hind legs pale; wings bright rufous sparsely irrorated with black. Forewing with indistinct waved antemedial line bent outward below cell; traces of a medial waved line; two dark discoidal points; postmedial line minutely waved and with dark and white points at the veins, bent outwards below costa, excurved to vein 4, then incurved

and excurved again above inner margin; an indistinct waved subterminal line; a series of black points just before termen and a crenulate terminal line. Hindwing with black point at lower angle of cell; traces of a sinuous medial line, dentate postmedial line with dark and white points at the veins, a series of black points before termen and a crenulate terminal line; underside greyish with dark discoidal lunule and sinuous postmedial line.

*Habitat.*—TRAVANCORE, Pirmâd (R. S. Imray). *Exp.* 44 mill. Type in B. M.

PYRALINÆ.

CLEDEOBIA MOLBAVICA, *Exp.* subsp. with the ground color black-brown.

2564. *a.* ACANTHOLIPES RETRACTA, n. sp.

♀. Head and thorax grey mixed with some black; palpi blackish at sides; tarsi banded with black; abdomen grey mixed with fuscous brown. Forewing grey irrorated with black-brown; a subbasal black-brown spot on costa and small spot below the cell; an oblique antemedial band from costa to submedian fold expanding somewhat at extremities and with slight line from it to inner margin; a triangular spot on middle of costa; the postmedial line bent outwards below costa, angled inwards in discal fold and produced as a short fascia to discocellulars, incurved below vein 4 and with a diffused line on its inner side; some black striæ on costa towards apex; a dentate subterminal line angled inwards in discal and submedian folds; some brown suffusion on terminal area from apex to vein 4; a terminal series of blackish striæ. Hindwing fuscous brown, the cilia pale at tips; the underside pale, the costal and terminal areas irrorated with brown, a slight discoidal lunule.

*Habitat.*—CEYLON, Haputale (Mackwood). *Exp.* 30 mill. Type in B. M.

2564. *b.* ACANTHOLIPES BISIGNATA, n. sp.

♀. Head and thorax and abdomen ochreous white irrorated with brown; tarsi ringed with fuscous. Forewing ochreous white irrorated with brown; a conical brown antemedial patch on costa with traces of a line arising from it excurved below cell and angled inwards on vein 1; a semicircular brown medial patch on costa with brown oblique line arising from it, incurved in discal fold; a black point at lower angle of cell; a curved series of dark points on the veins also arising from the costal patch; some black striæ on costa towards apex; a pale minutely waved subterminal line defined on each side by brown and incurved at submedian fold; a brown patch on apical half of terminal area extending to inner side of subterminal line; a terminal series of small black spots. Hindwing pale ochreous suffused with brown, especially on terminal area; the underside whitish, the costal area irrorated with brown, a black discoidal spot, curved postmedial series of points, traces of a subterminal line, a terminal series of small black spots.

*Habitat.*—CEYLON, Haldamulla (Mackwood). *Exp.* 26 mill. Type in B. M.

P. 533. Under THERMESIA insert Sect. *Tiruvaca*, Swinh., A. M. N. H. (7), vii., p. 497 (1901) type.

*Subcostalis.* Forewing of male with the membrane in, beyond, above and below cell distorted, vein 2 strongly curved downwards, the lower angle of cell

produced, veins 3, 4, 5 approximated for some distance; hindwing with the basal half of costa lobed.

2592. *a*. THERMESIA BUTLERI, Leech, Trans. Ent. Soc., 1900, p. 570.

♂. Head, thorax and abdomen rufous; palpi except at base and frons black-brown; legs fuscous irrorated with grey; pectus and ventral surface of abdomen orange fulvous. Forewing rufous irrorated with black and tinged with purplish grey towards apex; an indistinct waved antemedial line; a black point in middle of cell and white point ringed with black above lower angle; medial line indistinct, waved, strongly excurved round end of cell; postmedial line indistinct, bent outwards below costa, then oblique; a prominent oblique rufous line from apex, defined by purplish grey on inner side and approximated to the postmedial line below vein 6, a series of slight fuscous spots beyond it and some fuscous suffusion at middle. Hindwing rufous slightly irrorated with black; an oblique rufous postmedial line defined by purplish grey on inner side; traces of a subterminal series of diffused fuscous spots. Underside orange yellow irrorated with brown; forewing with fuscous point in cell; both wings with fuscous discoidal point slightly waved oblique postmedial line and diffused subterminal line.

♀. Greyer; forewing with discoidal lunule defined by fuscous.

The Khasi form has the area beyond the subterminal spots of hindwing yellow.

*Habitat*.—W. CHINA, Chow-pin-sa, Kwei-chow, Omei-shan; ASSAM, Khasis. *Exp*. ♂ 64, ♀ 56 mill.

2601. THERMESIA RIVULOSA insert (syn.) *Acantholipes quadripuncta*, Swinh., A. M. N. H. (7) ix. p. 423 (1902).

2606. *a*. PLATYJA MINUTIPUNCTA, Swinh., A. M. N. H. (7), vii., p. 497 (1901).

Dark brown shot with purple especially on forewing; tarsi ringed with white. Forewing sparsely irrorated with grey-white scales; traces of a subbasal white line from costa to submedian fold; the antemedial line represented by white points on costa, median nervure, and vein 1; white points in middle and end of cell and a small spot at upper angle and medial white points on veins 2 and 1; a postmedial series of points excurved below costa, then oblique and with a grey reniform spot on its inner side from vein 3 to below 2; a terminal series of points. Hindwing with curved postmedial series of white points obsolescent towards costa and a terminal series; cilia white at tips. Underside of both wings in male velvety black with indistinct postmedial series of points, of female brown irrorated with white with the series of points distinct.

*Habitat*.—ASSAM, Jaintia Hills; SINGAPORE. *Exp*. 60 mill.

2611. CRITHOTE HORRIDIPES, Wlk.

♀. Head and thorax reddish brown with darker irroration, the back of head and tips of tegulæ black; abdomen brown tinged with fuscous. Forewing with the basal half reddish brown tinged with fuscous on costal area; antemedial line oblique, curved inwards to costa with a black patch on its outer

edge from cell to inner margin strongly excurved above vein 1 and edged with white; a black point in middle of cell; the terminal half fuscous black, deep black, except on costal area, towards the medial white line which is oblique from subcostal nervure to submedian fold; postmedial line, subterminal and terminal whitish points as in male. Hindwing brown suffused with fuscous.

2649. *a.* CALPE NUBIFERA, n. sp.

♀. Head and thorax ochreous mottled with brown; palpi tinged with fulvous; abdomen ochreous. Forewing brownish ochreous thickly mottled with dark olive-brown; traces of three oblique lines on basal area; a more distinct diffused very oblique medial line; an oblique pale ochreous subterminal line arising from termen just below apex and strongly excurved at middle. Hindwing ochreous tinged with rufous brown especially towards termen.

*Habitat.*—S. INDIA, Rajahmahendri (Bird.) *Exp.* 32 mill. Type in B. M.

Under MECODINA insert *Bathanta*, Wlk. XXXIII., p. 82 (1865). Type *bisignata* for Sect. VI.

2706. *b.* MECODINA CERULEOSPARSA, n. sp.

♂. Head and thorax dark olive-brown irrorated with blue-white; tarsi black ringed with white; abdomen fuscous mixed with grey. Forewings black-brown with an olive tinge; a slight blueish white subbasal line from costa to submedian fold, with some blue-white irroration between it and the fine sinuous antemedial line which is angled outwards below costa; a white point in middle of cell; a medial band of blueish white irroration followed by an indistinct waved and curved black medial line; postmedial line blueish-white, excurved from below costa to vein 4, then incurved and angled outwards at vein 1, a band of blue-white irroration before it from costa to vein 6 and patches beyond it below costa and from vein 3 to inner margin; a sinuous subterminal line strongly incurved and obsolescent near vein 3 and with pale brown spots on it at discal and submedian folds and slight marks above the former, the area beyond it irrorated with blue-white from costa to vein 5; cilia with some white at tips. Hindwings fuscous; a fine white medial line with some white irroration beyond it towards tornus; an indistinct brownish subterminal line except towards costa, slightly defined by blackish on inner side; a fine pale line at base of cilia; the underside with the basal half suffused with white, a dark antemedial line bent outwards at middle; a minutely waved white medial line, an interrupted sinuous subterminal line.

*Habitat.*—ASSAM, Khasis. *Exp.* 34 mill. Type in B. M.

2708. Will stand as MECODINA PLACIDA Hmpsn. (nec. Moore).

2717. MECODINA *præcipua*, insert *Bathanta* BISIGNATA, Wlk., XXXIII., 983 (1865) which has precedence and *ctypansa bocanidia*, Butl. A. M. N. H. (5), x. p. 231 (1882). = the *turbida* form.

PERAK; SIAM; BORNEO; PULO LAUT; JAVA; TIMOR; NEW GUINEA; DUKE OF YORK I.

2725. *a.* ZETHES ENIGMARIA, Swinh., A. M. N. H. (7), xv., p. 161 (1905).

Head, thorax and abdomen fuscous, the ventral surface mostly ochreous. Forewing ochreous entirely suffused with greyish fuscous, the costal area greyer; subbasal line represented by a dark striga from costa; antemedial line waved, bent inwards to costa; orbicular and reniform round ochreous spots defined by fuscous, the former small, the latter with dark lunule in centre; medial line indistinct, excurved round reniform; postmedial line excurved from costa to vein 4, then incurved, some greyer suffusion beyond it on costal area followed by two ochreous points; subterminal line indistinct, minutely waved, with some ochreous beyond it at apex and above tornus and before it above middle. Hindwing ochreous, the basal and postmedial areas and a patch on middle of terminal area fuscous; the basal area bounded by a waved line, the postmedial by a waved line on inner side and a dentate line angled outwards at middle on outer; a fine slightly waved terminal line. Underside ochreous irrorated with fuscous; forewing with some dark suffusion beyond postmedial line except on costal area and a dark mark on costa with two pale points on it before apex; hindwing with oblique antemedial line, discoidal bar and postmedial band.

*Habitat.*—ASSAM, Khasis. *Exp.* 32 mill.

2734. EGNASIA COSTALIS.

♀. Forewing with the costal area suffused with black; the subterminal line of both wings dark.

2737. ZETHES NIGRILINEA insert (syn.) *Zethes ochrodes*, Swinh., A. M. N. H. (7), iii., p. 115 (1899).

2740. *b.* ZETHES MULTIPLAGA, Swinh., A. M. N. H. (7), vii., p. 498 (1901).

♀. Brownish white irrorated with dark scales; vertex of head with two small olive green spots. Forewing with indistinct waved subbasal line with olive-green spot below costa between it and the double waved antemedial line; a dusky medial line angled outwards in cell round the olive-green somewhat triangular spot in end of cell, a pale sinuous postmedial line angled outwards below costa and with small olive-green spots on each side of it between veins 7 and 2; a waved dusky subterminal line defined by white on inner side and dentate inwards below costa and at discal and submedian folds; a series of black points before termen and a crenulate terminal line. Hindwing with pale incurved antemedial line with olive green band beyond it between the cell and inner margin; an irregularly dentate dusky subterminal line defined by white on inner side and with olive-green spots before and beyond it near tornus; a series of dark points before termen and a crenulate terminal line.

*Habitat.*—ASSAM, Jaintia Hills. *Exp.* 38 mill.

2741.*a.* ZETHES CASTANITIS, n. sp.

♂. Chestnut with a yellow tinge; head and thorax suffused with white; palpi in front, tarsi and extremity of abdomen dark brown and white. Forewing with slight whitish suffusion on costa; an oblique dark subbasal striga from costa; a waved antemedial line angled outwards below costa; orbicular small,

round, grey with slight dark centre and defining line ; reniform a narrow dark lunule with greyish centre ; medial line waved, bent outwards round end of cell ; postmedial line indistinct, waved, bent outwards below costa and excurved at middle, the costa beyond it dark with white points ; a nearly straight grey and white subterminal line from just before apex to just before tornus ; cilia dark brown with greyish line through them from vein 3 to tornus. Hindwing with waved antemedial and medial dark lines ; the postmedial line grey defined on each side by black, nearly straight from apex to tornus but dentate on outer side at veins 6, 4, 3 ; a terminal black line from vein 3 to tornus ; cilia brown and grey, yellowish white in the excisions towards tornus. Underside yellower.

*Habitat.*—Assam, Silchar. *Exp.* 40 mill. Type in B. M.

2769. *a.* Diomea pagana, Swinh., A.M.N.H. (7), vii., p. 495 (1901).

♂. Mid tibiæ with tufts of long reddish hair from base ; wings with the termen crenulate.

Head, thorax, and abdomen dark brown mixed with grey ; pectus and ventral surface of abdomen grey ; wings fuscous brown suffused with grey. Forewing with diffused black patches on basal area and on costal area at middle and before apex ; traces of a curved antemedial line and of a waved postmedial line angled at vein 4, then oblique ; a series of points before termen. Hindwing with diffused antemedial black patch and a series of points before termen ; the underside greyer ; a discoidal spot with line from it to inner margin ; a postmedial line on inner area and traces of a diffused subterminal band.

*Habitat* —Assam, Jaintia Hills. *Exp.* 40 mill.

No. 2781. Diomea (*Raparna*) multifasciata.

♂. Fore and mid tibiæ thickly clothed with rough hair, hind tibiæ smoothly scaled ; four legs with a tuft of long ochreous hair from joint of coxa and femur and mid legs with a tuft of long pink hair from outer side of femero-tibial joint.

2772. *a.* Raparna marginalis, Wlk., XXXIII., 802 (1865).

*Rhodaria formosalis*, Wlk., XXXIV., 1284 (1865).

Head and tegulæ crimson ; thorax and abdomen ochreous. Forewing ochreous ; crimson costal fascia ; a crimson fascia on inner margin not extending to base ; terminal area crimson, broad at inner margin, narrowing to a point below apex. Hindwing pale ochreous, the terminal area suffused with fuscous in male, wholly suffused with fuscous except at base in female.

*Habitat.*—Ceylon, W. Haputale (Mackwood) ; Australia. *Exp.* 26 mill.

2782. *a.* Raparna purpureo-rufa, n. sp.

♂. Dark purplish red, palpi and wings irrorated with black, the former with the tips of 2nd and 3rd joints white ; antennæ brown, ringed with white towards base ; tarsi ringed with white, abdomen fuscous with whitish segmental lines. Forewing with indistinct subbasal and antemedial pale lines defined by black, angled below costa, then oblique and minutely waved ; two black-edged whitish discoidal points ; the postmedial line with an obliquely curved pale

mark from costa, strongly angled at vein 7, then oblique, dark edged with grey scales and bisinuate; two white points on costa towards apex; an irregularly sinuous subterminal line with some grey scales on it and strongly excurved at middle; a series of black points just before termen. Hindwing with two black discoidal points; an oblique grey medial line with dark inner edge and fine black line through it; a series of black points just before termen; both wings with fine grey line through the cilia. Underside largely suffused with grey.

*Habitat.*—CEYLON, Pundaloya (Green), *Exp.* 28 mill. Type in B. M.

2785. AVITTA SUBSIGNANS insert (syn.) *Avitta surrigens*, Wlk. J. Linn. Soc.; Zool. VII., p. 81 (1864).

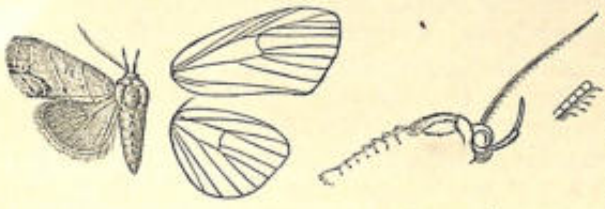
HYPENTNÆ.

Genus CODONODES, nov.

Palpi upward, sickle-shaped, about four times length of head, the 2nd joint smoothly scaled, the 3rd naked; antennæ of male with cilia and bristles; tibiæ with the spurs long, abdomen with dorsal crests. Forewing with veins 3 and 5 from near angle of cell; 6 from upper angle; 7·8·9 stalked, 10·11 free. Hindwing with veins 3·4 shortly stalked, 5 from above angle of cell; 6·7 from upper angle.

2792,*a*. CODONODES RECTIGRAMMA, n. sp.

Head and thorax reddish-brown mixed with grey; tarsi with pale rings; abdomen dull brown. Forewing whitish suffused with reddish brown, deepening at costa; a slight grey subbasal line from costa to submedian fold angled outwards below costa; a straight oblique brown antemedial line defined by whitish on outer side and with a brown point on its outer edge in submedian fold; a brown and grey discoidal bar; postmedial line defined by whitish on outer side, excurved below costa, then oblique, slightly excurved and with brown point on its inner edge in submedian fold; subterminal line whitish, angled outwards to termen at vein 4, then incurved and with irregular black marks on its inner side from vein 6 to inner margin; a terminal series of black points and a blackish patch at tornus.



*Codonodes rectigramma* ♂ ¾.

*Habitat.*—SIKHIM (Dudgeon), CANARA, Karwar (T. R. Bell). *Exp.* ♂ 22, ♀ 24 mill. Type in B. M.

2803. *a*. ADRAPSA ATRATALIS, Swinh., A. M. N. H. (7), xv., p. 501 (1095).

" *curiosalis*, Swinh. A. M. N. H. (7), xv., p. 162, ♀ (nec. ♂).

Fuscous black, slightly irrorated with white; tegulæ reddish brown at tips in male; tarsi with pale rings. Forewing with slight waved white antemedial line; a white discoidal lunule; a minutely waved white postmedial line, bent inwards to costa and angled inwards in submedian fold; subterminal line

white and prominent at costa, then merged in a quadrate white patch from below apex to below vein 5, then reduced to points ; cilia chequered with white on apical half. Hindwing with waved white medial line from vein 5 to inner margin ; an interrupted waved white subterminal line from vein 6 to tornus ; cilia fuscous and whitish, the underside strongly irrorated with white, waved dark antemedial, medial and subterminal lines, the two latter defined by whitish on outer side.

*Habitat.*—W. China, Chow-pin-sa ; Assam, Khasis. *Exp.* 46 mill.

2804. *a.* Adrapsa curiosalis, Swinh., A. M. N. H. (7), xv., p. 162 (1905).

♂. Palpi with tufts of hair on inner side of 2nd and 3rd joints, antennæ with bristles and cilia, the basal half of shaft fringed with hair above ; fore femora with large tuft of hair from base.

Fuscous black, slightly irrorated with whitish ; tegulæ tipped with ochreous. Forewing with slight subbasal striga from costa ; a sinuous antemedial line ; a white point in middle of cell and elliptical discoidal spot ; an indistinct post-medial line defined by paler color on outer side and angled outwards below costa and at vein 4 ; a minutely waved subterminal line, white and distinct on costal half, angled slightly outwards at vein 7, incurved and forming a white lunule at discal fold, incurved below vein 4 with an ochreous white patch beyond it from below apex to vein 5 ; cilia chequered fuscous and ochreous white. Hindwing with minutely waved medial and post medial lines defined by whitish on outer side ; cilia chequered fuscous and ochreous ; the underside thickly irrorated with white, a white discoidal bar, the lines more distinctly defined.

*Habitat.*—Assam, Khasis. *Exp.* 36 mill.

2825. Bleptina prunosa. Antennæ of male with large tuft of scales on middle of shaft.

2827. Bleptina ochreistigma. ♂. Palpi not recurved or tufted with hair ; antennæ with a tuft of scales on middle of shaft ; fore tibiæ without sheath.

2834. *b.* Mastigophorus placida. Moore. Lep. Atk., p. 194.

♀. Head and thorax dark red-brown ; abdomen fuscous brown. Forewing dark red-brown suffused with purple-grey ; a minutely waved antemedial line ; a blackish discoidal lunule on traces of an oblique medial line ; a minutely waved oblique postmedial line slightly excurved at middle ; an indistinct irregularly waved subterminal line with paler brown marks on its inner edge. Hindwing dark brown, the inner area suffused with purple-grey ; indistinct minutely waved medial and subterminal lines.

*Habitat.*—Sikhim. *Exp.* 40 mill.

2840. *d.* Falcimalis diacia, Swinh., A. M. N. H. (7), xv., p. 163 (1905).

Head and thorax ochreous whitish ; palpi to near end of 2nd joint and at extremity of 3rd, sides of frons, tegulæ and base of patagia dark brown ; fore tibiæ and the tarsi with dark bands ; abdomen ochreous tinged with fuscous. Forewing pale ochreous ; a triangular black-brown patch at base of costa ;

antemedial line angled outwards below costa, then oblique; the medial area suffused with brown and with an oblique black-brown wedge-shaped patch from the costa to angle of postmedial line with a rather conical black discoidal spot on it; postmedial line very oblique to vein 4 where it is angled, obliquely curved to vein 3, then retracted to below angle of cell; some black and white points on costa towards apex; a whitish subterminal line, incurved below vein 4, crossed by a wedge-shaped black shade from termen below apex to above angle of the postmedial line; a terminal series of small black spots; cilia fuscous with whitish points. Hindwing pale fuscous; the underside whiter with traces of diffused postmedial and subterminal bands.

*Habitat.*—ASSAM, Khasis. *Exp.* ♂ 20, ♀ 22 mill.

2848. *a.* HYDRILLODES SUBFLAVALIS, n. sp.

♂. Palpi with the 2nd and 3rd joints slightly fringed with hair in front, the 3rd joint long fringed with hair behind; fore femora and tibia fringed with hair on inner side; abdomen with protusible lateral tufts of hair from base and large anal tuft; fore and hindwings on underside with the base clothed with long yellow hair, on latter extending to lower angle of cell and on inner margin to near tornus.

Head, thorax and abdomen fuscous, the last with some ochreous. Forewing fuscous; an indistinct waved dark antemedial line arising from a pale point on costa; traces of a medial line with pale point at costa; a small black discoidal lunule; postmedial line slightly defined by grey on outer side, waved; a fine minutely waved whitish subterminal line, slightly excurved at vein 7 and middle; a terminal series of black points; a fine pale line at base of cilia. Hindwing pale fuscous; a dark discoidal lunule; indistinct curved postmedial and subterminal lines; a fine white line at base of cilia; the underside whitish with some dark irroration, the discoidal lunule black, the lines distinct and diffused.

*Habitat.*—CEYLON, N. C. Province (J. Pole). *Exp.* 24 mill. Type in B. M.

2858. *b.* NODARIA PRODUCTA, n. sp.

Purplish brown; abdomen with slight dark segmental lines. Forewing irrorated with black scales; the veins with slight dark streaks; a short subbasal line angled below costa; the antemedial line angled below costa, then slightly incurved; a discoidal striga; the postmedial line very oblique from costa to vein 5 where it is acutely angled, then retracted to below end of cell at vein 2 where it is obtusely angled, then bent outwards to inner margin; a strong slightly incurved line from apex to inner margin before tornus; a fine terminal line. Hindwing irrorated with black; a slight discoidal striga; a fine postmedial line obtusely angled at vein 5 then sinuous; a strong subterminal line defined by whitish on outer side and obtusely angled at vein 2; a fine terminal line.

*Habitat.*—CEYLON, Pundaloya (Green), Puttalam (Mackwood). *Exp.* ♂ 28, ♀ 32 mill. Type in B. M.

2875. *a.* CATADA COSTIPUNCTATA, n. sp.

♂. Pale ochreous; palpi with the 1st and 2nd joints and frons black; fore tibiæ blackish, joints of legs with black rings; abdomen irrorated with black;

wings strongly irrorated with fuscous. Forewing with black points on costa and large ante and postmedial spots; a prominent discoidal spot; the termen with waved black line, and two excisions below apex. Hindwing with discoidal black spot and terminal series of lunules. Underside of forewing largely suffused with black.

*Habitat.*—CEYLON, Pundaloya (Green). *Exp.* 14 mill. Type in B. M.

2877. *b.* CATADA NIGRIPUNCTA, n. sp.

♂. Ochreous; head irrorated with black and red scales; palpi with black bands at extremity of 1st and 2nd joints and at middle of 3rd; tegulæ and metathorax with patches of black and red scales; abdomen dorsally irrorated with a few red scales, black points on 2nd, 4th and 6th segments and a larger spot on terminal segment. Forewing irrorated with a few dark scales below costa; five black points on costa; a diffused spot above base of inner margin; traces of waved antemedial, medial, and postmedial red lines and of a blackish subterminal line with two black spots before it below costa and a large round spot at middle; a terminal series of black points and spots on termen and cilia at apex and middle. Hindwing with traces of antemedial, medial and postmedial waved red lines and of a black discoidal point; an indistinct waved blackish subterminal line; a terminal series of black spots.

*Habitat.*—CEYLON, Matelé (Pole). *Exp.* 16 mill. Type in B. M.

2885. *a.* CATADA HEMIPHÆA, n. sp.

♂. Head and thorax dark brown mixed with grey; pectus and legs whitish, the tarsi black tinged with white; abdomen grey irrorated and suffused with fuscous and with dorsal black crests on 2nd and 3rd segments, the ventral surface whitish. Forewing grey, the basal area suffused with black-brown deepening to the medial line which is white, slightly sinuous and oblique from costa to above vein 1; traces of a waved subbasal line and oblique antemedial line; the terminal area irrorated and suffused with fuscous; a slight pale discoidal lunule, some whitish points on costa towards apex; an indistinct pale sinuous subterminal line with some dark suffusion before it towards costa; a fine black terminal line; cilia fuscous with a series of white points. Hindwing fuscous brown; the underside grey thickly irrorated with fuscous leaving an ochreous white patch from below end of cell to near termen.

*Habitat.*—MADRAS, Bellary, Ramandrug, 3,000′ (Campbell). *Exp.* 20 mill. Type in B. M.

Genus. ARÆOPTERON.

A. Frons black or dark brown.

*a.* Forewing with oblique white postmedial line from below costa to inner margin ..... *fascialis.*

*b.* Forewing without oblique white postmedial line.

$a^1$. Forewing with the costal and postmedial areas pure white.

$a^2$. Forewing white ..... *nivalis.*

$b^2$. Forewing largely suffused with rufous ..... *proleuca.*

$b^1$. Forewing with the costal and postmedial area grey.

$a^2$. Hindwing suffused with bright rufous except terminal area ..... *pictalis*.

$b^2$. Hindwing not suffused with rufous..... *griseata*.

B. Frons concolorous.

$a^1$. Hindwing without discoidal tuft of fulvous scales ..... *goniophora*.

$b^1$. Hindwing with discoidal tuft of fulvous scales..... *xanthopis*.

2887. *b*. ARÆOPTERUM NIVALIS., n. sp.

♂. White; palpi and frons tinged with fuscous. Forewing with subbasal and antemedial black points on costa, the latter with a faint obliquely curved brown line arising from it; a black discoidal point with another above it on costa with the faint brown postmedial line arising from it, bent outwards below costa, then waved; a series of black points on costa with a brown spot before them above the discal fold; cilia brownish. Hindwing slightly irrorated with brownish; a brown medial band with black spot at costa and point at inner margin; faint traces of a curved postmedial line; cilia brownish.

*Habitat*.—CEYLON, Peradeniya (Green). *Exp*. 10 mill. Type in B. M.

2887. *c*. ARÆOPTERON PROLEUCA, n. sp.

Head and thorax white; palpi and frons brown, the former banded with black; abdomen red-brown. Forewing pure white more or less suffused with red-brown and fuscous except on costa and postmedial areas; the costa with series of red-brown marks with white points on them; subbasal line represented by a black point on costa; the antemedial line oblique, waved, more or less interrupted; a black discoidal lunule with striga on costa above it; a waved postmedial line incurved below cell; subterminal line only defined by the area beyond it being fuscous except at apex, angled outward at middle; a terminal series of black points. Hindwing white at base, then fuscous, with a black discoidal spot, to the postmedial black line which is incurved to costa, then white; the terminal area pale rufous irrorated with fuscous and with indistinct sinuous white subterminal line.

*Habitat*.—BENGAL, Calcutta (Atkinson); CEYLON (Pole). *Exp*. 12 mill.

2887 *d*. ARÆOPTERON GRISEATA, n. sp.

Head and tegulæ white; palpi and frons black; thorax grey; abdomen fuscous. Forewing grey irrorated and suffused with brown; subbasal line represented by a black point on costa, the antemedial line by a black point on costa and an oblique sinuous more or less complete brown line; a rather V-shaped black mark on discocellulars with a black and orange mark above it on costa and an oblique line from it to inner margin; subterminal line indistinct, grey with a blackish patch with white points on it before it on costa, incurved at discal fold where there is a blackish mark before it, again incurved at submedian fold, the area beyond it rather darker, a terminal series of black points. Hindwing grey, suffused and irrorated with brown; a black discoidal point with some blackish suffusion near it; an ill-defined sinuous black postmedial line; a very indistinct sinuous grey subterminal line with area beyond it rather darker; termen fulvous yellow with a series of black points; cilia brown and grey.

*Habitat.*—CEYLON, Peradenyia, Nawala Pltiya (Green); Hambantota. Puttalam (Pole). *Exp.* 10-11 mill. Type in B. M.

2887. *e.* ARÆOPTERON GONIOPHORA, n. sp.

Head, thorax and abdomen grey mixed with brown, the last tinged with reddish brown. Forewing grey irrorated and suffused with brown; the subbasal line represented by a black point on costa, the antemedial line by a triangular brown mark on costa with oblique somewhat sinuous line from it to inner margin; a black discoidal spot with triangular brown mark above it on costa and oblique line from it to inner margin; an indistinct postmedial line obliquely curved from costa to vein 3 where it is sharply angled, then incurved; subterminal line grey defined on each side by brown, obliquely curved from costa to vein 4, incurved at submedian fold; a terminal series of dark-brown points. Hindwing grey suffused with red-brown and irrorated with fuscous; a black discoidal spot with diffused black between it and inner margin; a sinuous black postmedial line; the terminal area darker with a terminal series of black points.

*Habitat.*—CEYLON, Nawalapitiya (Green), Hambantota (Pole). *Exp.* 12 mill. Type in B. M.

2887. *f.* ARÆOPTERUM XANTHOPIS, n. sp.

♂. Head and thorax whitish slightly tinged with rufous; abdomen with the basal segment whitish tinged with rufous, the terminal segments black, the anal tuft white. Forewing leaden grey partly suffused with black to the postmedial line; the basal inner area whitish; an indistinct curved, waved, black antemedial line; a black discoidal point with diffused band from it to inner margin; an outwardly oblique postmedial line, slightly angled inward at vein 3; terminal area whitish with some blackish points on costa; a conical fulvous subterminal patch on costa; some terminal dark points. Hindwing with the basal area whitish with some black subbasal scales on it, the rest of wing leaden grey with diffused black band on its inner edge; a small fulvous discoidal tuft of scales; a diffused black subterminal band.

*Habitat.*—CEYLON, Haldamulla (Mackwood). *Exp.* 12 mill. Type in B. M.

2894. *b.* TALAPA BIRTHAMA, Swinh., A. M. N. H. (7), xv., p. 161 (1905).

♀. Head, thorax and abdomen grey irrorated with fuscous; palpi blackish towards base, forewing ochreous greyish irrorated with fuscous brown; the costa and medial area except below costa suffused with brown; a velvety black triangular subbasal patch between cell and inner margin, bounded by the sinuous yellowish antemedial line which is obsolete in cell; excurved and brown defined by yellowish on inner side at costa; a black point in middle of cell; an inverted comma-shaped white mark on a rounded black patch at lower angle of cell; traces of a waved medial line; postmedial line angled outwards below costa, then oblique, sinuous, black and prominent, some brown suffusion beyond it extending to apex and to termen at middle; a faint waved whitish line just beyond the postmedial line and a similar subterminal line incurved near discal and submedian folds and with oblique black streak beyond it from apex and spot before it above vein 6; a waved brown terminal line. Hindwing

fuscous brown ; the underside greyish thickly irrorated with brown, a discoidal lunule, faint, curved medial line and more distinct postmedial line shewing through to upperside.

*Habitat.*—ASSAM, Khásis. *Exp.* 36 mill.

2903. Should stand as MARAPANA RUBRIPUNCTALIS.

2903. *a*. MARAPANA MINORALIS, n. sp.

Differs from *M. rubripunctalis* in being smaller. Forewing with the postmedial line very minutely waved ; hindwing with the postmedial line sinuous, not waved ; both wings with the lunules at base of cilia black, not crimson.

The medial and postmedial areas of forewing are sometimes suffused with rufous or the medial area has a black patch on inner half.

*Habitat.*—CEYLON, Maturata, Puttalam, Uva (Mackwood, Green, Pole, Alston). *Exp.* 18-20 mill. Type in B. M.

2903.*b*. MARAPANA LACTIGUTTA, n. sp.

♂. Head, thorax and abdomen purplish red-brown mixed with some black ; palpi and frons mostly black ; pectus and ventral surface of abdomen whitish; anal tuft rufous. Forewing purplish red-brown ; a black patch at base of costa enclosing a spot of the ground colour, a small spot on inner margin ; a black spot with white centre at middle of cell with a black patch above it on costa ; an ill-defined quadrate patch on discocellulars ; postmedial line black, diffused, with some white lunules on its outer edge and prominent patch in submedian interspace, bent outwards below costa, excurved to vein 4, then incurved ; subterminal line very indistinct, pale, with black patch before it at costa and slight black spots on its outer edge, angled outwards at vein 7 and excurved at middle ; a terminal series of black points. Hindwing with some fuscous suffusion at middle forming a very ill-defined band ; an indistinct curved postmedial series of dark points and a prominent terminal series.

*Habitat.*—CEYLON, Maskeliya (J. Pole). *Exp.* 24 mill. Type in B. M.

2905. *a*. MARAPANA OLIVESCENS, n. sp.

♀. Head and thorax whitish mixed with olive-green ; abdomen whitish ochreous, sometimes with some blackish dorsal marks. Forewing whitish tinged with ochreous and pink and on costal area with olive-green ; an obliquely curved olive-green antemedial band from subcostal nervure to inner margin ; an obscure dark-edged whitish discoidal lunule with black point at lower angle of cell and traces of a waved line from it to inner margin ; the postmedial line pale, oblique, and with olive green above it from costa to vein 4 where it is strongly angled, then obsolescent ; an indistinct pale lunulate subterminal line, strongly angled at vein 5 and with black streak from its angle extending into cilia ; a series of short black strigæ just before termen ; some black points on cilia below apex ; the termen excurved below apex and sharply angled at vein 4. Hindwing purplish pink with slight dark discoidal spot ; traces of a sinuous postmedial line ; the termen crenulate with a fine dark line.

*Habitat.*—WYNAD (Cardew) ; CEYLON, Corigama (Mackwood). *Exp.* 30 mill. Type in B. M.

2913. *a.* RHYNCHINA FERREIPARS, n. sp.

Head, thorax and abdomen grey-brown. Forewing purplish grey; the postmedial line very sharply angled below costa where it is joined by a whitish streak from apex, then whitish and oblique to middle of inner margin, the area beyond it and the apical streak ferruginous with obscure diffused waved subterminal fuscous line. Hindwing fuscous brown; the cilia pale.

*Habitat.*—CHINA, Ichang; BOMBAY, Nasik (Davidson); Madras, Belgaum (Watson). *Exp.* 22 mill. Type in B. M.

2915. *a.* RHYNCHINA PALLIDINOTA, n. sp.

♀. Head and thorax whitish; palpi with dark streaks on second joint; fore and hind legs fuscous; the tarsi ringed with white; abdomen whitish tinged with fuscous. Forewing greyish fuscous; a creamy-whitish patch on base of inner area extending to middle, traversed by an oblique rufous line with a fuscous spot beyond it on inner margin and another rufous line near its outer edge; reniform stigma white, the orbicular indistinct with some raised black scales on and round it; the postmedial line indistinct, obliquely curved from costa to vein 3, then bent inwards to below middle of cell and erect to inner margin, its inner half with blackish streaks and tufts of scales; the apical part of costa whitish with slight dark streaks and some brown suffusion below it; traces of a subterminal line, angled at middle and with prominent dentate white and blackish marks on it towards inner margin; a fine dark crenulate terminal line. Hindwing whitish suffused with brown and with a dark terminal line.

*Habitat.*—SIKHIM, 7000′ (Pilcher). *Exp.* 34 mill. Type in B. M.

P. 76. Under HYPENA insert *Aphypena*, Swinh., A. M. N. H. (7), viii. p. 21, (1901), Type *dissimulans* and *Anepa*, Swinh., A. M. N. H. (7), xv., p. 502 (1905). Type *oxydata*.

2935. HYPENA ICONICALIS insert (syn.) *Bomolocha similis*, Swinh., A. M. N. H. (7), viii., p. 20 (1901) and *Bomolocha herpa*, Swinh., A. M. N. H. (7), viii., p. 20 (1901).

2941. *b.* HYPENA PHECOMALIS, Swinh., A. M. N. H. (7), xv., p. 164 (1905).

Dark brown; the hair of frontal tuft, tegulæ and dorsal crests of abdomen grey at tips. Forewing with the postmedial area paler; an indistinct waved antemedial line; a dark spot in middle of cell; a brown postmedial line angled at vein 5, then incurved and slightly sinuous with diffused dark brown band on its inner side, traces of another line beyond it excurved between veins 6 and 4, then incurved and sinuous; a subterminal maculate line with some grey scales on its outer edge, excurved below costa, at middle, and above inner margin; a triangular terminal dark shade from apex to vein 2 extending to inner side of the second postmedial line; a series of grey points before the fine dark terminal line. Hindwing fuscous brown with fine dark terminal line and pale line at base of cilia. Underside irrorated with grey; forewing with two dark subapical points; hindwing with small discoidal lunule and curved postmedial and subterminal lines.

ab. 1. Forewing with the antemedial line on inner side, the postmedial and subterminal lines on outer side defined by violet blue.

*Habitat.*—ASSAM, Khàsis. *Exp.* 42 mill.

2955. *a.* HYPENA CAMPTOGRAMMALIS, n. sp.

♂. Head, thorax and abdomen dark-brown slightly mixed with grey. Forewing red-brown to the postmedial line; the costal area slightly irrorated with black; the terminal area dark-grey brown irrorated with blackish; the antemedial line indistinct, rufous, irregularly sinuous and angled outwards in submedian fold; small tufts of black and grey scales in middle and end of cell; an oblique streak of diffused black scales from median nervure at origin of vein 2 to postmedial line in submedian fold; the postmedial line rufous defined by grey on outer side sharply retracted to costa from vein 6, then oblique and with minute black dentitions in submedian interspace; an indistinct dentate subterminal line with dull rufous beyond it and two slight subapical black marks on it; a series of whitish and black terminal striæ; cilia blackish. Hindwing fuscous brown, with fine black terminal line; a discoidal lunule on underside.

*Habitat.*—CEYLON, Haputale (Mackwood). *Exp.* 28 mill. Type in B. M.

2955. *b.* HYPENA SINUISIGNA, n. sp.

♂. Dull grey-brown. Forewing with traces of antemedial line with tuft of black scales on it below the cell and angled above vein 1; a pale streak in submedian fold to the postmedial line; a small tuft of black scales in middle of cell and a somewhat V-shaped discoidal mark, the ground color blackish below end of cell and from thence to termen below apex; the postmedial line indistinct oblique sinuous, on an indistinct greyish band; a sinuous ochreous oblique streak from apex to near upper angle of cell, diffused towards costa and with slight dark marks above it; a terminal series of grey and black striæ. Hindwing fuscous brown with fine dark terminal line; the underside whitish tinged with brown towards costa.

*Habitat.*—CEYLON, Haputale (Mackwood). *Exp.* 30 mill. Type in B. M.

2955. *c.* HYPENA RIVULA, n. sp.

♀. Head, thorax and abdomen dark grey-brown; pectus, legs and ventral surface of abdomen whitish. Forewing dull reddish brown slightly irrorated with black; a diffused dark discoidal mark; postmedial line formed of black striæ defined by greyish on outer side, arising from costa towards apex, oblique, sinuous, excurved at middle; a subterminal series of black points excurved at middle. Hindwing dull reddish brown thickly irrorated with fuscous; the underside paler.

*Habitat.*—MADRAS, Bellary, Ramandrug, 3,000′ (Campbell). *Exp.* 26 mill. Type in B. M.

2964. *a.* HYPENA ÆNESCENS, n. sp.

Brown mixed with grey; abdomen dull brown. Forewing with the basal half bronze green suffused with olive-brown scales; a waved olive-brown antemedial line; a black point in cell; a somewhat waved, slightly oblique olive-brown medial line defined by white on outer side; the terminal half purplish

grey suffused with brown, especially before the irregularly waved subterminal line, which is incurved below vein 3, and obliquely from termen below apex ; a series of white points on apical half of costa and termen. Hindwing dark-brown with a fine dark terminal line ; the cilia grey at tips. Underside of forewing with subapical white point ; hindwing grey irrorated with brown ; a brown discoidal point and curved postmedial and subterminal lines.

One specimen has the medial line of forewing excurved at the discocellulars and more waved below the cell ; a black point at lower angle of cell.

*Habitat.*—CEYLON (Mackwood), Clodagh (Pole). *Exp.* 26 mill. Type in B. M.

2980. *b.* HYPENA DODA, Swinh. A. M. N. H. (7), ix., p. 180 (1902).

Head and thorax violaceous grey tinged with brown ; tarsi fuscous with pale rings ; abdomen grey irroated with brown, the dorsal crests dark. Forewing violaceous grey tinged with red-brown and sparsely irrorated with black ; an indistinct curved antemedial line sometimes reduced to a striga from costa and points on the veins ; a small white spot in middle of cell ringed with brown ; a dark discoidal point ; a strong slightly oblique brown postmedial line usually with a more or less distinct fine line just beyond it followed by a series of minute dentate dark marks slightly bent outwards to costa and excurved at middle ; a terminal series of black points and slight lunule above tornus ; cilia with black mark at apex and two or three between the angle at vein 3 and tornus. Hindwing fuscous brown with terminal series of small dark lunules and fuscous marks on cilia ; the underside grey tinged with brown and irrorated with dark-brown, a discoidal spot and postmedial line showing through to upperside.

*Habitat.*—SIKHIM ; ASSAM, Khasis ; PENANG ; PERAK ; FORMOSA. *Exp.* 30-34 mill.

2988. *a.* HYPENA TUMA, Swinh., A. M. N. H. (7), viii., p. 21 (1901).

Palpi with tuft on outer side of 3rd joint at base and no tuft on inner side.

Head and thorax reddish brown mixed with black ; abdomen fuscous, the dorsal tufts tipped with black. Forewing purplish suffused with chestnut to the postmedial line ; the antemedial line rufous, slightly angled outwards below costa, then very oblique to submedian fold at middle, then acutely angled inwards on vein 1 ; the medial area blackish above vein 2 with the tuft in middle of cell and a diffused spot in end of it blackish ; postmedial line black defined by purple on outer side, erect and angled outwards in discal and submedian folds ; the terminal area fuscous with a curved whitish mark from apex with two small black and white dentate marks above it and a series of less prominent similar marks between it and inner margin ; some white points on costa towards apex and a terminal series of black and pale points. Hindwing fuscous brown with fine dark terminal line.

*Habitat.*—ASSAM, Jaintia Hills ; SINGAPORE ; BORNEO. *Exp.* 36 mill.

3008. *d.* PROLOPHOTA PERSTRIATA, n. sp.

♂. White ; palpi blackish at sides ; abdomen tinged with brown and with fulvous medial band. Forewing with black streak from near base through the

cell and discal fold to termen, interrupted by a point in middle of cell and slight discoidal bar; some yellow brown suffusion on terminal half, three subterminal black points towards apex and one above tornus. Hindwing slightly irrorated with brown; a black discoidal point; a yellow-brown medial band, angled below costa and with black line on its outer edge except towards costa; some brownish suffusion on terminal area and three diffused black spots at apex, discal fold and above tornus.

*Habitat.*—CEYLON, Hantone (E. E. Green). *Exp.* 10 mill. Type in B. M.

3016. *a.* RHÆSENA CHLOROCROTA, n. sp.

♀. Ochreous; palpi strongly irrorated with black; forelegs streaked with black. Forewing with patch of purplish silvery and fuscous scales at base; a streak of similar scales above median nervure and a discoidal patch with the black-edged reniform on it; a blackish streak in cell and discal fold to the subterminal line; an olive-green patch in end of cell; an olive-green streak beyond upper part of cell and an oblique series of short streaks before a purplish silvery obliquely curved postmedial line from vein 6 to submedian fold; an irregularly sinuous black subterminal line from vein 6 to inner margin, oblique between veins 4 and 2, with some olive-green on its inner side and fuscous irroration beyond it; some olive-green on termen and a crenulate black line just before termen; cilia greenish chequered with black-tipped grey scales. Hindwing suffused with fuscous on terminal area.

*Habitat.*—KANARA, Karwar (Davidson). *Exp.* 30 mill. Type in B. M.

# THE OOLOGY OF INDIAN PARASITIC CUCKOOS.

By E. C. Stuart Baker, F.Z.S.

Part III. (With Plate III.)

(*Continued from page 374 of this Volume.*)

## Cacomantis merulinus. (Scop.)

*The Rufous-bellied Cuckoo.*

*Cacomantis threnodes.* Hume and Dav., S. F., VI, p. 158 ; Hume, *ibid.*, VII, p. 207 ; XI, p. 72 ; *ibid.*, Cat. No. 209 ; Cripps, S. F., VII. p. 265 ; Bingham, *ibid.*, IX, p. 167 ; Oates, B. of Burmah, II, p. III.

*Cacomantis merulinus.* Shelly, Cat. B. M., XIX, p. 268 ; Oates, Fauna of B. I., III, p. 218 ; Nehrkorn, Cat., p. 171.

*Polyphasia tenuirostris.* Jerd., B. of I., I, p. 335.

*Cacomantis rufiventris.* Armstrong, S. F., IV, p. 312.

Information as to the breeding of this cuckoo is scanty and very conflicting. Fielden took the eggs of a cuckoo from the nest of a tailor-bird in Thayetmyo, Burmah, and, as *passerinus* is not found there, these are *almost* to a certainty those of *merulinus*.

Nehrkorn describes eggs in his collection as "cream-white, with delicate red brown and violet specks which form a ring at the larger end, 20 by 15 mm. (from the nest of *Pycnonotus aurigaster*)." His eggs came from Java.

Herr Kuschel in a letter to me writes :—"The eggs of *Cacomantis merulinus* resemble very closely those of *Surniculus lugubris* (The Drongo Cuckoo), but they are rather smaller and not so profusely spotted as are the eggs of the latter. I have received eggs of this species with nest eggs of *Pycnonotus, Henicurus leschenaulti* (Leschenault's Forktail), *Stoparola indigo, Abrornis trivirgata* and *Megalurus palustris* (The Striated Marsh-Warbler)."

The eggs Herr Kuschel calls *Surnikulus lugubris* is like a rather stumpy egg of *Cuculus saturatus*. I doubt extremely whether either Herr Kuschel's or Herr von Nehrkorn's eggs are properly identified. I have myself one egg which I believed to be that of *C. merulinus*, which was taken from the nest of *Copsychus saularis* (The Magpie-Robin), together with two eggs of the foster-parent bird. It is exactly like a large egg of *Prinia inornata*, and agrees fairly well with Miss Cockburn's description of the eggs of *C. passerinus*. This latter bird is, however, very rare here,

whereas *C. merulinus* is very common. The egg is a cuckoo's egg of some kind, and is not that of any of the cuckoos, the eggs of which one knows at present unless it is that of *merulinus*. This egg which I have figured in Pl. III, fig. 1, has a blue ground colour and is sparsely blotched with large blotches of vandyke-brown and inky-brown and others underlying these again, and still larger, of inky-grey and purple-grey. The blotches are confined principally to the smaller end, but this is, of course, an abnormality which occurs occasionally with all birds' eggs.

In shape it is very broad oval, the smaller end very obtuse. The shell is very fine and smooth, but has no gloss. It measures ·71″ by ·61″, and was taken at Margherita on the 20th April, 1902.

The Rufous-bellied Cuckoo is the Eastern representative of the Plaintive Cuckoo, and is found all over Eastern Bengal, Assam and Burmah; it is resident in all these provinces and very common. Hume obtained two specimens, probably stragglers only, in Raipur.

In habits, &c., it is like the Plaintive Cuckoo, and its voice resembles that of that bird, but is less seldom used and perhaps less high-pitched and shrill.

### Genus Penthoceryx. (Latham.)

The genus *Penthoceryx* contains a single Indian species which is very closely allied to the genus *Cacomantis*. It differs in the adults, always being barred above, in the tail feathers narrowing towards the tip and in having a proportionately stouter, blunter bill.

Blanford remarks that this genus is nearer to *Cacomantis* than to *Cuculus*, and this must be so when one comes to consider it, for the young are, to all intents and purposes, one and the same generically, and it would therefore follow that *Cacomantis* is probably a merely highly developed form of *Penthoceryx* which has not yet acquired a true *Cuculine* adult plumage.

### Penthoceryx sonnerati. (Latham.)

*The Banded Bay Cuckoo.*

*Cuculus sonnerati.* Jerdon, B. of I., I, p. 325; Fairbank, S. F., IV, p. 255; Hume and Davidson, *ibid.*, VI, p. 156; Hume, *ibid.*, VII, p. 207; *id.*, Cat. No. 202; Legge, B. of Ceylon, p. 233; Vidal, S. F., IX, p. 54; Butler, *ibid.*, p. 388; Oates, B. of Burmah, X, p. 107; *id.*, Hume's Nests and Eggs, 2nd Ed., II, p. 382; Barnes, B. of Bom., p. 125; Shelly, Cat. of B. M., XIX, p. 262.

*Ololygon tenuirostris.* Hume, S. F., II, p. 472; *ibid.*, III, p. 80.

*Penthoceryx sonnerati.* Blanford, Fauna of B. I., III, p. 219; Reid, Cat. Eggs B. M., III, p. 115, Plate II, fig. 2.

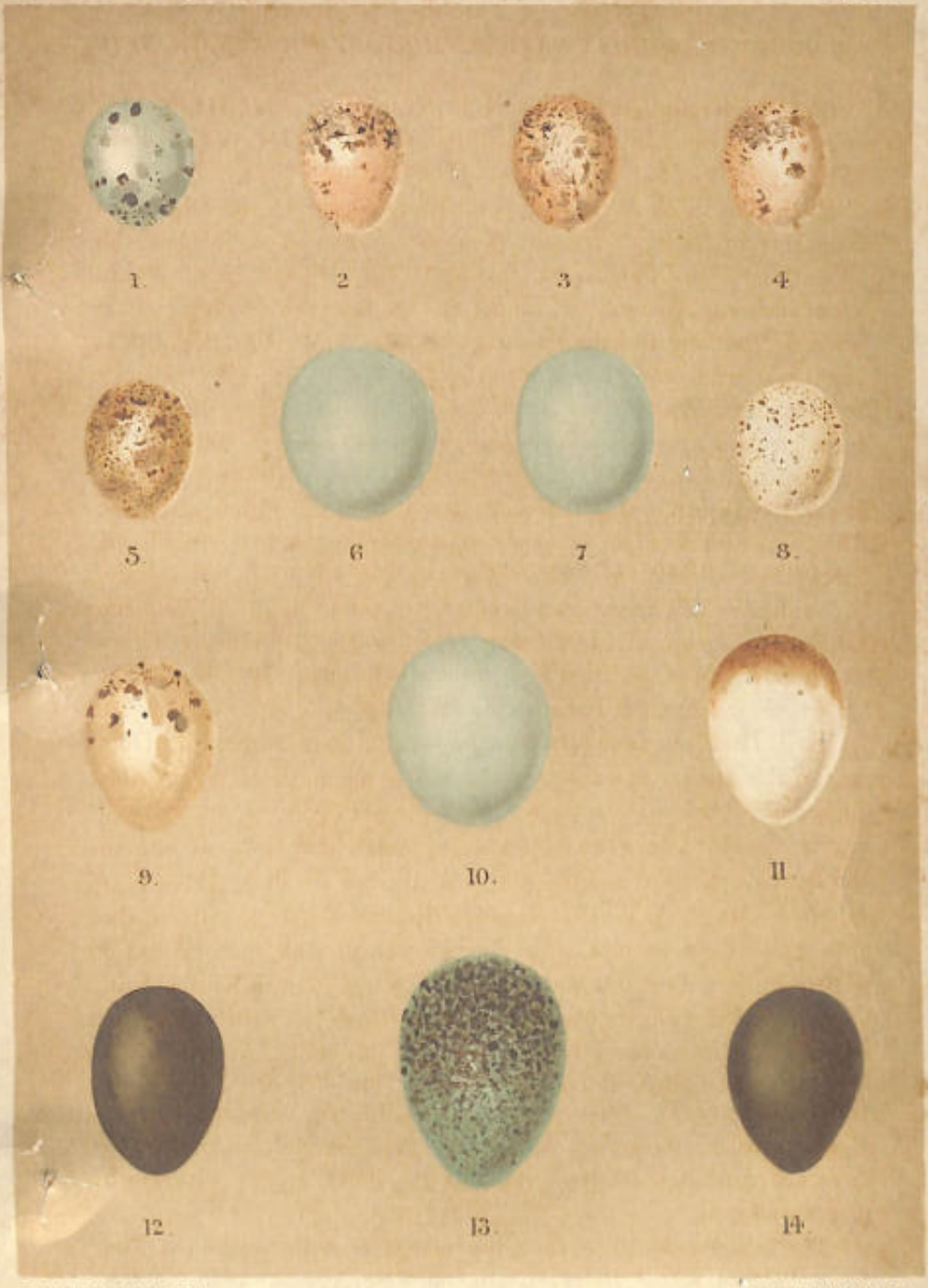
From Hume's Nests and Eggs we have one note to the effect that fragments of an egg extracted from the oviduct of a female of this species, shot in the Neilgherries on the 19th May, 1874, "are pale bluish-green and quite spotless." I cannot find out who shot this bird. It is probably, however, that this record is a mistake, as Mr. Davidson, I.C.S., has also an oviduct egg which is totally different.

It is also recorded that eggs, believed to be of this species and taken from the nests of *Otocompsa fuscicaudata* (The Southern Red-whiskered Bulbùl) are "moderately broad ovals, distinctly pointed towards the small end. The shell fine, smooth and with a faint gloss. The ground colour white or merely so, with ever so slight a pinky tinge. They measured 0·83" and 0·81" in length by 0·62" and 0·61", respectively, in breadth." This agrees with Reid's description in the British Museum Catalogue and *may* refer to the same eggs. One of these is fairly shewn in Pl. II, fig. 3, of the Third Vol. of the B. Museum Cat. These eggs were taken in Coorg, S. India, on the 18th July.

Mr. J. Davidson, as already noted, appears to have the only oviduct egg of this species in existence. He writes me on the oology of this cuckoo as follows:—

"Of this bird I have one egg extracted from a shot bird. It is from the Barnes' collection, and the bird was shot on 1st June, 1893, near Mhow, by Mr. J. A. Kemp. It is a fairly large egg for the size of the bird, ground colour lilac, with numerous small pink spots scattered all over it. I noticed this bird at the Khondabari Ghat in Khandesh in the rains, and it was very common in all the more open parts of Kanara. I have four eggs which, I believe, belong to this bird. Two were taken from the nests of *O. fuscicaudata* in Kanara (9th February, 1890, and 16th March, 1893). They much resemble the egg extracted, but are slightly smaller; the ground colour is of a brownish-pink, and neither in shape nor markings did they resemble the bulbul's eggs with which they were found.

"The others were taken from the nest of *Dumetia albigularis* (The Small White-throated Babbler), one on 31st August, 1885, in the Khondabari Ghat, Khandesh, and the other in the Nassik Dangs on 1st June, 1887. One is similar in size to those just described, the other




E. C. STUART BAKER, DEL. J. GREEN, CHROMO-LITH.

## INDIAN CUCKOOS' EGGS.

1. Cacomantis merulinus. 2, 3. Chrysococcyx xanthonotus. 4. C. maculatus. 5. Penthoceryx sonnerati. 6, 7. Coccystes jacobinus. 8, 9. Surniculus lugubris. 10. Coccystes coromandus. 11, 12, 14. ? 13. Eudynamis honorata.

little smaller; the ground colour is paler and browner, and the markings are faint lilac and dull brown.

"Now, on the other hand, the only birds I have ever seen feeding young *sonnerati* were *Iora typhia* (The Common Iora)."

One of the above eggs was very kindly given me by Mr. Davidson, and is said by him to closely resemble the oviduct egg. This I have shewn in Plate III, fig. 5.

The ground colour is a cream, with the faintest tinge of brown, but I think the brown impression is given by the markings rather than the ground colour. These, the markings, consist of numerous small blotches and specks of a rusty red-brown, with others of the same character underlying them of a pale lilac-grey. Both markings are rather numerous everywhere, but, perhaps, more so towards the larger end. The texture of this cuckoo's egg is like that of *Cuculus canorus*, but finer and more fragile, with the surface more glossed. In shape it is also like the eggs of the Common Cuckoo, being a broad, blunt oval, but little compressed towards the smaller end. It measures ·76″ by ·63″, and is, I gather from what Mr. Davidson says, the smallest of his eggs.

Mr. T. R. Bell has been kind enough to furnish me with some notes of this little cuckoo: "I have an egg, I am sure, of *Penthoceryx*, but not having seen it laid, so to speak, am not in a position to say that it is so without any doubt. Half a dozen times at least I have seen *Ioras* (*typhia* of course) in the act of feeding a noisy, fledged, young *Penthoceryx* twice, and in consecutive seasons, just outside my bungalow: the other times in the jungles. In an *Iora's* nest we got one egg that I am nearly certain must belong to a Banded Bay Cuckoo, as it is far larger than an *Iora's*, is of a different shape (more equal at both ends), and is not at all blotched, though rather finely spotted round the larger end, with similar coloured spots to those of the *Iora* egg: a sort of grey-purple. I have no *Iora* eggs without some blotches, at least, besides spots; and from what I have seen of young *Penthoceryx* the fact of their being fed by *Ioras* and no other birds seems to make fairly certain that my eggs must belong to the latter genus."

*Penthoceryx sonnerati* has two distinct cries—one exactly like that of *Cuculus micropterus*, except in a much higher key; the other like that of *passerinus*, with this difference that it (*sonnerati*) *always* stops in the middle of the second or third repetition.

This bird is extremely common in Ceylon and the South of India, but becomes much more rare further North, especially to the West. It is met with in small numbers throughout Bengal and, perhaps, rather more plentifully in Assam, though even there I have found it rare; it extends through the Shan States, Northern and Southern Burmah, and is common again in the South of that province, the Malay Peninsula, Sumatra, Borneo and Java.

### Genus Chrysococcyx (Boie).

This lovely genus cannot possibly be mistaken for any other genus of Indian cuckoo for the upper parts in all stages, but that of the nestlings' first plumage, is more or less metallic. Both species of the genus are also far smaller than any other Indian cuckoo.

*Key to Species.*

Upper parts glossed with metallic violet.....*xanthorhynchus* ♂ ad.
Upper parts glossed with metallic green.....*maculatus* ♂ ad.
Head more or less light rufous, mantle green.....*maculatus* ♀ et. juv.
Head not rufous, mantle tinged with copper-bronze.....*xanthorhynchus* ♀ et. juv.

The nestlings, when a fair size, may be distinguished generally by the fact that *xanthorhynchus* has the head and neck rufous, with longitudinal streaks, whilst *maculatus* has the head rufous, with the chin and throat barred.

### Chrysococcyx xanthorhynchus. (Horsf.)

*The Violet Cuckoo.*

*Chrysococcyx xanthorhynchus.* Hume, Cat. No. 211 *bis.*; *id.*, S. F., IX, p. 248; XI, p. 75; Oates, *ibid.*, X, p. 193; *id.*, B. of Burm., II, p. 114; Blanford, Fauna of B. I., III, p. 221.

*Chalcococcyx xanthorhynchus.* Hume, S. F., II, p. 191; *ibid.*, III, p. 81; Hume and Davidson, *ibid.*, VI, pp. 161, 506; Shelly, Cat. B. M., XIX, p. 289.

*Chrysococcyx limborgi.* Tweedale, S. F., VII, p. 319; Hume, Cat. No. 211 *quat.*; Bingham, S. F., IX, p. 168; Oates, B. of Burm., II, p. 116.

*Chrysococcyx malayanus.* Hume, Cat. No. 211 *ter.*; *id.*, S. F., XI, p. 76.

With the exception of my own observations and those of the late Mr. H. A. Hole, I have no note on the oology of this cuckoo.

The first egg I received of this bird was from Mr. Hole who found it in a nest of *Turdinus abbotti* (Abbot's Babbler), together with two eggs

of the foster-parent. This egg was sent me marked by mistake as *C. maculatus*, and as such I recorded it in our Journal (IX, p. 368). Mr. Hole, however, wrote to me and said that the only birds haunting the nullah in which he took the nest were several *xanthorhynchus* and that the egg he believed to belong to that bird and not *maculatus*. Both the Violet Cuckoo and the Emerald Cuckoo were very common in Jellalpur, Cachar, where this was taken, but *at the time* it was taken no Emerald Cuckoos were about.

This egg is a most lovely cream-pink in ground colour, and is marked with irregular blotches, spots and a few short broad lines of deep red-brown, many of the dark spots being surrounded with a paler tint of the same colour; there are also numerous underlying spots of pale lavender and lilac. About the broad end the markings of all kinds are numerous, about the smaller end they are scanty. The surface is very smooth and glossy, but has not the silky surface of eggs of *Coccystes*, *Hierococcyx varius* or *Cuculus poliocephalus*. The shell is neither noticeably stout nor fragile, the grain is very fine and close.

A second egg taken from the nest of *Turdinulus roberti* (Robert's Babbler), which also had two eggs in it of the owner, is much like the above, but wants the deepest coloured markings and has practically no lines. The freckles, specks and blotches are numerous all over the egg, but mostly at the larger end. This egg was taken on 6th June, 1903.

These eggs are very much like in detail the eggs of *Penthoceryx*, but whereas the eggs of the Banded Bay Cuckoo strikes one always as being very brown eggs, the first thing that strikes one about the eggs of the Violet Cuckoo and Emerald Cuckoo is the brilliant pink of their general tone.

My eggs measure ·76″ by ·58″, ·80″ by ·59″ and ·78″ by ·59″. Two are blunt ovals, but slightly compressed towards the smaller end; the third is narrower and more pointed.

During the season 1905, I was fortunate in obtaining several specimens of this Cuckoo's eggs, in every case in the nest of *Alcippe nepalensis* (The Nepal Babbler). Dr. Coltart obtained three specimens—one in one nest and two in a second. All three of these agree fairly well with those I have described above, but the latter two are far less dominantly pink, and the markings are more profuse and more speckly in their character than in any of the three shewn in Plate III.

They are very much like one type of *Alcippe* eggs, but *pinker* and different in texture and, again, did not agree with their fostero eggs.

These three eggs average ·75″ × ·56″, and agree in shape and texture with those already described.

The fourth egg was taken by Dr. Gregerson in the 1st August, also in the nest of *Alcippe nepalensis*; this egg I have not seen, but he describes as agreeing exactly with fig. 4 in Pl. III, whereas the *Alcippe* eggs were of the pure white type, with a ring of purple *scriggles* round the large end. The Cuckoo's egg was fresh, the others hard set.

The Violet Cuckoo is confined to the East of the Empire, throughout Assam, in parts of which it is quite common, especially Cachar and Dibrugarh, the whole of Burmah and Malay Peninsula, Sumatra, Borneo, Java, the Andamans and Nicobars. It is said to be rare everywhere throughout its range, and there is practically nothing on record about its habits, voice, &c. Mr. Hole told me that he could not distinguish between the notes of the two little cuckoos of this genus, hat they kept much to the tops of the lofty trees on high ground, except the females who might sometimes be found skulking in brushwood in nullahs and broken ground at the foot of the mountains. The call of both species, he said, was a loud, shrill, but not unmusical, whistle of three ascending notes. Unlike most cuckoos, he did not find them shy, but they were hard to procure on account of their selecting the very highest trees to hunt for food. They were very fond of haunting *Bombax* trees when these were in flower.

CHRYSOCOCCYX MACULATUS. (Gmel.)

*The Emerald Cuckoo.*

*Chrysococcyx hodgsoni.* Jerdon, B. of I., I, p. 338; Davidson, S. F., X., p. 299.

*Lamprococcyx maculatus.* Hume and Dav., S. F., VI, pp. 161, 503.

*Chrysococcyx maculatus.* Hume, Cat. No. 211; *id.*, S. F., IX, p. 248; *ibid.*, XI, p. 74; Bingham, *ibid.*, IX, p. 167; Oates, B. of Burm., II, p. 113; Stuart Baker, Jour. Bom. N. H. Soc., X, p. 367; Blanford, Fauna of B. I., III, p. 222; Reid, Cat. Eggs B. M., III, p. 117.

*Cuculus maculatus.* Legge, B. of Ceylon, p. 238.

*Chalcococcyx maculatus.* Shelly, Cat. B. M., XIX, p. 291; Oates, Hume's Nests and Eggs, 2nd Ed., II, p. 387.

There are a good many notes recorded about the supposed eggs of this beautiful little cuckoo, but every single note, as we know now

refers, it would seem, to *Cuculus poliocephalus*. Mr. J. Davidson has two reputed eggs of this bird in his collection—one which Barnes got from Major Moon, taken near Darjeeling, and a second taken in Natore, Sikhim, on the 22nd June, 1885. The latter egg was taken from the nest of *Horornis fortipes* (the Strong-footed Bush-Warbler), and Mr. O. Moller, who procured this egg, told Mr. Davidson that he had taken similar eggs from the nests of *Tribura luteiventris* (The Brown Bush-Warbler), *Stachyrhidopsis ruficeps* (The Red-headed Babbler) and *Tesia cyaniventris* (The Slaty-bellied Short-wing), all above 5,000′.

Both eggs are said to be "a sort of brick-dust-red, but this is owing to very close mottling on a reddish ground."

I think there can be no doubt that these are *poliocephalus* eggs.

Again, the eggs described in Hume's Nests and Eggs as belonging to this cuckoo seem, without doubt, also to belong to *poliocephalus*. Both eggs were found in the nests of *Stachyrhidopsis ruficeps*, and are described as "a uniform pink, with a certain chocolate tinge in it, and with, when closely examined, a few very minute, pale, claret-coloured specks, scarcely darker than the ground . . . . It measures 0·8″ by 0·62″." This description, of course, exactly agrees in every detail with the egg laid by *poliocephalus* in Mr. Osmaston's hand.

It is probably one of these which is described by Reid in the Catalogue of Eggs. This is also shown in Pl. II, figure 8, but is mistakenly made an oval egg instead of an ellipse and is also not pink enough.

Although I have no oviduct egg of the Emerald Cuckoo, yet I have one, the evidence concerning which satisfies me as to its identity, although it cannot be accepted as altogether complete.

On the 10th August, 1891, at Gunjong, North Cachar, and quite close to my bungalow, a Naga found a nest of the Black-throated Babbler (*S. nigriceps*), at the entrance to which he set a noose of mithna hair and went away. About an hour afterwards when he returned he found an Emerald Cuckoo caught in the noose, and he at once brought up nest, eggs and cuckoo to my bungalow. Examining the first, I found it contained three eggs—two of the *Stachyris* and a third totally different. This in ground colour is a very pale but bright pinkish-cream. It is blotched, freckled and spotted with red-brown, some very dark, others paler and more washed out. There are also a few short, scriggly lines of deep umber-brown, which are almost entirely confined to the larger end. The secondary markings consist of blotches and specks of pale neutral

tint and pinkish-grey. All the markings, which are fairly numerous, are more so at the larger end. In shape the egg is a blunt oval, but not at all elliptical as are the eggs of *poliocephalus*. The texture is fine and close and the surface smooth and glossy, but not silky to the touch, as are the eggs of the cuckoo just mentioned. This egg measures ·82″ by ·60″.

I took another egg, which, I believe, is an Emerald Cuckoo's, on the 10th of May, 1892. I found it in a nest of *Orthotomus sutorius* (The Indian Tailor-bird), together with three eggs of the owner. When first found the Tailor-bird had laid but two eggs; the following day it laid another egg, and I took the whole nest and its contents. The day when found I shot an Emerald Cuckoo in the patch of grass and scrub in which the Tailor-bird's nest was situated, but at some distance from the nest itself. This egg is a blunt *facsimile* of that above described as regards shape, texture, &c., but the whole tone of the egg is less bright, and there are no lines on it. With the exception of a few large, smudgy blotches, the markings are also somewhat smaller. It measures ·78″ by ·63″.

Mr. Hole also sent me two eggs which he considered were of this bird, one of which he took from the nest of *S. nigriceps* and one from that of *S. rufifrons* (Hume's Babbler). They measured ·79″ by ·61″ and ·80″ by ·61″, and were in colouration intermediate between the two described already. They were both taken in July, 1892, at Jellalpur, Cachar, and Emerald Cuckoos were shot haunting the proximity of the nests.

The eggs are very large *for Cuckoos' eggs*, in proportion to the size of the bird, the bulk being as much as it is in the eggs of *poliocephalus* and *saturatus*, birds of, perhaps, between three or four times the cubic contents of the tiny Emerald Cuckoo.

The range of this bird is much the same as that of the Violet Cuckoo, but it extends further West, having been recorded as far as Kumaon in that direction. It also straggles into Eastern Bengal.

It used to be wonderfully common during the breeding season at Jellalpur, in Cachar, in the broken ground running along the foot of the hills, and Mr. H. Hole had a marvellous series, all collected at that place. He informed me that he used to find them frequenting *Bombax* and other lofty trees, hunting for insects and constantly on the move, darting from one perch to another incessantly and twisting about in every position, every now and then giving vent to their musical whistle. They seemed to be sociable birds and consorted much with bulbuls and other birds, and often two or three, or even more, *Chrysococcyx* might be found together.

Other birds shewed no dislike to their company and had evidently no knowledge of their evil nesting habits.

This cuckoo has a comparatively large powerful foot, hence its activity when in trees.

### Genus Surniculus (Lesson.)

India contains one species of this curious genus which can be mistaken for no other cuckoo found within our limits, though it may be, and almost certainly is, frequently mistaken for *Dicrurus ater* (the Black Drongo). It is black, with the exception of a few white spots and patches which are hardly noticeable unless the bird is extremely close. It has a long forked tail, like the drongo, and imitates that bird also in its flight.

### Surniculus lugubris. (Horsf.)

*The Drongo Cuckoo.*

*Surniculus dicruroides.* Jerdon, B. of I., I, p. 336.

*Surniculus lugubris.* Hume and Dav., S. F., VI, pp. 159, 502; Ball, *ibid.*, VII, p. 207; Hume, Cat. No. 210; *id.*, S. F., IX, p. 248; XI, p. 75; Legge, B. of Ceylon, p. 243; Barnes, B. of Bom., p. 128; Oates, B. of Burm, II, p. 112; Shelly, Cat. B. M., XIX, p. 227; Blanford, Fauna of B. I., III, p. 223; Nehrkorn, Cat. Eier., p. 170; Reid, Cat. Eggs B. M., III, p. 104.

There is nothing absolutely authentic on record about this Cuckoo's eggs beyond the fact that Davidson saw some King-Crows feeding a young one, and Mr. T. R. Bell also informs me that he has noticed one being fed by *Dicrurus ater*, the Black King-Crow. He has also found eggs in King-Crow's nests which he thinks must belong to this Cuckoo, though he has no certain proof that they are so. He describes the eggs as "the same size as those of *Dicrurus ater*, in whose nests they were found, and are similar: the shape is also slightly abnormal, tending to both ends being equally obtuse."

An egg sent me by Col. Rattray to examine agrees well, as far as I can tell, with Mr. Bell's eggs. It is a pale cream in ground colour, with spots and blotches of Indian red and dark red-grey or purple. There are also a few large secondary marks, consisting of smears of very pale yellow-brown. The markings are mostly confined to the larger end, but form no ring or cap there. The texture is rather close, and the surface is hard and smooth with a fine gloss: the texture is rather coarser than that of the egg of the Common Cuckoo, and the shape

is also much the same, *i.e.*, a stout, obtuse oval, but in no way elliptical.

This egg was taken from the nest of *Dicrurus longicaudatus* (The Indian Ashy Drongo) at Murree on the 28th May, 1899, and a Drongo Shrike was shot a few days afterwards near the place. The nest contained three Drongo eggs, totally different to the supposed Cuckoo's.

Col. Rattray wrote to me concerning this egg: "Whilst out with Major Wilson I sent my man up to a nest of *D. longicaudatus*. While he was taking the eggs, I shot one bird and the male kept flying round when Major Wilson called my attention to a second, but rather smaller, bird, something like a Drongo, which kept coming up, but which I failed to shoot. The supposed Cuckoo's egg was absolutely fresh, whereas the others were more or less incubated. A few days after, near the same place, I shot a Drongo-Cuckoo."

This egg measures ·91″ by ·69″, and is, in proportion to the size of the bird, if genuine, the largest Cuckoo's egg there is, as far as India is concerned.

Although not proved, it is more than likely that this egg and Mr. Bell's are genuine Drongo-Cuckoo's.

Nehrkorn describes a totally different egg in his Cat. der Eiersammlung. He writes: "Cream-white with reddish-brown blotches and freckles which form a ring at the larger end; the egg was taken in the nest of *Suya crinigera* (The Brown Hill-Warbler), which had three *Suya's* eggs to which it bore a close resemblance: 19·5 by 14 mm."

Herr Kuschel, who also kindly gave an egg, writes: "You yourself know the egg of *Surniculus* which I have sent. I have received eggs of this species, together with the eggs of foster-parents taken from the nests of *Pycnonotus aurigaster, Henicurus leschenaulti* (Leschenault's Fork-tail), *Megalurus palustris* (the Striated Marsh-Warbler) and *Lanius*."

The egg sent to me, and shewn in Plate III, fig. 8, is a very pale yellow-cream colour, so pale that unless put against anything really white, it appears white itself. It has fairly numerous, tiny blotches and specks of reddish-brown, with secondary ones of pale lavender and purple, scattered sparsely over the whole surface and forming an indefinite wide ring round the larger end. The egg is very nearly an ellipse, but not quite; for, though both ends are equally obtuse, one is slightly larger than the other. The texture is that of the eggs of *Cuculus poliocephalus* and *saturatus* to which it bears a strong family likeness. It is not

in any way like Mr. Bell's or Col. Rattray's eggs, either in shape, colour or texture, and one type must, I am sure, be wrong. It measures ·75″ by ·57″, and was taken from the nest of *Henicurus leschenaulti* in Java, on the 14th June, 1889.

This cuckoo is distributed throughout Ceylon, Southern, Central and Eastern India: it extends as far West at least as Nepal and probably much further. Mr. Bell tells me that it is common below the Ghats in Kanara, and wherever observers have gone who have known the bird and its habits and calls, it has been reported as more or less common. It is so in Ceylon, Southern India, Eastern Bengal and Assam at all events, and most probably is so also in the intervening countries, but so close is its resemblance to the Common Black-Drongo that it escapes observation.

It extends through Burma to Borneo and Java and the Malay Peninsula.

Its flight is varied, sometimes dipping, much as it is with the King-Crows, at others quick and direct. Its call is a most human whistle of six notes running up in scale, and this it gives frequent utterance to both by day and on moonlight nights. I have also heard one utter a double plaintive note like *whee-whip*, much like a call indulged in by *Dicrurus ater* in the breeding season. Indeed, had I not been standing close under the cuckoo as it was in the act of calling, I should have thought it was the Drongo.

### Genus Coccystes (Gloger).

The two fine species of cuckoo which form this genus may be at once distinguished from all others by the crest, the central feathers of which are a considerable length. The tail also is long in proportion and the rectrices very wide. The plumage is rather lax, and the bird appears much larger in life than when made into a skin.

*Key to Species.*

Wings dark-brown with a white band ... ... *jacobinus.*
Wings bright chestnut and black ... ... ... *coromandus.*

### Coccystes jacobinus. (Bodd.)

*The Pied Crested Cuckoo.*

*Coccystes melanoleucus.* Jerdon, B. of I., I, p. 339.

*Coccystes jacobinus.* Hume, S. F., I, p. 173; XI, p. 76; *id.*, Cat. No. 212; Butler, S. F., V, p. 327; *ibid.*, VII, p. 181; Davis. and

Wen., *ibid.*, p. 79; Ball, *ibid.*, p. 207; Cripps, *ibid.*, p. 265; Legge, B. of Ceylon, p. 246; Davis., S. F., X, p. 360; Oates, B. of Burm., II, p. 118; *id.*, Hume's Nests and Eggs, II, p. 388; Barnes, B. of Bom., p. 129; Shelly, Cat. B. M., XIX, p. 217; Stuart Baker, Jour. Bom. N. H. Soc., X, p. 368; Nehrkorn, Cat. Eier., p. 170; Blanford, Fauna B. I., III, p. 225; Reid. Cat. Eggs B. M., III, p. 103.

The eggs of this species are well known, several oviduct eggs having been obtained by Mr. A. G. R. Theobald, who was apparently the first to obtain one, Col. Marshall, Mr. Davidson, Col. Bingham, Mr. E. H. Aitken and Mr. Charles Inglis.

An oviduct egg I owe to the last mentioned was taken from a female shot on the 10th June, 1902, at Baghownie Factory, Darbhanga. This egg is rather curious, in that it is the only one I have seen which in any way approaches an oval in shape. If carefully examined, however, one end of this egg is seen to be distinctly smaller than the other. Of the numerous other eggs I have seen of this species all have varied between true ellipses and spheroidal eggs. It measures ·94″ by ·70″. This is also the most narrow egg I have any record of.

I have an egg taken by myself from the nest of *Alcippe nepalensis* at Gunjong, North Cachar, on the 15th May, 1892. This egg measures ·95″ by ·85″, and is the broadest and most spheroidal egg I have any record of. A second egg taken from the nest of same foster-parent measures ·93″ by ·80″. In the first instance I saw the cuckoo glide off the nest into the bushes, and shot her, so that there can be no doubt as to the ownership. In the second case I saw a *jacobinus* close by the nest, but missed her.

Mr. Davidson's oviduct egg was taken from a bird shot on the 19th August, 1888, and Mr. Theobald's from one shot on the 18th of the same month.

The eggs are nearly always laid in the nest of either *Argya* or *Crateropus*. The only exception I can find are the two I have mentioned as being taken in the nest of *Alcippe*, two taken by my collectors from the nest of *Garrulax moniliger* (The Necklaced Laughing-Thrush), eggs taken by Miss Cockburn on the Neilgherries from the nest of *Trochalopterum cachinnans* (The Nilgiri Laughing-Thrush), and the egg recorded by Barnes as having been taken from the nest of *Iora tiphia* at Baroda by Capt. Sadler. The huge blue Cuckoo's eggs in the tiny nests of *Alcippe* looked very ridiculous, and it seems incredible that the birds could have been so imposed upon as to be induced to hatch them.

Eggs have been taken from the nests of *Argya malcolmi* (The Large Grey Babbler), *A. caudata* (The Common Babbler), *A. earlii* (The Striated Babbler), *Crateropus canorus* (The Jungle Babbler), *C. griseus* (The White-headed Babbler), *C. striatus* (The Southern Indian Babbler), *C. somervillii* (The Rufous-tailed Babbler) and *C. rufescens* (The Ceylonese Babbler).

In colour the eggs are much the same in tint as the eggs of *Argya malcolmi*, that is to say, a rather dark green-blue, a good deal darker than what is known as hedge-sparrows' egg blue. The colour varies very little in intensity. Typically the eggs are broad ellipses, both ends being perfectly equal, and abnormal eggs tend towards spherical, culminating in the spherical egg taken by myself and already remarked upon.

The surface is remarkable for its extreme smoothness, which is even greater than it is in *poliocephalus* and *saturatus* eggs. The texture is very fine and close, and the surface often highly glossed, but, though the shell is thick and strong, it is not *hard* and is decidedly porous.

The eggs which have passed through my hands and those which are recorded already in various other places, besides those of which I have received notes from the owners, vary in length between ·9″ and 1·01″ in length and between ·7″ and ·85″ in breadth. I have only records of one egg exceeding ·98″ in length, and I am rather inclined to think that this was *coromandus*, though it is rather dark in colour for that bird's egg.

This cuckoo is practically found throughout India and Burma, its Eastern boundary being the Irawaddy River. It does not extend further South in Burma than Upper Pegu, but is common in Ceylon. Outside India it is obtained throughout Southern and Central Africa. Its flight is slow, but fairly direct. It haunts indifferently the loftiest of trees, secondary growth and small saplings or mere scrub jungle. Its call is a very loud metallic double note, too harsh to be called a whistle. In the early part of the season, before its voice has fully formed, its cries are particularly harsh and disagreeable, and the second note, which should be the same in tone as the first, often goes off at a tangent. Later on in the year, though it becomes more noisy than ever, its notes are rather musical.

### COCCYSTES CORONANDUS (Linn).

*The Red-winged Crested Cuckoo.*

*Coccystes coromandus.* Jerdon, B. of I., I, p. 341; Hume, S. F., III, p. 82; *ibid.*, XI, p. 76; *id.*, Cat. No. 213; Hume and Davis, S. F.,

VI, p. 162; Legge, B. of Ceylon, p. 249; Scully, S. F., VIII, p. 257; Vidal, *ibid.*, IX, p. 55; Oates, B. of Burm., II, p. 117; *id.*, Hume's Nests and Eggs, 2nd Ed., II., p. 391; Barnes, B. of Bom., p. 130; Shelly, Cat. B. M., XIX, p. 214; Blanford, Fauna of B. I., III, p. 226; Stuart Baker, Jour. Bom. N. H. Soc., X, p. 369; Nehrkorn, Cat. der Eier., p. 170; Reid, Cat. Eggs B. M., III, p. 103.

The first oviduct egg of this bird was taken by Mr. Valentine Irwin from a female shot in Tipperah. This is the egg described by Reid in the B. M. Cat., and is now in the collection of the British Museum, but I cannot find any record of the date on which it was shot. Mr. Mandelli and Mr. Hume himself also obtained oviduct eggs. The bird was extremely common in Cachar some years, and here in Dibrugarh it is equally common, and a very large series of eggs, many authentic without doubt, though not oviduct ones, has passed through my hands.

On the 31st May, 1890, I noosed a Red-winged Cuckoo on a nest of *Garrulax moniliger*. A noose had been set on the nest, which contained three eggs, for the parent bird; but while we were watching, the cuckoo slipped on to the nest, and was caught by the head and one wing by the noose. Whilst struggling to escape she broke one of the *Garrulax* eggs, but to my delight laid one herself in the nest.

I got no more eggs in 1891, but in 1892 these cuckoos swarmed in North Cachar, and I got eggs in numbers. On the 30th May I shot a Red-winged Cuckoo as it left a nest of *Garrulax moniliger*. This nest contained two cuckoos' eggs, but one was congealed and bad and must have been laid long prior to the second one. On the 17th I got another egg in the nest of *Garrulax pectoralis* (The Black-gorgeted Laughing-Thrush). This was the only egg in the nest, the parent bird was not shot, but there can be no doubt as to its identity.

On the 1st June a Cachari brought in a nest of *Copsychus saularis* (The Magpie-Robin) with three *Copsychus* eggs and one egg of this cuckoo. He also brought in a female *coromandus* which contained the remains of an egg ready to be laid, but completely smashed by the slug which had killed the bird. On the 17th June yet another egg was taken from the nest of a *Garrulax moniliger*.

After that I took other eggs of this cuckoo in North Cachar, all in nests of *Garrulax moniliger* and *pectoralis*, except one in the nest of *G. leucolophus* (The Himalayan White-crested Laughing-Thrush).

In Dibrugarh the Red-winged Cuckoo is even more common than it was in Cachar, and Dr. Coltart and I have both collected fine series of its eggs. These have been found principally in the nests of *Garrulax moniliger* or *pectoralis*, more often the former than the latter, but we have also eggs from the nests of *Garrulax leucolophus*, *Ianthocincla rufigularis* (The Rufous-chinned Laughing-Thrush) and *Garrulax gularis* (McClelland's Laughing-Thrush).

All our eggs are almost the same in colour, or were when first taken, for they soon fade, and the only difference is a very slight one in degree of depth of blue. They are practically much the same in colour as a medium egg of *Garrulax moniliger*, a good deal paler than the eggs of *C. jacobinus*, but the same kind of blue. The texture, shell and grain are in every respect the same as it is in the egg of *C. jacobinus*, and it is quite possible to tell by touch alone the eggs of *Coccystes coromandus* from those of the Garruline birds in whose nests they are deposited.

In shape the eggs average far more spherical than do those of *jacobinus*, and spherical eggs are the ordinary form and elliptical eggs the abnormal. The most elliptical egg I have measures 1·18″ by ·90″, and this was taken from a nest which contained another cuckoo's egg of the usual spherical type.

My eggs vary in length between 1·00″ and 1·18″ and in breadth between ·80″ and ·96″, the average of 30 being 1·06″ by ·90″.

Mr. Mandelli's oviduct egg was obtained under such curious circumstances that his, or rather Mr. Hume's, remarks are worth quoting: "A nest, containing four fresh eggs, was obtained by Mr. Mandelli which was placed on the branches of a very large tree, at a height of 25 feet from the ground. A fifth egg was extracted from the oviduct of the parent bird. All the five eggs are precisely alike and like others that I have myself extracted from the oviduct of this species. I cannot, however, for a moment believe that it really belongs to the cuckoo."

It is curious the bird selected the same nest in which to lay all five eggs.

Capt. Fielden found this bird frequently being fed by quaker thrushes, and took an egg once from the nest of this latter bird.

Blanford thus describes the habitat of the Red-winged Cuckoo: "This is a very rare bird in India. Jerdon states that he saw it in Malabar and the Carnatic and that it has been found in Central India (Chutia Nagpur). There are skins in the Hume Collection from Madras, Trichinopoly, and the Neilgherries. The only other recorded occurrence I can find is at

Sawant Wadi, where Mr. Vidal obtained a specimen. This species appears to be rather common in Ceylon. It is found at the base of the Himalayas in Nepal and further East, in Assam, Eastern Bengal, Tipperah, the Garo Hills, and throughout Burmah, being common in Pegu, and its range extends to the Malay Peninsula, Southern China, the Phillipines, Borneo and Celebes."

In Assam, especially to the East, and in Cachar it is very common. Above 2,500 feet it is, however, seldom met with.

Oates says that it is strictly arboreal, but I have frequently seen it in bush and scrub jungle, though it perhaps prefers forest trees. In habits, voice, &c., it does not differ from *C. jacobinus*. It is not shy, though rather retiring in its habits.

Fielden speaks of their "usual magpie-like chatter," and also says that they have a "harsh, grating, whistling scream."

GENUS EUDYNAMIS (Vig. Hors.).

This genus is one, according to Blanford, of the Sub-Family *Phœnicophainæ* which is distinguished from the *Cuculinæ* by its wholly bare tarsus. The other genera and species of the Sub-Family are non-parasitic, non-arboreal birds of lax full plumage and poor powers of flight, and I personally think that *Eudynamis* can with justice be allied no more with the *Phœnicophainæ* than with true *Cuculinæ*.

EUDYNAMIS HONORATA (Linn.).

*The Indian Koel.*

*Eudynamis orientalis.* Jerdon, B. of I., I, p. 342.

*Eudynamis honorata.* Hume, S. F., I, p. 373; *ibid.*, IV, p. 463; Butler, *ibid.*, II, p. 182; Ball, *ibid.*, p. 208; Hume, Cat. No. 214; Scully, S. F., VIII, p. 257; Legge, B. of Ceylon, p. 251; Reid, S. F., X, p. 27; Barnes, B. of Bom., p. 130; Oates, Hume's Nests and Eggs, 2nd Ed., II, p. 392; Barnes, Jour. Bom. N. H. Soc., IV, p. 19; Stuart Baker, *ibid.*, X, p. 370; Shelly, Cat. B. M., XIX, p. 316; Blanford, Fauna of B. I., III, p. 228; Reid, Cat. Eggs, B. M., III, p. 121.

*Eudynamis malayana.* Hume, S. F., II, p. 192; *ibid.*, XI, *p.* 77; *id.*, Cat. No. 214 *bis*; Hume and Dav., S. F., VI, p. 162; Oates, B. of Burm., II, p. 119.

The habits of the Koel are far too well known to require much said about them. They lay their eggs in the nests of the common crow (*Corvus splendens*), as a rule, in India and in that of *Corvus insolens*

(The Burmese House-Crow) in Burma. Occasionally the nest of *Corvus macrorhynchus* (The Jungle Crow) is made use of, but this bird breeds so early that it is seldom the Koel finds that the jungle crow has her nursery ready late enough to suit her convenience.

Capt. Harington has twice obtained Koel's eggs from the nest of the Magpie (*Pica rustica*) in Burma, but I have never heard of its egg being found in this bird's nest in the Himalayas.

As many as five Koel's eggs have been once taken from the same crow's nest, rarely three or four eggs and often two eggs from one nest. Sometimes these appear to be the eggs of one bird, at other times they vary so much that they are certainly the product of different birds.

The eggs bear a rough sort of resemblance to crow's eggs, but are smaller and broader in proportion. The ground colour is any tint of green or greenish-yellow, sometimes stone colour, and they are densely marked all over with blotches, freckles and spots of dark reddish-brown. They average about 1·19″ by ·92″.

The Koel ranges throughout India, Ceylon and Burma, and is unpleasantly common everywhere but in Sind, where it is very rare, and in the West Punjab, where it is uncommon. It ascends the hills up to about 2,500 feet, above which it ceases to persecute.

Outside India, it extends to Western China, throughout the Malay Archipelago, the Andamans, Lacadives and Flores.

Its most common cries are *ko-il*, generally turned into *youre-ill* by Europeans and continuous shouts of *who-are-you*. By some people this bird has been called the Indian Nightingale (these have probably lived in Sind), and by others its music has been called "An introductory poem to Hades." It is *always* noisy, but more particularly so by night when it is moonlight. It is everywhere pushing and forward, but, perhaps, more especially so in the compounds of houses containing sick persons. Its breeding season lasts from the end of April to the end of August : in March it practises its voice and gets its throat into working order, and in September its voice breaks, gradually ceases, and the world has rest for a few cold weather months.

BRIEF RESUME OF KNOWLEDGE TO DATE OF CUCKOO'S OOLOGY.

*Cuculus canorus.* Common form well known. Blue eggs doubtful.

*Cuculus saturatus.* Oviduct eggs taken by Brooks and Rattray. Typically elliptical, very smooth and fine grain, pure white, minutely speckled and dotted with black or dark-brown.

*Cuculus poliocephalus.* Oviduct egg taken by Osmaston. As *saturatus* but uniform chocolate-pink.

Oviduct eggs taken by Rattray the same, but pure white.

*Cuculus micropterus. In all probability* pale blue, rarely faintly marked. Fine silky texture. Shape broad oval.

*Hierococcyx sparverioides.* Oviduct egg. Rattray. Pale blue. Long oval. Stout, hard texture, glossy and not very fine. *Possibly* also chocolate-brown.

*Hierococcyx varius.* Oviduct eggs. Blue texture like satin. Shape elliptical or spheroidal.

*Hierococcyx nisicolor.* Oviduct egg. Mandelli. Olive-brown or olive-green, sometimes marked with reddish. Texture fine and silky. Shape elliptical.

*Hierococcyx nanus.* Nothing known.

*Caccomantis passerinus.* Oviduct eggs. Miss Cockburn. Eggs like large *Orthotomus* eggs, of both blue and white varieties.

*Caccomantis merulinus. Possibly* like large eggs of *Prinia inornata* and of *Orthotomus.*

*Penthoceryx sonnerati.* Oviduct egg. Kemp. Brownish-pink ground, speckled and freckled with reddish-brown. Texture and shape as in *canorus.*

*Chrysococcyx xanthonotus.* } *Probably,* as above, but with general
,, *maculatus.* } tone, far more pink and less brown.

*Surniculus lugubris. Probably* white to pale-pink in ground, blotched with reddish, &c., texture hard and close, sometimes glossy, shape broad oval.

*Coccystes jacobinus.* Oviduct eggs. Dark blue-green. Texture extremely fine and silky, surface smooth. Shape broad, elliptical.

*Coccystes coromandus.* Oviduct eggs: pale blue-green. Texture as *jacobinus.* Shape spheroidal.

*Eudynamis honorata.* Well known. General tone green, blotched reddish.

# FLOWERING SEASON AND CLIMATE.

By

E. Blatter, S.J.

## Part II.

(*With 4 Plates.*)

(*Continued from page 350 of this Volume.*)

We pass over to Burma. This is, however, not the present British Burma, which we are going to examine, but only that narrow strip along the Bay of Bengal which is covered by Kurz's flora. This flora is, like Brandis', a forest flora, and treats as such of the woody plants only. An excellent description of the climatic conditions in that region is given by Kurz in the introduction to his flora, from which I quote the following passage :—

"Although Burma extends from lat. 11° to 25°, still by far the greatest portion of it is situated within the influence of the monsoons, and hence the seasons are divided into a rainy and dry season. The former commences about the end of May and breaks up about November, with a temperature ranging from 70-75° in the morning to 90-95° in the afternoon. The rainfall varies greatly according to the provinces. The dry season divides into a cold one from November to February, with a temperature of 57-60° in the morning to 85-88° in the afternoon, with a minimum of 52-54°; and a hot one commencing towards the end of February and continuing to the middle or end of May, showing a temperature of 70-74° in the morning to 95-100° in the afternoon. The maxima observed range from 104-106°, while the minima go down as far as 69 Fahrenheit. Rain is scanty during the whole dry season, being restricted to one or a few showers, which usually occur in March, but heavy dew in the cold and haze in the hot season act beneficially upon vegetation generally."[1]

The meteorological tables[2] I am going to add will be a useful illustration to Kurz's general remarks.

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(1) Kurz, Forest Flora of British Burma ; Introductory, pp. xiii, xiv.

(2) For these tables I am indebted to the kindness of Mr. N. A. Moos, Director of the Meteorological Observatory at Colaba.

*Rainfall recorded at 7 Stations.*

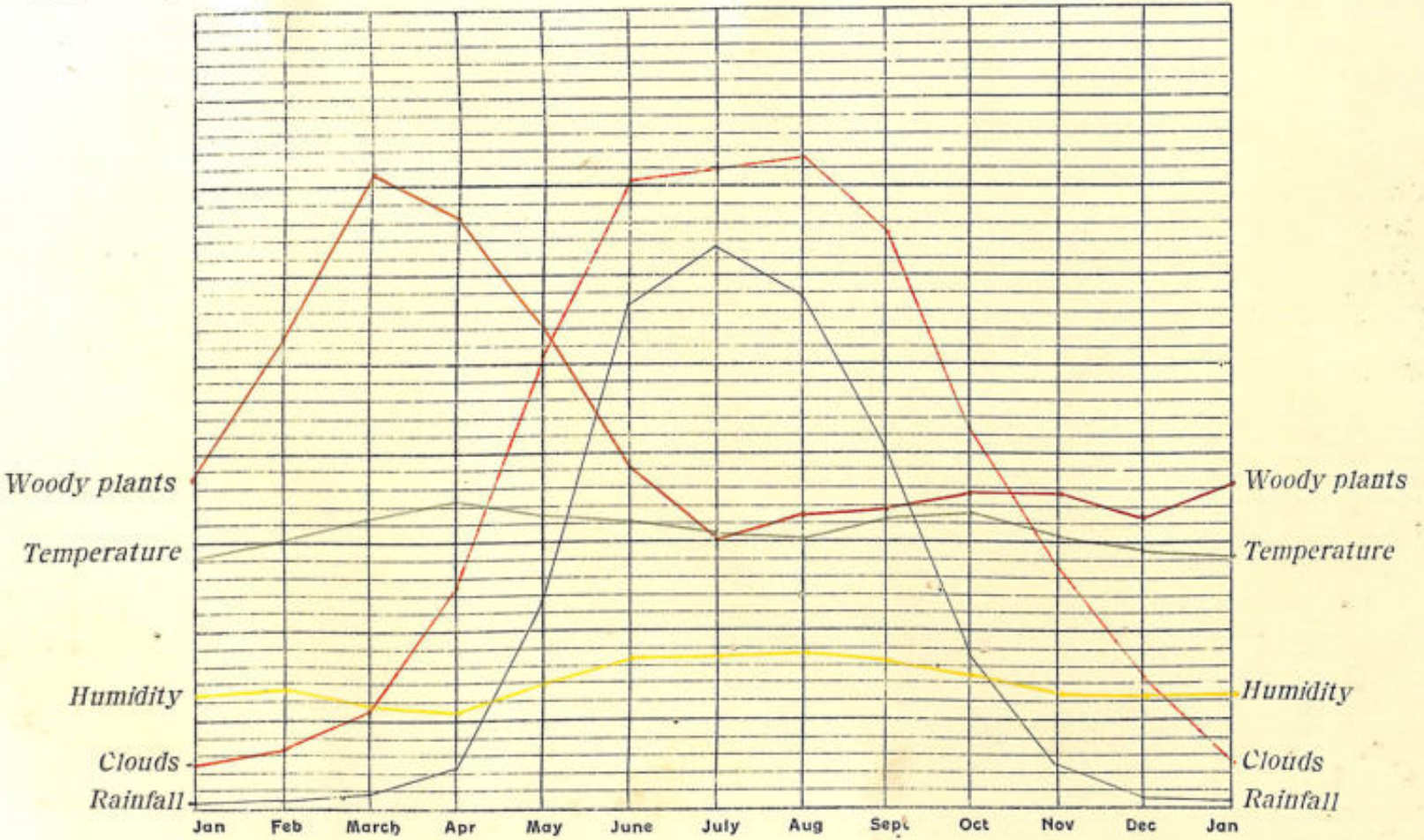
| — | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Akyab, 29 to 31 years .. .. | ·1 | ·2 | ·5 | 1·6 | 12·2 | 51·6 | 81·0 | 34·6 | 23·0 | 12·4 | 3·9 | ·4 |
| Thyet Myo, 17 years .. .. | .. | .. | ·1 | ·7 | 5·3 | 7·9 | 8·0 | 8·5 | 7·8 | 4·9 | 2·3 | .. |
| Toungboo, 17 years .. .. | .. | .. | .. | 1·5 | 6·6 | 13·4 | 17·5 | 18·1 | 11·8 | 7·4 | 1·4 | ·2 |
| Shwegyin, 14 years .. .. | .. | ·3 | ·3 | 2·3 | 10·9 | 20·0 | 33·8 | 32·5 | 19·4 | 10·1 | 2·0 | ·1 |
| Rangoon, 17 years .. .. | ·2 | ·1 | ·1 | 1·8 | 10·9 | 18·4 | 21·3 | 18·6 | 16·0 | 8·1 | 3·4 | ·1 |
| Moulmein, 37 years .. .. | .. | ·1 | ·1 | 3·3 | 19·7 | 38·4 | 43·9 | 42·0 | 30·3 | 8·4 | 1·3 | ·1 |
| Tavoy, 29-30 years .. .. | ·2 | ·6 | ·7 | 4·0 | 16·6 | 39·9 | 46·0 | 41·9 | 33·7 | 10·5 | 2·3 | ·1 |
| Mean rainfall .. .. .. | ·7 | ·24 | ·25 | 2·12 | 11·74 | 28·51 | 31·61 | 29·74 | 20·14 | 8·83 | 2·4 | ·17 |

*Humidity recorded at 8 Stations.*

| — | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. | Year. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Akyab .. .. .. | 80·5 | 82·3 | 81·5 | 79·3 | 81·1 | 92·5 | 93·7 | 93·9 | 92·2 | 90·5 | 89·4 | 87·2 | 87·1 |
| Thyet Myo .. .. .. | 74·1 | 65·9 | 59·2 | 62·4 | 72·4 | 82·9 | 84·5 | 85·3 | 83·9 | 84·2 | 78·4 | 76·6 | 75·8 |
| Toungboo .. .. .. | 88·0 | 83·5 | 74·3 | 73·3 | 82·5 | 89·7 | 92·1 | 92·2 | 10·5 | 88·3 | 88·2 | 88·6 | 86·0 |
| Bassein .. .. .. | 87·1 | 86·7 | 81·4 | 79·0 | 86·1 | 92·3 | 93·5 | 93·5 | 92·7 | 91·., | 86·4 | 84·6 | 88·2 |
| Rangoon .. .. .. | 82·3 | 85·3 | 84·9 | 80·3 | 88·9 | 93·7 | 93·8 | 94·4 | 93·5 | 91·3 | 86·6 | 82·6 | 88·0 |
| Moulmein .. .. .. | 4·8 | 84·3 | 80·3 | 78·5 | 87·9 | 91·8 | 93·4 | 93·9 | 92·4 | 84·2 | 83·1 | 82·5 | 86·7 |
| Tavoy .. .. .. | 86·6 | 88·1 | 84·3 | 82·5 | 87·8 | 91·7 | 92·4 | 92·3 | 92·5 | 87 5 | 80·8 | 81·6 | 87·3 |
| Mergui .. .. .. | 81·1 | 2·5 | 80·8 | 81·4 | 87·7 | 10·7 | 92 2 | 92·3 | 92·2 | 87·3 | 78·2 | 74 4 | 89·1 |
| Mean humidity .. .. | 81·3 | 82·3 | 78·7 | 77·1 | 86·5 | 93·4 | 91·9 | 92·3 | 91·2 | 88·6 | 83·9 | 82·1 | |

*Cloud Proportion recorded at 8 Stations.*

| — | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. | Year. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Akyab .. .. .. .. | ·7 | 1·2 | 2·4 | 4·5 | 6·9 | 9·0 | 8·3 | 9·0 | 7·8 | 5·9 | 3·7 | 2·3 | 5·3 |
| Thyet Myo .. .. .. | ·6 | ·6 | ·6 | 1·1 | 5·1 | 8·3 | 8·1 | 8·7 | 7·9 | 5·7 | 2·6 | 1·7 | 4·2 |
| Toungboo .. .. .. | 1·1 | 1·5 | 2·1 | 2·8 | 6·2 | 8·9 | 9·3 | 9·3 | 8·2 | 5·5 | 4·5 | 2·3 | 5·2 |
| Bassein .. .. .. .. | 1·8 | 2·0 | 2·0 | 3·5 | 6·0 | 8·0 | 8·8 | 8·1 | 6·9 | 5·2 | 3·4 | 2·9 | 4·9 |
| Rangoon .. .. .. | 1·5 | 1·2 | 2·0 | 3·1 | 7·0 | 8·6 | 9·0 | 9·2 | 7·0 | 5·6 | 3·2 | 2·3 | 5·0 |
| Moulmein .. .. .. | 1·3 | 1·3 | 1·9 | 4·0 | 7 3 | 7·9 | 8·5 | 8·0 | 7·2 | 5·0 | 3·7 | 2·3 | 4·9 |
| Tavoy .. .. .. .. | 2·0 | 2·4 | 2·4 | 4·3 | 6·8 | 7·6 | 8·2 | 8·4 | 7·5 | 4·8 | 4·0 | 2·7 | 5·1 |
| Mergui .. .. .. .. | 3·0 | 3·6 | 3·4 | 4·5 | 6 3 | 7·3 | 7·5 | 7·6 | 7·1 | 4·9 | 4·3 | 3·4 | 5·3 |
| Mean cloud proportion .. | 1·5 | 1·7 | 2·1 | 3·5 | 6·5 | 8·2 | 8·4 | 8·5 | 7·4 | 5·3 | 3·7 | 2·5 | |


Woody plants
Temperature
Humidity
Clouds
Rainfall
Jan
Feb
March
Apr
May
June
July
Aug
Sept
Oct
Nov
Dec
Jan
Woody plants
Temperature
Humidity
Clouds
Rainfall

*Temperature recorded at 8 Stations.*

| — | January. | February. | March. | April. | May. | June. | July. | August. | September | October. | November. | December. | Year. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Akyab .. .. .. | 69·3 | 72·8 | 79·2 | 83·4 | 85·[illegible] | 82·2 | 81·3 | 81·1 | 82·[illegible] | 81·6 | 77·5 | 71·7 | 78·9 |
| Thyet Myo .. .. .. | 68·2 | 73·5 | 81·9 | 87·2 | 87·[illegible] | 83·1 | 81·8 | 81·7 | 82·5 | 81·1 | 76·4 | 70·0 | 78·5 |
| Poungboo .. .. .. | 70·0 | 74·7 | 81·9 | 86·7 | 85·[illegible] | 81·3 | 80·1 | 80·[illegible] | 81·[illegible] | 81·4 | 77·4 | 71·[illegible] | 79·3 |
| Bassein .. .. .. | 72·8 | 77·1 | 82·7 | 85·4 | 84·[illegible] | 81·4 | 80·3 | 80·[illegible] | 80·[illegible] | 80·[illegible] | 78·1 | 7·[illegible]·6 | 79·8 |
| Rangoon .. .. .. | 74·7 | 77·3 | 81·2 | 85·0 | 82·2 | 79·5 | 78·[illegible] | 78·7 | 79·[illegible] | 80·0 | 78·8 | 75·0 | 79·2 |
| Moulmein .. .. .. | 75·9 | 79·2 | 83·6 | 84·0 | 83·2 | 79·8 | 78·[illegible] | 78·6 | 79·[illegible] | 80·[illegible] | 79·0 | 75·[illegible] | 79·9 |
| Tavoy .. .. .. .. | 76·0 | 78·6 | 82·0 | 83·6 | 82·4 | 79·9 | 78·9 | 78·[illegible] | 78·[illegible] | [illegible]·0 | 77·4 | 75 | 79·2 |
| Mergui .. .. .. .. | 76·6 | 79·0 | 81·9 | 82·3 | 82·1 | 79·[illegible] | 78·7 | 78·[illegible] | 78·1 | 75·0 | 77·8 | 75·8 | 79·1 |
| Mean temperature ... .. | 72·9 | 76·4 | 81·8 | 86 | 84 | 80·1 | 79·8 | 79·7 | 80·6 | 80·0 | 77·7 | 73·7 | |

If we repeat the mean monthly climatic data of Burma and add the flowering times as observed in the same country, we get this table.

| — | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean rainfall .. .. .. | 07 | ·24 | ·25 | 2·12 | 11·74 | 28·5 | 31·6 | 24·7 | 20·1 | 8·6 | 2·9 | ·17 |
| Mean humidity .. .. .. | 81·5 | 82·3 | 78·7 | 77·1 | 84·5 | 90·4 | 91·9 | 92·3 | 91·2 | 86·6 | 83·9 | 82·1 |
| Mean cloud proportion .. .. | 1·5 | 1·7 | 2·1 | 3·5 | 6·3 | 8·2 | 8·4 | 8·5 | 7·4 | 5·3 | 3·7 | 2·5 |
| Mean temperature .. .. | 72·9 | 76·5 | 81·8 | 86 | 84 | 80·1 | 79·8 | 79·7 | 80·6 | 80·1 | 77·7 | 73·7 |
| Flowering times of the woody plants .. .. .. .. | 190 | 330 | 514 | 466 | 340 | 182 | 102 | 122 | 138 | 149 | 153 | 136 |

Plate IV gives a graphic representation of the foregoing data.

The main features of these curves are essentially the same, and there is nothing of greater importance that could be deduced from them. A comparison, however, of the graphic representations of Bombay and Burma on the one hand, and of North-West and Central India and the Upper Gangetic Plain on the other, exhibits a striking difference between the two, which needs an explanation. In Bombay and Burma the minimum of flowering times of the woody plants coincides with the maxima of the hydrometeors in July, whilst in the other regions the minimum of flowering times is reached in October; that means more or less three months after the maxima of rain, clouds, and humidity. When trying to account for this remarkable fact we must not forget that nearly the whole of Bombay and Burma are situated within the tropics, whilst the greatest part of North-West and Central India and of the Upper Gangetic plain belongs to the temperate zone, which is marked by much greater variations of temperature. Though we seemed to neglect temperature when discussing Bombay, it was not our intention to

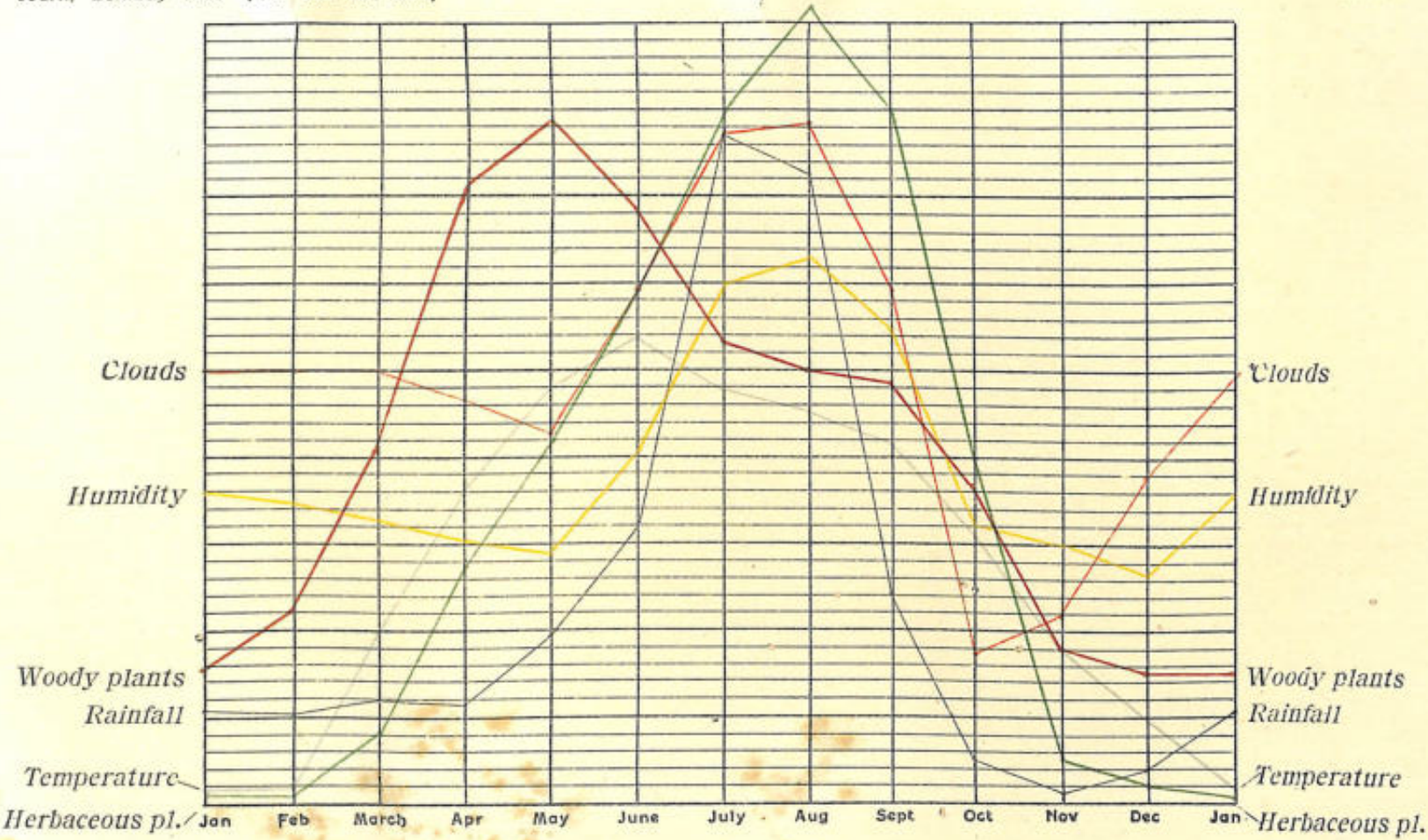
imply that temperature is superfluous; on the contrary, everybody knows how necessary a condition temperature is for the development of plant life, not only in the temperate zone, but also in the tropics. What we wanted to say was only this: Temperature in the tropics is usually so uniform throughout the whole year that its influence does not cause any great disturbance in the course of vegetable life as determined by the action of rainfall, clouds and humidity. Temperature is, thus, as it were, hidden behind the hydrometeors. The further we go northwards starting from the tropics, the more distinctly marked is the influence of temperature. Thus we see that in North-West and Central India, and in the Upper Gangetic Plain, the curves of the flowering times, after having reached their maxima, are strongly influenced in their course by the temperature; not so in Bombay and Burma. The curves of the flowering times show at every point their dependence upon the hydrometeors, whilst they are not affected at all by the temperature.

A good illustration of how the flowering season is determined by the temperature in extra-tropic regions, is the vegetation of Simla. I collected the data from the "Flora Simlensis" by Colonel Sir Henry Collet. In this flora those plants are described which can be seen in Simla and on excursions from this town to Mushobra, Mahasu, Shali Peak, Fagoo, Narkunda, Huttoo, Baghi Forest, Sutlej Valley down to the hot springs near Suni.

"The climate of the district exhibits considerable variations at different elevations and exposures. In round numbers there is a total difference of 8,000 feet in elevation. From observations near Simla, at about 7,000 feet, the mean temperature of January, the coldest month is 40°·6 Fahr., and of June, the warmest month, 67°·1, whilst for the year it is 54°·86. The lowest temperature recorded, 26°·6, occurred on two days in February 1882. Snow falls from December to March, and not infrequently lies for several weeks. The period of greatest rain is from June to September, with an average of 52in., whilst the fall for the whole year is 70in. There is a considerable decrease in the rainfall northward; at Kotgarh, for example, it is little more than half that of Simla." [1]

The data as to the flowering season given in the "Flora Simlensis" are nearly complete, and we would, therefore, be able to get accurate results, if some meteorological observations made in the surroundings

[1] Collet: Flora Simlensis. Introduction.


Clouds
Humidity
Woody plants
Rainfall
Temperature
Herbaceous pl.
Jan
Feb
March
Apr
May
June
July
Aug
Sept
Oct
Nov
Dec
Jan
Clouds
Humidity
Woody plants
Rainfall
Temperature
Herbaceous pl.

of Simla were at our disposal. But that is not the case, and we have to be satisfied with those of Simla:—

| | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean rainfall ... .. .. | 2·8 | 2·7 | 3·0 | 2·8 | 4·7 | 7·9 | 19·3 | 18·1 | 6·7 | 1·4 | ·3 | 1·1 |
| Mean humidity .. .. .. | 48 | 56 | 53 | 51 | 49 | 64 | 84 | 91 | 82 | 53 | 50 | 47 |
| Mean cloud proportion .. .. | 5·0 | 5·0 | 4·0 | 4·6 | 4·1 | 6·1 | 8·3 | 8·6 | 6·2 | 1·0 | 1·5 | 3·5 |
| Mean temperature .. .. .. | 41 | 41 | 52 | 58 | 64 | 67 | 64 | 63 | 61 | 56 | 49 | 45 |
| Flowering times of the woody plants .. .. .. .. | 14 | 30 | 76 | 154 | 171 | 146 | 107 | 100 | 96 | 66 | 18 | 13 |
| Flowering times of the herbaceous plants .. .. .. | 11 | 11 | 47 | 139 | 212 | 297 | 356 | 455 | 396 | 200 | 25 | 10 |

For the graphic representation, *vide* Plate V.

As is shown by these curves, the maximum of flowering times of woody plants falls, compared with our former tables, very late in the month of May; whilst the flowering times of the herbaceous plants reach their maximum very early, in August already. After August a rapid decrease in the number of flowering times takes place, and in November the sexual processes come nearly to a stillstand. Though the maxima of the flowering times of the woody plants as well as of the herbaceous plants are confined to the period of four months, and, as it were, concentrated towards the middle of the year, their respective dependence upon rainfall, clouds and humidity are clearly shown, nevertheless.

Before we are going to examine the flora of Ceylon, I should like to turn to another part of Peninsular India, to Northern Ganjam. Fischer has given a valuable catalogue of the plants of that region in the "Journal of the Bombay Natural History Society,"[1] which will soon, as we hope, be followed by a complete flora. The notes as to the flowering season are scanty, and probably, in most cases, only that month is given during which a plant was seen flowering when collected. The catalogue refers "only to the two northern taluqs of the plains—the Berhampur taluq near the coast and the Gumsur taluq from 30 to 70 miles from the sea. The elevation of this tract is from 0 to 3,000 feet."[2] Of Ganjam itself no meteorological statistics were available. I made, therefore, use of the observations made in Cuttack, as there is not a very great difference in the climatic conditions between this station and Ganjam.

[1] Journal B. N. H. S., Vol. XV, 4, page 587. Vol. XVI, 3, page 473.

[2] Journal B. N. H. S., Vol. XV, 4, page 587.

In spite of these imperfections, the main features of the following table confirm our former results:—

| | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean rainfall .. .. .. | ·4 | ·6 | 1·1 | 1·5 | 3·2 | 10·7 | 12·6 | 11·2 | 9·8 | 5·8 | 1·0 | ·5 |
| Mean humidity .. .. .. | 65 | 63 | 62 | 62 | 66 | 74 | 81 | 81 | 82 | 75 | 68 | 66 |
| Mean cloud proportion .. .. | 1·7 | 1·9 | 2·3 | 3·0 | 3·8 | 6·6 | 7·5 | 7·0 | 6·3 | 4·2 | 2·3 | 1·7 |
| Mean temperature.. .. .. | 72 | 76 | 83 | 88 | 89 | 86 | 83 | 83 | 83 | 81 | 76 | 70 |
| Flowering times of the woody plants .. .. .. | 29 | 17 | 23 | 9 | 17 | 11 | 9 | 13 | 12 | 5 | 17 | 14 |
| Flowering times of herbaceous plants .. .. .. .. | 33 | 14 | 9 | 9 | 7 | 10 | 33 | 43 | 39 | 27 | 38 | 40. |

The most striking illustration of how little the flowering season in tropical countries is determined by the temperature is furnished by the flora of Ceylon. Trimen, in his "Handbook of the Flora of Ceylon," gives such a good and concise sketch of the climatic regions of that island, that I think it best to reproduce here his own words: "The island may be divided into three regions, distinguished by varying amounts of rain and temperature, and marked by characteristic differences in their floras. And, though, it is of course the case that there are no abrupt lines of demarcation, yet it is also the fact, that the great proportion of our species are restricted to one or two of these climatic regions, only a few occurring throughout the area. These regions are :—

"1. *The Dry Region.*—This is by far the most extensive, occupying nearly four-fifths of Ceylon in a continuous area, and comprising the whole of the Northern, North-Central, and Eastern Provinces. The whole is included in the 'low country,' and for the most part is considerably below 1,000 feet, but a few isolated rocky hills rise out of the plain, of which the following are the highest:—Ritigala 2,506 feet, Kokagala 2,241 feet, Friar's Hood 2,148 feet, Westminster Abbey 1,829 feet, Gunner's Quoin 1,736 feet, Yakdessa. The rainfall nowhere exceeds 75 inches per annum, and falls mostly between October and January during the north-east monsoon. Portions of this region about Mannar on the north-western coast and Hambatota on the south-eastern have a rainfall of under 30 inches, which all falls in a short time, so that they possess an almost desert climate with a long period of drought.

"2. *The Moist Low-Country Region.*—Though occupying less than one-fifth of our area, this is by far the best known, the richest, and the most interesting part of the island. It comprehends the whole of the

Western Province, the greater part of the Southern and Sabaragamuwa Provinces, a large portion of the Central Provinces, and small tracts in the Uva and North-Western Provinces. The upper limit of this region is fixed, where it passes into the montane zone, at 3,000 feet. The rainfall over this region varies from 75 up to 200 inches per annum, and is well distributed over the year, falling in both the north-east and south-west monsoons, and especially in May and June during the latter season. A short dry time occurs during some portion of the first quarter of the year, and often again in August and September, the rest of the year being more or less rainy.

"3. *The montane region of Hill Country.*—This includes all the country above 3,000 feet elevation and occupies about one-twelfth of the area. It lies wholly in the moist region, *i.e.*, the rainfall is nowhere less than 25 inches per annum. In most parts the fall is much greater and in some localities in the Adam's Peak Range reaches 250 inches or even more, mostly falling during the south-west monsoon. The hill country occupies a large portion of the Central Province and of the Provinces of Uva and Sabaragamuwa, and very small parts of the North-Western and Southern Provinces, the whole mountain mass being thus situated S.-W. of the centre of Ceylon."[1]

There were no meteorological statistics available for the montane region of the hill country and we can, therefore, examine only the "Dry Region" and the "Moist Low-Country Region."

The data for the "Dry Region" are these :—

| | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rainfall .. Batticaloa .. | 3·1 | 3·3 | 3·2 | 1·5 | 2·0 | 1·2 | ·8 | 2·8 | 2·3 | 5·5 | 12·9 | 13·7 |
| Rainfall .. Jaffna .. | 2·3 | 1·5 | 1·2 | 2·1 | 2·3 | 1·0 | ·7 | 1·2 | 2·8 | 9·3 | 14·6 | 9·9 |
| Mean rainfall .. .. .. | 5·2 | 2·4 | 2·2 | 1·8 | 2·15 | 1·1 | ·75 | 2·0 | 2·55 | 7·4 | 13·85 | 12·8 |
| Clouds .. Batticaloa. .. | 6·9 | 6·9 | 5·4 | 5·6 | 5·9 | 6·8 | 6·8 | 6·8 | 6·5 | 6·7 | 7·2 | 6·8 |
| Humidity .. Batticaloa .. | 88 | 85 | 85 | 84 | 82 | 79 | 79 | 82 | 83 | 87 | 89 | 92 |
| Humidity .. Jaffna .. | 81 | 77 | 79 | 82 | 85 | 86 | 85 | 86 | 87 | 86 | 88 | 87 |
| Mean humidity .. .. .. | 84·5 | 81 | 82 | 83 | 83·5 | 82·5 | 82 | 84 | 85 | 86·5 | 88·5 | 89·5 |
| Temperature *Celsius* .. Batticaloa .. | 24·9 | 25·7 | 26·8 | 28·1 | 28·6 | 28·4 | 28·3 | 27·9 | 27·7 | 27·0 | 25·7 | 24·8 |
| Temperature *Celsius* .. Jaffna .. | 25·3 | 26·2 | 28·1 | 29·5 | 29·3 | 28·7 | 28·1 | 27·9 | 27·8 | 27·4 | 26·1 | 25·2 |
| Mean temperature, *Celsius* .. | 25·1 | 25·9 | 27·4 | 28·8 | 28·9 | 28·5 | 28·2 | 27·9 | 27·8 | 27·2 | 25·9 | 25·0 |

[1] Trimen: a handbook of the Flora of Ceylon.

"*Moist Low-Country Region.*"

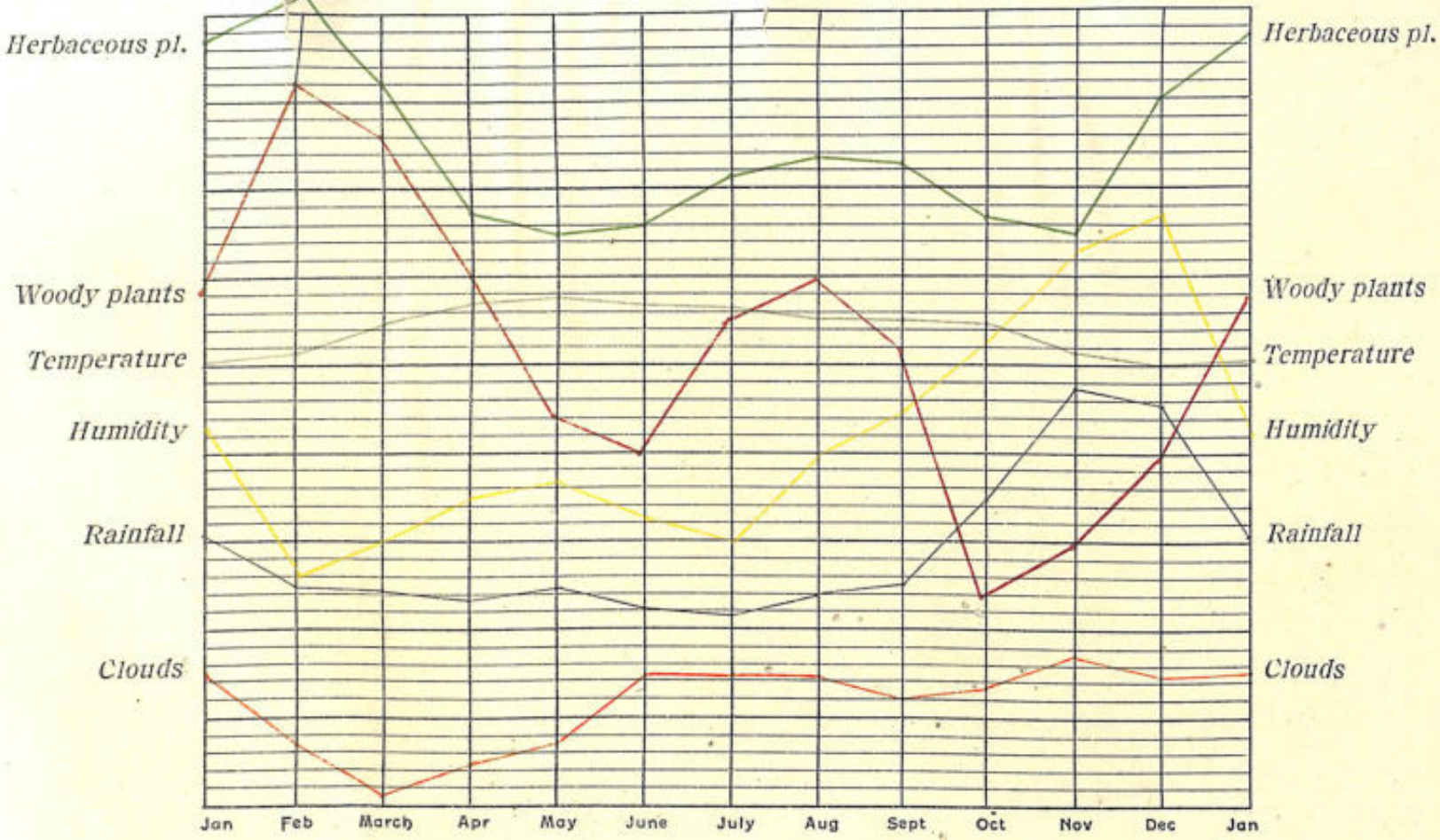
| | | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rainfall .. .. | Colombo .. | 3·2 | 1·9 | 5·7 | 9·3 | 13·1 | 7·6 | 5·5 | 4·8 | 4·8 | 12·6 | 13·3 | 6·7 |
| | Galle .. | 4·3 | 3·4 | 4·9 | 9·2 | 11·4 | 8·0 | 5·4 | 5·7 | 7·5 | 12·5 | 11·5 | 6·4 |
| Mean rainfall .. .. .. | | 3·7 | 2·6 | 5·3 | 5·5 | 12·2 | 7·8 | 5·4 | 5·2 | 6·1 | 12·5 | 12·4 | 6·5 |
| Clouds .. .. | Colombo .. | 4·9 | 4·1 | 4·0 | 9·2 | 6·8 | 7·4 | 6·8 | 7·0 | 6·8 | 6·8 | 6·3 | 5·6 |
| | Galle .. .. | 5·6 | 4·9 | 5·0 | 6·0 | 6·7 | 7·0 | 6·5 | 6·8 | 6·5 | 6·7 | 7·0 | 5·6 |
| Mean cloud proportion .. .. | | 5·3 | 4·5 | 4·5 | 5·7 | 6·7 | 7·2 | 6·6 | 6·8 | 6·6 | 6·7 | 6·6 | 5·6 |
| Humidity .. | Colombo .. | 78 | 77 | 77 | 80 | 81 | 83 | 82 | 83 | 81 | 82 | 82 | 80 |
| | Galle .. .. | 89 | 87 | 84 | 86 | 88 | 91 | 90 | 91 | 91 | 91 | 91 | 90 |
| Mean humidity .. .. .. | | 83 | 82 | 81 | 83 | 84 | 87 | 86 | 87 | 86 | 85 | 85 | 85 |
| Temperature Celsius .. | Colombo .. | 26·1 | 26·7 | 27·6 | 28·3 | 28·1 | 27·3 | 27·0 | 26·9 | 27·1 | 26·8 | 26·5 | 26·2 |
| | Galle .. .. | 25·3 | 26·1 | 27·1 | 27·6 | 27·4 | 26·7 | 26·3 | 26·4 | 25·4 | 26·2 | 25·9 | 25·5 |
| Mean temperature Celsius .. | | 25·7 | 26·4 | 27·4 | 27·9 | 27·7 | 27·0 | 26·6 | 26·6 | 26·7 | 26·5 | 26·2 | 25·8 |

To the description of nearly every plant the flowering time is added, but, as the author himself confesses, the months given, being correct "as far as they go, cannot be regarded as at all exhaustive." In the following tables I kept the flowering periods observed in the "Dry Region" separate from those of the "Moist Low-Country Region." It is useless to give the flowering times of the "Hill Country", as for want of meteorological statistics we are not able to compare them with the climatic conditions.

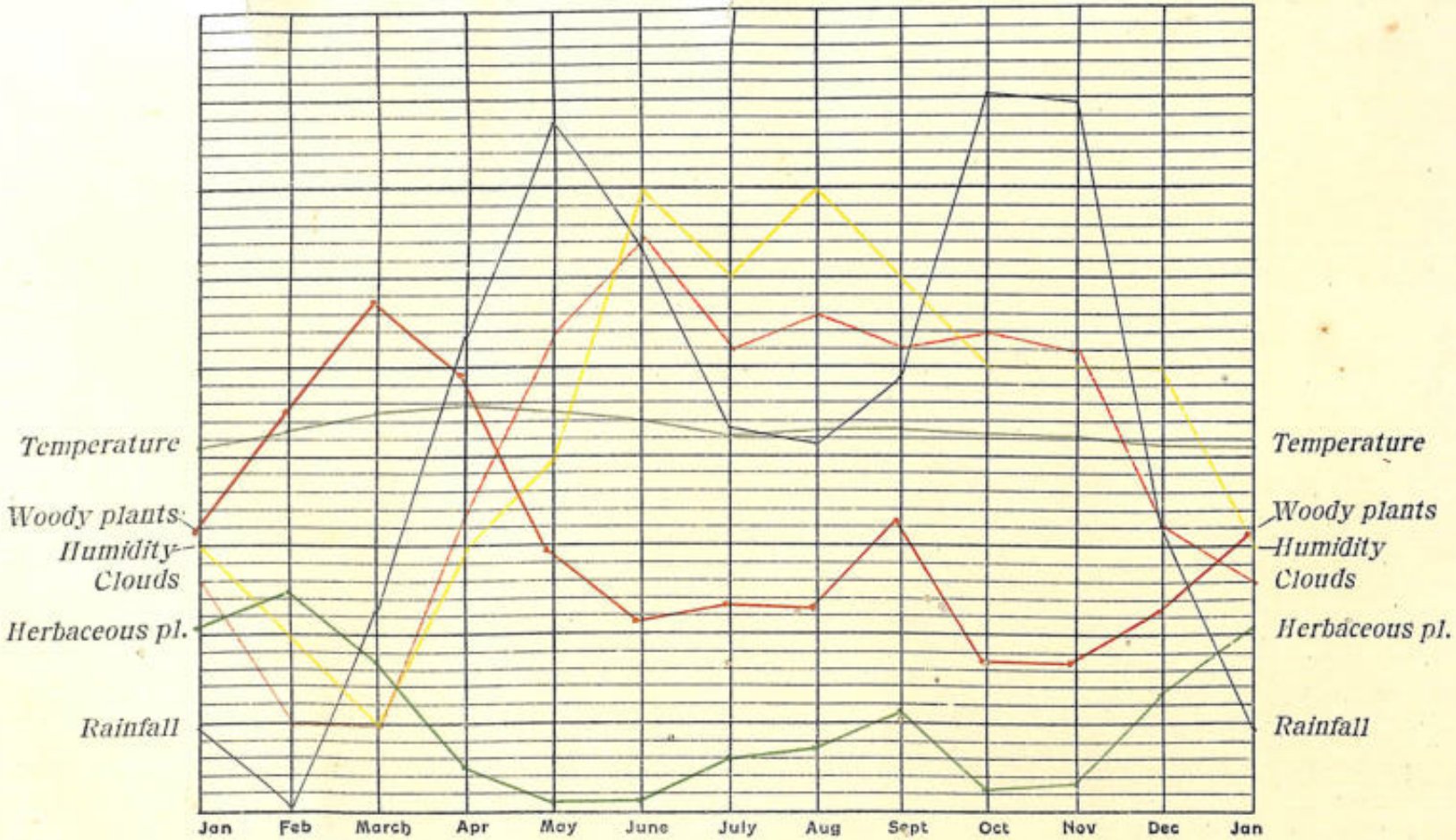
"*Dry Region.*"

| | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean rainfall .. .. .. | 5·2 | 2·4 | 2·2 | 1·5 | 2·15 | 1·1 | ·75 | 2·0 | 2·5 | 7·4 | 13·8 | 12·8 |
| Mean cloud proportion .. .. | 6·9 | 5·9 | 5·4 | 5·6 | 5·9 | 6·8 | 6·8 | 6·8 | 6·5 | 6·7 | 7·2 | 6·8 |
| Mean humidity .. .. .. | 84·5 | 81·0 | 82·0 | 83·0 | 83·5 | 82·5 | 82 | 84 | 83·5 | 82·5 | 83·5 | 84·5 |
| Mean temperature.. .. .. | 23·1 | 23·9 | 27·4 | 28·8 | 28·9 | 28·6 | 28·2 | 27·9 | 27·8 | 27·2 | 25·9 | 25 |
| Flowering times of the woody plants .. .. .. .. | 116 | 164 | 159 | 120 | 89 | 80 | 114 | 120 | 107 | 54 | 60 | 81 |
| Flowering times of the herbaceous plants .. .. .. | 237 | 267 | 213 | 140 | 128 | 130 | 156 | 166 | 162 | 135 | 144 | 200 |

The same is given graphically in Plate VI.




FLOWERING SEASON AND CLIMATE




FLOWERING SEASON AND CLIMATE

"*Moist Low-Country Region.*"

| | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean rainfall .. .. .. | 3·7 | 2·6 | 3·3 | 9·2 | 12·2 | 7·8 | 5·4 | 5·2 | 6·1 | 12·3 | 12·4 | 6·9 |
| Mean cloud proportion .. .. | 5·3 | 4·5 | 4·3 | 5·7 | 6·7 | 7·2 | 6·4 | 6·8 | 6·6 | 6·7 | 6·6 | 5·6 |
| Mean humidity .. .. .. | 82 | 82 | 81 | 85 | 84 | 87 | 86 | 87 | 86 | 85 | 85 | 85 |
| Mean temperature . .. | 25·7 | 26·4 | 27·4 | 27·1 | 27·7 | 27·0 | 26·7 | 26·6 | 26·7 | 26·5 | 26·2 | 25·8 |
| Flowering times of the woody plants .. .. .. .. | 187 | 223 | 287 | 247 | 149 | 108 | 112 | 113 | 161 | 87 | 84 | 114 |
| Flowering times of the herbaceous plants .. .. .. | 251 | 275 | 236 | 177 | 156 | 167 | 186 | 185 | 205 | 161 | 162 | 216 |

The same is given graphically in Plate VII.

Let us first have a look at the graphic representation of the climate and the flowering periods as observed in the "Dry Region" of Ceylon. The flowering times of the woody plants show two distinct maxima, one in February and the other in August. The first one corresponds to the minimum of humidity, to little rainfall and low cloud proportion, whilst the second one is distinguished by similar relations. The influence of the hydrometeors is especially well shown during the last four months of the year, where the curve of the flowering times takes always the opposite direction when compared with the curves of the hydrometeors; it is descending when the curves of rainfall, cloud proportion, and humidity are ascending, and it is seen to be ascending as soon as those of the hydrometeors are descending. The curve of flowering times of the herbaceous plants follows more or less closely that of the woody plants. From climatic conditions alone I am not able to explain this fact. There is one difference, however, between the flowering times of the woody and those of the herbaceous plants. The latter reach a comparatively high percentage in December and January already, *i.e.*, during and immediately after the maxima of humidity and rainfall, whilst the woody plants attain their maximum in February only, after a considerable decrease in the hydrometeors.

Very much the same relations with regard to the flowering season and climate hold good for the "Moist Low-Country Region." The beneficial influence of dryness on the processes in the sexual sphere of the woody plants is well shown in March and September. The curve of the flowering periods of the herbaceous plants does not go down so much

comparatively during the rainy season, and reaches its maximum not a long time after the heavy rains.

Before we leave our subject I should like to make a short remark on a certain opinion expressed in many books of travels. Not seldom we find the statement that in the tropics there is no period of rest in the sexual sphere, that the vegetation bears blossoms throughout the year. This is true if understood in the way that there is no season without flowers. This fact can easily be collected from our tables. But the statement is not correct if it implies that the single plants generally develop flowers during the whole year. There are, no doubt, plants which can be seen flowering without interruption, but their number is a limited one, though perhaps, as it seems, not quite so limited as stated by many botanists. When examining the floras of the different regions, I found a surprisingly small number of plants which are mentioned as flowering throughout the whole year. Cooke and Woodrow, *e.g.*, give 18 woody and 15 herbaceous plants for the Bombay Presidency, Brandis 14 woody plants for North-West and Central India, Duthie 5 woody and 3 herbaceous plants for the Upper Gangetic Plain, Kurz 30 woody plants for Burma, Collet 7 for Simla, Trimen 36 woody and 102 herbaceous plants for Ceylon. It is not surprising to see that there are so few in the Upper Gangetic Plain and in Simla but for the rest, the numbers seem to be too small; and they would, no doubt, by longer and repeated observations be raised considerably. There is, on the one hand, no doubt about the fact, that each plant is characterized by special periods, during which it develops a fulness of flowers, but there are, on the other hand, also seasons, during which flowers are developed not on the whole tree, but on portions of it, on certain branches or twigs. This fact can be observed by everybody at any season of the year. It would be interesting to inquire into the reasons why, *e.g.*, just this branch produces flowers, whilst its neighbour is in a state of rest.

With respect to the question touched above, *viz.*, whether herbs possessed of tubers, rhizomes, etc., reveal the same relations to climate as woody plants do, I shall add two more examples, which might help to form an opinion that comes nearer the truth, than too general statements usually do. Of Simla I give the flowering times of the plants belonging to the orders Liliaceæ, Dioscoreaceæ, Orchidaceæ, and Scitaminaceæ; of Darjeeling, of which I add the necessary meteorolo-

gical statistics the flowering periods of 68 orchids are given, which are described in a valuable article of the "North Point Annual."[1]

| | | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Simla, flowering time | .. .. .. | 1 | 1 | 8 | 16 | 20 | 21 | 30 | 15 | 5 | 3 | .. |
| Darjeeling. | Flowering time .. .. | 2 | 1 | 3 | 9 | 27 | 19 | 24 | 27 | 11 | 6 | 4 | 4 |
| | Rainfall .. .. .. .. | 2 | 4 | 5 | 11 | 13 | 24 | 28 | 26 | 22 | 7 | 1 | 1 |
| | Clouds .. .. .. .. | 5·7 | 5·9 | 5·3 | 6 | 7·2 | 8·7 | 8·7 | 8·5 | 8·1 | 5·2 | 4·4 | 4·3 |
| | Humidity .. .. .. | 78 | 78 | 71 | 77 | 84 | 91 | 92 | 92 | 91 | 81 | 75 | 73 |
| | Temperature .. .. .. | 41 | 44 | 50 | 63 | 65 | 62 | 63 | 62 | 61 | 57 | 50 | 44 |

These numbers of the flowering times do not seem to be in favour of the statement that the plants with bulbs, etc., follow the same laws with regard to the flowering season as are observed by the woody plants. The table just given shows, *v. g.*, the maximum of flowering times in August, in the same month in which the herbaceous plants generally reach their maximum. In Darjeeling, too, the rainy season develops more flowers than the comparatively dry part of the year.

Just now I found mentioned in a book, that the flowering period of the individual plant is much longer in the tropics than in the temperate zones. In order to see how far that statement was reliable, I put together the flowering times of 100 herbaceous plants of Germany, belonging to the Papilionaceæ, and compared them with the flowering times of 80 herbaceous plants of the same order, growing in the Bombay Presidency. The total of the flowering times in Germany was 263 months, in Bombay 179. The mean flowering time for one plant is, therefore, 2·6 months in Germany and 2·2 months in the Bombay Presidency. Similar relations I detected in the herbaceous plants of the orders Ranunculaceæ, Malvaceæ, and Umbelliferæ, the mean flowering times of which are:—

| Order. | Bombay. | Germany. |
|---|---|---|
| Ranunculaceæ ... ... ... ... ... .. | 1·5 | 2·2 |
| Malvaceæ ... ... ... ... ... ... | 2·5 | 2·9 |
| Umbelliferæ ... ... ... ... ... ... | 2·0 | 2·6 |

1 Miller in "North Point Annual," No. X., January 1905, page 97.

That the woody plants in the tropics are flowering during a longer period in the tropics than in the temperate zones, needs no further proof, and we might, therefore, restrict the statement, that the flowering periods of the individual plants are longer in the tropics, to the woody plants, while the herbaceous plants are in bloom during a more or less equal period in both the regions. Our table, of course, is not decisive on account of the limited number of orders we examined, but it shows at least that too general statements are not always reliable.

In our previous investigation we paid special attention to the minima and maxima of the flowering times in the different regions, and, so far, we did not find the slightest difficulty in explaining their relation to the minima and maxima of the climatic factors. Thus, *v.g.*, it is not surprising, that the woody plants reach the maximum of their flowering periods during the dry season, but I am not able to explain adequately the comparatively great number of flowering times during the rainy season. Partially, no doubt, it is due to the change in the climatic conditions, and, for the rest, we might say, that the presence of certain insects during the rainy season caused various adaptations, the effects of which are shown in the apparent lawlessness of the flowering seasons.

This, however, as well as the other questions, we touched above, need further investigation, and satisfactory results can be achieved by prolonged local observations only. I noticed repeatedly that a certain plant was in full bloom at Khandala at a given time, whilst the same plant was flowering in Bombay a month or two later. Even a very limited area, as, *v.g.*, Khandala, exhibits differences as regards the flowering period of the same plant, when growing at the bottom or on the margin of a ravine. Similar differences may be noted in two specimens of the same plant, but of different age, and, again, between individuals of the same species, but growing on different soil, under different surroundings, and in different illumination. Before all these circumstances are registered and taken into account, it is impossible to form any precise opinion as to the various and complicated relations between the climate and the flowering season.

# THE CLIMATAL CHANGES OF *MELANITIS LEDA*.

BY

LIEUT.-COL. N. MANDERS, F.Z.S., F.E.S.

It is difficult, when writing on this fascinating subject, to refrain from indulging in equally fascinating theories regarding the why and wherefore certain species of butterflies vary according to the season of the year. In some cases, particularly among African butterflies, these changes are truly wonderful, and it is quite easy to understand why, when examining examples of seasonal variation from that continent, so many insects now known to be the same species were formerly regarded as distinct and were so described. My object, however, at present is simply to record the facts I have observed with regard to one species only, and my experiments connected with it.

The genus *Melanitis* has always been a puzzle both to systematic and field entomologists. The extraordinary variations on the under surface to which all its members are liable, have led to a most extensive synonymy, and the causes which induce those variations are not yet by any means definitely settled. I have hesitated whether to put on record the results of my experiments of the last two years, but as it is a fascinating study, and one which, so far as I see, will require observations and experiments far more extensive than any I can hope to undertake, I give them in the hope that my failures will help others to avoid many pitfalls and assist them to a right conclusion regarding a very important biological problem. I am not concerned for the moment as to the correct specific name of the insect under discussion, it is known in this island as *Melanitis leda*, and as there is only one species, its identity can easily be established. It is a species not found in India, but has the same habits and varies in the same remarkable manner as the Indian species. I may recapitulate the chief facts regarding its seasonal variation. The specimens found in the rains, which are known as the "wet" season form, have well marked and well developed ocelli (I am referring in this paper to variation of the underside only), the general ground colour being dark grey evenly and minutely striated with darker grey. The "dry" season form varies in ground colour from a pale rufous to a deep vinous purple, sometimes almost black, sometimes again pale green with darker spots and blotches; there is a partial or total disappearance of the ocelli, usually these are represented by white dots in the pupils of the ocelli, there is also a median line or fascia resembling in some respects the midrib of a leaf; but what is perhaps chiefly remarkable, especially in the female, is a prolongation of the forewing below the apex, and a slighter prolongation of the hindwing at the anal angle. Every variation (known as "Intermediate") can be found between the extreme forms. I hope Mr. Young will figure some of these forms when dealing with the Indian allies of this insect in his papers on the Butterflies of the Indian Plains. If the seasonal forms were confined to their respective seasons, the problem would be a simple one; but this is far from being the case. Mr. de Nicéville many years ago bred both

seasonal forms of *M. ismene* from the same batch of eggs. Mr. Green (Spolia Zeylanica, Vol. II., Pt. VI., Aug. 1904) has captured the two seasonal forms and intermediates on the same day, and so doubtless have many other entomologists. De Nicéville says that both forms of *M. leda* occur in Sumatra all the year round. In Java the dry season form is also to be met with during the rains.

I have long been under the belief that the cause of these variations was to be found not so much in wet or dry conditions but in heat and cold, and I may give one instance out of many which induced this belief. The Lycænid *Tarucus theophrastus* in the Punjab has a well marked rainy and dry season form, the latter differs so materially from the former that it was considered by Butler to be a distinct species to which he gave the name *T. alteratus*, this form occurs in the autumn, throughout the winter and spring. The seasons in the Punjab are very well marked—intense heat in summer and very cold in winter. About 'Xmas it is frequently wet, at least this was the case at Rawal Pindi where I collected many specimens.

I regret, owing to my note books being in England, that I am unable to give exact dates regarding the capture of these two forms, but I think my memory is fairly correct.

In Ceylon at Trincomalee *T. alteratus* has never, so far as I know, been collected, certainly I have never seen it myself, though I have specimens approaching it. The climate of this part of Ceylon is extremely hot and dry all the year round with the exception usually of December, very occasionally November or January, when heavy rains—20 or 30 inches—fall If *T. alteratus* is due to dryness alone, it ought to be the dominant form in Ceylon; but if it is due to cold, as I believe it to be, one can understand its absence. There is a general consensus of opinion that the terms "wet" and "dry" seasonal forms are misnomers, but they have the virtue of convenience.

The life history, as it occurs in Mauritius, is briefly as follows: There is a succession of broods throughout the year. In the cold weather the larvæ cease feeding or only feed when the sun is shining brightly, and the pupal stage is decidedly prolonged. In the hot weather, *i.e.*, in January, this stage lasts usually for a fortnight, but at the commencement of the cold weather, April and May, some pupæ may hatch out at the ordinary time or remain over for a month or longer. The female lays freely in confinement, the eggs being laid close together usually, but not invariably, on the underside of the leaf. The larvæ feed on grasses, sugarcane being a great favourite. I have fed mine on bamboo planted in kerosene oil cans and on this they thrive well, but curiously enough they by no means do so on sprigs of bamboo placed in water in the breeding cage; at half growth they gradually cease to feed, the resulting butterfly, if any, being dwarfed. The larvæ when hatched invariably make for the underside of the leaf and lie together in small colonies—head to tail—until about a third grown. Up to this time they are uniformly green with black heads, but when half grown they assume more distinctly the satyrid shape, and change to bright apple green with darker dorsal and spiracular lines. The duration

of the larval stage under ordinary conditions is about a month. They pupate either on the stalk of the leaf or beneath it.

They are subject to innumerable enemies. Ants are extremely fond of their eggs, and will also carry off the larvæ; a green and particularly obnoxious spider fastens itself on to the anal orifice and sucks the unfortunate larva dry. The immature forms of the preying *Mantis* hide themselves among the plants, and very speedily reduce their numbers. It is better, therefore, to keep them on growing plants of the food plant, and protect them by placing them over water and surrounding them with muslin; to save them from their numerous foes is a task which has taxed my energies to the utmost.

The pupæ are at first bright translucent green, changing, as the butterfly is being formed, to an opaque whitish green, particularly about the wing covers; it is only 24 hours before emergence that the colours of the butterfly begin to show, they rapidly become more visible in clearness of outline and intensity of colouring, the white apical spot being very conspicuous six hours before emergence. It is remarkable in the hot weather how very little the pupæ vary in their time of emergence. One may be almost certain that pupæ reared under the same conditions will hatch out together.

The pupal stage lasts a fortnight,—the life history from the hatching of the egg to the emergence of the butterfly in the hot weather being approximately six weeks.

The few hours before emergence is the critical time for the butterfly, and owing to my high mortality in future experiments, I intend removing the pupæ from artificial to natural conditions on the first sign of the brown colouring matter being formed.

My first endeavour was to ascertain the definite relation between the seasonal forms and meteorological conditions, and for this I was happily situated. The observatory is at Curepipe, and all the insects recorded were caught in the same lane within 200 yards of the observatory. The meteorological conditions under which they were born and bred are therefore exact. I may state an objection which may be raised regarding the tables below, and that is that an insect caught early in the month can scarcely be affected by the climate of the end of the month. This no doubt is true, but I have gone on the supposition that the seasonal changes take place in the last few days of pupal life, and as I was careful to take fresh specimens (*Melanitis* soon tatters itself), the meteorological data for each specimen can easily be worked out, and it will be found also that the results are the same for each specimen as I have given for the total number for the whole month.

I have kept female specimens of *Melanitis* alive in captivity for three weeks, but the males for a much shorter time, most of my captures were of this sex, and I should put the life of a male *Melanitis* as not much more than a fortnight, and in really good condition as inside of a week.

The following meteorological observations were taken at Curepipe, 1,860 feet above sea level, at 9 a.m. and 3 p.m. The insects were taken within 200 yards of the observatory. W="wet" form, D="dry" form, I="intermediates."

| JANUARY 1903. | | | | | FEBRUARY 1903. | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Date. | Minimum. | Maximum. | Rainfall. | Melanitis leda captured. | Date. | Minimum. | Maximum. | Rainfall. | Melanitis leda captured. |
| 1 | 67 | 74 | 2·10 | | 1 | 70 | 74 | ·30 | |
| 2 | 68 | 75 | .. | | 2 | 69 | 78 | .. | |
| 3 | 70·5 | 74 | ·70 | | 3 | 69·8 | 81·3 | ·03 | |
| 4 | 68 | 71 | ·78 | | 4 | 69 | 81 | .. | |
| 5 | 71 | 79·8 | 1·69 | | 5 | 69 | 81·5 | .. | |
| 6 | 69 | 75 | 2·31 | | 6 | 68 | 81·5 | ·3 | |
| 7 | 68 | 77 | ·29 | | 7 | 67·5 | 77·3 | ·08 | |
| 8 | 67 | 76 | 1·35 | | 8 | 68 | 79 | ·40 | |
| 9 | 67 | 78 | ·70 | | 9 | 69 | 76·8 | 1·07 | |
| 10 | 67 | 77·5 | 2·33 | | 10 | 70 | 78·8 | ·45 | |
| 11 | 69 | 80 | ·23 | | 11 | 69·8 | 82 | ·73 | |
| 12 | 67 | 89 | 2·30 | | 12 | 69 | 79 | .. | |
| 13 | 69 | 79·2 | ·15 | | 13 | 69 | 82 | ·27 | |
| 14 | 69·8 | 77·2 | ·35 | | 14 | 68 | 85·2 | ·02 | |
| 15 | 6 ·3 | 78 | ·26 | | 15 | 69 | 73 | 1· | All wet season form. |
| 16 | 67 | 82 | .. | All wet season form. | 16 | 68·8 | 80·6 | ·28 | |
| 17 | 70 | 73 | 7·06 | | 17 | 67·8 | 80·2 | ·07 | |
| 18 | 72 | 75 | ·90 | | 18 | 69·5 | 79·5 | ·21 | |
| 19 | 72 | 83 | 1·55 | | 19 | 67·5 | 79 | ·11 | |
| 20 | 70 | 80 | ·23 | | 20 | 70 | 81·8 | ·82 | |
| 21 | 73 | 72·3 | ·10 | | 21 | 69·5 | 81·2 | ·18 | |
| 22 | 70 | 71 | 2·17 | | 22 | 68 | 79 | ·18 | |
| 23 | 71 | 74 | ·82 | | 23 | 69 | 77 | ·20 | |
| 24 | 71 | 79·5 | ·33 | | 24 | 70 | 77·2 | ·65 | |
| 25 | | | | | 25 | 69 | 80 | ·22 | |
| 26 | | | | | 26 | 67 | 80 | .. | |
| 27 | | | | | 27 | 69 | 78·5 | .. | |
| 28 | No record. | | | | 28 | 64 | 80·5 | ·02 | |
| 29 | | | | | | | | | |
| 30 | | | | | | | | | |
| 31 | | | | | | | | | |

| MARCH 1905. | | | | | APRIL 1905. | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Date. | Minimum. | Maximum. | Rainfall. | Melanitis leda captured. | Date. | Minimum. | Maximum. | Rainfall. | Melanitis leda captured. |
| 1 | 67 | 80 | 1·50 | | 1 | 68·5 | 72·3 | 1·10 | |
| 2 | 66 | 80 | ·15 | | 2 | 67 | 70·8 | ·97 | |
| 3 | 68 | 76 | ·09 | | 3 | 67 | 74·5 | 1·55 | |
| 4 | 66 | 77 | ·32 | | 4 | 67·8 | 75·8 | 1·17 | |
| 5 | 67 | 78 | ·09 | | 5 | 65·8 | 77·5 | ·03 | |
| 6 | 68 | 81 | .. | | 6 | 63 | 77 | .. | |
| 7 | 71 | 71 | ·19 | | 7 | 63·5 | 78 | ·11 | |
| 8 | 69 | 79 | 2·88 | | 8 | 63·8 | 81 | .. | |
| 9 | 69 | 79 | ·55 | | 9 | 67 | 80 | ·01 | |
| 10 | 66 | 79 | ·08 | | 10 | 63 | 79 | ·35 | |
| 11 | 68 | 78 | ·85 | | 11 | 67·5 | 77·8 | .. | |
| 12 | 68 | 76 | ·28 | | 12 | 66·5 | 78·8 | ·15 | |
| 13 | 69 | 77 | 1·57 | | 13 | 65·5 | 77·5 | ·42 | |
| 14 | 69 | 81 | ·30 | | 14 | 66·3 | 74·8 | .. | |
| 15 | 68 | 78 | 1·70 | | 15 | 66·5 | 73·3 | ·25 | |
| 16 | 69 | 79 | ·04 | All wet season form. | 16 | 63·3 | 76 | 2·24 | All wet season form. |
| 17 | 68 | 72 | ·02 | | 17 | 68·8 | 73·3 | ·05 | |
| 18 | 69 | 79 | ·18 | | 18 | 64·2 | 80 | ·33 | |
| 19 | 69 | 72 | 1·83 | | 19 | 60·3 | 79·8 | .. | |
| 20 | 67 | 72 | ·58 | | 20 | 63·5 | 76·8 | .. | |
| 21 | 70 | 75 | 1·06 | | 21 | 61·5 | 73·3 | .. | |
| 22 | 71 | 75 | 4·03 | | 22 | 61·8 | 72 | .. | |
| 23 | 69 | 78 | ·40 | | 23 | 64·8 | 72·3 | ·13 | |
| 24 | 65 | 78 | .. | | 24 | 65·2 | 71 | ·40 | |
| 25 | 64 | 75 | .. | | 25 | 64·3 | 72 | ·53 | |
| 26 | 63 | 74 | .. | | 26 | 63·8 | 74·5 | ·1 | |
| 27 | 64 | 74 | .. | | 27 | 67·8 | 72·8 | ·80 | |
| 28 | 66 | 75 | ·03 | | 28 | 60·3 | 73·5 | ·32 | |
| 29 | 69 | 72 | 1·35 | | 29 | 63 | 72 | ·68 | |
| 30 | 68 | 71 | 2·40 | | 30 | 61 | 73 | ·19 | |
| 31 | 69 | 73 | 1·32 | | | | | | |

| MAY 1905. | | | | | JUNE 1905. | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Date. | Minimum. | Maximum. | Rainfall. | Melanitis leda captured. | Date. | Minimum. | Maximum. | Rainfall. | Melanitis leda captured. |
| 1 | 69·2 | 73·2 | ·20 | | 1 | 57·3 | 72 | ·05 | |
| 2 | 63·5 | 74·4 | ·37 | | 2 | 57·3 | 72·8 | ·06 | |
| 3 | 63·2 | 72 | ·27 | | 3 | 52·8 | 74·3 | ·03 | |
| 4 | 61·2 | 73·8 | ·20 | | 4 | 57·3 | 73·8 | | D. 1. |
| 5 | 63·6 | 72·2 | ·06 | | 5 | 57 | 73·5 | | |
| 6 | 61·3 | 72·5 | .. | | 6 | 57·5 | 73·5 | | |
| 7 | 62 | 73 | ·68 | | 7 | 59·2 | 68·5 | ·27 | |
| 8 | 63·2 | 70 | 1·03 | | 8 | 62·3 | 70 | 2·43 | |
| 9 | 63·8 | 74·4 | 1·12 | | 9 | 59 | 74·8 | ·23 | |
| 10 | 60·8 | 71 | 1·73 | W. 7. | 10 | 55 | 75·7 | | |
| 11 | 63·5 | 71·3 | ·05 | | 11 | 61 | 75 | | |
| 12 | 51·3 | 76 | ·15 | | 12 | 53·2 | 75·3 | | I. 1. D. 3. |
| 13 | 63 | 75·5 | .. | | 13 | 53·8 | 74·8 | | |
| 14 | 61·8 | 74 | ·19 | | 14 | 56 | 72 | ·29 | |
| 15 | 58·3 | 71·5 | .. | | 15 | 53 | 69 | ·45 | W. 4. D. 5. |
| 16 | 59 | 71·2 | .. | | 16 | 58 | 69 | ·03 | |
| 17 | 57·6 | 71·8 | ·04 | | 17 | 58 | 75 | | |
| 18 | 57·8 | 71·5 | ·09 | | 18 | 59 | 70 | | |
| 19 | 55·3 | 70·8 | ·20 | W. 2 I. 1. D. 1. | 19 | 60 | 71·8 | | |
| 20 | 54 | 71 | ·53 | | 20 | 54 | 76 | | |
| 21 | 54·4 | 71·8 | ·60 | | 21 | 56 | 72·8 | | |
| 22 | 53·8 | 70·2 | ·23 | | 22 | 57 | 76·8 | ·10 | W. 2. Worn. I. 3. D. 7. |
| 23 | 59 | 72·2 | ·12 | | 23 | 52·8 | 72·8 | ·50 | |
| 24 | 58 | 70·8 | ·43 | | 24 | 53 | 66·5 | ·45 | |
| 25 | 57 | 73·5 | ·55 | I. 1. | 25 | 52·3 | 68 | | |
| 26 | 61·5 | 72 | ·27 | | 26 | 52 | 70 | | |
| 27 | 53 | 72·8 | ·05 | W. 1. | 27 | 53·8 | 68·3 | ·29 | |
| 28 | 54 | 69 | .. | | 28 | 55·3 | 67·2 | ·17 | |
| 29 | 55 | 74 | ·12 | | 29 | 55·5 | 69 | ·27 | W. 1. I. 2. D. 2. |
| 30 | 53 | 73 | .. | | 30 | 55·5 | 70 | ·74 | |
| 31 | 54 | 73·6 | ·07 | W. 1. I. 1. D. 1. | | | | | |

| JULY 1905. | | | | | AUGUST 1905. | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Date. | Minimum. | Maximum. | Rainfall. | Melanitis leda captured. | Date. | Minimum. | Maximum. | Rainfall. | Melanitis leda captured. |
| 1 | 60 | 69 | ·26 | | 1 | 57 | 67·8 | ·03 | |
| 2 | 58·3 | 68·7 | ·53 | | 2 | 47·3 | 63·7 | ·03 | I. 1 D. 3. |
| 3 | 54 | 69 | ·05 | | 3 | 5·7 | 68 | .. | |
| 4 | 57·8 | 71 | 1·59 | | 4 | 62·3 | 64·6 | .. | |
| 5 | 50·5 | 72 | .. | | 5 | 63 | 67·3 | ·12 | |
| 6 | 54·3 | 70 | .. | | 6 | 47 | 67·3 | .. | |
| 7 | 57·3 | 67 | 2·90 | | 7 | 61·3 | 69 | ·29 | |
| 8 | 60 | 72·3 | ·20 | I. 4. D. 2. | 8 | 62 | 65·5 | ·33 | |
| 9 | 54 | 71 | .. | | 9 | 61·9 | 71·9 | ·49 | |
| 10 | 57 | 69 | ·36 | | 10 | 58·5 | 68·3 | ·28 | |
| 11 | 53 | 63·8 | ·23 | | 11 | 57·5 | 72 | ·40 | D. 2. |
| 12 | 54 | 69 | .. | | 12 | 57·5 | 72·8 | .. | |
| 13 | 57·3 | 69·3 | .. | | 13 | 55 | 72·3 | ·38 | |
| 14 | 57·8 | 69·8 | ·20 | | 14 | 54·8 | 72·7 | .. | |
| 15 | 60 | 69·8 | ·23 | I. 1. D. 3. | 15 | 52·5 | 70·4 | .. | |
| 16 | 54 | 65·8 | ·10 | | 16 | 52·2 | 71·9 | .. | |
| 17 | 55·6 | 65 | 1·20 | | 17 | 60·8 | 72·3 | .. | I. 1. D. 1. |
| 18 | 57·2 | 67 | ·37 | | 18 | 56·3 | 73·8 | .. | |
| 19 | 58·5 | 73 | ·26 | I. 1. D. 6. | 19 | 59 | 67·4 | 1·15 | |
| 20 | 52·8 | 70·5 | .. | | 20 | 59·8 | 68 | ·55 | I. 2. D. 3. |
| 21 | 51·7 | 69·3 | ·19 | | 21 | 57·3 | 68·9 | ·03 | |
| 22 | 53·4 | 65·5 | .. | | 22 | 58·8 | 67·9 | 1·26 | |
| 23 | 55 | 68 | .. | | 23 | 59·5 | 69·7 | ·45 | |
| 24 | 55·5 | 70·3 | ·35 | W. 1. Worn. D. 4. | 24 | 61 | 67·8 | ·18 | |
| 25 | 55·7 | 65·3 | ·15 | | 25 | 57·5 | 67·5 | ·12 | |
| 26 | 57·2 | 68·4 | ·08 | | 26 | 53 | 71 | ·08 | |
| 27 | 60 | 68·4 | ·20 | | 27 | 53·2 | 71 | .. | D. 2. |
| 28 | 58 | 68 | ·25 | | 28 | 58·7 | 68·5 | ·25 | D. 1. |
| 29 | 51 | 60·5 | ·18 | | 29 | 52·7 | 67·7 | ·02 | |
| 30 | 52 | 65 | ·12 | W. 1. Worn. I. 1. D. 2. | 30 | 13·8 | 68 | .. | |
| 31 | 51 | 61 | ·44 | D. 2. | 31 | 53 | 68 | ·03 | D. 1. |

| SEPTEMBER 1903. | | | | | OCTOBER 1903. | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Date. | Minimum. | Maximum. | Rainfall. | Melanitis leda captured. | Date. | Minimum. | Maximum. | Rainfall. | Melanitis leda captured. |
| 1 | 51·5 | 67·3 | .. | | 1 | 60 | 69·3 | 1·19 | |
| 2 | 47·2 | 69·7 | .. | | 2 | 58·5 | 74·2 | ·41 | |
| 3 | 54 | 71·5 | .. | | 3 | 54·4 | 75·3 | .. | |
| 4 | 55·2 | 71·3 | .. | | 4 | 55 | 73·9 | .. | |
| 5 | 56·2 | 70·7 | .. | | 5 | 51 | 71·4 | .. | |
| 6 | 55 | 70·5 | .. | | 6 | 51 | 72·5 | .. | W. 3. I. 1. |
| 7 | 57 | 74·6 | 1·35 | | 7 | 61 | 72·8 | .. | |
| 8 | 61·6 | 75 | .. | | 8 | 60 | 73·5 | ·07 | |
| 9 | 62·3 | 76·5 | ·59 | | 9 | 62 | 74 | ·12 | |
| 10 | 59 | 72 | ·43 | | 10 | 62·3 | 75·8 | ·36 | |
| 11 | 58 | 73·6 | .. | | 11 | 62·3 | 70 | ·13 | |
| 12 | 57·8 | 75 | ·18 | | 12 | 61·5 | 75·2 | ·05 | |
| 13 | 56 | 74·2 | .. | | 13 | 61·5 | 74·8 | 30 | |
| 14 | 56·4 | 74 | ·17 | | 14 | 61 | 74·3 | ·20 | |
| 15 | 5 ·3 | 73 | .. | | 15 | 61 | 74 | .. | |
| 16 | 57·7 | 73·9 | .. | | 16 | 60 | 74·3 | .. | |
| 17 | 57·2 | 75·4 | .. | | 17 | 59·8 | 73 | ·03 | W. 1. I. 2. D. 2. |
| 18 | 57·2 | 74·5 | ·08 | | 18 | 61·5 | 75·5 | ·06 | |
| 19 | 54·8 | 75 | .. | I. 1. D. 6. | 19 | 59 | 73·2 | ·42 | |
| 20 | 61·3 | 74·6 | 2·60 | | 20 | 60·2 | 72·9 | ·05 | D. 3. |
| 21 | 61·8 | 74·8 | .. | | 21 | 61·5 | 74·2 | ·2 | |
| 22 | 58 | 75·8 | .. | I. 1. D. 1. | 22 | 60·5 | 74·8 | ·11 | |
| 23 | 56 | 73·8 | .. | | 23 | 54·4 | 70·4 | ·05 | |
| 24 | 59 | 74·1 | .. | | 24 | 53·4 | 76 | .. | |
| 25 | 59·8 | 75·3 | .. | | 25 | 52 | 75·8 | .. | W. 4. I. 1. D. 4. |
| 26 | 59·2 | 73·8 | .. | | 26 | 50·6 | 77·8 | .. | |
| 27 | 55·3 | 75·8 | .. | | 27 | 51 | 76 | .. | I. 1. |
| 28 | 53·4 | 74·8 | .. | | 28 | 54 | 77 | .. | |
| 29 | 55 | 74·4 | ·25 | | 29 | 5 | 78 | ·21 | |
| 30 | 60 | 70·8 | ·31 | W. 2. I. 1. D. 4. | 30 | 59·3 | 73 | ·02 | |
| | | | | | 31 | 58 | 72 | ·38 | |

| NOVEMBER 1905. | | | | | DECEMBER 1905. | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Date. | Minimum. | Maximum. | Rainfall. | Melanitis leda captured. | Date. | Minimum. | Maximum. | Rainfall. | Melanitis leda captured. |
| 1 | 57·4 | 76 | ·52 | | 1 | 60·5 | 68·2 | 1·07 | |
| 2 | 57 | 74·6 | .. | | 2 | 66·2 | 72 | 2·55 | I. 1. |
| 3 | 57·9 | 76·8 | .. | | 3 | 65 | 72·1 | .. | |
| 4 | 60 | 74 | .. | | 4 | 63·4 | 71 | 2·54 | |
| 5 | 58 | 71 | ·03 | | 5 | 66·2 | 72·8 | 1·51 | |
| | 55·2 | 78·8 | .. | | 6 | 65·6 | 80 | .. | |
| 7 | 56 | 76 | .. | | 7 | 65 | 75·1 | ·03 | |
| 8 | 53 | 79·8 | .. | I. 1. | 8 | 65·8 | 7·4 | .. | |
| 9 | 54·6 | 76·5 | .. | | 9 | 67·5 | 85·2 | .. | |
| 10 | 64·3 | 79 | ·90 | W. 3. I. 3. D. 2. | 10 | 65·8 | 81 | .. | |
| 11 | 6 ·4 | 75·9 | .. | | 11 | 65 | 85 | .. | W. 3. I. 5, D. 1. |
| 12 | 59·3 | 75 | .. | | 12 | 65·6 | 79·5 | ·11 | |
| 13 | 58·5 | 76 | ·36 | | 13 | 66·3 | 80·6 | .. | |
| 14 | 57 | 73 | 2·75 | | 14 | 64 | 81 | .. | I. 1. |
| 15 | 54 | 78·6 | ·65 | | 15 | 64 | 78·4 | ·05 | W. 1. |
| 16 | 56 | 77·6 | 3·55 | | 16 | 66 | 78·5 | ·01 | |
| 17 | 59 | 77·6 | ·15 | W. 4. D. 2. | 17 | 65·8 | 79 | ·65 | |
| 18 | 59 | 79·2 | ·01 | | 18 | 65·7 | 75 | ·21 | |
| 19 | 62·3 | 77·8 | .. | | 19 | 65·6 | 75·4 | 1·75 | |
| 20 | 62·3 | 76·2 | ·79 | | 20 | 63·3 | 76·8 | .. | W. 5, I. 1. |
| 21 | 61 | 71·9 | 1·0 | | 21 | 66·5 | 75·2 | 2·20 | |
| 22 | 61·3 | 68 | 1·8 | | 22 | 65·8 | 73 | 4·15 | |
| 23 | 60·3 | 66 | 1· | | 23 | 62·8 | 76 | ·06 | |
| 24 | 63·5 | 78 | ·.5 | | 24 | 55·8 | 64·8 | .. | |
| 25 | 61·5 | 77 | ·24 | | 25 | 62 | 74 | .. | |
| 26 | 63·5 | 75 | ·05 | | 26 | 63·8 | 77·2 | .. | |
| 27 | 64 | 77 | ·24 | | 27 | 53·2 | 80 | ·1 | |
| 28 | 63·7 | 75 | ·62 | | 28 | 65·3 | 80 | ·21 | |
| 29 | 64·8 | 75·3 | ·03 | W. 2. I. 1 | 29 | 63·4 | 78·8 | .. | W. 6. |
| 30 | 64·8 | 67 | ·11 | | 30 | 62·5 | 78 | .. | |
| | | | | | 31 | 62 | 79 | .. | I. 1. |

*Summary* 1905.

| Month. | Mean + | Mean − | Mean. | Highest reading. | Lowest reading. | Maximum variation. | Rainfall. | Wet days. | Insects captured. |
|---|---|---|---|---|---|---|---|---|---|
| January (24 days) | 76·9 | 69·1 | 73 | 89 | 67 | 7·8 | 28″·63 | 22 | All "wet." |
| February .. .. | 79·3 | 68·6 | 72·8 | 82·3 | 64 | 10·7 | 7″·92 | 22 | Ditto. |
| March .. .. | 76 | 67 | 71 | 81 | 63 | 9 | 23″·79 | 26 | Ditto. |
| April .. .. | 75·5 | 64·7 | 70·1 | 81 | 60·3 | 10·8 | 13″·28 | 22 | Ditto. |
| May .. .. | 72·4 | 58·6 | 65·5 | 76 | 51·3 | 13·8 | 5″·35 | 25 | W. 11. I. 3. D.2. |
| June .. .. | 71·8 | 56 | 63·9 | 76 | 51·8 | 15·8 | 6″·46 | 16 | W. 7. I. 6. D.18. |
| July .. .. | 68 | 55·8 | 61·9 | 73 | 51 | 13·2 | 10″·77 | 23 | W. 2. I. 7. D.20. |
| August .. .. | 69·1 | 57 | 63 | 75·8 | 47 | 12·1 | 6″·38 | 20 | W. 0. I. 4. D.15. |
| September .. .. | 73·4 | 57 | 65·2 | 76·5 | 47·2 | 16·4 | 7″·31 | 9 | W. 2. I. 3. D.11. |
| October .. .. | 74·3 | 57·9 | 66·1 | 78 | 50·6 | 16·4 | 4″·59 | 19 | W. 10. I. 5. D.9. |
| November .. .. | 75·3 | 59·8 | 67·5 | 79·8 | 53 | 15·5 | 14″·49 | 20 | W. 9. I. 5. D.4. |
| December .. .. | 76·9 | 64·2 | 70·5 | 85·2 | 53 | 12·7 | 61″·62 | 16 | W. 15. I. 9. D.1. |

*Conclusions.*

On the hypothesis that the seasonal form is determined in the last few days of pupal life, we may draw the following conclusions from the above observations:

1. When the mean temperature falls below 70° F., the "dry" forms appear, and the lower the mean the more numerous they become.

2. When the temperature is lowest, the "dry" forms are most numerous, and conversely. As an instance, July, the coldest month, mean +68°—61·9, shows the greatest number of "dry" forms, though there were 23 wet days and a rainfall of 10·77 inches. February the hottest month, mean + 79·3—68·6, shows no "dry" forms, though the rainfall was only 7·92 inches.

3. It is not therefore a dry or humid atmosphere that produces a "dry" or "wet" form, but a low or high temperature.

The following experiments were undertaken with a view to testing whether the hypothesis is sound, that the seasonal forms are dependent on changes in the pupal state. For this purpose pupæ within twenty-four hours of their last ecdysis were placed under the following conditions. The *modus operandi* I will give more fully subsequently; at present it would confuse the issues.

| Conditions. | Average temperature | Average days in pupæ | Number of pupæ. | Results. |
|---|---|---|---|---|
| Dry cold ... | 40 F. | 20 | 12 | *I. d. 1. W. 1. Remainder died. |
| Moist cold ... | 40 | 20 | 4 | All cripples. D. 1. I. d. 3. |
| Dry heat ... | 95 | — | 8 | All died immature. |
| Moist heat ... | 95 | 7 | 10 | W.2,1 w.2, I.d.2 Remainder died. |

* Dr. Dixey has sub-divided the Intermediate forms into Intermediate wet and Intermediate dry, and the sub-division is a useful one. In order to simplify matters I combined the two under one heading in the first tables, but in these latter experiments the sub-division is imperative. There is, of course, no hard and fast line between the two intermediates and each individual must use his own standard. My own ideas are as follows. By Intermediate dry I mean an insect (*Melanitis*) with pronounced median fascia: subapical and basal fasciæ distinct. Ground colour, more or less uniform not minutely striated. Ocellated spots clearly marked, but iris absent or indefinite. Outer margin of wing below apex more or less but still distinctly falcate. Intermediate wet, fasciæ indistinct or almost absent, ground colour uniformly coloured and minutely striated. Ocellated spots clearly marked, the iris present, but indefinite. Outer margin of wing almost even, especially in the male.

Owing to the heavy mortality among the larvæ far fewer pupæ were available than I could have wished, and these were still further reduced by the abnormal conditions they were placed in. I am aware that no definite conclusion can be drawn from the above table, but so far as it goes, it supports the hypothesis rather than negatives it. My last and still more disappointing experience was with my effort to ascertain whether the change occurred during the larval stage or not. For this purpose I divided over sixty larvæ into two batches, putting one-half on one bamboo plant growing in a pot and the remainder on another. Both plants were kept on the same verandah, but whereas one was given a full share of sunlight and no water approximating as near as I could to dry season conditions, the other was kept entirely in the shade and was copiously watered every morning. Owing to the excessive mortality above detailed, the results were meagre in the extreme, and I can only hope to repeat them at some future date.

The pupæ were kept separate in adjoining breeding cages.

The following are the results:—

| Conditions. | Number. | Days in pupa. | Results. |
|---|---|---|---|
| Wet ... ... | 3 | — 10 32 | 1 died. ♀ D. ♂ D |
| Dry ... - | 6 | 18 21 21 | ♀ D. ♀ ♀ D. ♂ D. |
| | | 25 26 26 | ♀ ♀ D. |

The number of females is remarkable; there was also a very noteworthy similarity of colouring among the "dry" female specimens, all of them being of a very pale reddish ground colour with well marked fasciæ. On the other hand the "wet" female was of a deep purple brown, the most heavily marked specimen I have ever seen. The three males were very similar to each other, the ground colour being pale greenish brown. The insects taken at large at this time were nearly all dry forms of varying shades and colouring. While it is impossible to draw any definite conclusions from such meagre results, yet I think there are grounds for believing that though these forms are dependent on heat and cold, yet the diversity of colouring may be due in some measure to the condition of the food plants.

I have no intention of theorising on this subject, but I may lay some stress on the fact, for the benefit of those so inclined and who are unacquainted with tropical countries, that there is nothing in the appearance of an evergreen tropical jungle which favours one season form more than another. In those parts of the world such as Mauritius, Ceylon, Java and Sumatra the leaves and decaying vegetation under bushes and trees (the haunts of *Melanitis*) is precisely the same whether the weather is wet or dry. Even in cyclonic weather, when there is a deluge of rain, the debris at the roots of bamboos and other tropical shrubs is frequently perfectly dry, and presents no differences from that found in the height of the dry weather. In such districts as the plains of India or S. Africa, there is a vast difference in the appearance of the country at different seasons of the year, and it is readily comprehensible how one seasonal form is

benefited to the exclusion or diminution of the other ; but in evergreen jungle this is not so. If the climate of Mauritius underwent some considerable change by the wholesale destruction of the forests, the dry season form would in all probability predominate and perhaps permanently supplant the wet, and this would not be due to natural selection but merely the effect of those obscure processes which are grouped under the comprehensive term climate.

The methods I have adopted in the above experiments are, briefly, as follow. For the dry cold and dry heat processes a glass jar was obtained and the air having been exhausted by the ignition of a little rectified spirit the pupæ were suspended from the lid, which was then securely fastened down and glued round the edges.

For the moist cold a piece of muslin was tied over the jar to prevent the moisture from the melting ice coming in direct contact with the pupæ, but this was frequently not sufficient, as I often found beads of moisture on them. The jars containing the pupæ for cold conditions were kept in an ice box surrounded by ice with a self-registering thermometer. For the moist heat no covering was used in order to allow the heated moisture to escape, and for the suspension of a thermometer, a little water was kept at the bottom of the jar and was heated by a lamp beneath the water bath on which both jars, the dry and moist, rested. I should be grateful for any hints which would tend to reduce my high mortality in another series of experiments.

[*Note.*—It is to be hoped that Colonel Manders will make some further experiments, as in those which he has so far conducted he has been so singularly unfortunate that it is difficult to draw any conclusions therefrom.

In a climate like that of Mauritius one would naturally not expect any very sharp demarcation between the seasons of prevalence of the two forms.

The rain fall is heavy and well distributed throughout the year so that there is no marked dry season, and the "wet" form is evidently for the most numerous in eight months of the year. Colonel Manders attributes the increasing numbers of the "dry" form in the remaining four months to the fact that these are the cold months.

To a stranger, however, it would seem that in a country where the mean temperature does not vary nearly so much as that of Bombay there can be no very marked cold season either, unless the lower temperature is accompanied by a lowering of the relative humidity as in our case. It would be interesting to have the figures of the mean average humidity for the different months I have tried to obtain them in Bombay without success.

In one respect, however, I think Colonel Manders is making rather a bold assumption and that is in supposing that the seasonable changes take place in the last few days of pupal life. I would be inclined rather to attribute them to the relative amount of sap nutriment and pigment in the food plant of the larva.

So far as my own observations on the companion Indian species, *M. ismene*, are concerned, I should say that near Bombay the insect is only really common except in October and early November when it is often excessively abundant both by day and night.

These—or at any rate the fresh specimens—are all of the "dry" season form October, I need not say, is one of our hottest months. In the monsoon I have only observed the ocellated form.

It is a pity that more of our members do not undertake similar experiments to those made by Colonel Manders, and it is to be hoped that the relation of his experiences may encourage others to do so.

L. C. H. YOUNG,
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Entomological Dept., Bo. Nat. Hist. Society.]

## THE FAUNA OF INDIA—INSECTA.

The latest addition to this series is Mr. Distant's "Rhynchota," Volume III, containing the Aquatic Bugs, the Cicadids and Fulgorids, which the student of Indian entomology will find as useful as its predecessors. It is, however, an extraordinary commentary on the state of Indian entomology, and reveals in a striking manner the almost absolute lack of interest taken in insects, excepting butterflies, by residents in India. As usual, we went through the Volume to prepare a list of species recorded from localities *not in the hills*, that is recorded from localities in the plains, which are typically Indian. The result is simply amazing; if we except such useless records as "Bombay," "N. Bengal" and the like, which may mean Mahableshwar and Darjiling, a total of thirteen species will be found, according to this Volume, outside of such localities as Simla, Mussoorie, Darjiling, Ootacamund and Ceylon. Two conclusions may be drawn; it is an extraordinary exception to find any person—not a professional naturalist—collecting in India at all (such an exception is Mr. Mackinnon, of Mussoorie), and all collecting naturalists go to the hills and do not collect in the plains. Yet we have been frequently told that residents in the plains do not collect because the insects are worthless. The truth is we do not know what they are, and, while this is the state of things, every insect, whether described or new, common or rare, is of value as showing what the fauna of the plains really is. We believe that if members of the Bombay Natural History Society realise this fact, the almost utter ignorance of our real Indian fauna would disappear as soon as the collections of "plains" insects were worked out. Appeals for insects of special groups have been frequently made and probably produce little result; possibly it will be of more value to point out the groups in which work can be readily done which will be of value in later volumes of the Fauna. Every possible specimen of the earwig tribe is wanted; these are not uncommon, are quite harmless and inoffensive, and if put into a box and posted to my address with a slip giving date, locality and collector's name, will be set, pinned, labelled and sent on. The same applies to grasshoppers of all sorts, to cockroaches, to the praying mantids; an excellent method for keeping and sending them is to roll paper round a pencil, ruler or other object of the desired bore, gum up the paper and so make a cylinder, into which the insect slides. We

may include beetles, and have no hesitation in saying that the common beetle that comes in at night to the dinner table is worth putting in a box and posting. These are the chief things required, which *any member of the Society* could supply in large numbers. To the budding naturalist may we suggest the systematic collection of these groups, or of flies (Diptera) or the common bugs (Hemiptera). Supplementary lists of the Hemiptera will appear, and an effort should be made to add locality records from the plains. We have not suggested collecting Micro-lepidoptera because this is a special business, but of the ordinary beetles every member could send in a hundred and more easily. We may add that we shall be glad to give duplicates of every species sent in to the Society, properly pinned, etc., as well as duplicates of all others we can spare, and that every assistance in the way of information will be supplied.

H. MAXWELL-LEFROY.

Pusa, Bengal.

# BIRDS OF THE PROVINCES OF KASHMIR AND JAMMU AND ADJACENT DISTRICTS.

By

A. E. Ward.

## Part III.

(*Continued from page 485 of this Volume.*)

Fam. Motacillidæ.—Wagtails and Pipits.

(826). *Motacilla alba.*—The White Wagtail is rarely met with.

(829). *Motacilla personata.*—The Masked Wagtail, breeds at elevations of about 6,000′ to 8,000′ in Kashmir and probably in Baltistan.

(830). *Motacilla hodgsoni.*—Hodgson's Pied Wagtail is common and breeds in Kashmir.

(831). *Motacilla maderaspatensis.*—The Large Pied Wagtail.

(832). *Motacilla melanope.*—The Gray Wagtail, breeds in Kashmir at various high altitudes. Eggs found as late as June 28 at 7,000′.

(835). *Motacilla beema.*—The Indian Blue-headed Wagtail, breeds in parts of Ladak. I have not found the eggs in Kashmir proper, but it is said to breed there.

(833). *Motacilla borealis.*—The Indian Grey-headed Wagtail.

(836). *Motacilla fieldeggi.*—The Black-headed Wagtail. I have not as yet found this bird on its breeding grounds, but it migrates through Kashmir.

(837). *Motacilla citreola.*—The Yellow-headed Wagtail. This Wagtail breeds in Kashmir, but sparsely ; it migrates through in considerable numbers.

(838). *Motacilla citreoloides.*—Hodgson's Yellow-headed Wagtail. The eggs have been obtained in Ladak and in Kashmir. Numbers of these birds migrate over the Logila and other passes in June.

(841). *Anthus maculatus.*—The Indian Tree-Pipit (doubtful).

(844). *Anthus similis.*—The Brown Rock-Pipit.

(847). *Anthus rufulus.*—The Indian Pipit. I have no specimens of this bird or of *A. similis* from within Kashmir boundaries, but both must occur in the lower hills.

(846). *Anthus striolatus.*—Blyth's Pipit.

(848). *Anthus campestris.*—The Tawny Pipit (doubtful).

(849). *Anthus cervinus.*—The Red-throated Pipit.

(850). *Anthus rosaceus.*—Hodgson's Pipit, breeds at high elevations in June and July in Kashmir, and is plentiful particularly near the upland tarns.

(851). *Anthus spinoletta.*—The Water-Pipit.

(853). *Oreocorys sylvanus.*—The Upland Pipit.

Fam. Alaudidæ.—The Larks.

(855). *Otocorys penicillata.*—Gould's Horned Lark, found in summer in Ladak and Gilgit.

(856). *Otocorys longirostris.*—The Long-billed Horned Lark. I have specimens from Moulbekh-Ladak Road obtained in May from the foot of the Kherdong Pass and an immature bird, July 8, from Leh.

(857). *Otocorys elwesi.*—Elwes's Horned Lark. This like the preceding species is freely common in Ladak. In the summer, when it breeds, I have the eggs from Baltistan but without date.

(859). *Melanocorypha bimaculata.*—The Eastern Calandra Lark. The only specimen secured in Kashmir was obtained Dec. 27, 1903, near Srinagar. It is plentiful in some of the Northern districts.

(860). *Alauda arvensis.*—The Sky-Lark is found in most of the districts we are dealing with, varies greatly in size, and in the depth of the brown colouring of the upper plumage. Breeds generally in May, at various altitudes ranging from the main valleys to certainly over 10,000'.

(861). *Alauda gulgula.*—The Indian Sky-Lark. Does not appear to come to the Kashmir hills, but is reported from the flat country within the boundaries of Jammu, etc.

(862). *Calandrella brachydactyla.*—The Short-toed Lark (doubtful).

(864). *Calandrella tibetana.*—Brooks's Short-toed Lark. I have the eggs of this bird taken on the Ladak Road in May.

(865). *Calandrella acutirostris.*—Humes' Short-toed Lark, said to summer in Gilgit.

(878). *Ammomanes phœnicuroides.*—The Desert Finch Lark.

ORDER PICI. FAM. PICIDÆ.—Woodpeckers and Wrynecks.

(946). *Gecinus squamatus.*—The West-Himalayan Scaly-bellied Green Woodpecker, is widely distributed. The eggs are often six in number, and are laid in May or April.

(950). *Gecinus occipitalis.*—The Black-naped Green Woodpecker. Generally breeds later than the foregoing species and has a wide range.

(951). *Gecinus chlorolophus.*—The Small Himalayan Yellow-naped Woodpecker is rarely found and probably only in Kishtwair and Badrawar and the extreme western boundaries of Kashmir.

(960). *Hypopicus hyperythrus.*—The Rufous-bellied Pied Woodpecker. I have rarely seen this bird within the District under observation.

(961). *Dendrocopus himalayensis.*—The Western Himalayan Pied Woodpecker. Ascends to considerable altitudes and is a common bird in Kashmir and Baltistan, and generally lays its eggs in April. I found the young well grown on May 16th, 1904.

(963). *Dendrocopus sindianus.*—The Sind Pied Woodpecker. I think it is safe to enter this bird in our list, although I have not personally observed it actually within Kashmir territory.

(967). *Dendrocopus macii.*—The Fulvous-breasted Pied Woodpecker. Whether this bird is to be found or not, I am doubtful. The specimen in the museum did not apparently come from Kashmir.

(969). *Dendrocopus auriceps.*—The Brown-fronted Pied Woodpecker is rarely found.

(986). *Brachypternus aurantius.*—The Golden-backed Woodpecker.

(1003). *Iynx torquilla.*—The Common Wryneck. This bird is fairly plentiful in Kashmir and Baltistan where it breeds.

ORDER TYGODACTYLI. FAM. INDICATORIDÆ.—Honey Guides.

(1004). *Indicator xanthonotus.*—The Yellow-backed Honey-Guide. I have never succeeded in finding the nest of this bird, which is to be met with in the Jhelum Valley and probably in Poonch.

FAM. CAPITONIDÆ.—Barbets.

(1006). *Megalæma marshallorum.*—The Great Himalayan Barbet is fairly common in the lower ranges, but does not seem to visit the main vale of Kashmir. I have found it at Tret-Murree Road.

(1012). *Cyanops asiatica.*—The Blue-throated Barbet. So far I have only found this Barbet in the Chenab Valley.

(1019). *Xantholæma hæmatocephala.*—The Crimson-breasted Barbet is very rarely found and apparently only in the plain and lower slopes of the Panjab ranges.

ORDER ANISODACTYLI. FAM. CORACIADÆ.—Rollers.

(1022). *Coracias indica.*—The Indian Roller. A few specimens have been obtained in the Jhelum Valley and on the outside ranges.

(1024). *Coracias garrula.*—The European Roller generally arrives in the main valley in May and stays till November if the weather is not severe.

FAM. MEROPIDÆ.—Bee-eaters.

(1026). *Merops viridis.*—Common Indian Bee-eater. The name Kashmir is often applied to the whole of the Maharajah's dominions, hence the specimens in the Hume collection may have come from the Jammu province. I have not seen this bee-eater in Kashmir.

(1028). *Merops persicus.*—The Blue-cheeked Bee-eater. This bird is said to migrate through parts of the provinces we have under review, but I have never seen it in any part of Kashmir or Jammu.

(1029). *Merops apiaster.*—The European Bee-eater. One of the commonest birds in summer, it assembles in flocks in April and breeds in June, laying its eggs in holes and in banks on the dry plateaux.

FAM. ALCEDINIDÆ.—Kingfishers.

(1033). *Ceryle varia.*—Indian Pied Kingfisher. A very common bird on the main rivers at altitudes up to about 6,000′.

(1034). *Ceryle lugubris.*—The Himalayan Pied Kingfisher. I have not found this Kingfisher in Kashmir proper, but it is fairly common in Kishtwar.

(1035). *Alcedo ispida.*—The Common Kingfisher is abundant in Kashmir up to about 6,000′.

(1044). *Halcyon smyrnensis.*—The White-breasted Kingfisher. My specimens are from Poonch.

FAM. UPUPIDÆ.—Hoopoes.

(1066). *Upupa epops.*—The European Hoopoe generally migrates from Kashmir in the autumn ; now and again a bird or two may be seen in winter ; it is widely distributed in summer, ascending to considerable altitude.

ORDER MACROCHIRES FAM. CYPSELIDÆ.—Swifts and Spine-tails.

(1068). *Cypselus melba.*—The Alpine Swift.

(1069). *Cypselus apus.*—The European Swift is met with in summer. The nests of both this and *C. melba* are hard to obtain as they are lodged in cliffs.

(1072). *Cypselus leucomyx.*—Blyth's White-rumped Swift.

(1073). *Cypselus affinis.*—The Common Indian Swift.

(1077). *Chætura nudipes.*—The White-necked Spine-tail. I enter this bird as it is reported from the Kishengunga Valley.

FAM. CAPRIMULGIDÆ.—Nightjars.

*Note.*—The list of these must be considered tentative. What specimens I have procured are from Kishtwar and the extreme boundaries.

(1089). *Caprimulgus mahrattensis.*—Syke's Nightjar. This bird I expect can be found on the plains below the Pir-Paiyal range.

(1091). *Caprimulgus asiaticus.*—The Common Indian Nightjar. See note.

(1092). *Caprimulgus europæus.*—The European Nightjar breeds, it is said, in Gilgit. I have never come across this bird in Kashmir proper.

(1095). *Caprimulgus indicus.*—The Jungle Nightjar. I expect this Nightjar is confined to Poonch and Jammu.

ORDER COCCYGES. FAM. CUCULIDÆ.—Cuckoos.

(1104). *Cuculus canorus.*—The Cuckoo.

(1105). *Cuculus saturatus.*—The Himalayan Cuckoo. I found the egg of this bird in a bush chat's nest in June and have many specimens from altitudes up to about 8,000′ from several districts.

(1106). *Cuculus polocephalus.*—The Small Cuckoo is obtained in May, June and July and about 6,000′ to 7,000′ and in the last mentioned month at higher altitudes.

(1107). *Cuculus micropterus.*—The Indian Cuckoo. I am not certain about this bird being found. We have a specimen in the Museum, but there is uncertainty as to the locality from whence obtained.

(1108). *Hierococcyx sparverioides.*—The Large Hawk Cuckoo (doubtful).

(1114). *Penthoceryx sonnerati.*—The Banded Bay Cuckoo. Mr. S. Whymper kindly sent me a specimen he shot in July 1905 in the Liddar valley. This is the only one I have heard of as being secured in Kashmir.

(1118). *Coccystes jacobinus.*—The Pied Crested Cuckoo is not very plentiful, but I have a specimen dated 29th May from Kashmir, and have seen others near Martan ruins and other parts of the vale.

(1120). *Eudynamis honorata.*—The Indian Koel.

(1129). *Taccocua leschenaulti.*—The Sirkeer Cuckoo is rarely met with and only on the outer ranges.

(1130). *Centropus sinensis.*—The Coucal is confined to the lower ground on the Indian side.

ORDER PSITTACI. FAM. PSITTACIDÆ.—Parrots.

(1135). *Palæornis nepalensis.*—The Large Indian Paroquet. We may expect to find this bird on the extreme east of the Jammu Province.

(1138). *Palæornis torquatus.*—The Rose-ringed Paroquet.

(1139). *Palæornis cyanocephalus.*—The Western Blossom-headed Paroquet is found in the lower hills, and in the Lolab, Kishtwar, &c.

(1141). *Palæornis schisticeps.*—The Slaty-headed Paroquet. A common bird in Pooneh and Lolab, &c., in summer. A good many birds come up the side valleys to about 7,500′ in the autumn, attracted, no doubt, by the food available.

ORDER STRIGES. FAM. STRIGIDÆ.—Owls.

(1152). *Strix flammea.*—The Screech Owl.

FAM. ASIONIDÆ.

(1156). *Asio otus.*—The Long-eared Owl is fairly plentiful.

(1157). *Asio accipitrinus.*—The Short-eared Owl is found in the low country.

(1158). *Syrnium nivicola.*—Himalayan Wood Owl. This bird is, I think, less common than the next species.

(1159). *Syrnium biddulphi.*—Scully's Wood Owl. I have found a good many eggs in the State Game rukhs in Kashmir, and this owl is found in Gilgit and Baltistan. Most eggs are taken in April and May.

(1160). *Syrnium indrani.*—The Brown Wood Owl.

(1161). *Syrnium ocellatum.*—The Mottled Wood Owl. We have a specimen which was sent to the museum as having been shot in Kashmir and I had another marked Jammu.

(1165). *Ketupa flavipes.*—The Tawny Fish Owl is uncommon.

(1167). *Bubo ignavus.*—The Great Horned Owl. Sparsely scattered over a large extent of country.

(1168). *Bubo bengalensis.*—The Rock-horned Owl is common; it lays its eggs in March and April. An oviduct egg was obtained in May.

(1173). *Scops giu.*—The Scops Owl.

(1174). *Scops brucii.*—The Striated Scops Owl recorded from the outlying districts towards Gilgit.

(1175). *Scops spilocephalus.*—The Spotted Himalayan Scops Owl.

(1178). *Scops bakkamaena.*—The Collared Scops Owl.

(1179). *Scops semitorques.*—The Plume-foot Scops Owl.

(1180). *Athene brama.*—The Spotted Owlet.

(1182). *Athene bactriana.*—Hutton's Owlet.

(1183). *Glaucidium cuculoides.*—The Large-haired Owlet.

(1186). *Glaucidium brodiei.*—The Collared Pigeon Owlet.

ORDER ACCIPITRES. FAM. PANDIONIDÆ.

(1189). *Pandion haliaëtus.*—The Osprey is not common, but it is met with in various parts of Kashmir.

FAM. VULTURIDÆ.—Vultures.

(1190). *Vultur monachus.*—The Cinereous Vulture is rarely met with. A specimen was obtained in December at Manasbal, Kashmir.

(1191). *Otogyps calvus.*—The Black Vulture is far from common.

(1192). *Gyps fulvus.*—The Griffon Vulture breeds in colonies in the high cliffs in March and is resident in many districts.

(1193). *Gyps himalayensis.*—The Himalayan Griffon is widely distributed. Most of the eggs I have are dated March.

(1194). *Gyps indicus.*—The Indian Long-billed Vulture. Up to date I have not secured a specimen, and I am very doubtful whether this bird is to be found.

(1195). *Gyps tenuirostris.*—The Himalayan Long-billed Vulture does not appear to ascend into the hills, but is found on the outer slopes and plains of the Punjab range.

(1196). *Pseudogyps bengalensis.*—The Indian White-backed Vulture is rare.

(1197). *Neophron percnopterus.*—The Egyptian Vulture breeds occasionally in Kashmir and in the side valleys.

FAM. FALCONIDÆ.

(1199). *Gypaëtus barbatus.*—The Bearded Vulture can be seen in nearly all the mountainous country. This bird breeds in Kashmir and generally lays in February and March. I have taken mouse-hares out of specimens shot, and on one occasion this vulture took a wounded chukor which was crouched on a rock. A very large egg measured 3·7″ × 2·75″.

(1200). *Aquila chrysaëtus.*—The Golden Eagle is a very rare bird.

(1201). *Aquila heliaca.*—The Imperial Eagle is not often to be seen; those obtained were killed in the winter in Kashmir.

(1202). *Aquila bifasciata.*—The Steppe Eagle is abundant.

(1203). *Aquila vindhiana.*—The Indian Tawny Eagle.

(1207). *Hieraëtus fasciatus.*—Bonelli's Eagle. This Hawk Eagle was breeding in Kishtwar on cliffs in March; it is not plentiful.

(1208). *Hieraëtus pennatus.*—The Booted Eagle was obtained in Kashmir in March.

(1210). *Ictinaëtus malayensis.*—The Black Eagle is met with in the winter, but I cannot remember having ever seen it during the summer months.

(1211). *Spizaëtus limnaëtus.*—The Changeable Hawk Eagle was included in my list which was made out some years ago, but I am rather inclined to doubt the correctness of the locality assigned to the specimen.

(1213). *Spizaëtus nepalensis.*—Hodgson's Hawk-Eagle is a fairly common bird.

(1216). *Circaëtus gallicus.*—The Short-toed Eagle.

(1217). *Spilornis cheela.*—The Crested Serpent Eagle is entered on the strength of a single specimen.

(1223). *Haliaëtus leucoryphus.*—Pallas Fishing Eagle.

(1225). *Haliaëtus albicilla.*—The White-tailed Sea Eagle. The only place I have seen this bird was on the shores of the Walar Lake.

(1227). *Polioaetus humilis.*—Hodgson's Fishing Eagle. This bird breeds in Kashmir and is common in the valley.

(1229). *Milvus govinda.*—The Common Kite.

(1230). *Milvus melanotis.*—The Large Indian Kite is common in Kashmir and the neighbouring valleys.

(1234). *Circus cinereaceus.*—Montagu's Harrier is to be found in the autumn and winter months.

(1235). *Circus cyaneus.*—The Hen Harrier can often be seen in winter, and then generally flying low in the vicinity of villages and on the bare country.

(1237) *Circus æruginosus.*—The Marsh Harrier is very plentiful on all the swamps. A bird was brought to me in June and what was supposed to be its egg, but I am doubtful, for it was too large.

(1238). *Circus macrurus.*—The Pale-Harrier (doubtful).

(1239). *Buteo ferox.*—The Long-legged Buzzard breeds in the hills round Kashmir, but seldom below 9,000′ altitude.

(1240). *Buteo leucocephalus.*—The Upland Buzzard is recorded on two occasions.

(1241). *Buteo desertorum.*—The Common Buzzard.

(1243). *Astur palumbarius.*—The Goshawk is rare.

(1244). *Astur badius.*—The Shikra. I have seen very few.

(1247). *Accipiter nisus.*—The Sparrow Hawk is resident.

(1248). *Accipiter virgatus.*—The Besra Sparrow Hawk. I am not very clear about this bird.

(1254). *Falco peregrinus.*—The Peregrine Falcon is far from uncommon.

(1257). *Falco jugger.*—The Laggar Falcon.

(1255). *Falco peregrinator.*—The Shahin Falcon. Now and again specimens have been secured close to Srinagar.

(1259). *Falco milvipes.*—The Shanghai Falcon. I expect this bird will be found in the northern district.

(1260). *Falco subbuteo.*—The Hobby breeds in the higher hills.

(1261). *Falco severus.*—The Indian Hobby was shot in August 1902 in the Liddar Valley, Kashmir.

(1263). *Æsalon regulus.*—The Merlin is widely distributed in the winter months.

(1264). *Æsalon chicquera.*—The Red-headed Merlin is rarely to be found, and I suspect the museum specimens were obtained from the Punjab.

(1265). *Tinnunculus alaudarius.*—The Kestrel.

(1266). *Tinnunculus cenchris.*—The Lesser Kestrel (doubtful).

*(To be continued.)*

# DESCRIPTIONS OF INDIAN MICRO-LEPIDOPTERA.

BY

E. MEYRICK, B.A., F.R.S., F.Z.S.

## III.

(*Continued from page* 417 *of this Volume.*)

Besides previously mentioned contributors, I have received material through the kindness of Major C. G. Nurse and Colonel C. Swinhoe, and also some obtained by native collectors in the Khasi Hills, a portion of which is included in the present instalment, as well as some sent by the Calcutta Museum, mostly collected by Mr. G. C. Dudgeon. Sixteen genera and sixty-one species are described as new.

PTEROPHORIDÆ.

*Exelastis*, n. g.

Face smooth. Palpi moderate, slender, ascending, pointed. Tibiæ slender, smooth. Forewings cleft from $\frac{1}{2}$—$\frac{2}{3}$, segments narrow, pointed, sometimes broader in ♀; 2 from near angle, 3 and 4 stalked from angle, 5 and 6 very short, 7 from near upper angle, 8 and 10 stalked, 9 absent, 11 from near angle. Hindwings cleft firstly from $\frac{1}{3}$, secondly from near base, segments very narrow, pointed, without scale-tooth in dorsal cilia; 2 remote, 3 and 4 stalked from angle, 5 and 6 absent.

Type *E. atomosa*, Wals. To this genus I also refer *liophanes*, Meyr., hitherto included in *Marasmarcha*.

*Exelastis atomosa*, Wals.

(*Aciptilia atomosa*, Wals., Proc. Zool. Soc. Lond. 1885, 885.)

The larva feeds in pods of *Cajanus indicus*, and has been bred freely by Mr. H. Maxwell-Lefroy. In this species the forewings are deeply cleft and the segments shorter and broader in the ♀ than in the ♂—an unusual circumstance.

ORNEODIDÆ.

*Orneodes ochrozona*, n. sp.

♂ ♀. 19-22 mm. Head and thorax whitish-ochreous, sprinkled with dark fuscous. Palpi long, whitish-ochreous, second and terminal joints each with two bands of dark fuscous irroration, second joint with projecting scales above and beneath. Forewings light yellow-ochreous; costa with about twelve short whitish strigulæ edged with dark fuscous; apex suffused with blackish; basal third of wing irrorated with dark fuscous; median and subterminal zigzag bands of dark fuscous irroration, margined by whitish lines edged with dark fuscous, obsolete on costal lobe; apex of each lobe with a black dot. Hindwings as forewings, but costal lobe marked like the rest, median band nearer base.

Bhotan, in June; several specimens in collection of Calcutta Museum, to which I am indebted for examples. Near *sikkima*, Moore, but that is a grey species.

EPIBLEMIDÆ.

*Chrosis ephippias*, n. sp.

♂ ♀. 11-16 mm. Head and thorax whitish-ochreous, sometimes partially tinged with brownish-ochreous. Abdomen grey, anal tuft whitish-ochreous. Forewings elongate, rather broader in ♀, costa gently arched, apex obtuse, termen straight, somewhat oblique ; whitish-ochreous, strewn with brownish-ochreous strigulæ which are finely sprinkled with black ; costa more sharply and darkly strigulated throughout ; basal patch very obscurely indicated, edge obtusely angulated in middle ; upper half of central fascia dark-brown, truncate beneath, posterior edge with a strong acute projection above truncation ; rest of central fascia represented by an elongate dark-brown discal mark at $\frac{2}{3}$, its anterior end sometimes curved and connected with costal half, and a brown blotch with two upward diverging lobes on dorsum towards tornus ; a triangular brown spot in disc towards apex ; a small dark brown apical spot : cilia ochreous-whitish, sprinkled with fuscous, with dark fuscous subbasal line. Hindwings with 6 and 7 stalked, rather dark fuscous ; cilia as in forewings.

Puttalam and Maskeliya, Ceylon (Pole, de Mowbray, Green, Vaughan) ; Bombay (Young) ; from July to April, twenty specimens.

*Proschistis*, n. g.

Palpi moderate, porrected. Antennæ in ♂ strongly fasciculate-ciliated (3). Thorax with small posterior crest. Forewings in ♂ without fold, termen sinuate ; 7, 8, 9 approximated at base. Hindwings with 3, 4, 5 approximated at base, 6 and 7 approximated towards base.

Allied to *Eucosma*.

*Proschistis zaleuta*, n. sp.

♂ ♀. 18-25 mm. Head and thorax dark fuscous, irrorated and thorax sometimes partly suffused with whitish. Abdomen fuscous. Forewings elongate, slightly dilated, costa moderately arched, apex obtuse, termen sinuate, little oblique ; white, sprinkled with dark fuscous and strewn with dark fuscous strigulæ, veins except posteriorly obscurely suffused with dark purplish-leaden ; costa spotted with dark fuscous ; basal patch indicated by coalescence of dark fuscous strigulæ, but undefined ; central fascia dark fuscous, narrow, irregular and undefined on upper half, broad and strongly marked on lower half ; a subquadrate dark fuscous spot on costa towards apex, whence proceeds a narrow striga to tornus, sometimes confluent with a narrow transverse spot before middle of termen : cilia fuscous, irrorated with white and indistinctly barred with dark fuscous. Hindwings and cilia fuscous.

Maskeliya, Ceylon (Pole, Alston, de Mowbray, Green) ; from July to September, twenty specimens.

*Platypeplus tetracona*, n. sp.

♂ ♀. 24-29 mm. Head and thorax brownish-ochreous, sprinkled with dark fuscous. Abdomen light fuscous. Brush of posterior tibiæ whitish in ♂, shorter and ochreous-tinged in ♀. Forewings elongate, considerably dilated,

costa rather strongly arched, apex obtuse, termen hardly rounded, nearly vertical; ochreous-whitish, more or less strigulated variably with ochreous, ferruginous, or dark fuscous; triangular dark fuscous dorsal blotches indicating posterior portions of basal patch and central fascia, respectively; basal patch otherwise indicated by dark striæ, little defined, outer edge irregular; rest of central fascia deep ochreous, dark ferruginous, or dark fuscous, moderately broad, reaching from costa ⅔ across wing, then posteriorly with an abrupt upwardly oblique elongate lobe extending above the triangular dorsal blotch, but clearly separated from it; a broad similarly coloured triangular apical patch: cilia ochreous-whitish, suffusedly mixed with fuscous or dark fuscous, except towards tornus. Hindwings and cilia fuscous.

Maskeliya, Ceylon (de Mowbray, Alston, Pole); in February, March, and October, seven specimens.

*Eucosma crophias*, n. sp.

♂ ♀. 21-24 mm. Head and thorax grey, mixed with dark grey and whitish-ochreous, sometimes suffused with ferruginous; crest of thorax strong, bifid. Antennæ and abdomen rather dark grey. Forewings elongate, posteriorly dilated, costa moderately arched, apex obtuse, termen almost straight, somewhat oblique; dark purplish-fuscous, very finely irrorated with whitish, sometimes ferruginous-tinged, costa finely strigulated with dark and pale; dorsal area more or less suffused with whitish, its outline running from costa near base obliquely to fold, then forming a triangular projection upwards before middle, beyond this running upward in a straight line to apex, edged above with darker suffusion posteriorly, terminal area sometimes clearer whitish sometimes suffused with deep ferruginous; dorsum suffused with blackish towards base; a transverse-linear white mark in disc at ⅔; several minute black dots on termen, and a larger blackish dot before tornus: cilia whitish, ferruginous, or dark grey, variably intermixed, but always with small dark præapical and prætornal spots. Hindwings with 3 and 4 sometimes short-stalked; fuscous, darker towards termen; cilia fuscous-whitish, with two fuscous shades.

Simla (Nurse), Khasi Hills; in August and September, seven specimens.

*Sporocelis*, n. g.

Palpi moderate, porrected. Antennæ in ♂ shortly ciliated. Thorax with posterior crest. Forewings in ♂ without fold, termen subsinuate, surface with raised tufts; 7, 8, 9 approximated at base. Hindwings with 3 and 4 connate, 5 parallel, 6 and 7 closely approximated towards base.

Probably an early form in the line of development of *Eucosma*.

*Sporocelis marmaropa*, n. sp.

♂ ♀. 16-18 mm. Head and thorax dark fuscous, partially finely sprinkled with whitish. Abdomen fuscous, sprinkled with darker. Forewings elongate, dilated, costa gently arched, bent at ⅔, apex obtuse, termen subsinuate, oblique; rather dark fuscous, strewn with blackish strigulæ, costa suffused with blackish; small scattered tufts of raised scales in disc; basal, antemedian, and

subterminal bands of purplish-leaden striæ interspersed with irregular white dots and scattered scales ; a larger white mark in disc beyond middle : cilia purplish-leaden, mixed with dark fuscous. Hindwings rather dark fuscous ; cilia fuscous.

Maskeliya, Ceylon ; in May and August, three specimens (de Mowbray, Pole).

*Epiblema ancyrota*, n. sp.

♂. 22-25 mm. Head and collar light brownish. Thorax grey-whitish, shoulders spotted with black, two dark grey dorsal dots. Abdomen grey. Forewings very elongate, narrow, gradually dilated, costa slightly arched, apex obtuse, termen subsinuate, little oblique, rounded beneath, costal fold strong, reaching from base to middle ; silvery-grey, closely irrorated with white, and strewn with more or less distinct dark fuscous strigulæ ; a broad dark brown suffusion, mixed with purplish-leaden, extending over costal half of wing from near base to $\frac{2}{3}$, then suddenly contracted and continued as a narrow and less defined costal suffusion to apex ; posterior half of costa with pairs of short whitish strigulæ ; an irregular dark fuscous spot in disc at $\frac{1}{3}$, resting on edge of dark costal suffusion ; a curved black linear mark from angle of costal suffusion at $\frac{2}{3}$ ; a series of six or seven short black linear marks before termen ; a small dark fuscous apical spot : cilia grey, irrorated with white, suffused with white towards base, on upper part of termen suffused with brown towards tips. Hindwings with 3 and 4 stalked ; fuscous, becoming dark fuscous posteriorly ; cilia fuscous, with pale basal line.

Maskeliya, Ceylon ; in January, March, June, and August, five specimens (Pole, de Mowbray).

*Cydia porpota*, n. sp.

♂ ♀. 13-15 mm. Head and palpi whitish-fuscous, second joint of palpi tufted beneath, terminal very short. Thorax whitish, suffused with pale fuscous, except posteriorly. Abdomen light fuscous. Forewings elongate, rather narrow, costa gently arched, apex obtuse, termen nearly straight, faintly sinuate in middle, somewhat obliquely rounded beneath ; whitish ; costa suffused with fuscous, and obliquely strigulated with dark ferruginous-brown and whitish ; dorsum suffused with fuscous and strigulated with darker fuscous ; some scattered fuscous or dark fuscous strigulæ in disc anteriorly ; a small dark fuscous spot beneath fold at $\frac{1}{3}$, indicating angle of basal patch ; a narrow, undefined, fuscous and brown fascia from $\frac{3}{4}$ of costa to before tornus, almost interrupted beneath costa, broadest on lower half and somewhat marked with black posteriorly ; a moderate round brown or fuscous spot towards apex, marked with about 6—8 variable black dots ; a ferruginous-brown stria from costa before apex to termen above tornus, preceded and followed by silvery-leaden striæ from costa ; a small ferruginous-brown apical spot : cilia fuscous, irrorated with white, with a white tornal patch. Hindwings wit 13 and 4 long-stalked ; grey ; cilia grey-whitish, with two grey shades.

Mhow, in June ; four specimens (Swinhoe).

*Cydia clydonias*, n. sp.

♂ ♀ 22—24 mm. Head and thorax light fuscous, irrorated with fuscous-whitish. Abdomen fuscous. Forewings elongate, posteriorly somewhat dilated, costa gently arched, apex obtuse, termen slightly sinuate, little oblique, rounded beneath ; fuscous, all scales finely tipped with whitish, sometimes with faint darker strigulæ ; costal edge dark fuscous with pairs of oblique whitish strigulæ ; a rather oblique more or less dark fuscous irregular streak from ⅓ of dorsum, reaching half across wing, sometimes almost wholly obsolete ; a very oblique more or less defined fuscous mark from middle of costa, extremity curved up to near costa at ¾ ; an irregular fuscous spot in middle of disc, partially marked with black and edged with whitish, two upper angles produced into elongate lobes, so as to form a crescent concave above, sometimes partially obsolete ; a strongly upcurved fuscous mark, edged with black and then with whitish, from near posterior arm of this spot to middle of termen, always well defined, from anterior extremity of which proceed one or two darker strigæ to tornus ; a small blackish-fuscous apical spot : cilia fuscous, towards tornus whitish-fuscous. Hindwings with 3 and 4 connate ; fuscous, darker towards termen ; cilia fuscous, with darker sub-basal line.

Wellawaya, Ceylon (Green) ; Muok-lek, Siam (Swinhoe) ; in November and January, seven specimens.

*Laspeyresia tricentra*, n. sp.

♂ ♀. 11-13 mm. Head and thorax rather dark fuscous, closely irrorated with ochreous-grey-whitish. Abdomen fuscous. Forewings elongate, lightly dilated, costa slightly arched, apex obtuse, termen sinuate, little oblique ; rather dark fuscous, finely irrorated with ochreous-grey-whitish, with indistinct darker transverse striæ ; a series of short oblique dark fuscous strigæ from costa, alternating with bluish-leaden-metallic strigæ which rise from pairs of pale costal strigulæ, becoming longer posteriorly ; a very faint hardly paler slightly leaden-tinged subtriangular blotch on middle of dorsum ; ocellus laterally margined with leaden-metallic, marked with three somewhat elongate black dots touching posterior edge : cilia fuscous, irrorated with whitish. Hindwings dark fuscous, lighter towards base ; cilia pale fuscous, with dark fuscous basal line.

Maskeliya, Peradeniya, and Puttalam, Ceylon ; Travancore, Mhow, Bombay, Poona (Pole, Green, Swinhoe); ten specimens. Larva feeds in stems of *Crotalaria* ( " Dekkan hemp " ) (Green). This is the insect recorded in Swinhoe's Catalogue (No. 4768) as *Dichrorampha subsequana*, Haw., an erroneous identification. I have seen Swinhoe's original specimens ; there is no reason to suppose that the true *subsequana* occurs in India, and it should be removed from the list.

TORTRICIDÆ.

*Oxygrapha dictyodes*, n. sp.

♂ ♀. 16-18 mm. Head, thorax, and abdomen grey. Forewings elongate, oblong, costa strongly arched towards base, slightly roughened with

scales towards $\frac{1}{3}$, faintly sinuate in middle, apex round-pointed, termen sinuate, oblique ; fuscous, finely and densely irrorated with white, appearing pale grey ; veins and numerous transverse strigulæ fuscous, forming an irregular network ; five slender transverse fuscous striæ mixed with black slightly raised scales, first marking edge of basal patch, angulated in middle, second and third marking edges of central fascia, second slightly curved, third irregular, fourth from $\frac{2}{3}$ of costa to tornus, fifth from costa near apex to near middle of termen ; costa sometimes with a triangular grey or fuscous suffusion, extending from second stria to fifth : cilia grey, sprinkled with whitish, with blackish-grey subbasal line. Hindwings light grey, faintly strigulated with darker ; cilia as in forewings.

Maskeliya, Ceylon, in August, January, and February ; five specimens (Pole, de Mowbray, Alston).

*Oxygrapha loxoscia*, n. sp.

♂ ♀. 14-16 mm. Head and thorax reddish-ochreous, tinged with purplish. Abdomen whitish-ochreous-grey. Forewings elongate, rather narrow, hardly dilated, costa anteriorly moderately, posteriorly slightly arched, apex round-pointed, termen slightly sinuate, oblique ; ochreous or ferruginous, in lighter specimens obscurely strigulated with fuscous, in darker specimens with indistinct purplish-leaden transverse strigæ ; scattered minute black dots of raised scales ; an oblique undefined fuscous shade from $\frac{2}{3}$ of costa to middle of dorsum : cilia ochreous, between apex and tornus light ochreous yellowish, on tornus suffused with grey. Hindwings ochreous-grey-whitish, in ♀ suffused with pale grey posteriorly ; cilia ochreous-whitish, in ♀ greyish-tinged.

Maskeliya, Ceylon, in October ; six specimens (Pole, Alston).

*Tortrix encausta*, n. sp.

♂ 23-25 mm. ♀ 32-34 mm. Head and thorax light brownish-ochreous. Palpi very short, with appressed scales, subascending. Abdomen in ♂ greyish-ochreous, in ♀ yellow-ochreous. Forewings moderately broad, in ♂ narrowed anteriorly, in ♀ sub-oblong, costa towards base in ♂ gently, in ♀ strongly arched, thence in ♂ nearly straight, in ♀ sinuate, apex obtuse, termen in ♂ hardly sinuate, little oblique, in ♀ strongly sinuate beneath apex, bowed beneath, vertical ; brownish-ochreous, with fine scattered grey or dark grey strigulæ, chiefly towards margins, often more or less suffused with light purplish-fuscous ; basal patch represented in ♂ by a very dark green trapezoidal blotch resting on dorsum towards base, reaching half across wing, in ♀ by a small irregular dark green transverse mark beneath costa at $\frac{1}{6}$ ; in ♂ upper half of central fascia very dark green, irregular, becoming brown on costa, in ♀ this mark is broken up and much reduced, rising on costa nearer base at $\frac{1}{3}$ ; three small semi-oval dark brown marks on posterior half of costa : cilia pale brownish-ochreous, tips brown, except towards tornus. Hindwings in ♂ fuscous, towards costa posteriorly sometimes slightly tinged with orange, and strigulated with darker ; in ♀ light ochreous-orange, towards dorsum sometimes slightly infuscated, posteriorly strigulated with fuscous, terminal edge

sometimes fuscous ; cilia in ♂ fuscous, in ♀ light fuscous.

Peradeniya, Maskeliya, Gampola, Ceylon, from May to January ; fourteen specimens (Pole, Green, Alston).

*Ulodemis*, n. g.

Antennæ in ♂ shortly ciliated, with dorsal notch in stalk near base. Palpi rather long, porrected. Thorax without crest. Forewings with 7 and 8 stalked, 7 to termen. Hindwings with 3 and 4 connate, 5 closely approximated at base, 6 and 7 connate or short-stalked.

Apparently allied to *Pandemis*.

*Ulodemis trigrapha*, n. sp.

♂♀. 20-23 mm. Head, palpi, and thorax brown, forehead in ♂ with blackish spot. Abdomen bronzy-grey. Forewings elongate-oblong, costa anteriorly moderately arched, posteriorly slightly sinuate, apex obtuse, termen in ♂ almost straight, somewhat oblique, in ♀ somewhat sinuate, hardly oblique, rounded beneath ; brown, more or less strewn with blackish-grey strigulæ, in ♀ sometimes hardly perceptible ; three obscure slender whitish oblique transverse lines, nearly straight and tolerably parallel, indicating edge of basal patch and margins of moderate central fascia, which are hardly darker than ground colour : cilia brown, tips pale. Hindwings in ♂ with subdorsal groove containing expansible hair-pencil ; grey ; cilia light grey, with darker basal line.

Bhotan (3,000 feet) in April, May and August ; three specimens (Dudgeon).

GELECHIADÆ.

*Thyreostoma*, n. g.

Head smooth ; tongue developed. Antennæ ¾, in ♂ moderately ciliated (1), basal joint very long, without pecten, second joint also elongate, about half basal, its apex angularly prominent above. Labial palpi long, recurved, second joint with very long fine expansible fringe of hairs beneath, terminal joint as long as second, thick, tolerably pointed. Maxillary palpi rudimentary. Posterior tibiæ with three tufts of scales above. Forewings with 4 absent, 7 and 8 stalked, 7 to costa, 9 absent, 11 from beyond middle. Hindwings ½, very narrowly elongate-trapezoidal, acutely pointed from ¾, cilia 4 ; 2-5 parallel, 6 and 7 approximated towards base.

Apparently related to *Aristotelia*.

*Thyreostoma glaucitis*, n. sp.

♂. 12-13 mm. Head and thorax shining white. Palpi white, apex greyish. Antennæ white, stalk grey above. Abdomen pale shining silvery-grey, basal half dorsally greyish-ochreous. Forewings linear-lanceolate, widest near base, gradually attenuated to acute apex ; grey with pale metallic-blue reflections ; a narrow inwardly oblique whitish fascia at ⅓ ; an ill-defined irregular whitish discal spot at ⅔ : cilia light grey. Hindwings and cilia grey, towards base paler and ochreous-tinged.

Peradeniya, Ceylon, in June ; two specimens bred "from mango leaf" (Green).

*Pachnistis*, n. g.

Head with appressed scales; tongue developed. Antennæ $\frac{3}{4}$, in ♂ rather thick, serrate, basal joint moderate, without pecten. Labial palpi long, recurved, second joint considerably thickened with appressed scales, terminal joint rather longer than second, stout, compressed, acute. Maxillary palpi rudimentary. Posterior tibiæ clothed with rather short rough scales. Forewings with 1b furcate, 2 and 3 stalked from angle, 7 and 8 stalked, 7 to costa, 9 absent, 11 from middle. Hindwings 1, trapezoidal, apex obtuse, termen slightly sinuate, cilia $\frac{2}{3}$; 3 and 4 connate, 5 tolerably parallel, 6 and 7 stalked.

Allied to *Protolechia*.

*Pachnistis cephalochra*, n. sp.

♂. 15 mm. Head pale whitish-ochreous. Palpi whitish-ochreous, second joint dark fuscous except towards apex, terminal joint with two or three dark fuscous scales. Antennæ dark fuscous. Thorax and abdomen rather dark fuscous, paler-mixed. Forewings elongate, costa gently arched, apex obtuse, termen slightly rounded, rather oblique; rather dark fuscous, sprinkled with light greyish-ochreous: cilia light fuscous, sprinkled with darker. Hindwings fuscous, paler towards base; cilia light greyish-ochreous, sprinkled with fuscous.

Bhotan (4,500 feet), in July; two specimens (Dudgeon).

*Tiriza*, Walk.

This name supersedes *Macrotona*, Meyr.; I have recently obtained the type-species from Borneo.

*Tiriza trigonopis*, n. sp.

♂. 21-24 mm. Head and thorax glossy whitish-ochreous, shoulders fuscous. Palpi ochreous-whitish, second joint fuscous except at apex, terminal longer than second. Antennæ ochreous-whitish, thinly ciliated ($1\frac{1}{2}$). Abdomen pale greyish, apex whitish ochreous. Forewings elongate, narrow, costa slightly arched, subsinuate in middle, apex obtuse, termen sinuate, oblique; light fuscous or brownish, suffusedly mixed with whitish-ochreous; a suffused dark fuscous spot on base of costa; an elongate-triangular dark fuscous patch extending in disc from near base to $\frac{1}{3}$; an undefined dark fuscous dot beneath costa just beyond this; a small triangular dark fuscous spot in disc at $\frac{2}{3}$; a pale line, preceded by darker suffusion, from $\frac{3}{4}$ of costa to $\frac{1}{2}$ of dorsum, slightly indented above middle: cilia whitish-ochreous, with a pale fuscous antemedian shade. Hindwings whitish-grey; cilia whitish-ochreous.

Simla, in May; two specimens (Nurse).

*Lecithocera plocamandra*, n. sp.

♂♀. 15-16 mm. Head and thorax fuscous, face paler, frontal fillet white. Palpi whitish-fuscous, terminal joint anteriorly dark fuscous. Antennæ white. Abdomen greyish-ochreous, anal tuft yellowish-ochreous. Posterior tibiæ in ♂ with large expansible tuft of very long pale ochreous-yellowish hairs from base above. Forewings elongate, narrow; costa gently arched, apex round-

pointed, termen nearly straight, oblique ; 8 and 9 out of 7, 7 to termen ; light fuscous : cilia pale fuscous, tips more whitish. Hindwings in ♂ beneath with large expansible tuft of very long pale ochreous-yellowish hairs from base of dorsum ; light fuscous, somewhat lighter towards base ; cilia as in forewings.

Sikkim (1,800 feet), Bhotan ; in May and July, three specimens (Dudgeon).

*Brachmia arcifera*, n. sp.

♂ ♀. 14-15 mm. Head and thorax dark bronzy-fuscous, sides of crown with a whitish-ochreous line. Palpi dark fuscous, terminal joint longer than second, ochreous-whitish in front. Antennæ ochreous-whitish, spotted with fuscous beneath. Abdomen grey. Forewings elongate, rather narrow, costa gently arched, apex round-pointed, termen concave, oblique ; 2 and 3 long-stalked, 8 and 9 out of 7, 7 to termen ; dark purplish-bronzy-fuscous ; stigmata blackish, plical and first discal confluent, edged posteriorly by a slightly curved ochreous-whitish line from $\frac{2}{3}$ of costa to middle of dorsum, second discal obscurely edged with whitish and with an additional similar dot beneath it ; an ochreous-whitish dot on costa at $\frac{4}{5}$ : cilia fuscous, base obscurely paler. Hindwings and cilia fuscous.

Bhotan, in June ; two specimens (Dudgeon).

*Thymiatris*, n. g.

Head with loosely appressed hairs ; tongue obsolete. Antennæ $\frac{2}{3}$, in ♂ moderately ciliated (1), basal joint elongate, stout, without pecten. Labial palpi rather long, recurved, second joint with rough projecting scales beneath, terminal joint shorter than second, rather loosely scaled, pointed. Maxillary palpi rudimentary. Anterior tarsi thickened with rough projecting scales throughout ; posterior tibiæ rough-haired above and beneath. Forewings with 1b long-furcate, 2 from $\frac{4}{5}$, 8 and 9 out of 7, 7 to apex, 10 remote, 11 from before middle. Hindwings considerably over 1, trapezoidal-ovate, termen not sinuate, cilia $\frac{1}{2}$ ; 3 and 4 short-stalked, 5 parallel, 6 and 7 stalked.

Allied to *Brachmia*.

*Thymiatris melitacma*, n. sp.

♂. 42-44 mm. Head and palpi pale ochreous, palpi suffused with dark fuscous towards base. Antennæ dark fuscous towards base, pale ochreous above. Thorax whitish, irrorated with fuscous. Abdomen pale greyish-ochreous. Forewings very elongate, narrow, gradually slightly dilated, costa almost straight, apex rounded-obtuse, termen slightly rounded, hardly oblique ; ochreous-whitish, irrorated with fuscous and dark fuscous, costa and subcostal veins suffused with dark fuscous ; two cloudy dark fuscous dots placed transversely in disc beyond $\frac{1}{2}$ ; traces of a cloudy darker angulated subterminal line ; an ochreous-yellowish streak mixed with fuscous round apex and termen to near tornus : cilia whitish-ochreous, tips and an antemedian line ochreous-fuscous mixed with dark fuscous. Hindwings and cilia whitish-ochreous, cilia with an interrupted fuscous subbasal line.

Khasi Hills ; two specimens.

XYLORYCTIDÆ.

*Æolanthes*, n. g.

Head with appressed scales, side-tufts erect and meeting above crown; tongue developed. Antennæ $\frac{4}{5}$, stout, flattened, in ♂ simple, basal joint short, without pecten. Labial palpi long, curved, ascending, second joint thickened with scales, somewhat rough towards apex beneath, terminal joint much shorter than second, thick, pointed. Maxillary palpi rudimentary. Thorax with posterior crest. Posterior tibiæ rough-haired above. Forewings with anterior costal scale-projection; 1 b furcate, 2 and 3 stalked from angle, 7 and 8 stalked, 7 to termen, 9 closely approximated to 7, 11 from middle. Hindwings, 1, trapezoidal, apex obtuse, termen hardly sinuate, cilia $\frac{1}{2}$; cell shorter in ♂, less than half wing, 3 and 4 stalked, 5 somewhat approximated, 6 and 7 stalked, upper margin of cell curved upwards, but not connected with 8.

Type *Æ. callidora.*

*Æolanthes callidora*, n. sp.

♂♀. 21-24 mm. Head and thorax brown, mixed with ochreous and whitish. Palpi ochreous-brown, terminal joint fuscous, somewhat sprinkled with whitish. Antennæ and abdomen fuscous. Forewings elongate, moderately broad, costa gently arched, with broad scale-projection before middle, apex obtuse, termen rather oblique, in ♂ nearly straight, in ♀ more rounded; deep orange-ochreous, more orange towards costa; a narrow white median longitudinal streak from near base to middle, edged with grey; space between this and costa broadly suffused with white, towards costal scale-protuberance white mixed with leaden-grey; a dark red-brown streak along dorsum from near base to $\frac{3}{4}$, edged with purplish-grey suffusion, and posteriorly dilated into a triangular spot edged with white; a transverse discal mark at $\frac{2}{3}$ and some irregular suffused spots between veins beyond and above this pale yellow; an oblique white mark beneath costa towards apex and two or three dots beneath it, preceded by some red-brown suffusion; between this and apex some leaden-grey suffusion beneath costa; an irregular interrupted white streak along termen: cilia ochreous, mixed with darker and whitish. Hindwings pale greyish-ochreous, with fine scattered dark fuscous hair-scales, especially towards tornus: cilia ochreous-whitish, towards tornus with fuscous subbasal shade.

Khasi Hills; three specimens (Swinhoe).

*Æolanthes rhodochrysa*, n. sp.

♂. 18-19 mm. Head pale ochreous. Palpi deep ochreous mixed with fuscous; subapical ring of second joint and basal, median, and apical rings of terminal joint whitish-ochreous. Antennæ ochreous-fuscous. Thorax deep orange-ochreous. Abdomen grey. Forewings elongate, moderate, costa anteriorly moderately, posteriorly gently arched, with broad scale-projection before middle, apex obtuse, termen nearly straight, oblique; deep orange-ochreous suffused with yellow, and partially tinged with crimson; an oblique spot of crimson suffusion in disc towards base; a broad curved oblique whitish fascia from costa before middle, suffused with yellowish posteriorly, becoming broken

up in disc and not reaching dorsum ; beyond this a narrower fascia of purplish-crimson suffusion, edges irregularly dentate and marked with dark fuscous, obsolete towards dorsum, an acute median projection of posterior edge followed by some whitish suffusion ; a pale crimson streak mixed with white round apex and tornus : cilia deep yellow, obscurely barred with yellow-whitish, above apex suffused with orange on basal half. Hindwings pale grey, darker towards tornus ; cilia whitish-yellowish.

Khasi Hills ; two specimens.

*Paradoris*, n. n.

I propose this name for the genus described by Heinemann under the name of *Euteles*, which is preoccupied in *Coleoptera* (1834).

*Paradoris anaphracta*, n. sp.

♂. 12-13 mm. Head ochreous-whitish, slightly sprinkled with fuscous. Palpi fuscous irrorated, with blackish, apex of second joint white, terminal joint whitish with a few dark fuscous specks. Antennæ fuscous. Thorax ochreous-whitish sprinkled with fuscous, shoulders narrowly dark fuscous. Abdomen pale ochreous, more or less suffused with fuscous. Forewings elongate, rather narrow, costa gently arched, apex obtuse, termen very obliquely rounded ; ochreous-whitish or pale whitish-ochreous, thinly sprinkled with fuscous ; a small blackish spot on base of costa ; stigmata blackish, plical somewhat beyond first discal, second discal connected by a slightly incurved blackish streak with dorsum before tornus, followed by an undefined band of darker irroration from $\frac{3}{4}$ of costa to tornus ; undefined spots of blackish irroration round apex and termen : cilia ochreous-whitish. Hindwings grey ; cilia pale whitish-ochreous.

Bhotan (4,500 feet), from May to July ; three specimens (Dudgeon).

*Ptochoryctis gosaria*, n. sp.

♂♀. 23-24 mm Head, thorax, and abdomen snow-white. Palpi and antennæ grey. Forewings elongate, moderately broad, costa moderately arched, apex rounded-obtuse, termen obliquely rounded, shining snow-white ; a submarginal series of seven black dots round apex and termen : cilia white. Hindwings and cilia white.

Bhotan, in April and May ; two specimens (Dudgeon).

*Trypherantis*, n. g.

Head with appressed scales, side-tufts loosely raised ; tongue obsolete. Antennæ $\frac{3}{4}$, in ♂ moderately ciliated, basal joint moderate, without pecten. Labial palpi long, recurved, with appressed scales, terminal joint somewhat shorter than second, acute. Maxillary palpi rudimentary. Posterior tibiæ clothed with rough hairs above. Forewings with 1*b* furcate, 2 from $\frac{4}{5}$, 4 and 5 approximated, 7 and 8 stalked, 7 to termen, 9 absent, 11 from about middle. Hindwings over 1, ovate, cilia $\frac{1}{4}$ ; 3 and 4 stalked, 5 parallel, 6 and 7 short stalked.

Apparently allied to *Ptochoryctis*.

*Trypherantis atelogramma*, n. sp.

♂. 24-25 mm. Head, palpi, and antennæ ochreous-whitish, base of palpi fuscous. Thorax and abdomen whitish-ochreous. Forewings elongate, pos-

teriorly dilated, costa gently arched, apex rounded-obtuse, termen rather obliquely rounded; whitish-ochreous; all veins marked by rather irregular lines of blackish irroration, broadly obsolete towards base and ceasing abruptly near other margins, streak of transverse vein more or less dilated; an interrupted blackish line round apex and termen: cilia whitish-ochreous, with an obscure interrupted fuscous antemedian line. Hindwings whitish-ochreous; a terminal series of fuscous marks; cilia whitish-ochreous.

Bhotan, Sikkim, in May and June; three specimens (Dudgeon).

*Epimactis*, n. g.

Head loosely haired; tongue developed. Antennæ $\frac{2}{3}$, in ♂ strongly ciliated (2), basal joint moderate, without pecten. Labial palpi long, recurved, second joint with appressed scales, terminal joint shorter than second, slender, acute. Maxillary palpi rudimentary. Posterior tibiæ clothed with long hairs above. Forewings with 1*b* furcate, 2 from towards angle, 7 and 8 stalked, 7 to apex, 11 from middle. Hindwings 1, trapezoidal-ovate, cilia $\frac{1}{3}$; 4 absent, 3 and 5 approximated at base, 6 and 7 stalked.

Allied to *Myriopleura* and *Trichernis*.

*Epimactis monodoxa*, n. sp.

♂ ♀. 19–23 mm. Head, palpi, antennæ, thorax, and abdomen whitish-ochreous, slightly yellowish-tinged. Forewings elongate, costa moderately arched, apex rounded-obtuse, termen obliquely rounded; whitish-ochreous, yellowish-tinged, towards dorsum slightly tinged with brownish; discal stigmat fuscous, first minute, second moderate, round: cilia whitish-ochreous. Hindwings in ♂ light grey, in ♀ whitish-ochreous; cilia whitish-ochreous.

Bhotan, in June; four specimens (Dudgeon).

ŒCOPHORIDÆ.

*Lactistica*, n. g.

Head with loosely appressed hairs; tongue obsolete. Antennæ $\frac{2}{3}$, in ♂ strongly ciliated with fascicles (3), basal joint stout, without pecten (?). Labial palpi moderately long, recurved, second joint much thickened with dense rough projecting scales beneath, almost tufted anteriorly, terminal joint shorter than second, moderate, acute. Maxillary palpi rudimentary. Abdomen rather elongate. Anterior tibiæ and tarsi thickened with dense hair-scales, posterior tibiæ and tarsi sometimes greatly elongated. Forewings with tufts of raised scales in disc; 1*b* furcate, 2, 3, 4 closely approximated from angle, 7 and 8 stalked, 7 to apex, 11 from before middle. Hindwings, elongate-ovate, cilia $\frac{1}{4}$; 3 and 4 connate, 5-7 parallel.

Type *L. geranodes*. This curious genus is perhaps related to *Chimabache*.

*Lactistica geranodes*, n. sp.

♂. 47 mm. Head, palpi, antennæ, thorax, and abdomen grey mixed with dark fuscous. Legs dark grey, anterior pair mixed with whitish and blackish, posterior tibiæ very elongate, tufted with scales towards apex above and externally, posterior tarsi greatly elongate, half as long again as tibiæ, at apex with tuft of scales above. Forewings elongate, narrow, costa almost straight,

apex obtuse, termen somewhat sinuate, oblique; rather dark fuscous, sprinkled with white and irrorated with black; posterior edge of cell marked by an oblique white line; a submarginal series of white interneural marks round posterior third of costa and termen, followed by terminal spots of blackish suffusion, extremities of veins between these light reddish: cilia dark fuscous, with a white spot beneath tornus. Hindwings rather dark fuscous, with traces of a submarginal whitish line round apex and upper part of termen; cilia white, with dark fuscous subbasal line.

Khasi Hills; one specimen. The great development of the posterior tibiæ and tarsi is a very singular feature.

*Lactistica demotarcha*, n. sp.

♂ ♀. 59–60 mm. Head whitish-ochreous, with a blackish mark on middle of crown. Palpi ochreous-whitish, second joint mixed with dark fuscous, terminal joint with dark fuscous median band. Antennæ whitish ochreous, rounded-dentate. Thorax whitish-ochreous, with a dorsal stripe mixed with brown and blackish. Abdomen dark fuscous, segmental margins whitish-ochreous, preceded by ferruginous rings, and tuft whitish-ochreous. Anterior and middle tibiæ ochreous mixed with reddish, black, and whitish, with expansible tuft of black scales towards apex, anterior tarsi roughened with whorls of scales, all coxæ with patches of black scales, posterior legs normal, ochreous-whitish spotted with blackish, tibiæ long-haired above. Forewings elongate, narrow, costa gently arched, apex rounded, termen very obliquely rounded; whitish-ochreous, partially faintly pinkish-tinged, irregularly irrorated with ochreous-brown, especially towards termen; a blackish dot on base of costa; stigmata raised, mixed with black, plical and first discal small, plical beneath first discal, second discal large, roundish, a similar spot on fold obliquely before second discal; a submarginal series of white dots or marks preceded by black irroration or suffusion round posterior part of costa and termen: cilia whitish-ochreous mixed with blackish. Hind-wings and cilia whitish-ochreous.

Khasi Hills; two specimens.

*Eulechria phabas*, n. sp.

♀. 15-16 mm. Head, palpi, and thorax ochreous-yellow. Antennæ pale yellowish, towards apex ringed with dark fuscous. Abdomen grey, apex yellowish. Forewings elongate, rather narrow, costa gently arched, apex roundpointed, termen nearly straight, very oblique; rather deep ochreous-yellow, posteriorly slightly brownish-tinged; base of costa narrowly dark fuscous; stigmata black, plical obliquely beyond first discal, a small additional black dot beneath second discal: cilia yellow. Hindwings grey; cilia whitish-ochreous.

Bhotan (4,500 feet), in June; four specimens (Dudgeon).

*Mylothra*, n. g.

Head loosely haired, sidetufts raised; tongue apparently rudimentary. Antennæ ½, in ♂ filiform, simple, basal joint moderate, without pecten. Labial palpi long, recurved, second joint thickened with dense scales, somewhat rough

beneath towards apex, terminal joint as long as second, moderate, acute Maxillary palpi rudimentary. Posterior tibiæ clothed with long hairs. Forewings with 1*b* furcate, 2 and 3 stalked from angle, 7 and 8 stalked, 7 to apex, 11 from middle. Hindwings 1, elongate-ovate, cilia almost 1; 3 and 4 connate, 5-7 tolerably parallel.

Allied to *Phæosaces*.

*Mylothra creseritis*, n. sp.

♂♀. 19-20 mm. Head and thorax whitish-ochreous, edge of shoulders infuscated. Palpi ochreous-whitish, second joint irrorated with dark fuscous. Antennæ fuscous. Abdomen whitish-ochreous, sprinkled with fuscous. Forewings elongate, rather narrow, costa gently arched, apex rounded-obtuse, termen obliquely rounded, whitish-ochreous, very finely and thinly sprinkled with fuscous; stigmata and a prætornal dot very faintly indicated by similar irroration, plical beneath first discal: cilia whitish-ochreous. Hindwings pale grey irrorated with dark grey; cilia pale greyish-ochreous, with two faint fuscous shades.

Quetta, in June and July; two specimens (Nurse).

STENOMIDÆ.

*Agriophara argoplaca*, n. sp.

♂. 25-23 mm. Head whitish-ochreous, sides of face more or less infuscated, crown posteriorly brownish. Palpi whitish-ochreous, second joint infuscated, towards base dark fuscous. Antennæ fuscous, ciliations 7. Thorax pale fuscous. Abdomen light greyish-ochreous. Forewings elongate, posteriorly dilated, costa gently arched, apex obtuse, termen rather obliquely rounded; 2 from angle of cell; dark bronzy-brown, becoming whitish-fuscous towards dorsum and termen; a broad white patch extending along costa from near base to $\frac{3}{4}$, and reaching nearly half across wing, posterior edge inwardly oblique and somewhat concave; an interrupted dark fuscous terminal line: cilia pale fuscous. Hindwings and cilia whitish-fuscous.

Maskeliya, Ceylon, in March, June, and October; three specimens (de Mowbray, Pole).

*Agriophara encryphias*, n. sp.

♂♀. 23-24 mm. Head ochreous-whitish, crown fuscous-tinged. Palpi whitish, second joint fuscous except towards apex. Antennæ grey. Thorax fuscous mixed with whitish. Abdomen grey. Forewings elongate, moderately broad, costa anteriorly moderately, posteriorly slightly arched, apex obtuse, termen somewhat oblique, slightly rounded; 7 to termen; white, with some scattered fuscous scales, costa ochreous-tinged, dorsal half suffused with light fuscous; very small fuscous spots on costa at $\frac{2}{3}$ and $\frac{3}{4}$, giving rise to indistinct oblique series of fuscous dots on costal half of wing; cloudy subtriangular spots of dark fuscous suffusion on dorsum before middle and at $\frac{2}{3}$; a terminal series of minute dark fuscous dots: cilia whitish, tinged with fuscous towards tornus. Hindwings pale grey; cilia whitish with grey subbasal line.

Khasi Hills; two specimens (Swinhoe).

ELACHISTIDAE.

*Stathmopoda hexatyla*, n. sp.

♂♀. 18-20 mm. Head yellow-ochreous, face paler. Palpi whitish-ochreous, base dull bronzy-grey. Antennæ pale ochreous, ciliations in ♂ 6. Thorax yellow-ochreous, with three anterior leaden-grey spots. Abdomen whitish-grey. Posterior tibiæ and tarsi at apex of joints with grey spots and expanded whorls of yellow-ochreous scales. Forewings linear-lanceolate, widest near base, attenuated to acute and slightly curved apex ; deep ochreous-yellow ; three round metallic leaden-grey spots in disc, first almost basal, second at $\frac{1}{3}$, third at $\frac{2}{3}$ : cilia pale greyish-ochreous to grey. Hindwings linear, cilia 8 ; pale grey ; cilia pale greyish-ochreous or greyish.

Maskeliya and Madulsima, Ceylon, in April, July, and October ; four specimens (Pole, Vaughan).

*Stagmatophora arachnitis*, n. sp.

♂♀. 14-17 mm. Head and thorax ferruginous-ochreous, face whitish, sides of crown slenderly white. Palpi whitish, second joint ferruginous except apex, terminal joint longer than second, with base and two bands blackish. Antennæ white, with blackish annulations connected by a blackish line. Abdomen grey, basal half golden-ochreous. Forewings lanceolate, apex slightly curved ; 7 and 8 out of 6 ; ferruginous-brown ; very slender white lines finely edged with black as follows, *viz.*, an irregular line from beneath base of costa to $\frac{1}{3}$ of disc, nearly meeting at an acute angle an oblique white mark beneath fold, a line along fold from base to beyond middle, a line along costa from near base to $\frac{2}{3}$, where it forms a transverse white posteriorly black-edged mark reaching nearly half across wing, and an irregular angulated line from beneath costa at $\frac{2}{3}$ through disc almost to apex of this mark ; a subtriangular leaden-grey-metallic laterally black-edged spot beneath this mark, separated from it by a light ferruginous-ochreous spot ; some irregular marks between this and apex, and an elongate apical spot light ferruginous-ochreous, surrounded with fuscous suffusion ; a transverse black mark from costa at $\frac{3}{4}$, edged posteriorly with whitish : cilia ochreous sprinkled with dark fuscous towards base, beneath tornus greyer. Hindwings grey ; cilia light grey.

Maskeliya, Ceylon, in January, February, May, and July ; six specimens (Pole).

*Stagmatophora notochorda*, n. sp.

♂♀. 10-13 mm. Head, palpi and antennæ ochreous-whitish, terminal joint of palpi with dark fuscous anterior line except towards base. Thorax light reddish-brown, with broad ochreous-whitish dorsal stripe. Abdomen pale ochreous. Forewings narrow-lanceolate, 7 and 8 out of 6 ; light brown, slightly reddish-tinged ; a fine costal streak from near base to $\frac{2}{3}$, a fine median line from base to $\frac{2}{3}$, a broad dorsal streak (sometimes partially broken up with ground colour) from base to tornus, and fine streaks on veins posteriorly ochreous-whitish ; undefined marks of black irroration on upper edge of dorsal streak at $\frac{1}{3}$ and beyond middle, first sometimes strong, oblique, and sometimes

other scattered variable short marks of blackish irroration beween veins: cilia pale ochreous-grey. Hindwings grey; cilia light grey.

Puttalam, Ceylon, from November to February; six specimens (Pole).

*Limnæcia proclina*, n. sp.

♀. 14-15 mm. Head dark bronzy-fuscous, face more or less mixed with whitish ochreous. Palpi whitish, second joint with four, terminal joint with three longitudinal blackish lines. Antennæ whitish, ringed and lined with blackish. Thorax dark bronzy-fuscous, more or less mixed with whitish. Abdomen rather dark grey mixed with whitish-ochreous and whitish. Forewings lanceolate; dark bronzy-fuscous or blackish; a moderate oblique whitish fascia partly suffused with ochreous-yellowish about $\frac{1}{4}$, dilated on dorsum; an ochreous-whitish dot on middle of costa, a small spot on dorsum a little beyond it, and a small spot on costa at $\frac{4}{5}$, more yellowish on margin; some minute white marginal dots round apex: cilia light grey sprinkled with blackish, with a large whitish-ochreous tornal patch. Hindwings rather dark grey; cilia grey.

Maskeliya, Ceylon, in February, March, June and October; five specimens (Pole).

PLUTELLIDAE.

I propose to transfer the groups of *Gracilaria* and *Zelleria* to this family, reserving discussion for the present.

*Gracilaria thriambica*, n. sp.

♂. 13 mm. Crown of head yellow, face white, each with a transverse crimson band. Palpi crimson, terminal joint of labial white, becoming ochreous-yellow towards apex. Antennæ ochreous-grey, basal joint yellow, above it a crimson ring. Thorax crimson, posterior half white. Abdomen light grey, beneath white with dark grey rings. Legs ochreous-whitish ringed with dark grey, anterior and middle femora and tibiæ yellow banded with crimson. Forewings elongate, very narrow, parallel-sided, short-pointed; crimson; markings bright yellow, partially edged with black; an oblique fascia near base, a curved oblique mark from costa before $\frac{1}{2}$, four approximated oblique wedge-shaped marks from costa between $\frac{2}{3}$ and $\frac{3}{4}$, a rounded spot on dorsum about middle, and another more trapezoidal on tornus; a black longitudinal streak in disc from beyond middle to $\frac{5}{6}$; a transverse series of three yellow-ochreous dots towards apex, costal preceded and followed by white marks, median followed by a round black præapical spot: cilia pale grey, round apex yellow with basal third crimson. Hindwing grey; cilia light grey.

Maskeliya, Ceylon, in January; one specimen (Pole).

*Coriscium hieranthes*, n. sp.

♂ ♀. 10-11 mm. Head white, crown yellowish-tinged, collar pale crimson. Palpi pale crimson, terminal joint of labial yellowish-white. Antennæ light ochreous, basal joint yellowish-white. Thorax crimson, posterior third white. Abdomen grey. Legs yellowish ringed with dark grey. Forewings sublinear, slightly narrowed posteriorly, shortly round-pointed; crimson; markings pale yellow, finely edged with blackish; a dot on costa near base, a curved

oblique mark from costa at $\frac{1}{3}$, four approximated oblique parallel-sided marks from costa between $\frac{2}{3}$ and $\frac{3}{4}$, and four semi-oval equidistant dorsal spots; a round almost apical fuscous spot, centred with black, and edged beneath by a white mark: cilia grey, at apex yellow with basal third crimson, above apex with a dark grey hook. Hindwings and cilia rather dark grey.

Maskeliya, Ceylon, in August; two specimens (de Mowbray).

*Conopomorpha isochorda*, n. sp.

♂ ♀. 6-7 mm. Head and thorax greyish-bronze, face white. Palpi white. Antennæ grey ringed with white, beneath white. Abdomen grey. Forewings linear, pointed; bronzy-grey; costal edge whitish; a series of oblique cloudy pale ochreous strigæ from dorsum, becoming obsolete towards costa; a fine whitish line from tornus to near apex; a dark grey præapical dot, extreme apex ferruginous-orange: cilia ochreous-whitish, basal third light shining rosy-purple, edged by a deep violet line. Hindwings grey; cilia ochreous-grey-whitish.

Peradeniya, Ceylon; twenty specimens (Green). Larva mines in young leaves of ebony, *Diospyros emblyopteris* (Green). Owing to the extreme slenderness and delicacy of the wings the neuration proved very difficult to ascertain, but in a denuded specimen the forewing appeared to be as follows: 1*b* simple, 2 from $\frac{1}{3}$, 4 and 5 approximated from angle, 6 and 8 long-stalked, 6 to termen, 7 absent, 9 and 10 from near 8, 11 absent.

*Zelleria petrias*, n. sp.

♂ ♀. 20-21 mm. Head and thorax pale whitish-ochreous, more or less mixed with fuscous. Palpi fuscous, mixed with whitish-ochreous towards apex of joints. Antennæ grey. Abdomen grey, apex ochreous-whitish. Forewings elongate, very narrow, costa gently arched, apex acute, somewhat produced, termen sinuate, extremely oblique; 4 and 5 separate; light grey; four longitudinal series of minute black dots, first subcostal, not reaching beyond middle, others fairly complete; an oblique spot of blackish-grey suffusion above dorsum at $\frac{2}{3}$, and some undefined dark fuscous scales in disc at middle and $\frac{3}{4}$: cilia pale greyish-ochreous, on costa mixed with dark grey, at apex with a blackish basal dot. Hindwings light grey, with a small transparent basal patch; cilia whitish-ochreous-grey.

Simla, in April and May; two specimens (Nurse).

*Yponomeuta melanaster*, n. sp.

♂ ♀. 20-24 mm. Head, palpi, antennæ, and thorax grey; thorax with two black dots on shoulders, four on back, and one on posterior extremity. Abdomen dark grey. Forewings elongate, narrow, costa gently arched, apex obtuse, termen nearly straight, oblique; ochreous-grey; 17-21 moderate round black dots scattered throughout disc, *viz.*, two near base, four in a subdorsal series, three or four in a subcostal series, three approximated in a curved transverse series above fold at $\frac{1}{3}$, one or two on fold posteriorly, and a group of from three to six towards apex: cilia ochreous-grey. Hindwings with lanceolate transparent basal patch; dark fuscous; cilia fuscous, with darker basal shade.

Puttalam, Ceylon, in December and January; two specimens (Pole).

*Pyrozela costa*, n. sp.

♂. 17-18 mm. Head, palpi, antennæ, and thorax shining white. Abdomen grey-whitish. Forewings elongate, costa moderately arched, apex obtuse, termen nearly straight, oblique, shining white; extreme base of costa blackish; a transparent patch and longitudinal groove beneath between cell and vein 12 near base, 11 bent at base to make room for this: cilia white. Hindwings and cilia whitish-grey.

Bhotan, in September; two specimens (Dudgeon).

*Pyrozela argophenes*, n. sp.

♂ ♀. 15-18 mm. Head, antennæ, and thorax white. Palpi white, apex of second joint sometimes tinged with fuscous. Abdomen light grey. Forewings elongate moderate, costa gently arched, apex obtuse, termen rather obliquely rounded; shining white; an oblique streak of dark fuscous irroration from middle of dorsum, reaching nearly half across wing; a short fuscous mark along dorsum before tornus; sometimes a few scattered fuscous scales in disc, and on costa towards apex: cilia light brown, outer third dark fuscous. Hindwings grey, paler towards base; cilia grey-whitish, with grey basal line.

Khasi Hills; five specimens.

*Pyrozela tridelta*, n. sp.

♂ ♀. 20-24 mm. Head yellow, back of crown red. Palpi yellow, second joint mixed with red. Antennæ pale yellowish, towards base reddish-tinged, thorax yellow, anterior margin and posterior half except extremity crimson. Abdomen pale crimson. Forewings elongate, somewhat dilated, anteriorly gently, posteriorly strongly arched, apex obtuse, termen obliquely rounded; 2 and 3 stalked; crimson-fuscous, becoming bright crimson on margins of wing or of markings; markings clear yellow; a triangular blotch extending on costa from $\frac{1}{4}$ to $\frac{3}{5}$, and reaching nearly half across wing; a bent streak from near dorsum towards base to near apex of costal blotch; two small spots near dorsum towards middle, first sometimes obsolete; an oblique streak from lower angle of cell to dorsum just before tornus; an irregular marginal streak round posterior fourth of costa and apex to below middle of termen: cilia yellow, on lower part of termen crimson-fuscous. Hindwings pale crimson; cilia pale crimson, at apex pale yellowish.

Khasi Hills; twelve specimens.

*Pyrozela anticlina*, n. sp.

♂ ♀. 18-19 mm. Head yellow, lower part of face and a dot on crown red. Palpi red, apex pale yellowish. Antennæ yellow. Thorax yellow, collar and posterior margin crimson-red. Abdomen light ochreous-rosy. Forewings elongate, costa moderately arched towards base and apex, nearly straight towards middle, apex rounded-obtuse, termen oblique, slightly rounded; rather light crimson, deeper on margins, dorsum more or less orange; costa narrowly yellow from about $\frac{1}{4}$ to $\frac{3}{4}$; an outwardly oblique yellow bar from $\frac{1}{4}$ of dorsum, reaching nearly half across wing, and a similar inwardly oblique bar from before tornus; a yellow dot above middle of dorsum: cilia yellow, on lower

half of termen crimson. Hindwings and cilia light ochreous-rosy, costal cilia pale yellowish.

Sikkim and Bhotan (1,800 feet), in May ; two specimens (Dudgeon).

*Cerace sardias*, n. sp.

♀. 33-40 mm. Head and palpi blackish. Antennæ black, spotted with white. Thorax purple-blackish with scattered yellow scales. Abdomen purple-blackish with lateral series of thick yellow bars. Forewings elongate, costa strongly arched, apex obtuse, termen nearly straight, very oblique ; 6 to costa; bright yellow ; extreme base purple-blackish ; a narrow irregular-edged deep purplish fascia, mixed with black and strewn with small bluish-leaden-metallic spots, from beyond middle of costa to dorsum before tornus, including a yellow dot on costa and dorsum ; apical area beyond this fascia wholly deep red, strewn with bluish-leaden-metallic dots : cilia purple-blackish. Hindwings bright yellow ; apical third purple-blackish, anterior edge straight ; cilia purple-blackish, round tornus and dorsum yellow.

Khasi Hills ; three specimens (Swinhoe).

*Simæthis sandaracina*, n. sp.

♂. 16-18 mm. Head dark grey, irrorated with white. Palpi white, sprinkled with dark grey. Antennæ white, ringed with black. Thorax dark grey, suffused with red-brown and sprinkled with white. Abdomen dark fuscous, sprinkled with whitish, apex ferruginous. Forewings elongate-triangular, costa moderately arched, apex obtuse, termen bowed, rather oblique ; red brown, posterior ⅔ of costa broadly suffused with ferruginous-ochreous ; exterior half of dorsum broadly suffused with dark grey ; a short fine white line from costa near base ; an irregular fine white line from ⅓ of costa to before middle of dorsum, irrorated with dark grey except on costa ; a very indistinct fine irregular line of grey irroration from a white spot on costa beyond middle to ⅔ of dorsum, followed on costa by a patch of dark grey irroration ; a subterminal line of grey irroration from beneath apex to tornus : cilia dark red-brown, tips white on subapical and submedian patches. Hindwings orange-ochreous, partially suffused with ferruginous ; costa rather broadly dark fuscous, dorsum rather broadly suffused with grey ; cilia grey, suffused with white round apex and with red-brown on termen.

Simla, in August and September ; two specimens (Nurse).

*Brenthia catenata*, n. sp.

♀. 8-9 mm. Head, antennæ, thorax, and abdomen dark fuscous. Palpi whitish, second and terminal joints with basal and subapical dark fuscous rings. Forewings elongate-triangular, costa moderately arched, apex obtuse, termen little rounded, slightly oblique ; dark fuscous ; four (subbasal, first, median, and second) irregular curved transverse shades of fine whitish irroration, median forming part of a transverse-oval discal spot outlined with whitish irroration ; a small blue-green-metallic spot on costa at ½ ; a slender partially interrupted whitish subterminal line, curved parallel to apical part of costa and termen ; a series of black spots round apex and termen, centred with violet-silvery-metallic

dots: cilia fuscous, with two dark fuscous shades, between which is a whitish shade. Hindwings dark fuscous; an oblique oval spot in middle of disc outlined with whitish; a subterminal whitish line, more or less interrupted below middle; a violet-metallic line between this and termen; cilia as in forewings.

Poona, in December; four specimens (Swinhoe).

*Glyphipteryx tetrachrysa*, n. sp.

♂ ♀. 9-12 mm. Head and thorax ochreous-bronzy. Palpi ochreous-whitish second joint with two oblique black bars, scales projecting beneath towards apex, terminal joint with a black lateral line. Antennæ dark fuscous. Abdomen grey. Forewings elongate, rather dilated posteriorly, costa gently arched, apex obtuse, termen somewhat sinuate, oblique; light ochreous-bronze; markings silvery-white edged with dark fuscous, *viz.*, a streak from base to near dorsum before middle, an oblique streak from $\frac{1}{3}$ of costa reaching to fold, a slightly bent transverse streak from $\frac{2}{3}$ of costa to beyond middle of dorsum, a slightly inwards oblique streak from costa beyond middle reaching nearly half across wing, a slightly incurved transverse streak from beyond $\frac{2}{3}$ of costa to before tornus, a sometimes interrupted streak from $\frac{4}{5}$ of costa to termen beneath apex, and a short streak across apex; between the last two streaks and the preceding transverse streak a black tornal patch extending nearly to costa, upper portion crossed and obscured by several longitudinal irregular pale ochreous streaks, lower portion marked with four small round golden-metallic dots, of which three are marginal and one above and between the two anterior of these: cilia whitish, basal half ochreous-bronze edged with dark fuscous, with a whitish indentation on termination of metallic streak. Hindwings dark grey, lighter anteriorily; cilia grey.

Maskeliya, Ceylon, in January and February; six specimens (Pole).

*Automacharis*, n. g.

Head loosely hairy on crown, face smooth; tongue developed. Antennæ $\frac{2}{3}$, in ♂ simple-basal joint elongate, somewhat dilated, with pecten of scales. Labial palpi long, recurved, second joint with appressed scales somewhat angularly dilated beneath at apex, terminal joint as long as second, with appressed scales, acute. Maxillary palpi obsolete. Anterior tibiæ and tarsi dilated with rough scales, posterior tibiæ with appressed scales. Forewings with tufts of scales on surface; 2 from towards angle, 2-10 approximated, parallel, 7 to apex, 7 and 8 closely approximated, 11 from before middle. Hindwings 1, elongate-lanceolate, cilia $1\frac{1}{2}$; 2 remote, 3 and 4 connate, 5-7 nearly parallel.

Allied to *Cerostoma*.

*Automacharis epichlora*, n. sp.

♂ ♀. 20-22 mm. Head and thorax whitish, sprinkled with pale ochreous. Palpi, antennæ, and abdomen ochreous-whitish, palpi with a few fuscous specks. Forewings elongate-lanceolate, apex caudate, subfalcate; ochreous-whitish, sprinkled with pale ochreous scales, sometimes tipped with fuscous, especially posteriorly, with a few minute black specks; three transversely placed pairs of small black dots, at about $\frac{1}{4}$, before middle, and at $\frac{3}{4}$, lower dot of each pair

subdorsal, preceded by a tuft of scales, upper dot of first two pairs discal, of third costal: cilia whitish, more or less speckled with dark fuscous round apex, with some minute black dots at base, a median dark line round apex, and sometimes a median series of undefined dark dots. Hindwings and cilia whitish.

Khasi Hills; five specimens.

TINEIDÆ.

*Opogona amphicausta*, n. sp.

♂. 11-12 mm. Head dark purplish-fuscous on crown; face, fillet, antennæ, and palpi whitish-ochreous. Thorax dark purplish-fuscous. Abdomen light bronzy-grey. Posterior tarsi with whorls of projecting bristles at joints. Forewings lanceolate; bright brassy-yellow; base and apex rather narrowly dark purplish-fuscous; a small dark bronzy fuscous dorsal spot before tornus, sometimes almost obsolete: cilia fuscous. Hindwings dark grey; cilia fuscous.

Maskeliya, Ceylon, in January and February; two specimens (Pole).

*Agriothera*, n. g.

Head densely tufted on crown, face smooth; tongue developed. Antennæ over 1, basal joint rather large, dilated with scales. Labial palpi rather long, slender, smooth-scaled, slightly curved, porrected, terminal joint shorter than second, pointed. Maxillary palpi obsolete. Posterior tibiæ clothed with long hair above and beneath. Forewings with 1 b furcate, 2 from angle, 7 to costa, 8 absent, 11 from beyond middle. Hindwings 1, subtrapezoidal, apex pointed, produced, termen sinuate, cilia $\frac{1}{3}$; 4 absent, 5-7 parallel, transverse vein very oblique inwards.

*Agriothera melanacma*, n. sp.

♂. 13 mm. Hairs of crown white, posteriorly greyish-tinged, in centre dark grey, face whitish, sprinkled with grey. Palpi dark grey, terminal joint white. Antennæ and thorax grey. Abdomen pale grey. Forewings elongate, narrow, costa gently arched, apex pointed, produced, termen concave, very oblique; bronzy-fuscous, irrorated with dark fuscous, towards costa mixed with greyish; an irregular white streak beneath middle from base almost to termen; lower edge with an abrupt indentation before middle; margin of apex and upper half of termen black, preceded by a curved white mark in apex, and some irregularly arranged white scales before this: cilia whitish, with dark fuscous antemedian shade, and subapical shade round apex. Hindwings grey, thinly scaled, except towards termen; cilia pale grey, tips whitish.

Maskeliya, Ceylon, in July; one specimen (Pole).

*Endophthora phepsalias*, n. sp.

♂. 9 mm. Head yellow-ochreous. Palpi dark fuscous, base and apex of terminal joint whitish. Antennæ 1, grey. Thorax golden. Abdomen grey. Forewings elongate, very narrow, costa gently arched, apex round-pointed, termen extremely obliquely rounded, 6 and 7 stalked; bright golden, toward costa suffused with dark bronzy fuscous; six short white oblique strigulæ on posterior half of costa; about twenty-five small white dots irregularly strewn in disc; about twelve small white dots along dorsum and termen, mostly

accompanied by small raised or projecting black dots: cilia pale whitish-golden. Hindwings and cilia grey.

Maskeliya, Ceylon, in February and May; two specimens (Pole).

*Decadarchis*, Meyr.

Head densely rough-haired, tongue obsolete. Antennæ ♀, in ♂ simple, sometimes with subbasal notch, basal joint moderate, thickened with scales. Labial palpi moderate, slightly curved, subascending, second and terminal joints with dense tufted fringe of very long projecting scales beneath, terminal joint short. Maxillary palpi long, filiform, folded. Posterior tibiæ clothed with long hairs above and beneath. Forewings with 1 b furcate, 2 from about $\frac{2}{3}$, 3 from angle, 6 absent, 7 to costa, 8 absent, 11 from before middle, apex turned up in repose. Hindwings 1, ovate-lanceolate, cilia 1; 2-4 parallel, 5 and 6 stalked, 6 to costa, 7 parallel.

I am now able to re-constitute this genus as a good and natural one, well characterised by the peculiar palpi. Besides the type *D. simulans*, I refer to it the Australian *mystacinella*, Walk., and the three following species.

*Decadarchis platydelta*, n. sp.

♂ ♀. 18-27 mm. Head white. Palpi white, externally somewhat mixed with dark fuscous. Antennæ whitish-grey. Thorax white, with a fuscous curved mark near posterior extremity. Abdomen whitish or pale grey. Forewings elongate, narrow, costa moderately arched, apex acute, termen sinuate, extremely oblique; white, with a few scattered ochreous and brown scales; two flattened-triangular dark fuscous dorsal blotches, not reaching half across wing, first extending from near base to before middle, second larger, extending from beyond middle to tornus, enclosing a spot of whitish suffusion; an irregular dark fuscous apical dash, sometimes incomplete: cilia white, with two dark fuscous lines more or less obsolete except round apex, tips suffused with brownish. Hindwings grey, paler towards base; cilia whitish-grey, more or less suffused with white round apex.

Ceylon (North Central Province), in November; four specimens (Pole).

*Decadarchis antimicras*, n. sp.

♀. 14-22 mm. Head white. Palpi white, externally somewhat mixed with dark fuscous. Antennæ whitish, sometimes tinged with dark fuscous. Thorax white, with a curved fuscous mark before posterior extremity. Abdomen whitish. Forewings elongate, narrow, costa moderately arched, apex acute, termen sinuate, extremely oblique; white with scattered dark fuscous scales; two triangular dark fuscous spots on dorsum before middle and before tornus, not reaching half across wing; small oblique dark fuscous spots on costa at $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$; a small dark fuscous spot in disc at $\frac{1}{3}$, sometimes connected with apex of first dorsal spot; an elongate dark fuscous spot before middle of termen, and another at apex; dorsal and posterior area sometimes much suffused with fuscous: cilia white, sprinkled with dark fuscous, above apex with two dark fuscous lines. Hindwings grey, lighter towards base; cilia whitish-grey, more or less suffused with white round apex.

Peradeniya, Udagama, and Matale, Ceylon, from October to February; four specimens (Pole).

*Decadarchis gephyrias*, n. sp.

♂♀. 12-18 mm. Head and thorax ochreous-whitish, shoulders dark fuscous. Palpi dark fuscous, apex of second and terminal joints whitish. Antennæ ochreous-whitish, ringed with dark fuscous. Abdomen ochreous-whitish. Forewings elongate, narrow, costa moderately arched, apex round-pointed, termen hardly rounded, extremely oblique; pale whitish-ochreous, with a few scattered dark fuscous scales; a broad dark purplish-fuscous streak mixed with black from base of costa through middle of disc to apex, connected by broad bars with costa about $\frac{1}{4}$ and $\frac{3}{4}$, so as to enclose three semi-oval costal blotches of ground colour, central much largest and containing a small undefined blackish spot on middle of costa: cilia ochreous-whitish, sprinkled with dark fuscous, round apex with dark fuscous basal line. Hindwings grey, darker towards apex; cilia grey or whitish-grey.

Maskeliya, Ceylon, in May; two specimens (Pole).

*Pylœtis*, n. g.

Head rough-haired; tongue developed. Antennæ $\frac{2}{3}$, basal joint moderate thickened with scales. Labial palpi moderate, porrected, second and terminal joints clothed with long rough projecting scales beneath, terminal joint short. Maxillary palpi moderate, porrected, loosely rough-scaled. Posterior tibiæ clothed with long hairs above. Forewings with 1 b furcate, 2 from $\frac{2}{3}$, 3 from angle, 7 to costa, 8 absent, 11 from before middle. Hindwings $\frac{2}{3}$, linear-lanceolate, cilia 2; 3-4 parallel, 5 and 6 stalked, 6 to termen, 7 parallel.

*Pylœtis ophionota*, n. sp.

♀. 13-19 mm. Head and palpi blackish-fuscous, hairs of crown whitish-ochreous above. Antennæ whitish-ochreous, basal joint blackish. Thorax dark fuscous, with broad whitish-ochreous dorsal stripe. Abdomen pale ochreous. Forewings elongate, very narrow, costa gently arched, apex acute, termen slightly sinuate, extremely oblique; blackish-bronze; a fine whitish ochreous streak along dorsum and termen throughout, upper edge five or six times irregularly sinuate: cilia whitish-ochreous with some scattered blackish points, on costa blackish-bronze except extreme base. Hindwings rather dark fuscous; cilia fuscous, becoming paler and sometimes whitish-ochreous towards upper half of termen.

Matale and Puttalam, Ceylon, in April and October; five specimens (Pole).

*Cryptothyris*, n. g.

Head densely rough-haired; tongue obsolete. Antennæ 1 or over 1, in ♂ simple, basal joint moderate, with pecten. Labial palpi moderately long, porrected, second joint beneath somewhat roughly scaled towards apex, with several long bristles, terminal joint shorter than second, pointed. Maxillary palpi long, filiform, folded. Posterior tibiæ clothed with long fine hairs. Forewings with round discal impression in cell; 1 b simple, 2 from angle, 4 and 5 stalked, 7 and 8 stalked, 7 to costa, 9 absent, 11 from beyond middle, on discal impression. Hindwings $\frac{2}{3}$, lanceolate, cilia 2; 2-7 parallel, or 5 and 6 stalked,

upper margin of cell mostly obsolete, sometimes transverse vein absent between 3 and 7, then 4 and stalk of 5 and 6 also becoming obsolete anteriorly.

Type *C. mesodyas*. Allied to *Monopis*, of which it has the discal impression of forewings, but not the characteristic stalking of veins 3 and 4; the long antennæ are also a distinguishing point. Besides the following, *amandatella*, Walk., and *fissella*, Walk., described under *Tinea*, are referable here.

*Crypsithyris orchas*, n. sp.

♀. 12-14 mm. Head pale yellow-ochreous. Palpi whitish-ochreous, suffused with dark fuscous except towards apex. Antennæ light fuscous. Thorax whitish-ochreous, sprinkled with dark fuscous. Abdomen whitish-ochreous. Forewings elongate, narrow, costa moderately arched, apex round-pointed, termen very oblique; pale ochreous-yellowish, sprinkled with dark fuscous; an oblique cloudy dark fuscous mark from base of costa; discal impression semitransparent; a transverse cloudy dark fuscous spot from dorsum beneath discal impression, not quite reaching it; a similar larger spot from middle of costa, passing just behind discal impression and reaching its lower edge; some undefined small cloudy dark fuscous spots round apex and termen: cilia ochreous-yellow, at base with a few dark fuscous scales. Hindwings with transverse vein absent between 3 and 7, 5 and 6 stalked; light grey, apex yellowish-tinged; cilia pale yellowish.

Maskeliya and Peradeniya, Ceylon, in February, May, and July; seven specimens (Pole, Green).

*Crypsithyris mesodyas*, n. sp.

♂♀. 9-10 mm. Head whitish. Palpi white, externally dark fuscous except towards apex. Antennæ pale fuscous. Thorax whitish, irrorated with fuscous. Abdomen grey. Forewings elongate, narrow, costa moderately arched, apex round-pointed, termen very obliquely rounded; whitish, variably irrorated with ochreous-brown and towards costa with dark fuscous; an oblique cloudy brown subbasal fascia; discal impression semitransparent; two round cloudy spots of ochreous-brown suffusion, irrorated with dark fuscous beneath and beyond discal impression: cilia whitish, with rows of brown and dark fuscous points. Hindwings with transverse vein entire; dark grey; cilia ochreous-whitish, sometimes suffused with grey towards base.

Peradeniya, Ceylon, from March to May; twelve specimens (Green). Larva in a portable case, feeding on lichens under rock-ledges and on tree-trunks (Green); case consisting of a broad elliptic-oblong arched upper roof (12 mm. long, 5 mm. broad), with four neat round holes arranged midway between corners and centre, and a slighter and less extensive floor beneath this, constructed of silk covered with lichen-grains and refuse, colour varying from grey-whitish to greyish-ochreous; the lateral connections outside the perforations are often worn away.

*Crypsithyris hypnota*, n. sp.

♀. 13 mm. Head whitish-ochreous, sides of face mixed with fuscous. Palpi whitish-ochreous, irrorated with fuscous, except towards apex.

Antennæ whitish-ochreous, ringed with fuscous. Thorax whitish-ochreous, irrorated with fuscous, shoulders with a dark fuscous spot. Abdomen grey. Forewings elongate, narrow, costa moderately arched, apex round-pointed, termen very obliquely rounded ; whitish-ochreous, irrorated with fuscous and dark fuscous ; base suffused with dark fuscous ; a streak of dark fuscous suffusion along fold from base to beneath discal impression ; discal impression semi-transparent, followed by a round cloudy spot of dark fuscous suffusion : cilia whitish-ochreous, sprinkled with dark fuscous. Hindwings with transverse vein entire ; grey ; cilia pale whitish-ochreous, mixed with pale grey towards base.

Peradeniya, Ceylon, in February ; one specimen (Green). Larva case-bearing, feeding on lichens under rock-ledges (Green) ; case tortoise-shaped, consisting of a broad oval arched upper roof (13 mm. long, 10 mm. broad) of silk covered with sand and refuse, whitish-grey mixed with brown and black, and a less extensive lower floor of whitish silk.

# SOME BIRDS OF SINGAPORE.

By

Major H. R. Baker, 73rd C. I.

The following list has no pretension to completeness. It comprises only those birds which I myself noticed or shot during my few leisure hours, in addition to the names of a few "cribbed" from the local museum where the specimens are labelled as having been obtained on the island, but which I did not secure or notice myself. Doubtless numerous other species escaped my notice in the almost impenetrable jungles and dangerous swamps. For those unacquainted with Singapore I may mention that the island is some 28 miles broad from east to west and 14 miles from north to south and is separated from the mainland by the narrow Straits of Johore.

The island, for collecting purposes, may be divided into three parts:—

(*a*) The jungle, which is in most places impenetrable.

(*b*) The clearings, usually on rising ground, which are either planted with cocoanuts or pineapples, or are formed into gardens by the Chinese.

(*c*) The swamps, which are mostly too dangerous to venture into.

The climate is damp and muggy, due to the amount of rain which falls at all times of the year; this of course accounts for the extraordinary greenness of the whole island, and this in turn accounts for the great difficulty experienced in finding any but the commonest birds' nests, unless by a fluke; there is so much and so thick shrubbery and undergrowth that egg-collecting is an almost hopeless task. Where possible in the following list I have taken the numbers from the "Fauna of British India", otherwise from the Catalogue of the British Museum.

4. Corvus macrorhynchus.—The Jungle Crow.

Strange as it may seem to a resident in India, this bird is not an inhabitant here. During my four years' stay in Singapore, I only saw one solitary individual and that must have been a straggler all the way from Penang, where I believe some birds were introduced from India years ago.

160. Turdinus abbotti.—Abbott's Babbler.

Common but shy and retiring; its note is frequently heard in the dense undergrowth, but the bird itself is not often seen. I found it breeding during March and April; nest cup-shaped, of dry leaves and twigs, placed near the ground in a low bush. The eggs were pinky-white, even after being blown, and were spotted and clouded with pinkish-brown; their average length ·88″, breadth ·62″.

177. Mixornis gularis.—The Sumatran Yellow-breasted Babbler.

This small babbler is fairly common in gardens and clearings.

243. Ægithina tiphia.—The Common Iora.

Very common everywhere.

298. Pycnonotus analis.—The Yellow-vented Bulbul.

One of the commonest birds on the island; breeds from March to May or June; nest of the usual bulbul type, ditto the eggs. This bird has a very

pleasing "rippling" song which it utters chiefly at dawn, and which is unlike the notes or song of any other bulbul that I have met with.

299. Pyc. finlaysoni.—Finlayson's Stripe-throated Bulbul.

Common in Malacca where I noticed a pair building in February, but not often seen in Singapore.

307. Pyc. plumosus.—The Large Olive Bulbul.

Common on the outskirts of the jungles.

308. Pyc. simplex.—Moore's Olive Bulbul.

Common. I found it breeding during May; nest and eggs of the usual Bulbul type.

310. Microfus melanocephalus.—The Black-headed Bulbul.

Though common on the mainland, it is by no means so on the island.

364. Acrocephalus orientalis.—The Eastern Great Reed-warbler.

Not common.

374. Orthotomus sutorius.—The Indian Tailor-bird.

Very common everywhere.

375. Orth. atrigularis.—The Black-necked Tailor-bird.

Rare.

376. Orth. ruficeps.—The Red-headed Tailor-bird.

Rare.

381. Cisticola cursitans.—The Rufous Fan-tailed Warbler.

Common in the swamps.

463. Prinia flaviventris.—The Yellow-bellied Wren-Warbler.

Fairly common.

481. Lanius cristatus.—The Brown Shrike.

Common in gardens and clearings.

483. Lan. tigrinus.—The Thick-billed Shrike.

Not so common as the previous species.

485A. Hemipus obscurus.—The Malay Pied Shrike.

Fairly common on the mainland; somewhat rare on the island.

503. Pericrocotus cinereus.—The Ashy Minivet.

A winter visitor I believe. I only saw it on two occasions, both during the winter months, and on both occasions it was in a small flock of a dozen or so, flitting from tree to tree at a rapid rate and keeping high up amongst the topmost branches; I was only able to shoot one specimen before the flock had vanished out of sight.

509. Campophaga terat.—The Pied Cuckoo Shrike.

A very common winter visitor.

514. Oriolus indicus.—The Black naped Oriole.

A rare visitor.

518. O. kundoo.—The Indian Oriole.

Another rare visitor.

527. CALORNIS CHALYBEIUS.—The Glossy Calornis.

One of the commonest permanent residents. Breeds during the early part of the year (probably more than one brood); nest in holes of trees or in roofs of houses; eggs deep-blue.

536. STURNIA SINENSIS.—The Chinese Myna.

A common winter visitor.

538. STUR. MALABARICA.—The Grey-headed Myna.

Name taken from specimen in museum.

539. STUR. NEMORICOLA.—The White-winged Myna.

Name taken from specimen in museum.

542. AGROPSAR STURNINUS.—The Daurian Myna.

A common winter visitor.

588. ASLEONAX LATIROSTRIS.—The Brown Flycatcher.

Common in gardens and clearings.

606. RHIPIDURA JAVANICA.—The Java Fantail Flycatcher.

Very common along the roadsides.

610. PRATINCOLA MAURA.—The Indian Bushchat.

I believe I am right in claiming to have shot the first and only specimen of this bird ever seen on the island.

663. COPSYCHUS SAULARIS.—The Magpie-Robin.

A beautiful singer; very common everywhere. I once saw a caged cock bird in the possession of a Chinaman; but whether the species sings in captivity I do not know.

664. CITTOCINCLA MACRURA.—The Shama.

Another fine songster, a permanent resident in the jungles. It is an inquisitive bird: one has only to go to some piece of jungle which they frequent and begin to imitate their whistling to have all the birds within hearing attracted to the spot, no doubt with the dual object of finding out who is the intruder and of driving him away if possible.

727. UROLONCHA ACUTICAUDA.—Hodgson's Munia.

Very common.

731. URO. LEUCOGASTRA.—The White-bellied Munia.

Also very common.

735. URO. PUNCTULATA.—The Spotted Munia.

Very common.

779. PASSER MONTANUS.—The Tree Sparrow.

Very common everywhere. Curiously enough *P. domesticus* is not found on the island.

814. HIRUNDO GUTTURALIS.—The Eastern Swallow.

Very common; apparently a permanent resident though I did not observe it nesting.

833. MOTACILLA BOREALIS.—The Grey-headed Wagtail.

A very common autumn visitor.

839. LIMONIDROMUS INDICUS.—The Forest-Wagtail.

Found sparingly in gardens and thin jungle during the winter months.

847. ANTHUS RUFULUS.—The Indian Pipit.

A very common permanent resident.

881. CHALCOSTETHA PECTORALIS.—Maklot's Sun-bird.

This lovely sun-bird is found sparingly in certain localities.

896. ARACHNECHTHRA HASSELTI.—Van Hasselt's Sun-bird.

Rare; I only noticed 2 or 3 specimens in four years.

897. CINNYRIS PECTORALIS.—The Yellow-breasted Sun-bird.

Very common everywhere. Breeds during January and February. Nest of the usual sun-bird type, suspended from a twig or dried frond of a fern, usually at no great height from the ground. Eggs 2; greenish-white, peppered all over, but chiefly with a cap at the large end, with greenish-grey.

903. ANTHOTHREPTES MALACCENSIS.—The Brown-throated Sun-bird.

The commonest sun-bird on the island; it chiefly frequents cocoanut groves where it may be seen searching for food amongst the leaves and cocoanuts; probably it builds its nest high up in these same trees, which may account for my not having found one.

912. DICAEUM CRUENTATUM.—The Scarlet-backed Flower-pecker.

Somewhat scarce; I usually found it feeding in the vermilion blossoms of a certain tree (name unknown to me) which is much grown in gardens and along the roads.

913. DIC. TRIGONOSTIGMA.—The Orange-bellied Flower-pecker.

Decidedly rare; found in the same places as No. 912.

949. GECINUS VIRIDANUS.—The Burmese Scaly-bellied Green Woodpecker.

Name taken from specimen in Museum.

957. CALLOLOPHUS MALACCENSIS.—The Banded Red Woodpecker.

Common.

975. IYNGIPICUS CANICAPILLUS.—The Burmese Pigmy Woodpecker.

Common everywhere. I took a nest of two hard-set eggs on 23rd March 1904.

980. MIGLYPTES GRAMMITHORAX.—The Fulvous-rumped Barred Woodpecker.

Fairly common.

992. CHRYSOCOLAPTES GUTTICRISTATUS.—Tickell's Golden backed Woodpecker.

Name taken from specimen in Museum.

1025. EURYSTOMUS ORIENTALIS.—The Broad-billed Roller.

Fairly common in the more open parts of the island.

1027. MEROPS PHILIPPINUS.—The Blue-tailed Bee-eater.

Fairly numerous round the swamps.

1035. ALCEDO ISPIDA.—The Common Kingfisher.

Fairly common.

1037. AL. MENINTING.—The Malayan Kingfisher.

This tiny kingfisher is not at all common. It is very easily mistaken at first sight for No. 1035.

1040. CEYX TRIDACTYLA.—The Indian Three-toed Kingfisher.

I only saw one specimen which had flown into a house at night and had been captured.

1044. HALCYON SMYRNENSIS.—The White-breasted Kingfisher.

Common everywhere.

1045. HAL. PILEATA.—The Black-capped Kingfisher.

Found sparingly up the backwaters.

1047. SAUROPATIS CHLORIS.—The White-collared Kingfisher.

Very common. Its noisy scream is heard alike in gardens, far from any water and along the shores of the sea or rivers. I believe it nests in holes in trees.

1071. CYPSELUS SUBFURCATUS.—The Malay House Swift.

Exceedingly common. Breeds in vast colonies, apparently raising at least two broods a year; the nests are placed under the eaves of houses, or under verandahs, sometimes in huge clusters; the eggs, 3 or 4, are glossless white, much elongated and pointed at the small end.

1093. CAPRIMULGUS MACRURUS.—Horsfield's Nightjar

Very common in gardens and clearings. Breeds during February, March and April, the 2 eggs being laid, as usual, in a mere depression in the ground, under some bush; the eggs are pale salmon or stone colour, faintly spotted with light brown and pale purple.

1102. HARPACTES DUVAUCELI.—The Red-rumped Trogon.

Name taken from specimen in Museum.

1113. CACOMANTIS MERULINUS.—The Rufous-bellied Cuckoo.

A very common winter visitor; its notes, heard from early dawn to late at night, rise regularly up the scale after this fashion:—C B C, D C D, E D E, &c., till the bird seems unable to go higher and stops; at other times it commences on a high note, and comes down the scale note by note increasing in speed as the lower notes are reached.

1115. CHRYSOCOCCYX XANTHORHYNCHUS.—The Violet Cuckoo.

I should say very rare; I only saw and obtained one specimen.

1120. EUDYNAMIS HOMARATA.—The Indian Koel.

The only specimen I saw was shot by a friend in his garden and given to me.

1125. RHOPODYTES SUMATRANUS.—The Sumatran Green-billed Malkoha.

Found sparingly in the jungles.

1133. CENTROPUS BENGALENSIS.—The Lesser Coucal.

Common on bushy waste-land and such like places.

1212. SPIZAËTUS LIMMAËTUS.—The Changeable Hawk Eagle.

I only noticed one specimen which I secured.

1220. BUTASTUR TEESA.—White-eyed Buzzard-Eagle.

Fairly numerous. I shot a specimen on 17th December 1905 which had evidently just killed a *Turnix pugnax* which it was carrying in its claws.

1222. BUTASTUR INDICUS.—The Grey-faced Buzzard-Eagle.

Name taken from a specimen in the Museum.

1224. HALIAËTUS LEUCOGASTER.—The White-bellied Sea-Eagle.

Very common; large numbers haunt the harbour in company with *Milvus govinda* and *Haliastur indus*.

1228 HALIASTUR INDUS.—The Brahminy Kite.

Very numerous.

1229. MILVUS GOVINDA.—The Common Pariah Kite.

Also very common. It is extraordinary, but I never saw the nest of this or the previous species; yet they are certainly permanent residents.

1247. ACCIPITER NISUS.—The Sparrow-Hawk.

Common.

1248. ACC. VIRGATUS.—The Besra Sparrow-Hawk.

Also common.

1251. BAZA LOPHOTES.—The Black-crested Baza.

Name taken from a specimen in the Museum.

1265. TINNUNCULUS ALAUDARIUS.—The Kestrel.

Common.

1279. OSMOTRERON VERNANS.—The Pink-necked Green Pigeon.

Exceedingly common everywhere. Breeds from March to May or June; the usual nest and eggs. These birds roost in enormous numbers on the small mangrove-covered islands which are dotted about the north of the Johore river; here sportsmen betake themselves in July and August, and stationing guns round an island await the flighting in the early morning and evening; in this way bags of several hundreds of birds are sometimes made.

1284. CARPOPHAGA ÆNEA.—The Green Imperial Pigeon.

Name taken from a specimen in the Museum.

1289. MYRISTICIVORA BICOLOR.—The Pied Imperial Pigeon.

Only a few frequent the island, and these fly so high and keep so much to the tops of the highest trees that they are rarely shot at, much less killed.

1291. CHALCOPHAPS INDICA.—The Bronze-winged Dove.

Name taken from a specimen in the Museum.

1308. TURTUR TIGRINUS.—The Malay Spotted Dove.

Very common in all gardens and open places. Apparently breeds throughout the year; nest and eggs of the usual type.

1315. GEOPELIA STRIATA.—The Barred Ground-Dove.

Very common. As its name implies, it is generally seen upon the ground, on roads, &c., It is a favourite cage-bird with the Malays.

1354. EXCALFACTORIA CHINENSIS.—The Blue-breasted Quail.

Very common in the open, "lallong"-covered waste-land, and indigo plantations. From the examination of a bird shot by myself on 17th December 1905, I fancy this species breeds here during the cold months.

1355. COTURNIX COMMUNIS.—The Grey Quail.

Name taken from a specimen in the Museum.

1382. TURNIX PUGNAX.—The Bustard-Quail.
Very common in grassy places.

1389. HYPOTÆNIDIA STRIATA.—The Blue-breasted Banded Rail.
Common enough in the swamps, but owing to its skulking habits is not often noticed.

1396. RALLINA FASCIATA.—The Malayan Banded Crake.
Name taken from a specimen in the Museum.

1398. AMAURORNIS FUSCUS.—The Ruddy Crake.
Name taken from a specimen in Museum.

1401. AMAUR. PHŒNICURUS.—The White-breasted Water Hen.
Common everywhere where there is a pond or tank.

1403. GALLICREX CINEREA.—The Water-Cock.
Common in bushy, swampy places. Said to be excellent eating.

1425. GLAREOLA ORIENTALIS.—The Large Indian Pratincole.
Found in fair quantities during the winter months on the sandy portions of the shores of the Johore Straits.

1439. CHARADRIUS FULVUS.—The Eastern Golden Plover.
A common winter visitor.

1441. SQUATAROLA HELVETICA.—The Grey Plover.
Name taken from specimen in Museum.

1445. ÆGIALITITIS VEREDA.—The Eastern Dotterel.
Name taken from specimen in Museum.

1446. ÆG. ALEXANDRINA.—The Kentish Plover.
As above.

1454. NUMENIUS ARQUATA.—The Curlew.
An uncommon winter visitor.

1455. NUM. PHÆOPUS.—The Whimbrel.
Found in small flocks during the winter months on the mudflats of the tidal rivers.

1460. TOTANUS HYPOLEUCUS.—The Common Sandpiper.
A common winter visitor.

1461. TOT. GLAREOLA.—The Wood Sandpiper.
Name taken from a specimen in Museum.

1464. TOT. CALIDRIS.—The Redshank.
Common winter visitor; frequents the mudflats of the rivers.

1485. GALLINAGO STENURA.—The Pintail Snipe.
It is scarcely worth while going out snipe-shooting, except for exercise; one rarely gets more than 3 or 4 couple a day unless one has permission to shoot over certain preserved and prepared grounds where bags of 20 or more couple are sometimes made. It is perhaps worthy of note that I never came across a specimen of the "fantail," either in Singapore, Johore, or Malacca where there is fairly good shooting.

1488. ROSTRATULA CAPENSIS.—The Painted Snipe.
I did not see any, but a well-known local sportsman assured me he had occasionally shot one on the island.

1503. STERNA SEENA.—The River Tern.

Occasionally seen in the harbour and up the rivers.

1562. BUBULCUS COROMANDUS.—The Cattle Egret.

Although so numerous just across the water in Johore territory I only once saw a single specimen on the island.

1565 ARDEOLA GRAYI.—The Pond Heron.

Common, of course, on the mainland, but seldom seen on the island.

1567. BUTORIDES JAVANICA.—The Little Green Heron.

Name taken from a specimen in Museum.

1571. ARDETTA SINENSIS.—The Yellow Bittern.

As above.

1572. ARD. CINNAMONEA.—The Chesnut Bittern.

Common in all swampy places.

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The following birds are not included in the "*Fauna of British India*"-*Birds*:—

Brit. Mus. Cat. III.—DISSEMURUS BRACHYPHORUS.

Common in jungles and gardens.

B. M. Cat. VII.—MALACOPTERUM AFFINE.

Common.

B. M. Cat. IX.—ÆTHOPYGIA SIPARAJA.—The Siparaja Sun-bird.

This lovely little bird is found very sparingly both on the main island and on the adjacent ones.

B. M. Cat. XIII.—AMADINA MAYA.—The White-headed Munia.

The commonest munia on the island. It breeds during March and April; nest and eggs of the usual type.

B. M. Cat. XVI.—CHÆTURA GIGANTEA.—The Giant Spinetail.

A visitor, found in large numbers in certain localities; always flies about the tops of the hills, never over low ground. I once saw a great number flying around the Government Rest-house on the top of Bukit Timah Hill; the rate at which the birds were flying was amazing.

B. M. Cat. XX.—PALÆORNIS LONGICAUDA.

The common parrot of the island as well as of the mainland.

B. M. Cat. XX.—LORICULUS GALGULUS.

Also very common; a great cage-pet among the Malays.

B. M. Cat. XXIII.—PORZANA CINEREA.—The Grey-breasted Crake.

Common in all swampy places, though not often seen owing to its shyness.

B. M. Cat. XIII.—MUNIA ORYZIVORA.—The Java Sparrow.

I fancy an importation; large flocks now frequent the neighbourhood of the rice mills, but are not often seen elsewhere. Incredible numbers are trapped and sold by bird dealers to the steamships, when no doubt they appear on the dining-tables as "rice-birds," or may be as "quails on toast".

B. M. Cat. XVII.—MEROPS SUMATRANUS.—The Sumatran Bee-eater.

Very common; frequents dry grassy wasteland.

Very common everywhere, taking the place of *Carine brama* of India and Burma. It evidently breeds during January and February, for I was given a fluffy nestling in February 1904, which I fed on meat and bits of small birds; I gave it away afterwards to the Volunteer Sergeant-Major who, when I left in 1906, still had it; it had become quite tame and was in splendid plumage.

B. M. Cat. XIX.—EUDYNAMIS MALAYENSIS.—The Malayan Koel.

Name taken from specimen in Museum.

B. M. Cat. XIX.—CACOMANTIS THRENODES.

Name taken from specimen in Museum.

B. M. Cat. XVI.—LYNCORNIS TEMMINCKI.

Very common out in the country; flies very high in the air as a rule, looking like a large bat. It has a peculiar cry which it utters incessantly when on the wing, resembling "tiptee-bow," "tiptee-bow".

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Besides the foregoing, I also secured or saw the following in Malacca, or Johore; and I daresay several of them inhabit Singapore Island.

7. CORVUS SPLENDENS.—The Indian House Crow. (Mal.)

Like its cousin, *C. macrorhynchus*; I only saw one solitary specimen which was no doubt also a straggler.

227. ZOSTEROP AUREIVENTRIS.—Hume's White-Eye. (Joh.)

Secured by a friend. Breeds during April and May; nest of fibres and fine roots, cup-shaped, hangs from twigs of small bushes. Eggs 2, pale-blue.

244. ÆGITHINA VIRIDISSIMA.—The Green Iora. (Mal.)

Appears to be as common as *Æg. tiphia*.

293. TRACHYCOMUS OCHROCEPHALUS.—The Yellow-crowned Bulbul. (Mal.)

The largest bulbul found in the Straits. Appears to be locally distributed; I only found it in certain thin jungle a few miles outside Malacca town. It is easily tamed and taught to whistle and talk, and is therefore in great demand as a cage-bird.

721. PLOCEUS MEGARHYNCHUS.—The Eastern Baya. (Mal.)

Very common about the paddy fields.

908. ARACHNOTHERA MODESTA.—The Grey-breasted Spider-hunter. (Joh.) Procured by a friend.

910A. ARACH. FLAVIGASTRA.—The Great yellow-eared Spider-hunter (Mal.)

Somewhat rare.

940. CYMBORHYNCHUS MACRORHYNCHUS.—The Black-and-red Broadbill. (Mal.)

Common in jungle districts. Breeds from March to May. Nest large globular, with hole at side, of twigs and grass; usually suspended from the extremity of the branch of a thorny bush. Having a canopy over the entrance, the nest looks like that of a gigantic sun-bird. Eggs white, thickly spotted with rusty red.

B. M. Cat. II.—SCOPS LEMPIGI.

1005. CALORHAMPHUS NAVI.—The Brown Barbet. (Mal.)
Probably common, though I only saw a few specimens.

1087. MACROPTERYX LONGIPENNIS.—The Malayan Crested Swift.
Procured by a friend in Johore.

1088. MAC. COMATA.—The Tufted Tree-Swift.
Also procured by a friend in Johore.

1124. RHOPODYTES DIARDI.—Diard's Green-billed Malkoha. (Mal.)
Common in wooded districts.

1127. RHAMPHOCOCCYX ERYTHROGNATHUS. (Mal.)
Also common in wooded districts.

1128. RHINORTHA CHLOROPHÆA.—Raffles's Green-billed Malkoha. (Mal.)
As above.

1269. MICROHIERAX FRINGILLARIUS.—The Black-legged Falconet. (Mal.)
This tiny falconet is common in wooded districts; it is generally seen perched on the topmost twigs of some dry tree or branch, from whence it pounces upon its prey—beetles, &c.

1281. TRERON NEPALENSIS.—The Thick-billed Green Pigeon. (Joh.)
Quite common.

1327 bis. POLYPLECTRUM BICALCRATUM.—The Peacock Pheasant. (Mal.)
I only secured one specimen, a hen, which was bought from a Chinese fowl-seller and given to me; it had presumably been lately caught and was evidently injured, for it died a few minutes after changing hands.

1328. GALLUS FERRUGINEUS.—The Red Jungle Fowl. (Mal.)
Plentiful in the jungles, but difficult to get at. I have no doubt the bird was found on Singapore island in former days, but owing to the ruthless manner in which every species of furred or feathered game was and is slaughtered, it is many years since the last "Ayam hitam" disappeared off the island.

B. M. CAT. IV.—GRAUCALUS SUMATRENSIS. (Joh.)
Presented to me by a friend.

B. M. CAT. XIX.—MESSBUCCO DUVAUCELI. (Mal.)
I only procured one specimen, a young male. The length of the rictal bristles in this species is remarkable.

# AN ENQUIRY INTO THE PARASITIC HABITS OF THE INDIAN KOEL.

BY

D. DEWAR, I.C.S., F.Z.S.

Although the koel (*Eudynamis honorata*) is so common in India, there are several points regarding its nesting habits which need clearing up; accordingly I, long ago, determined to seize the first opportunity which presented itself to conduct an investigation. The opportunity came when, at the end of May this year, I went to live with Mr. Kelly, Assistant Principal of the Aitcheson College, Lahore. Mr. Kelly's bungalow is situated in the midst of the extensive and well-wooded grounds of the college. Both crows and koels abound, and the former build in the loftier trees.

The questions which I set myself to answer were the following:—

1. Does the hen koel first lay her egg upon the ground and carry it to the nest in her beak, or does she sit in the nest and lay it?

2. Does she take away or destroy the crow's eggs that are already in the nest?

3. Does the young koel, like the common cuckoo, eject its foster brethren?

4. Is the incubating period of the koel shorter than that of the crow?

In order to illustrate the uncertainty that exists upon this subject I quote what various Indian ornithological authorities have to say regarding these points:—

Hume writes of the koel in the second edition (1890) of *The Nests and Eggs of Indian Birds*:—"Mr. Blyth recorded the following remarks in regard to the "eggs of this species:—'The egg is certainly so often found alone that there "can be little doubt that the koel destroys the eggs of the crow at the time her "own is deposited; but it is doubtful whether the young koel is endowed "with the instinct of ejecting any companions it may have, and it would seem "that it has not that propensity; but the fact remains to be systematically "observed. Mr. Firth informs us that he has never found more than one koel's "egg in a nest.'

"My experience differs in some important particulars from Mr. Blyth's. In "the first place I deny that koel's eggs are generally found alone; in thirty cases "of which I have notes there is no single instance of the egg being found alone. "It is not the eggs that are destroyed, but the young crows that are got rid of, "probably by the young cuckoo; I have found the latter in a nest with three "young crows all freshly hatched, and a week later have found the young crows "'missing' and the young cuckoo thriving. In the next place I have frequently "found two koel's eggs in one nest."

Mr. William Jesse in a paper entitled "*The Birds of Lucknow*," contributed to the *Ibis* in 1903, states: "I have found 2 koel's and no crow's eggs in a nest, "3 crow's and 2 koel's, 4 crow's and 1 koel's, and so on. Reid records 1 koel's "and no crow's (3 times), 1 hard-set crow's and 2 koel's, 3 hard-set crow's and

"1 koel's, 1 fresh crow's and 3 koel's. Reid argued that this went to prove "that the female koel ejected the crow's eggs from the nest while depositing "her own. I have an open mind on the subject, but I have never found "broken eggs underneath a nest from which koel's eggs have been taken."

The plan I adopted was to mark down all the crow's nests in the neighbourhood, send my climber up every morning, provided with a tin half full of sawdust. Every time the man visited a nest he lowered the contents in the tin can to me, and I marked each egg, inscribing on it the number of the nest and the date on which I first saw the egg. By so doing I thought I should soon be in a position to see whether the koel ejected or destroyed any of the eggs it found in the nest. Unfortunately the Punjabi boy is very inquisitive and it was not long before I attracted considerable notice. The result was that some of the servants' children, who lived in the compound, took to climbing the trees and tampering with the nests, hence a great part of my labour was lost. I shall detail in full what happened (or what I believe to have happened) at each nest, and shall then set forth my inferences, and leave the reader to judge for himself how far they are justified.

Early in June I noticed that the crows were beginning to build, and, having located some nests, sent my climber up every day to see how they were progressing. But the effect of this was to make the crows desert the nests visited and commence others. There was, in consequence, nothing left but to wait until we saw a crow sitting. The crow is a very close sitter and begins to incubate the moment she has laid an egg, so that I had only to look each day to see whether any crow was sitting to find out whether she had commenced to lay. I then sent up my climber. The crow, having once laid, did not desert. I may here say that the crows took my climber's presence very calmly. In nearly every case the sitting bird flew away the moment he set foot upon the trunk, and did not return until he had climbed down. Only two crows made any attempt to attack him when in the tree.

I kept a careful daily record of my doings, but a full reproduction of this would prove very tedious; I have therefore decided to take each nest in turn and briefly recapitulate what happened.

I numbered each nest in the order in which I discovered it, but shall not take them in this order. I shall deal first with those that were tampered with, as by so doing the reader will be in a better position to understand my inferences. For this reason I lead off with nest No. V.

### Nest Number V.

On June 14th, after I had finished my round of inspection, I sent my climber to see whether he could find any more nests in the compound. An hour later he returned with the following story:—

"I saw a crow's nest in a tree standing by itself. I climbed the tree and found one crow's egg in it. I then went on to look for other nests. On my way back I saw the crow sitting on the nest, and noticed a hen koel in a tree near by. In another tree there was a cock koel. While I was looking at him

he flew to the tree in which the crow was sitting and called *kuil, kuil.* The sitting crow left the nest and 'went for' him. He flew off, followed by the crow. Immediately the hen koel flew to the crow's nest and laid an egg in it. I am certain she laid an egg (although I did not again climb the tree), because she had her mouth open and her whole body underwent contortions as though she were trying to squeeze something out. After about a minute she left the nest, carrying in her beak a crow's egg which she smashed. If you go to the nest you will find in it a koel's egg instead of the crow's. I did not climb up the tree to see, but came running to you, *sahib.*"

Ascertaining that the nest was only some three hundred yards from the bungalow, I at once went to the tree and sent my climber up. In the nest he found and lowered to me one crow's egg and one koel's egg!

It was therefore obvious that either the crow had returned and laid another egg between the time when my climber saw only one and the time I inspected the nest, or the man was not telling the truth when he said he saw the koel fly off with an egg in her beak. I cross-examined him carefully and he then admitted that he might have made a mistake about the egg being in the koel's mouth, but he was quite positive about the rest of the story, which I am inclined to believe. I had no pencil with me, so could not mark the eggs.

The next day (June 15th) I visited the nest and found only the koel's egg in the nest; that of the crow had disappeared. What had become of this? No traces of it were to be seen on the ground. Either my climber had been playing tricks, or the koel had returned and removed the egg, or some person had climbed up the tree and taken the egg. The first alternative I dismissed as most improbable, for I had promised the man a handsome reward if the experiments turned out well; he was a *chaprassi* in my office, which was three miles away, and I had taken him in my dog-cart to office the previous day, so that if he had removed the egg he must have done so in the afternoon and have walked six miles to do so. I am inclined to think that the koel returned and removed the egg. In other cases which I shall record it has certainly done so. I believe that the koel tries to remove an egg at the time that it deposits its own, but frequently it is not given time to do so; when this is the case it makes an attempt to return and do so subsequently.

On the other hand, the tree was outside the compound, near a temple, and some men had seen my man up the tree. But my subsequent experience showed me that it is the small boys who are the trouble and not the grown-ups. For these reasons I am of opinion that the koel removed that egg.

On the 16th June the nest contained the koel's egg *plus* one crow's egg. On the 17th it contained the koel's egg and two crow's eggs. While my man was up in this tree a small boy had come out of the temple and stood watching me. Thinking to make the best of a bad job I explained to him what I was doing and showed him the difference between the egg of the crow and that of the koel. He appeared interested.

On the 18th the nest contained the koel's egg and only one of the crow ; that of the 16th had disappeared. It is probable that the small boy and his friends removed it ! I then told my climber to twine branches round the stem of each tree he climbed, so that it would be impossible for any one to swarm up it without leaving traces. This he did.

On visiting the nest on the 19th it was evident that some one had been up the tree, and we found the nest empty. That was the end of that particular experiment.

Before leaving the account of this nest I should like to say a few words regarding the incident of the cuckoo laying its egg in the nest, which my climber declares he witnessed. I was most anxious to see the koel lay its egg and spent much time in watching likely nests, but never saw it do so. I was however, did see what was probably an attempt on the part of a koel to cook to an egg. A hen koel was sitting in a tree quite close to a crow's nest of my contained one egg. Presently the cock koel came up, and made a noi I believe owners of the nest "went for" him and he flew off followed by them. Both, and hen koel continued to sit upon her branch, her body motionless, and move head as if looking anxiously round. After the koel had been sitting thus having about ten minutes one of the crows returned to the nest and looked into here It then flew away again. The hen koel now flew to the tree in which the nest was situated and perched on a branch a few inches above it. I believe she was about to enter it, when suddenly a crow appeared and attacked the koel. She flew off followed by the crow. I waited for a quarter of an hour, but neither bird returned. I should add that no koel's egg was subsequently found in that nest. On another occasion I saw a cock koel come into a tree in which there was a crow's nest containing three crow's and one koel's egg. He began to cry *kuil, kuil,* and the crow "went for" him but did not follow when he flew off.

I am of opinion that the koel experiences considerable difficulty in getting her egg into the crow's nest. Sometimes the crows refuse to be drawn off by the cock koel, at others the hen is not quite ready to lay when the crows are enticed away ; the crows must frequently return and surprise the hen koel on the nest before she has had time to complete the operation.

### Nest Number VI.

On June 14th my climber reported one crow's egg in the nest.

On the 15th I inspected the nest and found one crow's egg *plus* one koel's. On the 16th there was in the nest a second crow's egg, that is to say, in all two crow's eggs and one koel's.

On the 17th the crow's egg of the previous day had disappeared, so that the nest now contained one crow's egg and one koel's. I am inclined to think that this egg was removed by a koel. It is true that a cultivator was working at a well near by with his oxen and saw my man ascend the tree, but it was a difficult one to climb and it is unlikely that the old man would have risked breaking his limbs for the sake of destroying an egg. On the 17th an

additional koel's egg was found in the nest, so that it now contained two koel's eggs and one crow's egg. I naturally put myself the question: are both these eggs laid by the same koel? And I am inclined to think that they were. In the first place the tree was isolated and at some dist..nce from any other trees in which crows were building. Secondly, the disappearance of the crow's egg looked as though the koels were paying some attention to the nest. The third and perhaps the most convincing reason was the nature of the koel's eggs. Koel's eggs have an oily surface and it is accordingly difficult to mark them with pencil; these two, however, took the pencil more readily than most of the other koel's eggs I have come across. Further, they were both of the same shape and similarly marked.

On the 18th the two koel's eggs and the crow's egg were still in the nest, but on the 19th this last had disappeared, so that the nest now held only the two koel's eggs. For the reason given above I am inclined to think that the koel herself had removed this egg. I may add that later we came upon a crow's nest which contained only two hard-set koel's eggs, and it is unlikely that any human being had climbed up the lofty tree in which this nest was situated and removed the crow's eggs that were in it when the koel visited it.

No further eggs of either crow or koel were laid in this nest (No. VI), which I continued to visit almost daily. On the 28th June one of the young koels hatched out and on the 29th the second appeared. These two young koels lived together in the nest quite amicably, and on July 20th they had both left the nest and were sitting on a branch in the tree that contained it.

I was then inclined to think that they were both females, as their plumage was much barred, but in one case the bars were white and in the other chestnut red. I shall return to this point later, when talking more particularly of the plumage of the koel nestling. The observation of this nest shows that more than one egg may be laid by the koel in the same nest, that the koel does sometimes destroy the eggs it finds in the nest, and that the *destruction does not necessarily take place at the same time as the koel's egg is laid*. It also shows that when there are two young koels in the same nest the stronger does not eject the weaker (or at any rate does not *always* do so) as happens in the case of the common cuckoo. I may add that there is no hollow in the back of the koel nestling, and that it does not appear to be sensitive when brought into contact with a foreign body or with another young bird. Neither koel seemed to object in the least to having the other placed on top of it.

NEST NUMBER X.

On the morning of June 22nd my climber told me that he had seen a crow sitting in a nest outside the compound. I went to the tree and sent him up to ascertain what there was in it, as he had not been up before reporting to me. While he was climbing up I noticed a broken crow's egg lying on the ground nearly directly underneath the nest. This egg must have been pitched, or have fallen, out very recently, since there was still uncoagulated albumen in the shell, and the ants had not yet found it.

Unfortunately the tree was in an exposed place, so that on the 26th we noticed that the arrangement of branches, which, being taught by experience, we now always made, had been disturbed, showing that some one had been up the tree. The koel's egg and one of the crow's eggs had been taken. I only mention this nest on account of the broken egg we saw lying on the ground, which was probably the handiwork of the koel.

NEST NUMBER IV.

On June 14th this contained one crow's egg, by the 15th a koel's egg had been added. On the 16th the nest contained two crow's eggs and one koel's. On the 17th there were three crow's eggs and one koel's egg in the nest. But as the small boy whom I suspected of stealing the eggs in Nest Number V had seen my climber at this nest, I feared that it would only be a matter of time before this was robbed and so seriously contemplated removing the koel's egg to a safer nest. As, however I had no proof of the guilt of the small boy in question and did not want to disturb things if possible, I allowed the koel's egg to remain in it. I inspected the nest daily from 19th to 21st June and always found the three crow's eggs and the single koel's egg, so decided not to inspect daily until it should be time for the eggs to hatch out, as I wanted to attract as little attention as possible. On the morning of the 28th the young koel was coming out while the three crow's eggs were still unhatched. On the 29th the young koel had hatched out while the three crow's eggs were unhatched, nor had they hatched out on July 1st.

But on visiting the nest on the evening of July 2nd I found that the young koel had disappeared and the crow's eggs that I had first seen on the 14th and 16th had hatched out, while the crow's egg of the 17th was still unhatched. What I had feared had happened. The small boy had taken the young koel and thus brought this experiment to an abrupt termination. However, it shows that the young koel did not eject any of the crow's eggs although he was in the nest over forty-eight hours with them. It further shows that the koel's egg hatches out more quickly than that of the crow, and I may here say that in all the nests I have examined where there are both crow's eggs and a koel's egg the last has invariably been the first to hatch out.

It will be noticed that in this case the parent koel did not destroy or remove any of the three crow's eggs that I discovered and marked in the nest. But three is a very small clutch for the crow, and although I found an egg on the 14th, and another on the 16th and a third on the 17th, I found no new crow's egg on the 15th, the date on which I discovered the koel's egg; it is therefore quite possible that an egg was laid by the crow on the 15th which was ejected by the koel before I set eyes upon it. I may here say that in no one of the nests inspected by me did I find that both a crow's egg and a koel's egg had been added on the same day.

NEST NUMBER VIII.

On June 17th I found one crow's egg in this nest, on the 18th a second, on the 19th a third, and on the 20th a fourth. On visiting the nest on the 21st

I found only three crow's eggs in the nest, that which had appeared on the 17th was lying broken on the ground under the tree. There were no signs of any one having been up the tree, which was in the compound within twenty yards of my bungalow, so it seems more probable that a koel had made an attempt to lay in the nest but had been frustrated, and that in the scuffle that took place between the koel and the crow an egg had fallen out of nest. This is, of course, all pure surmise. It is, however, worthy of note that I had seen a cock and a hen koel hanging around this nest the day before. On the 22nd there were still the three crow's eggs in the nest. I now played koel in this nest, removing those eggs which had been first seen by me and on the 18th and 19th respectively, and replacing them by two koel's eggs which I had found in a new nest under the following circumstances.

I had come upon a fresh nest with a crow sitting on it, the nest was in a low tree, and in a tree close by were a cock and a hen koel, both very excited. As they appeared to have designs upon this nest I decided to stay and watch. After a minute or two the two koels flew off, calling excitedly. My climber ran after them, but as it was very hot, and the sun was powerful, I remained where I was. I heard the cuckoos making the most tremendous noise in the distance. In about five minutes my climber came running up in a state of great excitement, and told me he had seen the hen cuckoo lay an egg in a crow's nest, of the existence of which he had previously not been aware, the cock had drawn off the crows, then the hen had rushed to the nest, and in less than a minute he had seen her leave it with an egg in her mouth. He was quite positive of this. He saw her fly with it to a tree near by. Without waiting to see what then happened he had come running to fetch me. He brought me to the tree which was a couple of hundred yards from where I had been waiting, and on swarming up he found that the nest contained two koel's eggs only. As there was quite a crowd watching him swarm up the tree, I decided to take away the koel's eggs and put them in nest number VIII, as being a safer place for them! Thus it was that I played cuckoo in nest number VIII, substituting two koel's eggs for two crow's. In marking the two koel's eggs I accidentally made a small hole in one with a pencil. Blood issued from it, showing that the egg was not fresh, hence, although the climber may have seen the koel fly away with a crow's egg in her beak, it was impossible that he had seen her lay an egg, since both appeared to be hard set. I stuck a piece of a fowl's egg-shell over the hole and had both the koel's eggs placed in nest number VIII, so that it now contained two koel's eggs and one crow's. The next day the three eggs were all right. The crow had apparently not noticed the substitution. I had been a successful cuckoo.

On the 24th the egg which I had patched up with the chicken's egg-shell had hatched out. The newly hatched koel is black all over and devoid of feathers. It thus differs from the beginning from a young crow which is, when it first issues from the egg, pink. The young koel, although less than a day old, was very lively; when it was lowered to me it opened its mouth wide and raised

itself on its legs, lifting its fore limbs right off the ground by way of asking for food. The other koel's egg and that of the crow were still in the nest. I put these up against the young koel and on top of its back (which is not hollowed out like that of *Cuculus canorus*), but it did not seem to mind in the least. On the 26th the second koel's egg was splitting and the young bird ready to emerge. Meanwhile the young koel was growing apace. Its rectrices and wing feathers had begun to show as bristles about one-sixth of an inch in length. I again tried it with the crow's egg, but it was not in any way sensitive as is the common cuckoo.

On June 27th I found only it and the crow's egg. The koel's egg had disappeared. I do not think that it was ejected by the koel that had hatched out, for, as I have said, this did not seem at all to mind contact with the egg. I believe that when the crow flew out of the nest the egg had adhered to its feathers, having become sticky owing to the fact that some albuminous fluid, had oozed out preparatory to the appearance of the young bird. Young pigeons are, I am informed, often lost in this manner.

On the 28th the young koel and the crow's egg were still in the nest. I again tested the sensitiveness of the koel to the egg and found none. I may here remark that the koel is considerably smaller than the crow, so that even were the former sensitive as is the common cuckoo, it probably would not be strong enough to eject the crow's egg until it was several days old. From the 29th June to July 1st I was away, but Mr. G. A. Pinto, of the Accountant General's office, very kindly had a look at all nests for me during each day of my absence. On my return both the koel and the crow's egg were in the nest.

On July 3rd I again experimented to see whether the koel was sensitive; I placed the crow's egg on its neck, then on its back and finally on its wing, but it did not seem to be aware of the presence of the egg, and made not the slightest attempt to remove it. The bird was very quiet and timid. The quill feathers had attained a length of nearly an inch and gave the bird the appearance of a young porcupine. The eyes were black.

On July 4th the young koel alone was in the nest, the crow's egg was lying broken on the ground beneath the tree; but it was clear from the appearance of the branches that some person had been up the tree. I again tested to see whether the koel minded contact with a foreign object, but it did not appear to do so. The feathers had just begun to emerge from the sheath and the tips were slightly tinged with red. I continued to examine the young bird daily. By the 7th quite ¾ of an inch of each tail feather was protruding beyond the sheath. With the exception of the tip, which was becoming more reddish, all the remaining feathers were black. The eye had become a smoky brown.

I find the following entry, anent the young koel, recorded in my diary of July 8th:—"The young koel now looks quite presentable. Its tail is two inches long. The feathers of the neck are glossy black, the remainder are brownish black, some of them (*i.e.* those which were the first to appear) having rufous tips. There is now little doubt that the young bird is a cock."

By July 10th the young koel had become as large as a myna. Its breast and abdominal feathers and its under tail-coverts were tipped with rufous, but from above very little rufous was visible. On July 12th the young koel was almost ready to leave the nest. When my climber tried to catch hold of him he jumped out of the nest and fell, but managed to clutch with his large and powerful claws a branch, and hung there, head downwards, until the climber secured him. I then made him perch on the side of the tin can, he assumed the characteristic koel attitude, and might have been mistaken for an adult cock but for his brown eye, short tail, and the fact that a few of his feathers were tipped with a rufous band.

On the 14th the young bird was sitting on a branch of the tree near the nest. The climber managed to secure it. Its earlier feathers still had rufous tips, but these had become less distinct. Having examined the bird I put it on the lower branch of another tree to the disgust of its foster parents. When I returned later on it was sitting on a higher branch of the same tree. I did not see it again.

This example shows that the description which Blanford gives of the nesting plumage is inaccurate.

NEST NUMBER II.

On June 13th this contained one crow's egg, on the 14th a second crow's egg had been laid. On the 15th we found, in addition to these two crow's eggs, a koel's egg. On the 16th another crow's egg had been laid, and on the 17th yet another, so that the nest now contained the koel's egg laid on the 15th and the four crow's eggs laid on the 13th, 14th, 16th, and 17th respectively.

The nest was visited daily and there was no change in its contents up to the 29th. If therefore the koel did eject a crow's egg it must have been one laid after my visit on the 14th, and this must have been taken out by the koel before my visit on the 15th, so that I never saw the egg at all.

On the evening of June 29th the young koel had emerged from its egg, as had two of the crows (on the 28th June not one of the eggs had hatched out), so that the nest now contained a young koel, two crows and two crow's eggs. By the 30th one of these had hatched out, so that there were three young crows in the nest. The same state of affairs prevailed on July 1st; by the 2nd all the eggs had hatched out, so that the nest now contained a young koel and four crow nestlings. I visited the nest daily and watched the growth of the brood with interest. On July 5th the eldest of the crows was just beginning to show wing and tail feathers as tiny bristles, whereas the wing and tail feathers of the koel were nearly half an inch in length. The crow's eyes were still closed, but those of the koel open. The neck of the crow nestling is long and the head hangs down. The koel's neck is short and it holds its head well back between the shoulders. The crow has a mouth very much larger than that of the koel, with great fleshy flaps to the edges of the mandibles. These the koel lacks. Nevertheless the biggest crow, although not nearly so far advanced, was considerably bigger than the koel. I tested the sensitiveness of this young koel

and found that it did not mind in the least contact with foreign bodies, or with its fellow nestlings.

On July 6th we found, from the fact that the branches we had arranged were broken, that some one had been up the tree, and one of the young crows had disappeared. The nest now contained the koel and three crows. I was most annoyed since the tree in which this nest was situated grows on the lawn in front of the bungalow in which I was living. It was therefore apparent that some of the servants living in the compound had taken the young crow. A protracted inquiry, in which the police were called in, elicited the fact that the son of the sweeper of the Principal of the College had swarmed up the tree and taken the young bird! The boy confessed. Had he been an English boy I should have boxed his ears and thus settled matters then and there; but I knew that if I dared to lay hands on a native boy, there would probably be a tremendous uproar; that telegrams would, as likely or not, be sent to the Viceroy; that Messrs. Keir Hardie and other pillars of the Empire would ask questions in the House of Commons, and that I should run the risk of being informed that, in the opinion of the Secretary of State, I had "failed to maintain the high traditions of the Civil Service"; so, although the boy was only about ten years old, an enquiry had to be held, and (the boy's guilt being proved) I gave the father the choice of three alternatives—of having his boy prosecuted criminally for "mischief," of being dismissed by his master, or of giving his son a shoe beating. He, as I expected, chose the last alternative, which was carried out in my presence to the tuneful accompaniment of the culprit!

I mention this ridiculous incident because it shows the difficulties under which my experiments were conducted and because there is a sequel, of which more anon.

I may say at once that there was no further tampering with this nest, and the young koel and three remaining crows grew up amicably together and left the nest in due course.

By July 8th the young koel looked quite presentable. His tail (it was a cock) was two inches long, the feathers of his neck were glossy black, the others were brownish black, some of them having reddish brown tips. These were not nearly so conspicuous as they were in the young koel in nest number VIII.

In both these cases it was only the first feathers to appear that had the lighter bars at the tip. Those that subsequently appeared had no reddish brown tips. The following entry occurs in my diary of July 12th anent this nest:—

"The koel is in a very dirty condition. The young crows have evidently been sitting upon him (I used the word literally), and some of them have left their *cartes de visite* on his plumage. The webs of the wing feathers of the two bigger crows are just beginning to emerge, but their eyes are not yet fully open."

We thus see that the young koel does not object to very close contact with its foster brethren, and that it develops very much more rapidly than they do.

It was born less than twenty-four hours before the two larger crows, yet its eyes were open on July 5th, while theirs were still half closed on July 12th. As the koel grew older the terminal bars on the tips of his wing and tail feathers grew fainter and, by the 18th July, they had completely disappeared; by this date the koel looked ready to leave the nest while the crows were still in a very backward state. On July 20th the young koel was still in the nest. I then left Lahore for nine days. On my return on the 30th, the young koel was sitting on the tree outside the nest and looking very little different from the adult male koel, the two elder crows were sitting near the nest and the smallest crow was still inside it.

When there are only koels in a nest they soon fly away when once they are able to leave the nest. In cases, however, where there are crow nestlings as well, the koel hangs about the nest tree to be fed by the foster parents until the young crows are ready for flight; then they all depart together.

NEST NUMBER I.

On June 13th this nest contained one crow's egg. By the 15th a second had been added. On the 16th the nest contained three eggs. In this nest I now put a large fowl's egg, for I was anxious to prove what I have for so long contended, that the theory that cuckoo's eggs are "mimic," those of the host is not tenable. I had previously in England put sparrows' eggs in swallow's nest, and a robin's egg in a blackbird's nest. This time I was determined to put my belief to a very severe test. I chose the most intelligent of the birds and put in its nest a white egg at least three times the size of its own blue eggs splotched with brown. Within ten minutes of the deposition of the fowl's egg the crow was sitting upon it in the most matter-of-fact manner. I may mention that I had previously put a fowl's egg in a nearly completed crow's nest, wondering whether the presence of this egg would fire the hen to lay in the nest without bothering to give this latter the finishing touches. The crows ate up that egg. Evidently the incubating instinct at that stage of the proceedings was not sufficiently strong to overcome the ordinary intelligence of the bird. On the 17th I returned to the nest and found not only my fowl's egg safe and warm, but an additional crow's egg. There were now five eggs in the nest—four legitimate ones and the fowl's egg. On the 18th the nest contained a fifth crow's egg and the fowl's egg was still in the nest. On the 19th all six eggs were in the nest. The crow must have had difficulty in covering them all. I then learned from the *Khansamah* who had furnished me with the fowl's egg that this was a fresh one from his village, so I determined to leave it in the nest for twenty-one days and see whether a young chicken would appear.

On the morning of June 18th the six eggs were all intact and it was evident that the fowl's egg was incubating.

On the evening of July 2nd I inspected the contents of the nest and found that the crow's eggs of the 16th and 15th June had yielded young ones. The other three crow's eggs were still in the nest. The egg of the 13th had

been damaged by me some days previously, so that I was not surprised that it had not hatched out. On July 4th I found that the crow's egg of the 17th had hatched out; and on the 5th the egg of the 18th yielded a young bird, so that there were now in the nest four crow's nestlings, the addled crow's egg of the 13th and the chick's egg.

On July 6th the movements of the young chicken inside the fowl's egg were apparent, and as the full twenty-one days would be completed on the morning of July 7th I went to the tree on that day wondering whether I should see a young chick in the nest. But I found the fowl's egg lying broken on the ground with a fully formed young chick inside, the ants had just discovered it but had not yet damaged it. The branches that we now always arranged had been disturbed; it was thus evident that some one had swarmed the tree. Two of the young crows had been taken away, so that the nest now contained two young crows and the addled crow's egg. I was naturally indignant at this prank, which had followed so closely on the removal of the young crow from nest number II. A small boy, whom I had appointed to watch, informed me that this time the culprits were the sons of the *dhobi* and the sweeper of the Principal of the College. These had each four rupees deducted from their pay as a punishment in order to teach them not to molest me in future. I took the young chick which was fully formed and have it preserved in spirit and shall be glad to present it to the Bombay Natural History Society as a curiosity if the Society cares to have it. There may even yet be an economic future for the Indian crow as an incubator.

On July 9th I took a young paddy bird (*Ardeola grayii*), three days old, out of a nest and put into this nest (No. I) which now contained only one young crow; the parents may have thrown the addled egg out of the nest, but I do not know what happened with the second crow. When I visited the nest the next day there were no signs of the young paddy bird although the young crow was still in the nest. The crows had evidently, somewhat to my surprise, "spotted" that the young paddy bird was a stranger and done it to death. I had expected that they would feed it, since the parental instinct was so strong.

I may here add that I put a golf ball in a crow's nest containing two eggs and the next day found the crow sitting on the ball! But when I replaced the two crow's eggs in another nest by two golf balls the crows deserted.

On August 7th I placed a fresh fowl's egg in the nest of a crow containing two crow's eggs, subsequently three more crow's eggs were laid and the crow sat upon all six. After the young crows had emerged, the crow still continued to brood the fowl's egg. I was away from Lahore on August 28th, but my climber went up the tree and found that the fowl's egg had just hatched out; the young bird was moving about in the nest. Contrary to my orders he left it there. A few minutes later the crows began cawing very loudly and excitedly; he again ascended the nest to secure the young chicken; when he

got up he found that this was in a dying state ; it had been savagely pecked by the scandalised crows. He removed it, and it shortly afterwards died in his hand. He preserved it in spirit.

Since making the above observations I have been reading Leverkühn's *Fremde Eier in Nest*, and I find that some German observers have performed similar experiments with various species of crows. The results of their observations may be of interest.

In 1788 Köhne replaced four crow's eggs by four of the smallest fowl's eggs he could find, which he coloured to make them resemble crow's eggs. He saw the crow sitting daily. On the 22nd day he noticed that she was sitting on the outermost branch of the tree and regarding the nest apparently with astonishment. Then Köhne noticed a young white chicken (a cock) running about under the tree, the other three chickens were in the nest. Köhne repeated the experiment next year with similar results.

Brehm placed a pebble stone in a crow's nest which she sat upon along with her egg.

Mathes placed fowl's eggs in a crow's nest and states that when the first chicken appeared and began to cheep, the crow fled in terror and did not again return to the nest.

Shramm substituted three fowl's eggs for five eggs of *Corvus cornix*, the crow promptly ate them up. He then coloured his fowl's eggs to resemble crow's ; the crow hatched these out, but devoured the chickens immediately upon their appearance. He performed a similar experiment with magpies ; but they reared up the young chickens.

Leverkühn relates several instances of owls and birds of prey hatching out fowl's eggs and rearing up the chickens. According to him a kite in the Zoo at Zittan laid forty-one eggs between 1851 and 1868, for these sixty-nine fowl's eggs were substituted, and of these fifty-three were hatched out and the young successfully reared.

NEST NUMBER IX.

On the 19th June my climber discovered this nest, it then contained one crow's egg and one koel's. On the 20th a second crow's egg was added, on the 21st a third, and a fourth on the 22nd, so that the nest now contained one koel's egg and four crow's eggs. No change took place in the contents of the nest until the 28th, when the young koel hatched out. On the 29th a crow hatched out, and to my astonishment a second crow emerged on 30th, *i.e.*, ten days after the egg was laid. By July 18th the third crow had hatched out and the fourth by July 2nd, so that these eggs appear to have incubated in ten days instead of fifteen or sixteen, the usual time. Either the crow laid special patent fast-hatching eggs or someone must have been playing the fool with the nest by putting in it day by day eggs from another nest four or five days after they were laid. I do not know whether the period of incubation can be materially shortened by very close sitting. Thus on July 2nd the nest contained a young koel and four young crows. On July 5th I visited the nest

and found in it the koel and two crows, one young crow was found lying dead on the road, and there was no trace of the other. I think that the aforesaid sweeper's son can, if he should choose to do so, explain what became of the crow. I am quite certain that the koel was in no way responsible for the disappearance of the one bird or the ejection of the other.

On July 8th the nest still contained the koel and two crows. I take the following extract from my diary of that date :—"The crows are much more vociferous than the young koel, which is very quiet and appears to be exceedingly timid. It is, however, much more advanced than the crows, its feathers being a long way out of their sheaths, while all the feathers of the crows still have the form of tiny bristles." On July 9th it was apparent that the koel was a hen, as her plumage was largely barred with white.

On inspecting the nest on July 18th, we found that the koel had left the nest while the crows were of course still in it. The koel was sitting on a branch within a yard of the nest.

On the 20th, when my *chaprassi* swarmed the tree, the young koel took fright and flew to the next tree, where it got caught in by its wings between two branches, but managed eventually to right itself. Meanwhile the parent crows swore lustily at my climber and tried to attack him.

When I returned from the Hills on July 30th the young koel was still sitting in the tree, and both the young crows had left the nest and were in the tree. When the young koel caught sight of us she flew quite strongly to a neighbouring tree. The fact that the young crows were unable to fly, kept the koel in the neighbourhood of the nest.

NEST NUMBER III.

This contained one crow's egg on the 14th June, and an additional egg was added daily until the 18th, but on that day instead of there being five eggs there were only four, the one laid on the 16th having disappeared between the morning of the 17th and the morning of the 18th. This disappearance of a crow's egg in nests in which there was no koel's egg happened several times, and I do not believe that in most cases they were removed by human agency. Either the egg may cling to the feathers of the sitting bird and thus be taken out of the nest, or there may be a scuffle with a koel in the nest, which causes an egg to fall out, or a tree-pie or some other creature may have caught the crow napping and breakfasted off one of the eggs. I may here say that, thanks to the ants, all traces of a fallen egg are removed from the ground within half a day of its fall.

On June 28th I found a nest containing a young koel and a crow's egg, and, as the nest was some way from my bungalow, I took out the young koel and put it in nest number III, which now contained only three eggs, that which I had found in it on the 14th having disappeared. The crows did not appear to resent the sudden arrival of the young stranger, for it was all right the next day and being well fed. On July 1st the young koel was going strong and the crow's eggs were still in the nest. I did not inspect on the 2nd July

and on the 3rd one of the crow's eggs had hatched out, one of the others was broken and in it a dead crow fully formed. This we removed. On July 4th there was no change in the contents of the nest, the young koel being now in what I may perhaps call the porcupine stage. On the 5th and 6th there was still no change in the contents of the nest; the white tips of the koel's feathers were now showing. On arriving at the tree on the 7th it was at once obvious that some one had been up it. This person had removed the crow nestling and the egg, so that the nest now contained the koel alone. On July 9th it became apparent that the young koel was a hen. On July 16th she had left the nest and was sitting on the tree. We saw no more of her after that.

NEST NUMBER VII.

This contained on June 15th one crow's egg. On the 18th it contained two, three on 20th, and four on 22nd. But on the 24th the egg laid on the 18th had disappeared, so that the nest now contained only three crow's eggs.

On July 3rd the egg of the 15th hatched out. On that day I put into the nest two young koels, two and three days old, taken from another distant nest containing two young koels and one crow. We had had this nest under observation for a couple of days and when we first came upon it the crow's egg was still unhatched. As the nest was too far off to enable me to inspect it daily, I removed the two young koels to nest number VII, so that it now contained two koels, one crow, and two crow's eggs.

On July 5th the egg of the 20th yielded its chick and the egg of the 22nd did likewise on July 6th, so that the nest contained two koels and three crows. There was no alteration on the 7th, but when we visited the nest on the 8th the two smaller crows had completely disappeared, and as the arrangement of branches which we left appeared to be undisturbed, it is most unlikely that any person had removed those young birds. I am not able to explain their disappearance. On July 9th the nest still contained one crow and two koels; the first was the biggest of the three, but not so far developed as the larger koel. He and the younger koel were very clamorous. When lowered, the young koel raised itself, flapped its fore limbs, opened its mouth, and squeaked. By the 16th the crow was far bigger than either his two foster brothers, but not nearly so far advanced. Both the koels were considerably barred, the bars of one being white and those of the other rufous.

The bird with the white bars had several of these in each of her tail feathers while the tail feathers of the other bird were only tipped with rufous, hence I was of opinion that the latter was a cock. But of this I am now not so sure, for when I returned from the Hills on July 30th, both of the koels had left the nest and flew away when the *chaprassi* ascended the tree. He declares that they were both hens. Unfortunately I did not obtain a sufficiently good view of them to express an opinion on this point.

I shall return to this matter later. On the 30th the young crow was still in the nest, but as the climber ascended the tree it fluttered out and dropped, but managed to catch hold of a branch in its descent and thus save itself. During

my absence from Lahore there had been a most violent dust-storm which blew down half the tree in which this nest was situated.

NEST NUMBER XI.

On June 23rd I discovered this nest in a low tree. The nest was very difficult to get at, as it was built on a slender branch. It contained five eggs, all crows. On the 25th we noticed that one of these had disappeared. On the 28th I placed in the nest a koel's egg, which I took from a distant nest. On July 3rd one crow had hatched out. On the 5th we found that the koel had emerged, on the 6th another crow, and on the 7th all four crows had hatched out, so that the nest now contained four crow nestlings and one young koel. On July 20th all five birds were in the nest. But when I returned from the Hills on July 30th the nest contained only the koel and one crow. The others were almost certainly flung out of the nest during the severe storm which I mentioned when speaking of nest number VII. This nest (number XI) was attached to very slender branches and must have been subjected to violent oscillations during the severe storm.

NEST NUMBER XII.

On June 23rd this contained one crow's egg, a second had been added by the 25th, and a third by the 27th. On the 28th I placed a koel's egg in the nest.

On July 6th the young koel emerged. None of the crow's eggs had yet hatched out. On July 9th I noticed that one of the crow's eggs had got spoiled, it had in it a hole nearly large enough to enable me to insert the blunt end of my pencil. The young koel, although nearly three days old, was so small that it could easily go inside a crow's egg. On July 10th the three crow's eggs were still in the nest, so that the parents had sat for some days upon an egg with a large hole in it. On this date I placed in the nest a paddy-bird's egg which was nearly incubated, as I wanted to see whether, if the youngster was hatched in the crow's nest, the crows would feed it.

On the 12th I found in the nest the paddy-bird's egg, the koel, and a newly hatched crow. The damaged egg and another egg had disappeared. No human being had been up the tree. The crows had probably noticed the hole in the egg and turned it out as well as another egg, for some reason best known to themselves. On July 13th the young paddy-bird could be heard cheeping inside the egg.

On July 14th the koel alone was in the nest, the young crow and the paddy-bird having completely disappeared. There were no signs of any one having climbed up the tree. The crows must, I think, have been disgusted at the appearance of the paddy-bird and turned both it and the young crow out in their wrath. It is, I think, unlikely that the young koel turned out these eggs and the young birds, for, as I have said, the koel nestling does not appear to mind the presence of others, and it was not until it had been hatched for eight days that the nest was finally emptied of everything but itself.

Having chronicled what took place in each of the twelve nests I had under observation, it is necessary for me to offer, in conclusion, a few general remarks on the facts which the enquiry has brought to light.

Firstly, as regards the plumage of the nestling. Its skin is invariably black and in each of the twelve koel nestlings, whose early life-history I followed, the earliest feathers to appear were not pure black but were tipped with white or a kind of reddish fawn colour. The nestlings that had the white tips to their feathers were undoubtedly females, for all their subsequent feathers were barred. But I am not at all sure whether the converse is true, *viz.*, that all birds whose earliest feathers are tipped with reddish fawn are cocks. In two cases the first wing and tail feathers to appear were alone thus tipped, so that before the young cuckoo left the nest it was almost as black as the adult. But many of the birds which had reddish tips to their feathers were subsequently barred to as great an extent as the undoubted females. Were these hens or very much barred cocks? I am inclined to take the latter view, since even in the two undoubted cocks one was more conspicuously barred than the other. If this is correct then the test of the sex of a nestling is not so much the extent of the barring of the feathers as the colour of the bars. There were three undoubted cocks among the birds on which I experimented, that is to say, three that were black almost all over when they left the nest and four undoubted hens, *i.e.*, that were very heavily barred with white when they left the nest. In addition to these there were two much barred birds with reddish bars; if these were hens, then of the nine young koels whose early history I followed no fewer than six, or two-thirds of the whole, were hens. If, however, these birds were cocks, then four of the nine were hens and five cocks. Again, as we have seen, one of the koels in nest VI had white bars and the other reddish ones. I have already given reasons for thinking that both eggs were laid by the same hen, and it seems unlikely that these should give rise to two females each differing markedly from the other in appearance.

The next point which these experiments bring out is the easiness of the path of the cuckoo. A nesting bird seems to cast intelligence to the winds. The crows sat upon a fowl's egg, upon a sea-green paddy-bird's egg, and on a golf ball, apparently without noticing that these differed in any way from their own eggs. Again, the addition or subtraction of an egg or two was not noticed. Further, when I introduced a young koel into a nest containing eggs only, the parent crows at once set to work to feed the young koel, as though they were quite accustomed to young birds, being thus introduced into the nest!

I consider it proven that the koel undoubtedly destroys or tries to destroy some of the crow's eggs it finds in the nest. My idea is that, given the opportunity, the koel will destroy all the crow's eggs. Unfortunately there was so much tampering with the nests that came under my observation that the evidence on this point, and indeed on most points, is not so conclusive as I could wish. However, I have no reason to think that nest number VI was tampered with by human beings, yet all the crow's eggs disappeared. Then there is the nest we found containing only two koel's eggs which were nearly incubated. Lastly, there was the incident of the broken crow's egg on the ground under nest number X.

Equally clear is it, in my opinion, that the young koel does not eject either crow's eggs or his fellow-nestlings. In the case of nest number II three young crows and a koel were reared up and fledged, in nest number VI two young koels, and in nest number IX a koel and two crows. It is true that many eggs and young crows disappeared but in nearly every case this disappearance can be otherwise accounted for. I think that I have said sufficient regarding the young koel's lack of that peculiar irritability which characterises the common cuckoo.

It is possible that the young koel may sometimes turn a crow nestling out of the nest, but this is, I believe, always the result of accident. At the best a crow's nest is an unsafe nursery.

Then there can be little doubt that the incubatory period of the koel's egg is slightly shorter than that of the crow ; as I have already said, in every nest that I have examined the young koel has always been the first bird to hatch out, and in some cases the koel's egg had been laid after some of the crow's eggs that were being incubated along with it.

Some ornithologists declare that the adult koels keep an eye upon their young while these are in the nest and feed them as soon as they leave it. I saw no signs of this, although I watched for it. I do not think that this feeding takes place as a general rule ; as, if it did, the koel, which leaves the nest so much earlier than the crows, would not wait about the nesting tree, as it does, until the crows are ready to fly.

In conclusion, I should like to mention two points regarding the nest and eggs of the crow.

The first of these is the varying rates of laying of different birds. Thus in nest number III the five eggs were laid within as many days, while in nest number VII the first egg was laid on June 15th, the second on the 18th, the third on the 20th, and the fourth on the 22nd. That is to say, four eggs were laid in eight days.

Then I noticed that there is a great deal of variation displayed in eggs of the same clutch, not only in marking but in colour, shape and size. In one clutch of four eggs each differed so greatly from the others that, unless I had myself taken all the four eggs out of the same nest, I should have not believed that one bird could have laid them.

Lastly, the crows about Lahore seem to be very catholic in their choice of materials with which to line the nest. The lining most commonly seen consists of a mixture of horsehair, dried grass and soft bast-like substance. One bird used pine needles, another hard twigs, and a third soft grass only. *Khas* (pulled out of some *tattie*) is a very favourite lining. A few nests were lined with feathers, chiefly those of green parrots and " blue jays."

One bird lined its nest with a mixture of feathers, dried leaves and bits of blue silk thread. Another nest was lined with hairs that once graced the tail of a roan horse.

# BIRDS OF THE KHASIA HILLS.

BY

E. C. STUART BAKER, F.Z.S., M.B.O.U.

## PART I.

The Khasia Hills, considering their extent and elevation, contain a great variety of country and should therefore contain also a corresponding proportion of birds; but, as a matter of fact, the Khasias are such universal slaughterers of all life that birds are not as numerous as one would expect.

All round the foot of the Hills, both towards Gauhatty and the Surma Valley, the dense, tropical woods contain much bird life, but this is not of great interest, as the fauna is much the same as that found elsewhere in the surrounding districts.

Towards Shillong one passes through immense stretches of grass land at an elevation of 3,500 to 5,000 feet and, about five miles from Shillong itself, one enters the pine forests. To the extreme east of the district there is yet another phase of country, rolling grass-covered hills covered with scattered oak forests, the same in fact as that to the east of the Kopili in the North Cachar Hills, but proportionately even less broken up.

Towards Cherrapoonji and its vicinity are many huge cliffs which afford breeding places to several interesting birds, principal amongst which is the local Swift, *Cypselus acuticauda*, and the fine striped Swallow, *Hirundo striolata*. *H. daurica* also breeds here, but this is much more of a domestic form than *striolata*, and haunts the villages, breeding in the Khasias' houses.

The local and most interesting birds are the Long-tailed Wren, *Urocichla longicaudata*, found in all suitable bush-covered ravines at sufficiently high elevation, and the local form of Laughing-Thrush, *Dryonastes subcœrulatus*. This bird, I regret to say, seems to be far more rare than it was 23 years ago when I first visited the Khasia Hills.

At that time although the bird was very rare, one could always get a certain number of specimens. This year, though I have had men specially deputed to hunt for the Babbler, it is with the greatest difficulty I have managed to get any.

A curious feature of the bird life here is that, though divided from the Himalayas by the Brahmapootra, several true Himalayan forms

are here plentiful which are found nowhere else in the Assam Hills south of this river. Thus in North Cachar, which is nothing but a continuation of the same hills as these, *Mesia argentauris* is extremely common, and *Liothrix lutea*, only a straggler in the Khasia Hills, exactly the reverse. Again we have *Tribura* breeding plentifully in the Khasia Hills, but quite rare in North Cachar Hills.

Thus on the whole the latter hills are far more Indo-Burmese in their avifauna, whereas the Khasia Hills are truly Himalayan. The list which follows, is admittedly a rough one and will, I trust, be very much enlarged before long. It is compiled from the collections made by Hume, Godwin-Austen and others, and small collections made by my men in 1886, 1887, 1889, 1894, 1895, 1896, and again in 1905, 1906.

ORDER PASSERES.

Family CORVIDÆ.

Subfamily CORVINÆ.

4a. CORVUS MACRORHYNCHUS.—The Jungle-Crow.

Common at Shillong and near villages.

7. CORVUS SPLENDENS.—The Indian House-Crow.

A straggler near the plains, but has not as yet ascended to Shillong or any way up the hills.

14. CISSA CHINENSIS.—The Green Magpie.

Common in the south and again in the Jowai Sub-division.

16. DENDROCITTA RUFA.—The Indian Tree-pie.

Common below 2,000 feet.

18. DENDROCITTA HIMALAYENSIS.—The Himalayan Tree-pie.

Common above 2,000 feet, at which height both forms are found in about equal numbers.

19. DENDROCITTA FRONTALIS.—The Black-browed Tree-pie.

A rare straggler only, although so common in the adjoining hills of North Cachar.

26. GARRULUS BISPECULARIS.—The Himalayan Jay.

Recorded from these Hills. I have received a single specimen with egg from Lyetkensaw, 5,500 feet elevation.

Subfamily PARINÆ.

31. PARUS ATRICEPS.—The Indian Grey Tit.

Common.

34. PARUS MONTICOLA.—The Green-backed Tit.

Very common everywhere, entering gardens in great numbers during the cold weather and haunting the pines.

36. ÆGITHALISCUS MANIPURENSIS.—Hume's Red-headed Tit.

Common and very confiding, seems to go in flocks, as I saw nearly a dozen together in my garden, hunting restlessly for insects in the pines. Disappears from Shillong in the breeding season.

41. MACHLOLOPHUS SPILONOTUS.—The Black-spotted Yellow Tit.

On the higher ranges only above 4,000 feet where it is very common. It breeds very early about Shillong and I procured full fledged young ones early in April. Here it always places its nest in holes in rocky banks, or in stone walls.

Subfamily PARADOXORNITHINÆ.

51. PARADOXORNIS FLAVIROSTRIS.—The Yellow-billed Crow-Tit.

Rare and very local, haunts reed-beds and ekra bordering streams, also bamboo jungle and occasionally long grass.

52. PARADOXORNIS GUTTATICOLLIS.—Austen's Crow-Tit.

Rare; replacing the previous bird at the higher levels. This form is far less given to frequenting grass and bamboo jungle, and I have found it in thin forest and bush jungle. It breeds principally in bamboo jungle.

56. SUTHORA POLIOTIS.—The Ashy-breasted Crow-Tit.

Obtained at Cherrapoonji.

59. SUTHORA ATRISUPERCILIARIS.—The Black-browed Crow-Tit.

I found this bird not uncommon on the higher reaches of the Kopili river. All Crow Tits go in fairly large flocks and are far more like the smaller *Crateropodidæ* than the Titmice in their habits, and will eventually be moved to that family.

60. SCÆORHYNCHUS BAKERI.—Baker's Red-headed Crow-Tit.

Series of this bird obtained in North Cachar have been shown by Hartert to be different to the western forms and have accordingly been named by him as above. The two forms extend throughout North Cachar, Manipur, Khasia and Naga Hills as far as the extreme east of Assam.

61. SCORHYNCHUS GULARIS.—The Hoary-headed Crow-Tit.

Family CRATEROPODIDÆ.

Subfamily CRATEROPODINÆ.

62. DRYONASTES RUFICOLLIS.—The Rufous-necked Laughing-Thrush.

Very common, but chiefly so at low elevations.

66. DRYONASTES SUBCÆRULATUS.—The Shillong Laughing-Thrush.

Not common, one of the very few birds hitherto only obtained in the Khasia Hills. It is curious to note that birds of this form which I procured in North Cachar seemed more true *cærulatus* than *subcærulatus*.

69. GARRULAX LEUCOLOPHUS.—The Himalayan White-crested Laughing-Thrush.

Common.

72. GARRULAX PECTORALIS.—The Black-gorgeted Laughing-Thrush.

Rare, and seems to keep to the higher ranges, whereas the next bird descends right into the plains.

73. GARRULAX MONILIGER.—The Necklaced Laughing-Thrush.
Very common.

74. GARRULAX GULARIS.—McClelland's Laughing-Thrush.
I obtained this bird on the Kopili River. Rare.

80. IANTHOCINCLA RUFIGULARIS.—The Rufous-chinned Laughing-Thrush.
Recorded by Blanford from the Khasia Hills.

81. IANTHOCINCLA AUSTENI.—The Cachar Laughing-Thrush.
Obtained by Godwin-Austen in the Khasia Hills.

84. TROCHALOPTERUM CHRYSOPTERUM.—The Eastern Yellow-winged Laughing-Thrush.
Another local bird not as yet obtained outside the Khasia and adjoining North Cachar Hills. It is fairly common in some parts and I have seen specimens from a large number of localities.

87. TROCHALOPTERUM PHŒNICEUM.—The Crimson-winged Laughing-Thrush.
Common.

92. TROCHALOPTERUM SQUAMATUM.—The Blue-winged Laughing-Thrush.
Very rare. I have seen specimens near Shillong and others again from Cherrapoonji.

102. GRAMMATOPTILA AUSTENI.—Austen's Striated Laughing-Thrush.
A straggler only.

103. STACTOCICHLA MERULINA.—The Spotted-breasted Laughing-Thrush.
Rather rare. A specimen was procured by one of my collectors in 1892. I have seen no others until this year when I obtained two females on their nests.

104. ARGYA EARLII.—The Striated Babbler.
Common.

109. ARGYA LONGIROSTRIS.—The Small Rufous Babbler.
Rare and an inveterate skulker.

110. CRATEROPUS CANORUS.—The Jungle Babbler.
Not rare near Gauhati.

116. POMATORHINUS SCHISTICEPS.—The Slaty-headed Scimitar Babbler.
This is the common form of Scimitar Babbler on these hills.

124. POMATORHINUS PHAYRII.—Phayre's Scimitar Babbler.
Common in many parts, more especially towards the east and south-east. It is numerous about Shillong.

125. POMATORHINUS RUFICOLLIS.—The Rufous-necked Scimitar Babbler.
Rather rare.

129. POMATORHINUS ERYTHROGENYS.—The Rusty-cheeked Scimitar Babbler.
Recorded hence, but I have seen no specimens.

130. POMATORHINUS MACCLELLANDI.—McClelland's Scimitar Babbler.
The commonest form near Shillong.

131 POMATORHINUS HYPOLEUCUS. The Arrakan Scimitar Babbler.
Common near the plains of Sylhet and Cachar, not ascending the Hills to any height. Has a very deep and sonorous hoot.

Subfamily TIMELINÆ.

134. TIMELIA PILEATA.—The Red-capped Babbler.

Common near the plains and ascends the grass covered plateaus up to nearly 6,000 feet.

137. GAMSORHYNCHUS RUFULUS.—The White-headed Shrike Babbler.

Not yet recorded hence, but must occur, as it is exceedingly common across the Kopili river, in the adjoining hills of North Cachar.

139. PYCTORHIS SINENSIS.—The Yellow-eyed Babbler.

Common in suitable localities. It keeps much to grass plains and bamboos, breeding in the former.

142. PELLORNEUM MANDELLII.—Mandelli's Spotted Babbler.

Common wherever there is bamboo jungle, but it also frequents scrub jungle and forest land as well.

143. PELLORNEUM MINUS.—Sharpe's Spotted Babbler.

I was surprised to find very typical specimens of this Babbler at Cherrapoonji where I procured several specimens on their nests. The same bird is also found at Shillong.

147. PELLORNEUM FUSCICAPILLUM.—The Brown-capped Babbler.

Rare; found in grass lands near water or swamps; a great skulker and very shy.

151. DRYMOCATAPHUS TICKELLI.—Tickell's Babbler.

Hume obtained specimens both of this and the next bird in these Hills.

152. DRYMOCATAPHUS ASSAMENSIS.—Austen's Babbler.

This is the common form to the east of Assam, but in North Cachar I only obtained *tickelli*.

154. CORYTHOCICHLA STRIATA.—The Streaked Babbler.

Found near the plains, a rare bird and very retiring.

160. TURDINUS ABBOTTI.—Abbott's Babbler.

Common near Sylhet, in the ravines which run through the broken land at the foot of the Hills. Though a skulker is not shy.

163. ALCIPPE NEPALENSIS.—The Nepal Babbler.

Common, going about in large parties and fluttering about more like fly-catchers than babblers.

165. ALCIPPE PHAYRII.—The Burmese Babbler.

Nearly as common as the last, but is found in smaller parties.

169. STACHYRHIS NIGRICEPS.—The Black-throated Babbler.

Common. Occurs as high as Shillong where I have taken its nest.

170. STACHYRHIS CHRYSÆA.—The Golden-headed Babbler.

Fairly common, above some 3,000 feet. Is found in rather large parties.

173. STACHYRHIDOPSIS RUFIFRONS.—Hume's Babbler.

Quite common—Blanford's statement to the contrary notwithstanding.

175. MIXORNIS RUBRICAPILLUS.—The Yellow-breasted Babbler.

Rare, in most places, but common to the extreme east where there are suitable bamboo jungles.

179. SCHŒNIPARUS MANDELLII.—Mandelli's Tit-Babbler.

Rare, except to the extreme west. I have taken its nest and eggs in Shillong.

181. SITTIPARUS CINEREUS.—The Dusky-green Tit-Babbler.

Rare. I saw a flock of these small babblers frequenting some scrub jungle, amongst pine forests, overhanging the Sweet Falls at Shillong.

182. SITTIPARUS CASTANEICEPS.—The Chestnut-headed Tit-Babbler.

Not very uncommon at Cherrapoonji.

Subfamily BRACHYPTERYGINÆ

For the sake of convenience I am retaining Oates' classification, but there is no doubt that the majority of the birds in this subfamily belong elsewhere, and I merely note against each, in brackets, the position the bird should really take, in my opinion.

187. MYIOPHONEUS TEMMINCKI.—The Himalayan Whistling Thrush.

Common about all streams and is found in Shillong itself. (TURDIDÆ.)

191. LARVIVORA BRUNNEA.—The Indian Blue Chat.

Very rare. (TURDIDÆ.)

198. DRYMOCHARES NEPALENSIS.—The Nepal Short-wing.

Common in some parts. (TURDIDÆ.)

201. TESIA CYANIVENTRIS.—The Slaty-bellied Short-wing.

Widely distributed but common nowhere. This tiny bird is more like a mouse than a bird in its actions, running up and down branches, twigs, etc., and only taking to flight when very closely pressed. Has a loud shrill note uttered at intervals of a minute or two. Haunts wet ravines in preference to drier jungle, and feeds much on small spiders.

202. OLIGURA CASTANEICORONATA.—The Chestnut-headed Short-wing.

Very rare.

Subfamily SIBIINÆ.

205. LIOPTILA GRACILIS.—The Grey Sibia.

A rare bird and very locally distributed. Keeps principally to tall tree forests.

208. LIOPTILA ANNECTENS.—Blyth's Sibia.

Rare, found only at above 4,000 feet.

211. ACTINODURA EGERTONI.—The Rufous Bar-wing.

Same as the last bird.

216. STAPHIDIA CASTANEICEPS.—The Chestnut-headed Staphidia.

Common where found. A very active little bird. Has a curious habit of soaring twenty or thirty feet into the air and then sinking down with outstretched wings to the lower bushes.

219. SIVA STRIGULA.—The Stripe-throated Siva.

A western form only occurring here as a straggler.

221. SIVA CYANUROPTERA.—The Blue-winged Siva.

Common, but doubtfully resident. This bird is found in large numbers in these and the adjoining Hills as late as May, but after that it becomes scarce, and few, if any, remain to breed under 6,000 feet.

225. YUHINA NIGRIMENTUM.—The Black-chinned Yuhina.

Rare.

226. ZOSTEROPS PALPEBROSA.—The Indian White-eye.

Common in parts. Is sometimes seen in gardens in Shillong.

231. IXULUS OCCIPITALIS.—The Chestnut-headed Ixulus.

Common at high elevations in broken forests.

232. IXULUS FLAVICOLLIS.—The yellow-naped Ixulus.

More rare than the last, but found in similar country.

234. HERPORNIS XANTHOLEUCA.—The White-bellied Herpornis.

Scattered in small numbers widely over the district.

Subfamily LIOTHRICHINÆ.

235. LIOTHRIX LUTEA.—The Red-billed Liothrix.

Not uncommon about Shillong and the higher hills where I have taken its nest frequently.

237. PTERUTHIUS ERYTHROPTERUS.—The Red-winged Shrike-Tit.

Very rare. This bird was comparatively common in North Cachar and it may be more common than supposed in suitable country. It is, however, a conspicuous bird unlikely to escape notice.

239. PTERUTHIUS MELANOTIS.—The Chestnut-throated Shrike-Tit.

Equally rare.

243. ÆGITHINA TIPHIA.—The common Iora.

Common below 2,000 feet.

247. CHLOROPSIS AURIFRONS.—The Gold-fronted Chloropsis.

Very common. Very easily tamed and a beautiful songster. In captivity feeds principally on fruit, but is also an insect eater and takes grasshoppers greedily.

249. CHLOROPSIS HARDWICKII.—The Orange-bellied Chloropsis.

Very common and like the last often kept as a cage bird by Khasias.

250. CHLOROPSIS CHLOROCEPHALA.—The Burmese Chloropsis.

Not common, but I have seen a fair number obtained by Mr. H. A. Hole at the foot of the Hills near Sylhet.

254. IRENA PUELLA.—The Fairy Blue-bird.

Fairly numerous in suitable localities in heavy tree forest, generally at low elevations.

255. MELANOCHLORA SULTANEA.—The Sultan-bird.

(This bird really belongs to the subfamily PARINÆ.) Common towards North Cachar. I have taken nearly full fledged young in early April.

261. PSAROGLOSSA SPILOPTERA.—The Spotted-wing.

(This species is a true Myna and should be included in the EULABETIDÆ.) Common. I do not think this starling breeds here, but it may do so in the higher Hills to the east.

Subfamily BRACHYPODINÆ.

263. CRINIGER FLAVEOLUS.—The White-throated Búlbul.

Very common in tree and scrub jungle below 2,000 feet, uncommon above that. A conspicuous, noisy bird, keeping much to strict jungle and low forest.

269. HYPSIPETES PSAROIDES.—The Himalayan Black Bulbul.
Common.

272. HEMIXUS FLAVALA.—The Brown-eared Bulbul.
Found on well wooded ranges at the higher elevations only.

275. HEMIXUS MACCLELLANDII.—The Rufous-bellied Bulbul.
On the higher ranges only where it is not uncommon.

277. ALCURUS STRIATUS.—The Striated Green Bulbul.
First recorded by Hume from these Hills.

279. MOLPASTES BURMANICUS.—The Burmese Red-vented Bulbul.
A straggler only. Many birds are however intermediate between this and the next.

282. MOLPASTES BENGALENSIS.—The Bengal Red-vented Bulbul.
Very common.

287. XANTHIXUS FLAVESCENS.—Blyth's Bulbul.
Rare, but widely scattered.

288. OTOCOMPSA EMERIA.—The Bengal Red-whiskered Bulbul.
Common near the plains, rare higher up.

290. OTOCOMPSA FLAVIVENTRIS.—The Black-crested Yellow Bulbul.
Common in parts, especially where there is forest with plentiful undergrowth.

292. SPIZIXUS CANIFRONS.—The Finch-billed Bulbul.
Peculiar to these and the adjoining Hills of Cachar and Manipur. A rare bird throughout its range and, as far as I know, seldom working much below 5,000 feet. I have taken its nest some half dozen times near Shillong.

295. IOLE VIRESCENS.—The Olive Bulbul.
Rare, haunting well wooded ravines, at low elevations. Mr. H. A. Hole procured this bird several times at Jellalpur just at the foot of the Hills.

310. MICROPUS MELANOCEPHALUS.—The Black-headed Bulbul.
This and the next bird, probably one and the same species, are not uncommon in the cold weather at the foot of the Hills near Sylhet.

311. MICROPUS CINEREIVENTRIS.—The Grey-bellied Bulbul.
Associates with the last. Both species haunt lofty trees in forest country, descending to scrub jungle in the breeding season. They have a very melodious whistle.

## Family SITTIDÆ.

316. SITTA CINNAMOMEIVENTRIS.—The Cinnamon-bellied Nuthatch.
Procured by Godwin-Austen.

324. SITTA FORMOSA.—The Beautiful Nuthatch.
Recorded hence by Blanford. In North Cachar, where it was extremely rare, I only found it on the highest peaks, but its eggs were brought to me here, taken at 5,000 feet.

325. SITTA FRONTALIS.—The Velvet-fronted Nuthatch.
Fairly common. I have seen no Nuthatches in the pine forests which are singularly destitute of all bird life.

Family DICRURIDÆ.

326. DICRURUS ANNECTENS.—The Crow-billed Drongo.

A straggler only.

327. DICRURUS ATER.—The Black Drongo.

Common.

329. DICRURUS NIGRESCENS.—The Tenasserim Ashy Drongo.

The gray Drongo of these Hills is *nigrescens*, not *cinereus* as recorded by Oates. It is fairly common and is found both at the highest elevation and down in the plains.

334. CHAPTIA ÆNEA.—The Bronzed Drongo.

Common up to 2,000 feet.

335. CHIBIA HOTTENTOTTA.—The Hair-crested Drongo.

Common in parts. Wherever there are Cotton trees (*Bombax*) Drongos of all sorts congregate and on the lower portions of the Gauhatty-Shillong road, where these trees are numerous, I have seen all seven species in a morning drive.

339. BHRINGA REMIFER.—The Lesser Racket-tailed Drongo.

Common.

340. DISSEMURUS PARADISEUS.—The Larger Racket-tailed Drongo, or Bhimraj.

Common.

Family CERTHIIDÆ.

344. CERTHIA DISCOLOR. The Sikhim Tree-Creeper.

The Tree-Creeper, which is to be found in the forests of the highest ranges, may be this or *manipurensis*. I saw a pair of Tree-Creepers in pine forest at Shillong, but though they were tame enough they kept high up in the trees and it was difficult to get a good sight at them. I *think* they were *discolor*.

354. UROCICHLA LONGICAUDATA.—The Long-tailed Wren.

Confined to the Khasia Hills. Nothing was known about this bird's habits or nidification. It has been found in Shillong and Cherrapoonji, and I had three of its nests with eggs brought to me this year.

356. PNŒPYGA SQUAMATA.—The Scaly-breasted Wren.

This and the next bird, which are extremely closely allied, are, curiously enough, both found in these Hills. Terrible little skulkers keeping much to ravines in evergreen forest at considerable elevations.

357. PNŒPYGA PUSILLA.—The Brown Wren.

Not rare.

Family SYLVIIDÆ.

360. LOCUSTELLA CERTHIOLA.—Pallas's Grasshopper-Warbler.

Procured at Cherrapoonji.

363. ACROCEPHALUS STENTOREUS.—The Indian Great Reed-Warbler.

In 1889 I purchased a specimen of this species which had been trapped in these Hills. *A. orientalis* is also sure to be found here.

371. TRIBURA THORACICA.—The Spotted Bush-Warbler.

A straggler from Sikhim.

372. TRIBURA LUTIVENTRIS.—The Brown Bush-Warbler.

A rare resident. I have had several nests brought to me this year. These agree exactly with others of this genus.

373. TRIBURA MANDELLII.—Mandelli's Bush-Warbler.

Taken in Shillong. I have procured two specimens both trapped on their nests.

374. ORTHOTOMUS SUTORIUS.—The Indian Tailor-bird.

Very common.

375. ORTHOTOMUS ATRIGULARIS.—The Black-necked Tailor-bird.

Specimens of Tailor-birds procured by my men at Lyetkynsew all proved to be of this species and it probably is not rare at the higher elevations.

379. CISTICOLA TYTLERI.—The Yellow-headed Fantail-Warbler.

Common in grass lands.

380. CISTICOLA VOLITANS.—The Golden-headed Fantail-Warbler.

A Malayan bird occurring on the Kopili River on both banks. Very local, but by no means rare in that one place.

381. CISTICOLA CURSITANS.—The Rufous Fantailed-Warbler.

Extremely common wherever the country is suitable. The nest is a favourite one for *Cuculus canorus* to deposit its eggs in. They look very ridiculous nearly filling up the tiny nest.

382. FRANKLINIA GRACILIS.—Franklin's Wren-Warbler.

Common.

383. FRANKLINIA RUFESCENS.—Beavan's Wren-Warbler.

Common.

389. MEGALURUS PALUSTRIS.—The Striated Marsh-Warbler.

Common near the plains, and breeds all round the foot of the Hills in the Assam Valley, but is rare in the Surmar.

393. ARUNDINAX AËDON.—The Thick-billed Warbler.

Common near Sylhet.

405. PHYLLOSCOPUS AFFINIS.—Tickell's Willow-Warbler.

Very common in Shillong gardens in winter, it is possible, that some stay to breed.

414. PHYLLOSCOPUS PULCHER.—The Orange-barred Willow-Warbler.

Has been found in these Hills.

415. PHYLLOSCOPUS PROREGULUS.—Pallas's Willow-Warbler.

A winter migrant.

417. PHYLLOSCOPUS SUPERCILIOSUS.—The Crowned-Willow-Warbler.

Very common, possibly resident.

419. PHYLLOSCOPUS MANDELLII.—Mendelli's Willow-Warbler.

Resident but rare. Undoubtedly many other *Phylloscopi* and allied Warblers occur in Shillong as migrants, but I can find no further records.

424. ACANTHOPNEUSTE MAGNIROSTRIS.—The Large-billed Willow-Warbler.

Recorded.

428. ACANTHOPNEUSTE OCCIPITALIS.—The Large Crowned Willow-Warbler.

Common. This little Warbler, which is a facsimile of the smaller billed *P. superciliosus*, swarms in the cold weather in every garden.

*A. viridanus*, *A. tenellipes* and others are also sure to occur.

431. CRYPTOLOPHA AFFINIS.—The Allied Flycatcher-Warbler.

Not common.

434. CRYPTOLOPHA XANTHOSCHISTA.—Hodgson's Grey-headed Fly catcher-Warbler.

Very numerous. This is quite one of the most common Warblers in the cold weather and unlike most birds seems to find something to eat amongst the pines which it frequents.

435. CRYPTOLOPHA JERDONI.—Brooks's Grey-headed Flycatcher-Warbler.

This bird has also been recorded from the Khasia Hills, but the specimens I have obtained have all been of the previous form. The two are very closely allied and, I think, may have been mistaken for one another.

436. CRYPTOLOPHA POLIOGENYS.—The grey-cheeked Flycatcher-Warbler.

Recorded by Oates from Cherrapoonji.

437. CRYPTOLOPHA CASTANEICEPS.—The Chestnut-headed Flycatcher-Warbler.

A male of this species was taken with the nest at Cherrapoonji this year.

438. CRYPTOLOPHA CANTATOR.—Tickell's Flycatcher-Warbler.

Oates has seen specimens taken in Shillong. I obtained both this and the last in North Cachar.

446. NEORNIS FLAVOLIVACEUS.—The Aberrent Warbler.

Recorded by Hume.

448. HORORNIS FORTIPES.—The Strong-footed Bush-Warbler.

Fairly common. Resident and breeds. Its nest is hard to find, but the owner calls attention to its situation by its loud call on entering and leaving it.

458. SUYA CRINIGERA.—The Brown Hill-Warbler.

Very common in suitable parts.

460. SUYA KHASIANA.—Austen's Hill-Warbler.

Extremely common in scrub jungle and grass lands.

*Prinia flaviventris*, *P. socialis* will certainly also be found in the Khasia Hills as they are common in North Cachar.

Family LANIIDÆ.

475. LANIUS NIGRICEPS.—The Black-headed Shrike.

Common and resident. Has a really beautiful song and is not sparing of it.

477. LANIUS EPHRONOTUS.—The Grey-backed Shrike.

Very common. Non-resident.

481. LANIUS CRISTATUS.—The Brown Shrike.

Common in winter. Breeds fairly frequently.

485. HEMIPUS CAPITALIS.—The Brown-backed Pied Shrike.

I have seen specimens this winter and taken fully fledged young.

486. TEPHRODORNIS PELVICUS.—The Nepal Wood-Shrike.

Very common in parts, especially near North Cachar.

490. PERICROCOTUS SPECIOSUS.—The Indian Scarlet Minivet.

This bird and the next one here more or less intermix; definite specimens of either may be obtained, but nearly all are intermediate.

491. PERICROCOTUS FRATERCULUS.—The Burmese Scarlet Minivet.

495. PERICROCOTUS BREVIROSTRIS.—The Short-billed Minivet.

Common near the plains and ascends as high as Shillong where I have seen it in my garden.

498. PERICROCOTUS SOLARIS. The Yellow-throated Minivet.

Common on the higher ranges and I have seen large flocks in Shillong itself.

499. PERICROCOTUS ROSEUS.—The Rosy Minivet.

Fairly numerous in suitable parts.

505. CAMPOPHAGA MELANOSCHISTA.—The Dark-grey Cuckoo-Shrike.

A pair of these birds frequented the compounds on Secretariat Hill in Shillong.

510. GRAUCALUS MACII.—The Large Cuckoo-Shrike.

Common in forest lands. I saw one in Government House compound where bird interests are keenly protected, but pine forests are not suited to it. If not seen, its vicinity is always made public by its loud harsh cries. It is usually found in small parties.

Subfamily ARTAMINÆ.

512. ARTAMUS FUSCUS.—The Ashy Swallow-Shrike.

Very common. Frequently occurs in Shillong itself.

Family ORIOLIDÆ.

514. ORIOLUS INDICUS.—The Black-naped Oriole.

A rare migrant.

515. ORIOLUS TENUIROSTRIS.—The Burmese Black-naped Oriole.

A rare resident.

521. ORIOLUS MELANOCEPHALUS.—The Indian Black-headed Oriole.

A common resident. I have heard its mellow whistle in the Government House compound, but failed to get a glimpse of it.

522. ORIOLUS TRAILLII.—The Maroon Oriole.

Resident, but nowhere common.

Family EULABETIDÆ.

524. EULABES INTERMEDIA.—The Indian Grackle.

Common at low elevations.

527. CALORNIS CHALYBEIUS.—The Glossy Calornis.

Common and resident, but I have never taken its nest.

Family STURNIDÆ.

538. STURNIA MALABARICA.—The Grey-headed Myna.

Common.

549. ACRIDOTHERES TRISTIS.—The Common Myna.

Common.

552. ÆTHIOPSAR FUSCUS.—The Jungle Myna.

Common near the plains. On the Gauhatty-Shillong road this myna may be found at every halting stage, where it feeds on the remains of cattle food and spilt rice and grain.

555. STURNOPASTOR CONTRA.—The Pied Myna.

Common near the plains.

(*To be continued.*)

# ON A NEW RACE OF SCIURUS LOKRIODES FROM BURMA.

BY

J. LEWIS BONHOTE, M.A.

(*From "The Annals and Magazine of Natural History," Vol.* 18, *No.* 107, *p.* 338.)

A small collection of mammals, recently brought home from Rangoon by Capt. A. Mears, contains four specimens of a squirrel closely allied to *S. lokriodes*, Hodgs., but so distinct as to be entitled to subspecific rank. I propose for it the name

*Sciurus lokriodes mearsi*, sub sp. n.

Similar in size and general characters to *S. lokriodes*, but much paler and greyer than examples from the typical locality. General colour above greyish [illegible], rather darker on the back and paler on the flanks, and especially over the thighs. Tail ringed with black and grey and with no black tip. Ears covered with short fulvous hairs. Underparts dull white, purest on the chin, duller on the body, on the inner side of either thigh is a patch of pale orange, and similar patches, though of a paler tint, are situated on the inner side of the arms and at the root of the tail, while in some specimens the yellowish tinge tends to cover the whole of the underparts between the limbs.

The *skull* shows no marked differences from that of *S. lokriodes* except in being slightly smaller, but in its general characters it closely resembles that of the typical race.

*Dimensions* (of type in flesh): —

Head and body 185 mm.; tail 172; hind foot 40; ear 19.

*Skull*: greatest length 46·5; length of palate from henselion 20; zygomatic breadth 27·5; greatest breadth of brain-case 20; length of nasals 15; length of molar series (alveoli) 10.

*Hab.*—L. Chindwin, Burma.

*Type.*—B. M. 6.7.5.10 (o ad.). Collected by Capt. Mears at Chinhyit, L. Chindwin, on 16th January, 1906.

The very much greyer general colouration of this race will enable it to be easily recognized.

# ON A NEW ENCHYTRÆID WORM (*HENLEA LEFROYI*, SP. N.) FROM INDIA—DESTRUCTIVE TO THE EGGS OF A LOCUST (*ACRIDIUM*, SP.).

By

FRANK E. BEDDARD, M.A., F.R.S., Prosector to the Society.

(*Received October* 5, 1905.)

(*Extract from the Proceedings of the Zoological Society of London*, 1905, *Vol. II, p.* 562.)

Dr. S. F. Harmer, F.R.S., of King's College, Cambridge, was so good as to forward to me recently a tube of small white worms for identification and study. These had been sent to him from India by Mr. H. Maxwell-Lefroy, Entomologist to the Government of India who discovered that they attacked and destroyed the eggs of a locust belonging to the genus *Acridium* when the ground in which those eggs were deposited is moist.

Dr. Harmer directed my attention to the fact that they were Oligochætous worms; they prove to be a species of the family Enchytræidæ, and were in a good state of preservation for microscopical examination. The family, as is well known, occurs in damp earth as well as in water; it is not so purely aquatic as are some of the families of the "Microdrili."

The species appears to be new, and presents a certain number of characters which in combination render its inclusion in any already defined genus difficult. I shall, however, describe its characters before proceeding to discuss its systematic position.

The species is small, 3-4 mm. in length and, as already mentioned, white. The *setæ* are curved and of the usual Enchytræid form; they are, however, rather few in number in each bundle, though present upon all the segments of the body, with the exception of the first and apparently the twelfth (in the mature worm with a clitellum). The lateral bundles possess *two* setæ, and the ventral bundles *three*; very occasionally I observed three setæ in a dorsal bundle. This arrangement extends from end to end of the body.

The *number of segments* in a large specimen is 27.

I could detect no *dorsal pores*.

The *clitellum* and other external characters call for no remark.

The *alimentary canal* shows certain characters which assist in the placing of the species. Peptonephridia are present and of very small length, though I am unable to give any details concerning them. The œsophagus appears to pass without any break into the intestine; I can find no demarcation between these two sections of the gut. Behind the clitellum the gut is of course much wider than it is in front of that region of the body. Furthermore, I can discover no cæca or pouches of any description appended to the gut: It is a simple tube without outgrowths. The septal glands of this species extend back as far as the sixth segment, in which the last pair occur; in front of this pair and in segments iv. and v. are equally prominent pairs of septal glands.

The *dorsal blood-vessel* is anteclitellian in origin and does not seem to be connected at its point of origin with any dorsal diverticulum of the gut such as exists in *Buchholtzia*. It arises in the eleventh segment. I could see no "heart body."

The exact origin of the dorsal vessel is rather difficult to locate exactly in this very minute Enchytræid. I fix the eleventh segment as the point of emergence from the intestinal plexus, since the vessel is very much broader here than in the dorsal region of the blood-plexus posteriorly* and stands out more from the walls of the gut. The vessel is, in fact, in this segment quite twice the width that it is anteriorly to the point in question. Commonly, for example in *Henlea nasuta*, the dorsal vessel is much wider at its emergence from the intestinal plexus than it is anteriorly.

This is confirmed by an examination of a series of transverse sections from which it was evident that the dorsal vessel stood away from the walls of the intestine in the anterior part of the clitellum; it was indistinguishable posteriorly.

Concerning the reproductive organs, it may be observed, in the first instance, that the position of the various ducts and pouches is perfectly normal. The external orifices of the atria are very conspicuous upon the ventral surface of the twelfth segment, in line or nearly so with the ventral setæ of that segment. These setæ are, however, absent, and there are no penial setæ of any kind. The testes and the ovaries occupy their usual segments, *i.e.*, xi and xii. Concerning the exact form of the sperm-duct funnel I am unable to give details; but I have identified them and satisfied myself that they are of the usual enchytræid pattern.

The spermathecæ offer characters of obvious systematic use. They open on the one hand into the œsophagus in the fifth segment, and on the other by a muscular duct on to the line dividing segments iv. and v. I could not find any diverticula. There are but a single pair of spermathecæ.

In the above description I have only been able to dwell upon a certain number of facts which are of systematic importance in the group. Of importance in determining the genus are: (1) the presence of four bundles of curved setæ on all the segments of the body, save the first and the twelfth; (2) intraclitellian origin of dorsal vessel; (3) absence of any diverticula to œsophagus; (4) simplicity of spermathecæ and their communication with œsophagus.

Of the thirteen genera allowed by Michaelsen†, 9, *viz.*, *Achæta*, *Michaelsena*, *Mesenchytræus*, *Chirodrilus*, *Buchholtzia*, *Enchytræus*, *Stercutus*, *Marionina*, and *Lumbricillus*, are excluded by these characters. Though I did not find any

* It must be borne in mind that Pierantoni ("Studii anatomici su *Michaelsena macrochaeta*, Pierant," Mitth. Zool. St. Neapel, xvi. 1903, p. 409) traces a distinct dorsal vessel in the intestinal plexus posteriorly to the region where the former is said to commence. But this does not affect the point of emergence.

† Oligochæta, in "Das Thierreich" (Berlin, 1900).

dorsal pores, it is clear that the present species cannot be safely referred to the genus *Fridericia*, which is so distinctly characterised by the peculiar paired character of its setæ. There remains only *Henlea* and *Bryodrilus*, from which, however, the species described in the present paper differs in several points. With genera described more recently than those included in Michaelsen's comprehensive work just quoted, e.g. *Hydrenchytraus*‡, I cannot identify this semiparasitic Enchytræid from India.

It is true that four species, *viz.*, *Marionina glandulosa*, *Enchytræus minimus*, *E. parvulus* §, and *E. turicensis*, possess, as does the species dealt with here, two setæ in each lateral, and three in each ventral bundle; but I do not regard those European species as identical with the present Indian form.

In the meantime I place the species in the genus *Henlea*, where the characteristic glandular pouches of the gut are occasionally absent (e.g. *Henlea dicksoni*), in default of living material and a more exhaustive examination. I propose to name it after Mr. Lefroy, who first directed attention to the species.

‡ Bretcher, Rev. Zool. Suisse, ix., p. 208.

§ This worm is described by Friend (Irish Nat. XI. 1902, p. 110), though not sufficiently to permit of any certainty.

# ON A COLLECTION OF MAMMALS BROUGHT HOME BY THE TIBET FRONTIER COMMISSION.

BY

J. LEWIS BONHOTE, M.A., F.L.S., F.Z.S.

(*Received August* 9, 1905.)

(* *Text-figures* 52 & 53.)

(*Extract from the Proceedings of the Zoological Society of London*, 1905, *Vol. II., p.* 302.)

The collection† of mammals brought home by the Tibet Mission, and collected by Captain H. J. Walton of the Indian Medical Service, although not large in numbers contains several specimens of great interest, and there can be no doubt but that the region is full of mammalian treasures only waiting time and opportunity for their discovery.

Of the eight species of which examples were brought back, two—*Microtus waltoni* and *Cricetulus tama*—are new to science, while the large red Fox of the country is sufficiently distinct to be entitled to subspecific rank. In addition to these, I have been enabled for the first time to examine the skull of another Fox, *Vulpes ferrilatus*, described 63 years ago, but of which the skull-characters have hitherto remained entirely unknown. This skull shows features of great peculiarity, and proves the validity of *ferrilatus* as a species, a matter hitherto considered doubtful by some writers.

In addition to the specimens collected by Captain Walton, the British Museum is indebted to Col. Waddell for two or three skins, an account of which has also been incorporated in this paper.

FELIS MANUL Pall.

*Felis manul* Pall. Reise Russ. Reichs, III., p. 692 (1776); Blanf., Faun. Br Ind., Mamm., p. 85 (1891).

*a*. ♂. Yamdok Lake, alt. 15,000′, 28th Sept. 1904.

This specimen, the only one procured, was brought home by Col. Waddell.

VULPES VULPES WADDELLI.

*Vulpes vulpes waddelli* Bonhote, Abstr. P. Z. S. No. 22, p. 14, Nov. 21, 1905.

*a*. Khamba Jong, alt. 16,400′, 8th Oct. 1903.

*b*. Phari Jong, Upper Chumbi Valley, 11th Jan. 1904 (*coll. Waddell*).

General colour above reddish-fulvous, the median dorsal area from the occiput to the root of the tail being bright red, shading to pale buff on the flanks and hindquarters. The head rufous; the ears moderately large and pointed, being clothed with long white hairs on the inside and short black ones externally. Feet rufous along their margins and white or grey in the centre. Tail long, woolly, and very bushy, tipped with white; each hair being pale

* Text-figures not reproduced.

† A sketch-map giving all the localities in which this collecton was procured is published in *The Ibis* (1905), p. 57, pl. ii.)

fulvous at its base, with a long, black, terminal portion. Underparts pure white.

The *skull* does not show any special characters by which it may be distinguished from that of the typical form. It is stout and well built, being short and broad in the muzzle and rather swollen in front of the orbits, but otherwise it shows no features of note.

*Dimensions of type* (in flesh). Head and body 25 in.; tail 16 in.; hind foot 6 in. Height at shoulder 14·75 in. Weight 8 lbs.

*Skull.*—Greatest length 145 mm.; zygomatic breadth 72; width in line with ant. root of pm. 4, 37·5. (Further skull dimensions are given under the next species.)

*Habitat.*—Khumba Jong, Tibet, alt. 16,400′.

*Type.*—B. M. 5, 4, 6, 1. Collected 8th October 1903, by Captain Walton.

This race may be readily distinguished from *V. v. flavescens* by its much brighter coloration throughout, and especially by the deep red median dorsal area. In the true *flavescens* the back is much more uniform in colour, the median dorsal area being but very slightly darker than the surrounding parts and of a more brownish yellow, the red tint being entirely lacking.

The local name is "Wamo."

VULPES FERRILATUS (Hodgs.).

*Vulpes ferrilatus* Hodgs. J. A. S. B., XI., p. 278, pl.; Blanford, Faun. Br. Ind., Mamm., p. 155 (1891); Mivart, Mon. Can., p. 121 (1890).

*a*. Karo-La Pass, alt. 16,600′, 30 miles E. of Gyangtse.

The only specimen procured is a typical example of *V. ferrilatus*, but in very bad fur. This species may always be recognized by the underfur, which, besides being close and woolly, is fulvous to the base. The peculiar and woolly character of the fur throughout is quite sufficient to distinguish it from all other species.

Captain Walton writes:—"The small fox does not, I feel pretty sure, occur near Khamba Jong, all the foxes seen there being of the large species (*V. v. waddelli*, *ante*). I saw other foxes almost certainly of this species between Karo-La and the neighbourhood of the Yan Dok Cho (Lake Palti)."

Accompanying the skin is a very fine adult skull (text-fig. 52), which, so far as I am aware, has never before been described. This skull is quite unlike that of any other species of Fox, and is characterised by the extreme slenderness and elongation of the muzzle and the great length of the upper canines. The brain-case and zygomata, on the other hand, do not show any signs of lateral compression or elongation, but are fairly normal in their dimensions and breadth. The supraorbital processes are stout and well developed, and the brain-case gradually widens out from immediately behind these processes and reaches its greatest breadth in line with the posterior roots of the zygomata. On the under side we may note the narrowness of the soft palate and the tendency of the pterygoids to approach each other posteriorly. The bullæ are more elongated and less rounded than usual. The dentition, which

is normal, except for the great length of the canines already noted, calls for but little comment. The spaces between the premolars are large in correlation with the length of the muzzle, and the first upper molar is relatively small.

| *Dimensions* :— | *V. ferrilatus.* mm. | *V. e. waddelli.* mm. |
|---|---|---|
| Greatest length | 155 | 145 |
| Basal length | 138 | 130 |
| Palatal length | 78 | 71 |
| Length from post. end of palate to basioccipital | 60 | 59 |
| Length from last incisor to ant. root of 1st premolar (alveoli) | 19 | 16 |
| Length of premolar series | 48 | 39 |
| Breadth of brain-case immediately behind supraorbitals | 26 | 23 |
| Greatest breath of brain-case | 50·5 | 49 |
| Zygomatic breadth | 84 | 72 |
| Breadth of muzzle at ant. root of 2nd premolar | 19 | 23 |
| Length of upper canine along its anterior margin | 29 | 20 |

This comparison of dimensions will show more clearly than any description the main features in which this skull differs from that of the more typical "*Vulpes*"; and in spite of the doubt of Mivart* there can be no question that *ferrilatus* not only is a good species, but is more differentiated than any other species in the region.

The only other skull of *ferrilatus* known is a very young one collected by Mr. Hodgson; it is, however, too young to show any of the specific characters enumerated above.

PUTORIUS ALPINUS (Gebler).

*Mustela alpina* Gebler. Mem. Soc. Imp. Nat. Moscou, VI., p. 213 (1823).

*Putorius alpinus* Blanford, Faun. Br. Ind., Mamm., p. 168 (1891).

*a*. ♂ ad. (in spirit). Gyangtse, alt. 12,900′, 1904.

*b*. ♂ Khamba Jong, alt. 15,500′, 11th September 1904.

CRICETULUS LAMA.

*Cricetulus lama* Bonhote, Abstr. P.Z.S., No. 22, p. 14, Nov. 21, 1905.

*a*. ♂ ad. Lhasa (skinned from spirit).

*b*. ♂ ad. Lhasa (in spirit).

The *Cricetulus* referred to† as "the little white mouse" is represented in the collection by two spirit-specimens, one of which has since been skinned. It appears, although closely related to *Cricetulus phæus*, to have been hitherto undescribed.

* *Op. cit. ante.* † Percival Landon; Tibet, App. by H. J. Walton (1905).

Size about that of *C. phæus*. General colour above pale fulvous grey, greyer than in *C. phæus*.

Each hair is slate-grey at its base, fulvous for about ⅓ of its distal end and with a black tip. Over the head and fore part of the body the fulvous portion of each hair is the more conspicuous, but on the hinder part of the back the dark tips predominate and a faint dark median dorsal line may be traced. The underparts are pure white, the hairs being slate-grey at their base. The line of demarcation between the upper and under parts, although abrupt, is very uneven in outline. The feet are but scantily clothed with hair and are white. The tail is moderately long and stout, well clothed with dark-brown hairs above and white hairs below; the tip is white.

The whiskers are for the most part black with a white tip, some shorter ones, however, being entirely white.

The *skull* resembles somewhat closely that of *C. phæus*, but is slightly larger and the brain-case more inflated and rounded. The chief points of difference when viewed from below, are the greater width of the basioccipital and the much flatter and smaller bullæ in the new species. Above there is a slight, although very constant, difference in the hinder margin of the parietals, which are practically straight in outline; whereas in *C. phæus* there is a sharp turn backwards when about two-thirds of their length from the middle line.

*Dimensions* (of type when in spirit).—Head and body 87 mm.; tail 40; hind foot 17; ear 16.

*Skull.*—Greatest length 28·5 mm.; basal length 24; palatal length from hensclion 12; interorbital breadth 5; greatest breadth of brain-case 12·5; width of basioccipital at anterior end of auditory bullæ 3.

*Habitat.*—Lhasa, Tibet.

*Type.*—B. M. 5, 4, 6, 4. Collected at Lhasa, Tibet, by Capt. H. J. Walton, I.M.S.

The darker colour of the hinder part of the back combined with the general much greyer coloration, and in addition the somewhat longer and stouter tail form characters by which this species may be distinguished from *C. phæus*. The animal, according to Capt. Walton, was extremely common, and was swarming in one of the shrines of the Jo Khang Cathedral at Lhasa.

MICROTUS (PHAIOMYS) WALTONI.

*Microtus* (*Phaiomys*) *waltoni* Bonhote, Abstr. P.Z.S., No. 22, p. 14, Nov. 21, 1905.

*a*. ♀ ad. Lhasa, Tibet.

Slightly smaller in size than *Ph. blythi*, to which it is by skull-characters closely allied, though widely differing in colour. General appearance above fulvous grey, slightly greyer over the anterior part of the body; below very pale buff. Each hair is slate-grey from its base and for the greater part of its length, with a fulvous subterminal portion and dark tip. On either side between the limbs, the dark tips are absent, leaving a clear fulvous patch. Interspersed in the fur are a few thin black bristles. The feet are whitish,

both palms and soles are 5-tuberculate. The tail is bicolor. The ears small and sparsely covered with hairs similar in colour to those on the rest of the body. Mammæ eight in number, four pectoral and four inguinal.

*Skull.*—The dental characters are practically identical with those of *Ph. blythi*. The skull itself is very similar in general outline, but slightly smaller; this is especially noticeable in the bullæ, which do not stand out so prominently from the rest of the cranium.

*Dimensions of type* (from spirit).—Head and body 98 mm.; tail 30; hind foot 17; ear 10·5.

*Skull.*—Greatest length 28 mm.; basilar length 24·5; zygomatic breadth 16·5; interorbital breadth 4; length of nasals 7; diastema 8·2; palatal length 15.; length of molar series (text-fig. 53), (alveoli) 7.

*Habitat.*—Lhasa, Tibet.

*Type.*—B. M. 5, 4, 6, 5. ♀ ad. Collected by Capt H. J. Walton, I.M.S.

This interesting species cannot well be confused with any other, as the skull-characters clearly prove it to belong to the subgenus *Phaiomys*, and its colour is quite unlike any of the other species of that group.

LEPUS OIOSTOLUS Hodgs.

*Lepus oiostolus* Hodgson, J. A. S. B., IX., p. 1186 (1840); Blanford, Faun. Br. Ind., Mamm., p. 452 (1891).

*a*. Khamba Jong, Oct. 1903.

Apparently the common Hare of Tibet, two more skins having been brought home by Col. Waddell. Capt. Walton states that this hare, which, as a rule, avoids cultivated land and frequents bare and rocky hillsides, was very common at Khamba Jong and also at Tuna at the head of the Chumbi Valley. It was, however, much scarcer, although still occurring between Gyangtse and Lhasa.

OCHOTONA CURZONIÆ Hodgs.

*Lagomys curzoniæ* Hodgs. (nec Stoliczka) J. A. S. B., XXVI., p. 207 (1858); Blanford, Faun. Br. Ind., Mamm., p. 457 (1891); Bonhote, P.Z.S. 1904, Vol. II., p. 214.

*a*. ♀. Yamdok Lake, 14,800′, 29th Sept. 1904.

*b. c*. No particulars.

*d*. ad. in spirit. Tuna.

The specimen from the Yamdok Lake had evidently just assumed its new winter pelage, the other two skins being in old and worn fur. Tuna, where the spirit-specimen was procured, is only a few miles north of the Chumbi Valley, the type locality of the species.

Capt. Walton writes of this species:—"They are exceedingly common at Khamba Jong, Tuna, and in all the open bare country from Tuna to Gyangtse as well as between Gyangtse and Lhasa. They, however, become less common as one approaches Lhasa, probably because the country is more cultivated. They avoid cultivated fields for the most part, and were always commonest in bare sandy country. They do not hibernate at all, and on any sunny day in

the middle of winter they might be seen sunning themselves at the entrance to their burrows. I dug up a few burrows during the winter. The tunnel runs more or less vertically downwards for 1 or 2 feet and then somewhat horizontally for 4 to 6 feet. The passage is dilated at irregular intervals in some two or three places. At these spots and at the end of the burrow, which is also dilated, there is a certain amount of coarse grass collected to form a kind of nest. The ground in many places is honeycombed with these burrows, which sometimes communicate with one another close to the mouth, but, as a rule, they are quite distinct. I never heard the animal utter a cry of any sort."

## MISCELLANEOUS NOTES.

### No. I.—PELICANS BREEDING IN INDIA.

As Blanford says that "of late years no authentic account of Pelicans breeding in India has appeared" (*vide* p. 336, Vol. IV, Birds, Fauna of British India), I consider I am extremely fortunate in having discovered a place in South India, where the Spotted-billed or Grey Pelican (*Pelicanus philippensis*) breeds regularly. As I have no doubt this will interest some of our members, I send an account of my experience.

I heard of the place quite by accident. My informant told me that there was a place close to where I was encamped, where Pelicans and several other kinds of birds built on trees in the middle of a village.

I had often come across places in the Kurnool, Vizagapatam, and other Districts, where colonies of Storks, Egrets and Herons built on trees in and around villages; so was a bit doubtful as to whether my informant was not mistaking one of the larger Storks for a Pelican. The village was not far off my line of march and I determined to pay it a visit. I am glad I did so.

The name of the village is Kundakolam in the Nanguneri Taluq, which is in the extreme south of the Tinnevelly District. I got to the village at about 9 A.M. and I shall never forget the sight! There were about a dozen large-sized tamarind trees in different parts of the village, and each tree was as full as it could hold of nests and birds. The leaves of the trees were stained white with the droppings of the birds and presented a very strange appearance. I visited the place at a very good time (8th June) for all the young birds were fully fledged and were able to come out of their nests. There were birds in all stages of immaturity, and I had no difficulty in examining them through a pair of field glasses. The villagers told me that several varieties of birds built there; the young of the smaller kinds however had grown up and had left their nests for good. There were only two kinds left—the Spotted-Billed Pelican and the Painted Stork (*Pseudotantalus leucocephalus*). From the vernacular names of the other birds referred to by the villagers, I recognized the Pond Heron (*Ardeola grayi*), the Cattle Egret (*Bubulcus coromandus*) and the Night Heron (*Nycticorax griseus*).

To return to the Pelicans and Storks, it was very amusing watching the young birds—especially the young Pelicans. There were little babelets whose only object in life appeared to be to prevent their huge bills overbalancing them; then there were great hobble-di-hoys who seemed to think it no end of fun opening their bills windwards and allowing the wind to bulge out their salmon-coloured pouches. There were also birds who had just learnt to fly and they kept on making trial trips from one tree to another and back again. The young of the Painted Stork may be a pretty bird with his pencilled plumage, but he is a noisy brute and seems to spend most of his time trying to let every one for miles around know how hungry he is.

The villagers look on these birds as semi-sacred and will not allow any one to disturb or molest them, so they return to build there year after year, and have done so for years past.

C. E. RHENIUS.

TUTICORIN, 10*th July* 1906.

## No. II.—FOOD OF PREDACEOUS FLIES.

I was under the impression that the fact that the *Asili* kill other insects —in much the same way as Falcons kill other birds—was well known, but as there appears to be some doubt on this subject I give below some instances of their predatory habits.

Many years ago, when in Kanara, I noticed an inch-long yellow *Asilus* frequenting the denser forest tracts in open situations. One day I saw one of them fly from the top of a dead stalk of grass at a three-inch long dragon-fly and collide with it. The result was, much to my surprise, the immediate collapse of the latter which fell to the ground at my feet. The *Asilus* flew back to its perch, whether owing to my presence I know not. The dragon-fly was just kicking when I picked it up and expired nearly at once.

Another time I captured one of this same species of fly immediately after it had caught a large *Cicada*, many times heavier than itself ; and it had its proboscis buried in the prey. I have still got the pair in my collections in Karwar.

I have often seen the smaller *Asili* hawk butterflies and occasionally diptera and suck them dry. A fact worth noting is that they will, with perfect equanimity, hawk their own species ; and it is a matter of frequent occurrence to see a female sucking a male. One has only to watch these flies regularly and the most sceptical person will soon be convinced of their predaceous and cannibal habits.

I have many species, perhaps eight or twelve, in my collections and all of them were caught in the act of hawking or sucking other insects. My species vary from an inch-and-a-half (the big yellow one first mentioned above) to delicate little green-eyed specimens of four or five millimetres in length caught in the desert places of Sind.

T. R. BELL, I.F.S.

BELGAUM, 27*th July* 1906.

## No. III.—SNAKE-BITE INFLICTED BY *MELANELAPS MCPHERSONI*.

I have just received another specimen of *Melanelaps mcphersoni*, the poisonous snake I described as new, last year. This specimen, like the first one, was procured in Dthalla, Aden Hinterland, and I am indebted to Lieut. A. C. Ingram, I.M.S., for it. It is of about the same size as the first specimen, and agrees with it very closely. I note the following differences however. The 4th supralabial only touches the eye. The anterior sublinguals touch 4 infralabials. The ventrals are 239, and the subcaudals 31. The scales, 2 heads-lengths

behind the head, are 25 ; midbody 23; and 2 heads-lengths before the vent 21. I also notice, what I omitted to note in the first specimen, that the supra-caudals, which are arranged in odd rows, show considerable enlargement of the vertebral row as is the case in the kraits where the subcaudals are entire.

Mr. Ingram has added much to the interest of this snake by having interviewed an Arab who had been bitten by it about 5½ hours previously. I quote from his letter: "There were marks of two very small punctures on the inner side of the proximal joint of the right thumb ° ° ° The thumb, hand, and wrist were very slightly, but perceptibly swollen at that time. There was no discolouration, and there appeared to me to be no effect beyond this either locally or systematically. He said that the pain had been very severe very soon after the bite, and had radiated right up the arm to the shoulder and neck, and that there was a swelling in the armpit at first which had subsequently subsided. The only treatment he had used was garlic locally, and internally." The next day all the pain had gone. It would be unwise to infer from this case that the snake is not mortal to man, for even bites from our most poisonous species such as the cobra yield very variable results, the effects being sometimes trivial though there may be every appearance in the local wounds to anticipate the worst consequences.

F. WALL, CAPTAIN, I.M.S., C.M.Z.S.

FYZABAD, *24th July* 1906.

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## No. IV.—NOTE ON THE BREEDING OF RUSSELL'S VIPER *(VIPERA RUSSELLI)* IN CAPTIVITY.

On three occasions lately Russell's vipers have produced young in the cages of the Laboratory and it may be worth while to record particulars of these occurrences.

On the first occasion, the viper was received from Howrah on the 9th of April 1904, and gave birth to 25 young on the 7th of June 1904. These were very active and the floor of the snake-room appeared alive with wriggling forms when the door was opened in the morning. A few egg-cases were noticed in the mother's cage split longitudinally like a bivalve shell.

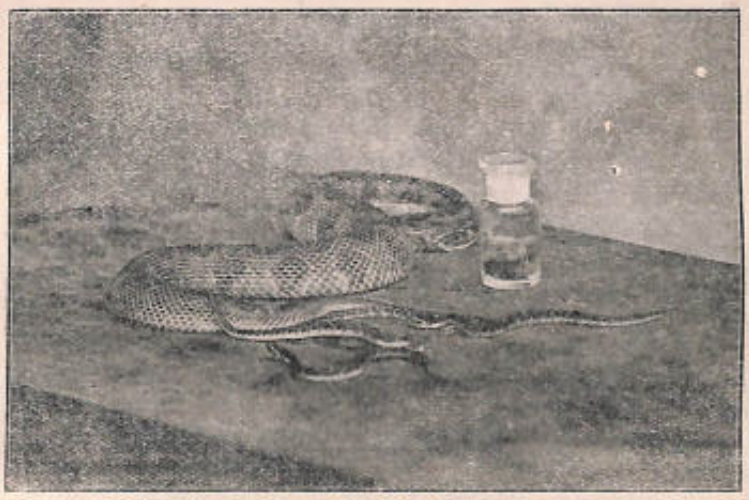
The second viper was caught in the compound of the Old Government House in which the Laboratory is situated on the 6th December 1905, and on the 21st June 1906 gave birth to nine eggs, four of which contained living vipers.

The third viper was received from Wardha on the 31st of March 1906, and on the 9th of July 1906 gave birth to 15 eggs, seven of which contained living vipers.

The second of these vipers happened to be in a glass-sided case, so the extrusion of the eggs and subsequent exit of one of the vipers therefrom was witnessed by Corporal J. Scott, European Assistant in the Laboratory. We witnessed the other eggs being extruded, but they did not contain vipers.

When first seen, three young vipers were already free in the case, but the birth of the fourth from the egg was clearly seen and was described by Corporal Scott as follows:—The oval egg split open in the long axis just "like a mussel-shell" and disclosed the young viper coiled up in the midst of a glairy material like white-of-egg. The tail was in the centre of the coil and the head in the outer ring at one side as in the illustration. Almost immediately, the head moved outwards like a watch-spring uncoiling, and the young viper moved off over the gravel in the case freeing itself in this way from the glairy matter surrounding it in the egg. The tail was somewhat sharply bent on itself, and did not straighten out till the viper had got several inches from the egg. The young reptile was enveloped in a thin grey papery skin which it soon got rid of by wriggling about over the gravel covering the bottom of the cage.

Section of egg laid in the Society's rooms showing embryo of *Vipera russellii* in situ.



*Vipera russellii* with four young, photographed a few days after their birth. Bottle contains 3 unfertilised eggs. Photo by C. R. Avari, Bo. Bact. Laby., Parel, 1906.

The eggs that were subsequently laid were extruded at intervals of 15 minutes or so, but none contained embryos. One was opened but was semi-solid all through and had probably not been fertilised, as no trace of an

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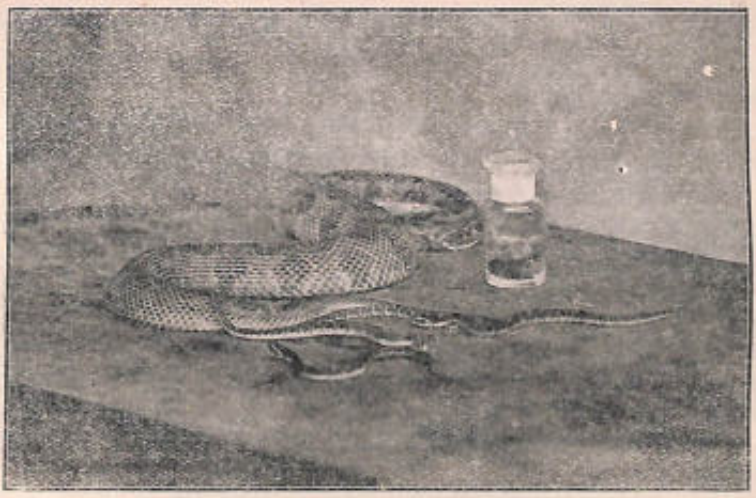

*Vipera russellii* with four young, photographed a few days after their birth. Bottle contains 3 unfertilised eggs. Photo by C. R. Avari, Bo. Bact. Laby., Parel, 1906.

The eggs that were subsequently laid were extruded at intervals of 15 minutes or so, but none contained embryos. One was opened but was semi-solid all through and had probably not been fertilised, as no trace of an

embryo was found. In colour they were distinctly orange, and not dead white as the eggs of *Bungarus cæruleus* are. (3 eggs shewn in bottle.)

As far as I know this is the first time that the actual birth of a Russell's viper from the egg has been recorded, and the question arises.—Is this the actual normal sequence of events, or an abnormality due to confinement in a case.

The breeding season, judging from these three events, is in the months of June and July in Bombay when food is plentiful on account of the onset of the monsoon. The period of gestation must be a long one, for the second viper had been in a cage by itself for over six months before the birth of the young ones. The young ones which were beautifully marked and about 9 inches long were kept alive by feeding with milk administered through a pipette with a rubber ball at the end such as one fills a fountain pen with.

The poison gland does not appear to be active at birth, for with two vipers the experiment was tried of allowing it to bite a mouse the day after its birth, and then at weekly intervals thereafter. In one case, the mouse bitten by a viper a fortnight old died, in another case not till the viper was three weeks old did a fatal result follow the bite.

In going through the Society's Journal, the following reference have been found :—

In Volume XII, page 765, Mr. Cholmondeley, writing from Indore on 1st July, reports examining a Russell's viper which contained 63 mature young from 9 to 10 inches long.

In Volume XIV, page 614, Mr. Millard notes that a Russell's viper in one of the Society's cages, gave birth to 33 young ones on the 20th June. No mention is made of eggs.

In Volume XV, page 134, Lieutenant Mosse reports having killed a Russell's viper at Mahissa, Guzerat, on 5th March, containing 55 eggs, 3 or 4 of which were not fully formed. In none was there any trace of embryo.

In Volume XV, page 729, Mr. Miller of St. Joseph's College, Darjeeling, records the receipt of 10 eggs of *Lachesis monticola* from Kurseong, from two of which the young ones issued while being examined by some of the Fathers of the Seminary there. This viperine snake then is oviparous.

In Volume XVI, page 374, Captain F. Wall, has a note on the breeding of Russell's viper with a record of one sent from the Parel Laboratory containing one embryo measuring 9½ inches and which he thinks would probably have been born in November. With this exception, all the Indian ones were, he notes, born in the months of May, June, July or August.

It may be taken as settled then that the time when the young vipers are born is during these months.

I have not been able to find any record of the duration of gestation.

That the Russell's viper, at least in captivity, is sometimes oviparous, is, from the above, beyond doubt, and I have been unable to find any observations showing that any one has seen the actual birth of eggs or young in this

reptile. Finally it appears that these young vipers are harmless for the first fortnight of their existence.

W. B. BANNERMAN, LT.-COL., M.D., B.SC., F.R.S.E., L.M.S.,
(*Director, Bombay Bacteriological Laboratory,*)
J. P. POCHA, L. M. & S., Senior Asst. Surgeon,
(*In charge of the Venom Dept., Bombay Bacteriological Laboratory.*)
PAREL, BOMBAY, 16*th August* 1906.

## No. V.—RECOVERY FROM A COBRA BITE.

The following incident came under my personal observation and I communicate it to you in the hope that it will be of some interest to your Society.

Some time in June last—to be exact—on the 20th, my dogs attacked a cobra which had found a resting place in a "dummy" hole in my garden. One of the dogs—a bull terrier—in unearthing the reptile got bitten in the upper lip ; the snake had in its apparent rage clung with some strength to the lip and it gave the dog no little difficulty to free itself. The cobra was despatched and measured a little over 4 feet 3 inches. It was jet black in colour.

I immediately set to work and after having the dog's lip washed with water, applied a strong solution of vinegar and table salt. I kept up the application rigorously for about ten minutes or more. During this time the dog frothed copiously from the mouth and exhibited signs of considerable weakness. At one time the dog appeared to me all but dead. I persevered however and after five minutes brisk application was glad to find that the dog shewed signs of recovering. I immediately gave her a cup of milk which she drank with relish. To prevent her from becoming drowsy, I kept up a brisk run with her for some 45 minutes. I could think of no better cure than this, so retired for the night, the attack having occurred at about 9-20 P.M.

Next morning and for a few days after, her face was very much swollen. The swelling however disappeared by the end of the week and she recovered completely.

And here I might mention that on the day of the fight the dog was two weeks pregnant. I thought at the time (my supposition has since been confirmed) that the excitement and above all the snake-bite would have some effect on her unborn pups. What I relate now explains the effects.

The day before yesterday, Thursday, at about 4 P.M., she gave birth prematurely to four pups. They came away singly at intervals of from six to seven hours and each time with an extensive discharge of some dark-green matter. The discharge continued till yesterday morning when the ordinary after-flow of birth occurred.

She is ten years old and how she has survived through all this terrible time I am at a loss to understand.

And now occurs what seems to me to be the most direct effect of the snake poison.

Another terrier of mine (a dog) a great friend of the slut's and who shared with her the honours of the fight, somehow happened to lick up a small

quantity of this dark-green discharge. He did this yesterday morning and died from its effect last evening. In his death struggles which pointed conclusively to a death by some virulent poison—he expelled all the dark-green stuff he had swallowed in the morning.

Perhaps there is some other solution to the bull-terrier's life having been saved from the effect of the cobra bite and to the terrier's untimely death from swallowing what was an evident poisonous discharge, not to mention the effect on the pregnant condition of the slut.

C. GRENVILLE ROLLO.

AJMERE, RAJPUTANA, *9th August* 1906.

[It is not an unusual event for animals to be bitten by our deadliest snakes with serious, trivial or no ill effects. The bitch in question evidently received a sublethal dose of poison and would have lived without any treatment. That practised we know would not have been of the least avail if the dose had been a lethal one. We can offer no explanation for the death of the dog.—

EDITORS.]

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## No. VI.—OCCURRENCE OF THE CHEER PHEASANT (*CATREUS WALLICHI*) IN THE N. W. F. PROVINCE.

I wish to record having obtained a specimen of the Cheer Pheasant at Durg Galli in the N. W. F. Province on the 25th July. I believe this pheasant has not been recorded so far west as this before, and in the "Fauna of British India, Birds," the range is mentioned as from Chamba on the west.

I heard of these birds here last year from a shikari, but could not get a specimen, and again this season I heard of them. I have heard them calling often from a small hillock opposite my house, and on several occasions tried to get them, but without success. This evening I heard them again shortly before sunset and being busy sent my man after them. I did not see him shoot but heard the shot fired and he called out at once from across the khud that he had hit one. In about half an hour he brought it in as it had fallen a long way down the khud among jungle and scrub and then had to be chased for some distance. The bare sides of the face were of a crimson colour. This bird was shot at about 8,000 feet above sea level. The native name for it is "Rehár."

WALTER VENOUR, MAJOR, 58TH RIFLES.

DURGA GALLI, HAZARA DISTRICT, *25th July* 1906.

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## No. VII.—A NEW SPECIES OF TREE-PARTRIDGE (*ARBORICOLA BATEMANI*) FROM THE CHIN HILLS.

(*From the Bulletin of the British Ornithologists' Club, No. CXXIII.*)

Mr. Ogilvie-Grant described a new Tree-Partridge from the Chin Hills, which he proposed to call:—

ARBORICOLA BATEMANI, sub sp. n.

♂ Adult. Closely allied to *A. torqueola*, from which it is distinguished by having the entire sides of the neck chestnut, spotted with black. In *A. torqueola*, a

short band of chestnut and black feathers commences behind the ear-coverts, and terminates half way down the neck, the remainder of the neck being black and white, like the throat. Wing 5·9, tarsus 1·7.

The type specimen was obtained by Mr. A. C. Ba.e-nan at Tiddim, near Fort White, Chin Hills, on the 3rd of December, 1905, and was forwarded to Mr. E. W. Oates, by whom it was presented to the British Museum. The present form takes the place of *A. torquecla* to the south of Manipur, and has been procured at Falam by Mr. P. F. Wickham, while a number of examples have been forwarded by Colonel G. Rippon from Mt. Victoria.

## No. VIII.—A MOUSE-HARE.

Colonel A. E. Ward will have already made the readers of this Journal familiar with the scientific names and descriptions of several of the varieties of the small animal, found high up in the Himalayas, and commonly known as the mouse-hare. In the interest of the few, who care for such small game, I send this note about one I recently captured in a remote part of the Chamba State, West Himalayas. One afternoon in May, while watching for bears, I saw among some large blocks of rock above a stream a small animal dart across from below one block to another. I thought at first it was a rat; but when it shortly afterwards reappeared I noticed it had no tail and I then felt certain it must be what I had long been looking for—a mouse-hare. The spring was unusually late, and as the hill sides were generally snow-covered, I could

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not previously discover mouse-hares anywhere, although I was told they were fairly common. As they live above 10,000 feet among piles of stones, their homes must be many feet covered in snow during the whole winter and part of spring Whether they hibernate like the brown bears, or store food for this gloomy period of their lives, I do not know. The natives I have questioned on the subject all state that they store food for the winter. I found the piles of stones where they lived so extensive and the blocks so heavy, that I was unable to see their actual nests so as to ascertain if there was any store of food. Some little time after I had seen this mouse-hare, I encamped not far from the place where I first saw it, and on the chance of catching it, I set a rat trap, one of those wire traps with a spring door at one end. To the usual hook for attaching bait, I suspended from one end a wide flat piece of tin, and tied across this, grass, strawberry leaves and flowers, in the hope that if the mouse-hare entered the cage, his weight on the tin platform would disengage the hook from the catch and so spring the door behind. For two days the trap was apparently not visited, and neither did I see the mouse-hare anywhere about the stones. I began to fear it must have moved elsewhere. However on the morning of the third day on visiting the trap I found one inside. So far as I could judge, from its size and colour, it was the same one I had previously seen. It appeared to take its misfortune very quietly, and had evidently made a good meal off the strawberry leaves and flowers. I carried it back to Camp and after a short time it became quite tame. I fed it with various grasses, Alpine flowers, strawberry leaves and strawberry berries. At first it would not eat any grain but after some time it took to "gram" and also occasionally eats cabbage, carrots and onions. As I was obliged till I obtained a wire cage, to keep it in the trap, I was unable for a considerable time to try and catch another one alive. When at last I was able to remove it into a cage, and so free the trap, vegetation had become so general that they were not to be tempted for the sake of food to enter the trap, although I set it in various places where I saw the animals. I, however, caught several in a "kill" trap. The "out of sight" rat trap I found most useful for obtaining specimens in good condition. I also use the trap for obtaining Voles. I have rarely seen two mouse-hares together and never any young ones. These hares are said to make a peculiar piping call, which can be heard to a great distance, but I have not heard them make any noise. My servant tells me, he once heard the one I caught make a whistling call. In the part of Chamba where I was encamped there appear to be two varieties so far as colour goes; one a dark rabbit grey and the other of a bright rufous or bay colour. The former are smaller in size than the latter. The one I caught and kept alive is of the bay coloured variety, but it was not so generally rufous when first captured. I refer to the general colour. I believe they change the colour of their coats a good deal according to the season of the year. The hair is exceedingly fine, straight and shiny. Although the weather was still very cold there was no sign of any underwool in the hair, as one would

expect in all animals which have to endure intense cold for many months. I found the two varieties in respect to colour in separate nullas, though not far apart. The one I have, takes its imprisonment most contentedly, eats well and sleeps a good deal with its eyes open. It is most active and greatly delights in jumping over and circling a small bar that I fastened across the cage. When sleeping it often lies stretched out on its side. It appears to sleep more by day than at night. It is most cleanly in its habits, and keeps its cage free from all dirt. When eating it often places one foot down on the food. It frequently cleans its face with its fore feet, moving them rapidly up and down. Although I have often placed dry grass in the cage it has never attempted to make a "form" or nest. It appears to dislike strong sunshine, always retreating from it to the covered part of the cage. In size it was about seven inches in length when first caught, but has grown a little since then. The largest I obtained was eight-and-a-half inches in length; it was of the bay coloured variety.

The young, usually four in number, are born towards the end of August and early in September. There is little difference in size between the adults of both sexes.

CHAMBA, PUNJAB, *July* 1906. G. S. RODON, MAJOR.

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## No. IX—LOCUSTS, BEARS AND DOGS.

While shooting in Chamba, in the spring of this year, the district I was in was visited by immense swarms of locusts, which apparently came from the South-West. They remained for over a month. Although I constantly watched, I never saw them eating anything. During the day they flew continuously up and down the valleys. I noticed them as high as 13,000 feet. Every now and then some would fly to the ground and remain motionless for a considerable time apparently resting, afterwards rising and resuming their to and fro flight. Towards evening all would settle down on bushes, grass, open stony slopes in numbers, strange to see, on snow slopes. I saw none settle on trees. The nights were then very cold, the thermometer often registering frost, and numbers of locusts were found dead in the mornings; especially all those which had settled for the night on snow. Those on bushes and grass appeared benumbed, but as the sun rose and warmed them they revived and again started on their daily flight. On several occasions in the early morning, I saw through a glass brown bears, eagerly hunting up and down the snow slopes for the bodies of the locusts, and apparently eating all they found. Shepherd dogs also appeared to hunt up and eat the dead locusts. Sometimes slight snow fell during the night which covered the locusts and the bears scratched them up. My shikari, who lived in the village not far off, assured me that both bears and dogs died from eating locusts; he further said that on previous occasions when locusts had come to the district he had afterwards found the remains of bears which had died and he personally knew of several dogs which after eating locusts

had got ill and died. Other villagers had the same story. I had previously believed that they were good for food, and that several of the low caste tribes made a fry or a curry of their bodies; possibly if really poisonous, the cooking renders them wholesome? For what special purpose these swarms of locusts should come far into the interior of the hills and close to the very high snowy ranges is difficult to understand. They can scarcely come for the purpose of laying eggs. No young locusts are ever seen and although the wheat and other hill crops were above ground none were touched; and as I previously mentioned, I never saw them eating anything whatever. I would add that all the locusts I saw were of a pink colour. I was informed that they rarely visit the district.

CHAMBA, *August* 1906. G. S. RODON, MAJOR.

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## No. X.—A NOTE ON AN EDIBLE PUFF-BALL FROM THE THANA DISTRICT.

I place before the Society to-day a dried specimen of an edible Puff-ball very commonly found in the Thana District, such as at Thana, Andheri, Goregaum and adjacent fields. The specimen placed before the meeting is very uninviting for culinary purposes. But when fresh-gathered, within twenty-four hours after gathering, it can be cooked and served as a table delicacy, in no way inferior to the French and English mushrooms served at table.

To students of Cryptogamic Botany the following note sent to me by Mr. C. G. Lloyd from Paris where he is now studying the Fungi of France, will be of interest. Mr. Lloyd is a distinguished American Cryptogamist and his opinion therefore is worth quoting. In his letter, dated the 6th May 1906, he writes to me thus:—"The Puff-balls that you packed so carefully have reached me in good condition. They are *Calvatia lilacina*, Berk. and Mont., a species that grows probably in every country in the world. These are the first I have received from India though the plant is known from Ceylon. In North and South America, Africa, the West Indies it is a very common species. It occurs in Europe but is more rare, chiefly in the Southern Countries. It is not known from England. Like all common plants it has a great many synonyms, "*Fragilis*" and "*cyathiformis*" are the best known. The older Botanists place it in the genus "*Lycoperdon*," but it belongs to the genus "*Calvatia*" of the present day, which differs from Lycoperdon in having a *peridium that breaks into pieces* and does not open by a definite mouth. The species is easily known as the only *Calvatia* with a *lilac coloured* gleba. The spores in your specimen are mostly 6 $\mu$. in diameter. A few small ones measure 5 $\mu$. I hope you will continue to send such specimens as you can find. The Puff-balls of India are very scantily known. While it is probable that you will not find many novelties because these plants are of wide distribution in the world, it is of

more interest to learn their geographical distribution. You have a few specie in India that as far as known are endemic. The most of your plants, as is the case in every country, will prove to be species that occur in other countries. But from the few scanty collections of the "Puff-balls" of India that have reached Europe, we can form no opinion of what your common species are. I am working now a Monograph of the "*Bird Nest*" Fungi, and although I have studied all the material that has reached Europe, I will only feel justified in recording *two species* from India. You may have a dozen. In fact there are not a few others but the material is so scanty. I would express no opinion as to their identity.

It may seem selfish on my part to ask those who I have not even the pleasure of a personal acquaintance to trouble in picking up "Puff-balls," but I feel that the permanent addition to knowledge will result, justifies the request." Here end Mr. Lloyd's remarks and here ends this note of mine.

K. R. KIRTIKAR, Lt.-Col., I.M.S. (retd.), F.L.S.

Andheri, Salsette, *8th August* 1906.

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## No. XI.—SOME NOTES ON BIRDS' NESTING IN TEHRI-GARHWAL.

The following notes on some nests and eggs that have not, I believe, been hitherto described may be of some interest. They were all taken in Tehri-Garhwal this year, mostly at an elevation of from 11 to 13,000 feet.

*Nucifraga hemispila.*—The Himalayan Nutcracker.

The nest of this bird has of course been described before, but I have not seen a description of the eggs. I obtained one very hard-set egg on May 16th in a rather curious way; seeing some crows rifling a nest and a pair of Nutcrackers protesting against the outrage, I sent up a man and he found one egg had slipped beneath the lining of the nest and had so escaped the crows' notice, though their bills had made two holes in it. It measured 1·44×·99 inches and was very pale green spotted and speckled with olive brown and pale ashy purple; the markings were well distributed but most numerous at the larger end. The bird was quite common, but all other broods appeared to have hatched out by this date.

*Ægithaliscus niveigularis.*—The White-throated Tit.

This Tit I found by no means uncommon at about 11,000 to 12,000 feet. Several parties of young were about and three nests with young were found, and I was inclined to think it was too late for eggs, but on June 14th one was seen carrying a feather, and the nest was soon discovered. It was placed in the fork of a willow about six feet up, a globular nest resembling that of the Red-headed Tit but larger; it was profusely lined with monal feathers, many of them quite large ones, over three inches long, with hard stiff quills; not at all a comfortable lining one would have thought for such a small bird. I took four fresh eggs from it on June 26th; they are white, rather feebly spotted at the larger end with brownish red, and show no trace of the zone of colour that

is so marked in the eggs of the Red-headed Tit. Some of the nests were from 28 to 30 feet up in trees. I secured several specimens of the birds, both old and young.

*Anorthura nepalensis.*—THE NEPAL WREN.

I take this to be the species or rather race of Wren inhabiting those parts, as although neither pale nor dark rufous it is decidedly inclined to dark and the hind toe and claw is large, measuring ·6 of an inch. Two nests were found with eggs and three with young birds, all in crevices of birch trees, from 20 to 30 feet up, a decidedly different situation to all the nests of the Kashmir Wren I have seen or heard of. The nests were large and domed, made of moss, grass and leaves and very thickly lined with feathers, the eggs white with a few red specks. I was unfortunately unable to preserve a specimen of this Wren, as all I secured were too much shattered by shot, my collecting gun having struck work.

*Phylloscopus pulcher.*—THE ORANGE-BARRED WILLOW-WARBLER.

Two nests only were found of this bird, with four and three fresh eggs on June 23rd and 26th. They were very untidy round balls, made of old man's beard, moss and dry grass, and lined with feathers, some of which were left sticking out of the entrance hole and were placed about ten feet up in the forks of willows. The nests were so ragged that I was doubtful of their being new, and no birds were about when first found; however, I went after some days a long distance to look them up again and was well rewarded, as I do not think the nesting of *P. pulcher* has been recorded before. These were the only birds of this species positively identified, but I am inclined to think they were only just beginning to breed and probably more nests would have been found later, but I had to leave on June 26th. The eggs are spotted and do not differ much from those of *Phylloscopus proregulus*.

*Acanthopneuste plumbeitarsus.*—MIDDENDORFF'S WILLOW-WARBLER.

Two nests only with the birds were secured and they have been identified as the above by Mr. E. C. Stuart Baker. The bird is very like *A. viridanus* but is slightly larger, and has traces of a second wing-bar even in the abraded summer plumage. It builds a domed nest on the ground like *viridanus*, but in slightly different situations, and the nest is not nearly so neatly made as that of *viridanus*. The bird appears to be more of a tree haunter, flying straight up from the nest into trees, whereas *viridanus* (of whose nests I saw at least fifty) on leaving the nest always shot straight down along the ground into bushes. The eggs in both the above nests were pure white, and it has occurred to me that the cases previously reported of *A. viridanus* laying unspotted white eggs may possibly be referable to *plumbeitarsus*, the two birds being very much alike in the worn summer plumage. *Acanthopneuste viridanus* was exceedingly common, and I saw over two hundred of its eggs, but never saw an unspotted one.

*Oreocincla dixoni.*—THE LONG-TAILED MOUNTAIN-THRUSH.

This bird was only observed on one occasion when it was shot over its nest. The nest contained three fresh eggs, and was placed about four feet up in tangle willows broken down by the snow, a very favourite situation for all the thrushes there. The eggs measured 1·16×·99 of an inch and were green, thickly marked all over, though mostly at the larger end, with two shades of reddish brown ; they showed none of the fine mottling of the eggs of *O. dauma*.

S. L. WHYMPER.

JEOLIKOTE, 16*th August* 1906.

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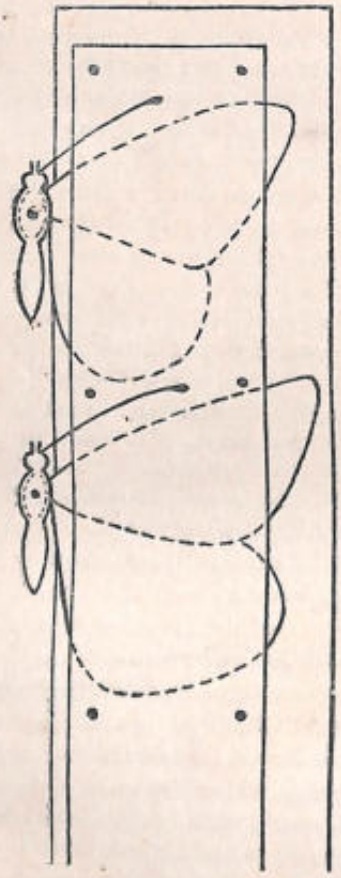
## No. XII.—FIRST HINTS ON COLLECTING BUTTERFLIES.

I should like to make a few remarks on Mr. Young's paper on "First hint on Collecting Butterflies," which appeared in a recent number of the Journal (p. 114, of this Vol.). I am pleased to see that some remonstrance has already been made regarding the changes of nomenclature which Mr. Young is endeavouring to introduce into our Indian butterfly fauna ; I trust without success. I confess I do not understand Mr. Young's reply to his critics given in the third paragraph of his article. He states that his "articles are not intended for people who have been collecting butterflies for thirty years, but for beginners only," and then he promptly uses a nomenclature which a beginner will find lands him in hopeless confusion when he studies the works of the older entomologists. Mr. Young further states in the same paragraph, "All I endeavour to do is to give a nomenclature which is not likely to be upset in our time." One naturally asks why upset the present nomenclature which has lasted some very considerable time and fulfils its purpose. Doubtless the answer will be that the law of priority must be obeyed ; and this opens up a very large question. I suppose the English butterflies have been studied for a hundred and fifty years, yet incredible as it may seem the nomenclature of these sixty odd butterflies is not yet settled. Scarcely a year passes without one or other of these unfortunate insects undergoing a change of name. In such a small number this, though exasperating, is not fatally confusing, but if the same interference with the names of Indian butterflies, numbering some hundreds of species, is permitted we shall end in an entomological Babel. The object of strict adherence to the law of priority is to fix the nomenclature; this, so far as the English butterflies are concerned, it has signally failed to do, and it is a question to my mind whether a law so painfully ineffective should not in some way be strengthened. It has failed for two main reasons, first the confidence with which each investigator in this line of research interprets the vague descriptions and inaccurate drawings of old authors, and secondly the ill-considered zeal with which these same gentlemen change the name of an insect before definitely proving that their proposed change is due to their having traced the insect to its veritable first description. Mr. Young states that his own labours being the latest modern research will fix our Indian

nomenclature for our time at any rate. I regret I have not the same confidence in Mr. Young as he has in himself, and if I may judge by what has happened and is happening to the British butterflies at the hands of men with all Mr. Young's acumen and powers of research, I am not at all satisfied that his nomenclature will be final, but rather the beginning of a series of revisions which will land us in the same bog as that in which English butterfly collectors are still struggling.

I agree with Mr. Young so far that our nomenclature requires revision, but only to a limited extent, and I would suggest that a committee of members of the Society be formed to settle the names of our Indian butterflies once and for all, taking as the basis for their labours the works of Kirby, Moore, de Nicéville and Bingham. The result should be looked upon by the members of the Society as final, and by this means check will be put on the efforts of zealous but incompetent reformers.



I should like to take this opportunity of describing a method of setting insects which differs materially from Mr. Young's, and I wish to do so not because I have personal predilection in its favour but because as it is the method adopted by professional setters, by the Natural History Museum, South Kensington, and by the majority of the possessors of extensive collections, such as Rothschild, Godman, Elwes and others, it may be considered the best. It was shown me many years ago by Mr. Elwes.

The setting boards are the ordinary flat boards for continental setting shown in Mr. Young's woodcut; they can be obtained from any dealer in entomological apparatus. Long continental pins are used for the very purpose Mr. Young condemns them, namely, that the label beneath may be easily read and that there should be a sufficient length of pin above the thorax to enable the insect to be held by the fingers if forceps are not available. The pin being passed through the thorax in the usual way is pushed through the cork in the groove until the point just

touches the wood beneath ; by this means all the insects on that board and indeed all insects of the same size will be on the same height of pin, thereby improving greatly the appearance of the collection. Instead of narrow strips of paper some ordinary tracing paper, or better still in the tropics, architects' tracing paper should be obtained. Two strips, the length of the board, should be cut one for each side, varying in breadth according to the size of the insects, but all the insects on one board will be nearly of the same size. The transparency of the paper enables one to see at a glance if the insect is properly set. I need not further describe the process as the woodcut given here will, I think, be sufficiently explanatory.

One decided advantage of this method is the greater number of insects that can be accommodated on the setting boards. There is no difficulty with regard to collecting boxes and cabinets for high set insects, all that is necessary is to state one's requirements to the dealers who are quite accustomed to this method of storing insects.

I am further constrained to make a few remarks on Mr. Young's methods of killing butterflies or rather his method of bringing them home for subsequent dispatch. I do so not because I wish to criticise Mr. Young's methods adversely but to save the young collector for whom he is writing from considerable mental perturbation when he endeavours by following Mr. Young's methods to inveigle a lively *Charaxes* into a glass bottomed box. I doubt the possibility of such an entomological feat and doubt whether an *Ornithoptera*, measuring some six inches in expanse, could by any means short of hydraulic pressure, be compressed into a pill box of ordinary dimensions. But perhaps I am hypercritical! I am personally an advocate for a judicious use of either of the three methods mentioned by Mr. Young according to circumstances. All large and medium size insects can be disposed of by the first method which if skilfully administered causes the victim less pain, I imagine, than suffocation in a killing bottle. The killing bottle is useful for the smaller insect, more particularly the *Hesperidæ* for which I consider it imperative. One great advantage of this method is that the capture being rendered insensible can be examined at leisure, and if not required can be discarded with the certainty of its recovery, provided, of course, that it has not been kept in the bottle too long. The glass bottom boxes are particularly useful for females we may wish to bring home for breeding purposes, but it is to be remembered that many butterflies are very restive in boxes and frequently damage themselves irremediably. After the victim is defunct I pin it sideway through the thorax with the finest available pin and subsequently re-pin it for setting. There is no difficulty in removing the fine pin provided a piece of damp sponge is kept in the collecting box. One tip I learnt from my Lepcha collectors in Sikhim was that if one's collecting box becomes full one can economize space by using very fine long continental pins ; the first capture is pinned sideways and pushed close up to the pin's head, the next close up to it and so on, and by this means some half dozen or more butterflies can be impaled on the same pin ; at first it looks disastrous but

if the insects are kept fresh they are easily removed. It is a good tip to remember that a butterfly removed from the killing bottle within a few hours of death and found stiff will generally be found relaxed after twenty-four hours in the bottle; some butterflies, *Terias* for instance, have been known to change colour if kept too long in bottle.

N. MANDERS, LT.-COL., F.Z.S., F.E.S., &c.

MAURITIUS, *August 1906.*

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[Colonel Manders will no doubt expect some rejoinder from me to his rather scathing criticism, but I confess I am quite at a loss to understand his reason for bringing up all this heavy artillery to bear on the sentence of mine which he quotes. All I stated was that a popular article was not the proper place for a scientific discussion as to the relative claims of two names for one species, whether a change was proposed in consideration of the law of priority or any other.

I cannot believe that Colonel Manders really disagrees with me in such a contention and must only suppose that he misunderstood my meaning.

As to the wholesale changes he accuses me of introducing into Indian nomenclature I would like to know what they are.

The only specific name that I have used so far—and almost the only one that I intend to use—in this series which differs from those used by de Nicéville is the substitution of *A. hyberbius*, Johan. for *A. niphe*, L.

In doing so I am only following Mr. Moore and Colonel Bingham, whose writings out of those named by Colonel Manders are the most easily accessible to Indian readers, and I have no doubt that had the synonomy been demonstrated at the time de Nicéville wrote, he would have accepted it also.

It was in fact remarks made to me as to this change which led me to write the passage cited.

In the only other article on the subject of nomenclature which I have contributed to this or any other periodical in India—I mean the list of the Society's collection that was printed two or three years ago—I do not think, speaking from memory, that I made half a-dozen changes on the score of the law of priority and not one of them as the result of my own researches.

In truth I take very little interest in the interminable and often futile discussions on the subject of the law of priority in the scientific Journals of the day, and have never adopted any synonomy which has not been accepted by many others besides myself.

I am aware of course that, in the catalogue referred to, I frequently amalgamated a number of forms which have been at various times separately described and named but which I did not think worthy of specific rank, and though of course we may differ in details here and there—and in the light of subsequent experience I might myself be disposed to alter my own opinion in a few cases—the majority of Indian Collectors whom I have been able to consult agree with me in so doing. However since Colonel Manders has not attacked

me on this point I need say nothing further beyond the fact that I am prepared to back my opinion, and I hope in any case I have said enough to prove that though possibly an "incompetent" I am certainly not an "over-zealous" reformer.

I do not think I need say much in reply to the remainder of his paper in which he suggests alternative methods of setting and so forth. As I pointed out in my paper it will take the young collector a long time and much patient experience before he will be able to set any insect well and not having any experience of Colonel Mander's method I cannot say whether he would learn quicker in that way than mine. The chief superiority so far as I can gather which he claims for his method is that it insures the insects being all set at the same height on the pin. I do not think this is necessarily assured unless the setter has already acquired some skill, in which case he will be able to achieve the same result by the method I described.

As to collecting methods, the efficacy of a glass-bottomed box depends of course on its size with reference to the insect it is expected to contain. I have personally never had any difficulty with a *Charaxes* nor with an *Ornithopteron*. It is of course not necessary to put an *Ornithopteron* into the box with its wings expanded.

Occasions will arise no doubt when a collector will come across an insect of a larger size than he had expected or was looking for and for which consequently he might have no suitable box with him. In such cases he may have to pinch it and pin it to the inside of his topi.

Personally I would rather run the risk of this than permanently encumber myself with a collecting box.

*September 1906.* L. C. H. YOUNG.]

In a communication I lately made to the Society regarding Mr. Young's paper "First hints on collecting butterflies" I suggested that a Committee of Members should be formed to revise the nomenclature of our Indian butterflies, taking the works of Moore, de Nicéville and Bingham, as the basis for their labours. I desire to withdraw this suggestion.

I have since received the "Fauna of British India," Butterflies, Vol. I., Bingham, and if the subsequent volumes attain the high scientific position of the first, and there is no reason to suppose they will not, it needs no suggestion of mine to make this work the standard for our nomenclature.

N. MANDERS, Lt.-Col., R.A.M.C.

MAURITIUS, *September 15th, 1906.*

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## No. XIII.—REDUCTION IN THE SPECIES OF THE GENUS *POLYODONTOPHIS*.

### SUPPRESSION OF *P. SUBPUNCTATUS*.

A few weeks ago I sent to the British Museum a snake of the genus *Polyodontophis* I found preserved in the Fyzabad Museum which perplexed me, combining as it did the characters of *P. subpunctatus* and *sagittarius*. The main

point of distinction between these two hitherto recognised species lay in the differences in the supralabial shields.

The specimen in question had 8 supralabials on the left side with the 4th and 5th only touching the eye, thus agreeing with *sagittarius*, whilst on the right side these shields numbered 9, with the 4th, 5th and 6th touching the eye, a condition characteristic of *subpunctatus*.

I have just had a letter from Mr. Boulenger, who thinks that the two forms can no longer be considered distinct, and should therefore be united.

*Sagittarius* being the older name has the prior right to be retained to designate the species, and *subpunctatus* as a species is therefore abolished.

F. WALL, CAPT., I.M.S., C.M.Z.S.

FYZABAD, 12*th August* 1906.

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## No. XIV.—HODGSON'S HAWK-EAGLE (*SPIZAËTUS NEPALENSIS*).

The description given by Blanford, on page 352, Vol. III, in the Fauna of British India, of the crest of the Hodgson's Hawk-Eagle, *S. nepalensis* is apt to be misleading and confounded with the Crested Hawk-Eagle (*S. cirrhatus*).

He mentions that the crest of *S. cirrhatus* is black, tipped with white except in very old birds, but makes no such exception with regard to *S. nepalensis*, whereas the characteristic is common to both species, each losing the white tip with age.

It is in reality a very minor detail, as a glance at the feathering of the tarsi is in itself sufficient to separate them, but as the crest is such a prominent feature of all, except one, of the *Spizaëti*, it is apt to arrest attention, and a man who is a stranger to either species, obtains an old specimen of *S. nepalensis* and seeing no white tip to the crest, would probably take it for granted, it was *S. cirrhatus* without looking further, unless he knew that both species lost the white tip.

Blanford also states that the crest in the young of *S. nepalensis* is "often small or wanting," but this is not the case, as a rule, and he must have procured all his specimens during the moulting season, to arrive at such a conclusion. Some years ago I sent three young birds, two alive and one stuffed, to Bombay, and the Secretary of the Bombay Natural History Society will be able to testify to each of them possessing ample crests. One of the two live specimens was an eyess taken from the nest, little more than a ball of fluff, and the second was a young tiercel, caught after it had left its nest and parents, and the third bird I shot after it had left the nest, but remained with its parents.

This year I have been able to examine some eight or nine first year birds, and each and all had the usual crest, of from 3 to 4 inches in length.

Blanford also entertains a doubt as to the nidification of this eagle, for he says: "It breeds in India only, *so far as is known*, in the Himalayas from January to early in May."

Why there should be any doubt about it, I am unable to guess, as this is by no means a *rara avis*, building all over the Himalayas, in suitable localities, from 6 to 8,000 ft. above sea level. I have found its nest in the hills north of Simla, in Tehri Garhwal, and at least half a dozen up here; though unfortunately never with eggs and always with only one youngster, though it is said to lay two eggs.

It almost invariably builds on a large deodar, and selects a tree which, though surrounded by dense forest, at a little distance, is itself in more or less a "clearing" with a few dead trees near it, on which the parents love to perch.

A broad "nullah" with heavy jungle on either side and cultivation some distance below, is an ideal site for its nest. The change in plumage from the nestling to the second year is considerable, but from that onwards gradual, the markings remaining very nearly the same and only the colouring becoming darker. The irides too, undergo a change, from the bluey grey of the nestling to bright yellow in a bird from one to two years old, thence to a bright golden in the haggard, which ultimately turns orange in a very old bird.

The Hodgson's Hawk-Eagle is one of the most tractable of all eagles, and when tamed, makes quite as affectionate a pet as a goshawk. I have a haggard in my possession now, after her fourth moult, which was flying to the fist, from over a hundred yards, the twentieth day after her capture, and that without one single night's waking.

In conclusion, I may add that she has already lost the white tip to her crest.

C. H. DONALD.

BHADARWA, KASHMIR, 14*th September* 1906.

POSTSCRIPT.

With reference to the black crest of *Spizaëtus nepalensis* referred to above, my eagle has now begun growing one-crest feather with a white tip, *i.e.*, she now has three feathers entirely black and one with a white tip, showing that they lose the tip gradually and feather by feather. One second year bird has no crest at all, which is odd, as she appears to have finished her moult for the year otherwise, but of course it may come yet.

WAZIRABAD, PUNJAB, *15th December 1906.* C. H. DONALD.

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## No. XV.—EARLY ARRIVAL OF DUCK.

On the 23rd of this month, whilst out walking, a pair of Red-crested Pochards (*Netta rufina*) flew over my head. They were both females. We are surrounded on all sides by floods, and pelicans are very numerous.

CHAS. M. INGLIS.

ANARH FCTY., LAHERIA SERAI, DARBHANGA, 27*th August* 1906.

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## No. XVI.—THE BOLDNESS OF PANTHERS.

### PANTHER HUNT IN A BUNGALOW.

From time to time one occasionally hears accounts of tigers and leopards taking shelter in houses and villages, but I think the episode which happened

here on Friday, June 22, in the middle of the day and inside my bungalow, which is in the most central part of Jubbulpore, is quite unique, and may prove of interest.

About 1 p. m. I was sitting writing in my verandah, when my wife came out from a side of the bungalow which we only use for visitors, and said that she had seen the tail of a panther protruding from behind a very large coil of matting which was standing on its end in a corner of the room. As one of my N.-C. O.'s has a full-grown panther as a pet, I naturally concluded this rather undersirable visitor had broken away from his chain and had taken up his abode for the day with me, so I promptly sent off a message for the owner to come up and reclaim his lost property. The R.F.A. lines are only a few hundred yards off, so a reply was soon received that the pet panther was on his chain. In the meantime I satisfied myself without doubt that the beast behind the coil of matting was a panther, and, hastily sending another messenger to the barracks for a brother officer, I prepared the ground by removing all the furniture from the adjoining room and closing the doors of the room in which the panther was apparently soundly sleeping, the noise of our voices and the moving of the furniture having no effect on the sleeping brute. Taking a rifle myself, and arming my wife and the battery rough rider, who had unexpectedly turned up, also with rifles, we decided on shooting him in the room, and in the event of his bolting out of the house by the only route we deemed he would most probably take, my wife and the rough rider stood outside, prepared to give him a warm reception.

Opening the door just sufficiently to get my rifle through, I fired through the grass matting roll at the spot which I thought most likely to be fatal to the panther. The crack of the rifle was followed by a whough and a growl, and out came the beast straight for the door behind which I was standing. Luckily it closed the right way, for I had barely time to step behind a big pillar in the room before the angry beast passed me within a foot or two, having succeeded in forcing an exit by springing against the door, which rebounded. I had just time to see he was badly wounded in the stomach and appeared completely non-plussed. How he missed noticing me I cannot tell; it is only attributable to the fact that the animal was bent on seeking his own safety, and was thoroughly startled at finding himself in such strange surroundings, as he immediately proceeded to bolt into an adjoining room, thus giving me a chance to clear out of the house and to reconsider the situation. I felt sure the beast was too badly wounded to take to the open, especially as the rumour of its presence had collected a crowd of natives, who wisely kept well in the background; but as there were ten rooms on the ground flour, in any of which he could take cover, I postponed pursuing the animal until the arrival of St. Macau, who now appeared, armed with a Paradox. Each room in turn was carefully reconnoitred, the blood tracks being very copious, showing exactly where he had gone. In one room a halt had been made opposite a large mirror, which the panther must have seen his image, as the presence of a very large in

pool of blood showed that the animal had sat down. Eventually, after searching all but one spare room, we found him in the latter, again taking shelter behind a coil of matting. This time there was a window in the room, some 14 ft. off the ground, so by climbing on the roof a good view of the beast was possible. A ladder was procured, the roof was surmounted, and a glance through the window or skylight showed me my friend, sitting in the corner, ready to make a spring. Unfortunately, he saw me before I could get my rifle up. Taking fright, he bolted out, this time passing through the house and close to St. Macan, who fired at him as he passed under a bed, and again a second later as he went through the door. Neither shot proved fatal, except to certain portions of the furniture! But they had the effect of driving him out of the house, badly wounded, across the tennis court into the mess compound, which is just opposite my house. Here he tried to take shelter in the cookhouse, but, failing to get in, he turned towards the servants' quarters, scattering the numerous occupants and their belongings, such as fowls and dogs, in all directions.

Just at this moment an inquisitive sweeper emerged from his house to see what the commotion was. Quickly spotting him, the panther made for the man as fast as his wounds permitted. A race ensued between the two, which onlookers reported as having its humourous as well as its serious side. Too feeble to do harm, the beast merely made two or three clutches at the man's clothes, and then, turning into an outhouse, he was polished off with a shot from a ·577. Thus an hour's exciting sport was brought to a close with the inevitable photograph! On examination the panther proved to be a female about three years old, in very poor condition, which was accounted for by the presence of an old bullet wound of some weeks' standing, the result of which had in all probability driven the unfortunate animal to wander into cantonments in quest of food.

Within a radius of six miles of Jubbulpore panthers are common, and within the last 10 years one was killed under a culvert in the brewery, and a three-quarter grown tiger cub was also accounted for in a nullah on the present golf links. The animal must have walked through the open doors at night, and hid in the hope that nightfall would again offer a chance of escape.

G. R. RUNDLE, LIEUT.-COL., R.F.A.

JUBBULPORE, C.P., *24th June.*

(*The above appeared in the "Field" of the 18th August* 1906.)

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## No. XVII.—THE BOLDNESS OF PANTHERS.

*Apropos* of "The boldness of panthers," the following may be of interest. A short time ago a friend of mine—B—was watching for a panther. He was sitting concealed behind a screen on one side of a nullah and a goat was tied on a rock on the opposite side, a distance of about twenty yards. At about 5 p.m., when still quite light, he saw a panther coming towards the goat from one side. When it was a short distance from the goat, B, who was using a single ·303

fired but missed. The panther took no notice of the shot but moved closer to the goat when B again fired and missed again. This time he saw the bullet strike the ground just beyond the panther, it having passed over her back. She still took no notice and continued moving slowly towards the goat. B then fired a third time and killed her. The panther proved to be a small female, and as she had killed and eaten a goat the previous night, she cannot have been very hungry. B was using a single shot ·303 and cordite powder.

J. R. J. TYRRELL, CAPT., I.M.S.

AJMERE, *26th October* 1906.

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## No. XVIII.—FURTHER NOTES ON BIRDS' NESTING ROUND QUETTA.

In continuation of my notes which appeared in Vol. XVI, No. 4, page 747 *et seq*, I will add this year's experience.

There is a large scope for egg collectors in these parts. I have done a certain amount, but have been handicapped by professional duties, and not knowing the localities which the birds haunt. The season is of short duration; nesting commences about the middle to end of March, and few eggs can be obtained after the middle of June. If one could arrange to get these three months to oneself and also knew the best places to go, I am sure a lot of eggs of species new to India would be added to one's collection. I regret to say I leave Quetta this fall, so will not have another season here.

*Coccothraustes humii*. HUME'S HAWFINCH.

My last year's experience was repeated through. The bird seems to commence to lay about the last week in April, and to finish by the end of May, few eggs being found before and after these dates. I found several nests this year in vineyards. These are cut down annually as they commence sprouting; the stumps are clothed in leaves, among which the birds build their nests. By searching a vineyard thoroughly, one can obtain any number of nests. 5 to 6 eggs is the usual complement, though I have found as many as 7 on occasions, and at other times 4 incubated eggs.

*Saxicola isabellina*. THE ISABELLINE CHAT.

Mr. Stuart Baker on the nidification of Indian Birds, page 283, a copy of which he has kindly sent me, quotes Colonel Rattray as having taken the eggs of this bird. As his account of the nest and the colour of the eggs is so totally different to my experience, I have sent two birds, which I take to be Isabelline Chats and to which the note below refers, to Mr. Baker for his opinion as to what they are.

This bird, whatever it may be, is very common round Quetta in the spring. It sticks to the plains and does not go up into the hills. Though so plentiful, I have not met with much success, as they are most astonishingly cunning. To begin with, they nest down natural holes, which have the appearance of ordinary rat holes, and give no indication that they are occupied. I do not

think the birds excavate them themselves, though they may enlarge the nesting chamber which is usually some 2 feet in. The holes are not as a rule straight but wind, and side passages or channels run from the main passage. In these it is not unusual to find toads and beetles when digging up the nest. They are early breeders and commence operations about the last week of March. The only way to find the nest is to watch the bird building or feeding the young. I have never succeeded in finding a nest in any other way. The nest is a conglomerate mass of hair, roots, wool, cotton, rags, feathers, etc., in the centre of which is a depression, nicely finished off, in which the eggs are deposited. 5 is the usual complement of eggs, although I have got 6 on occasions. They are of a very pale blue, absolutely unspotted, and of oval shape. The dates of taking are given below: 1-4-06, building. 11-4-06, young. 12-4-06, 5 incubated eggs, 13-4-06, 2 nests. 5 and 6, fresh eggs. 16-4-06, young. 17-4-06, 5 incubated eggs. 26-4-06, 4 fresh eggs. 30-4-06, 4 fresh eggs. After this I got no more eggs, though I came on birds feeding nestlings. I rather think there are two broods a year. If I find I am mistaken in the identity of the bird, I will make it known.

*Merops apiaster.* THE EUROPEAN BEE-EATER.

My remarks of last year apply to this. I noted that the nest holes all faced east and attributed it to their desire to remain cool. I have another suggestion to put forward, and that is a telegraph wire runs along the entire length of the breeding ground, on this the male perches, and from it he can see the entrance of the nest. If these faced west he could not do this.

*Hypolais rama.* SYKES' TREE WARBLER.

I visited the same locality as last year on 14th May, and found numerous nests. Nothing fresh to add.

*Saxicola picata.* THE PIED CHAT.

I noticed them building on the 1st April and took my first clutch on the 12th. Normal number of eggs 5, most taken in one nest 6. The nesting habits of this bird are very similar to those of *Thamnobia*, that is the Brown-backed and Black Robins, except that they do not haunt houses. The birds are very plentiful round Quetta: the favourite nesting sites are holes in steep river banks or under rocks and stones in the hills. The nest is of the usual robin type, made of roots bent and lined with hair, wool and any soft material that may be handy. I found numerous nests from early in April till about the third week in May, after which only young were found. The eggs are of a light blue colour, speckled with dull brick red; one clutch, however, was spotless.

*Anthus similis.* THE BROWN ROCK PIPIT.

Plentiful outside Quetta from about 6,000 feet upwards. The first nest I took was on the 19th April and contained three fresh eggs: most number 5, usual number 4 in one nest. The nest is of the usual Pipit type, built under a tussock or rock, usually well concealed, more occasionally not. Breeding season

extended probably according to height above sea. Last clutch taken 18th July. Obtained several clutches.

*Pica rustica.* THE MAGPIE.

Common on the hills in the district, but does not frequent Quetta or its immediate neighbourhood. At Ziarat it is much in evidence. I found nests there early in May, but birds had not laid. Captain Winter kindly sent me some from there later in the month.

*Sitta tephronota.* THE EASTERN ROCK NUTHATCH.

Quite plentiful round Quetta ; its nest is not difficult to locate once one knows its haunts and habits. I did not obtain many eggs this year, several of the nests found containing young. The first nest I took on the 2nd April. I will endeavour to describe it. The site was under an overhanging rock which looked as though it had been eaten out by the action of water. In the shelter of this it was built. An enormous plaster of mud formed the foundation, which was quite 30 inches by 18. The middle was worked out into a retort shape, very like the nest of the cliff swallow (*Hirundo fluvicola*), in the centre of which was the entrance to the nest proper. The mud was of the consistency of hard-bake ; I was unable to break the nest, but gained admittance by scraping with a clasp knife. The chamber of the nest was most capacious, and was filled up with some very soft material, resembling puttu or hair's down. Most of the nests were within hand reach and faced east, I presume because, at this time of year, the prevailing wind is from the west and very cold. I got 7 slightly incubated eggs, and on visiting the nest again on the 22nd took 8 fresh ones. The nest was repaired a third time, but I left it unmolested ; there were undoubtedly eggs as the bird was on the nest. On every occasion of taking a nest a bird was on it. The male I presume gives the nest away. He usually hangs round the neighbourhood, uttering his unmistakable cheery call, and returning, at intervals, to the nest. I do not know whether the same nest is occupied in successive years, but they undoubtedly repair and re-occupy a nest that has been broken into. Some of them go in for decorating their homes by plastering feathers on them. Most of the birds lay in April, the nests found in May contained young. Seven would appear to be the usual complement of eggs. I never found a nest against a tree for the simple reason that there were no trees in the haunts I found them

*Gyps fulvus.* THE GRIFFON VULTURE.

I got one hard set egg on the 5th April from a nest on a cliff.

*Tinnunculus alaudarius.* THE KESTREL.

A resident at Quetta and not uncommon. I obtained three clutches this season. The nests, if such they can be called, the eggs being laid on the bare ground, were all situated in holes and on ledges in the perpendicular banks of a river. As these were only some 30 feet high, they were easy of access I obtained my first clutch of 5 on the 12th April. I had noticed a pair haunting a particular locality, where there was a suspicious looking hole. On flinging a

clod of earth at this, which fortunately struck the entrance and broke up, out flew madam. I did not take long to get the eggs, which were quite fresh. I then got 4 eggs from a ledge, they were exposed to the heavens with no protection. The third clutch was taken on the 24th May. On this occasion the eggs were laid some way in. The female sat very close, in fact I had nearly given up hope when out she came.

*Sylvia jerdoni.* THE EASTERN ORPHEAN WARBLER.

I found this bird common round Quetta in the spring, more especially from 7,000 feet and upwards, and it breeds freely. Unfortunately I made this discovery too late, otherwise I could have got many clutches. The first nest I came on was on the 13th May; to my great disappointment it contained three young just hatched and one egg hatching. However, my mourning was soon turned to joy as I came on another nest, shortly after, containing 4 fresh eggs. In the same locality, on the 20th May, I found a nest with three young and one addled egg, and in another locality, much higher, I took 4 incubated eggs on the 18th June and 4 fresh eggs on the 21st idem, besides finding many nests with young. The nest is placed in a low bush and is not difficult to see. It consists of bents and twigs and is lined with hair and fine material, cobwebs being used outside. It is a compact neat cup, well made. The bird is a close sitter.

*Lanius phœnicuroides.* THE RUFOUS SHRIKE.

This bird is abundant on the hills near Quetta and comes down very nearly to the plains surrounding it. It is curious how it should have come to be overlooked. There is no doubt about its identity as I shot a specimen, which went home to the British Museum. It frequents the low thorn bushes, common on the hills. I took my first nests on the 13th May, which contained 4 and 5 fresh eggs and my last on the 21st June, but these latter were at a much higher altitude. The nest is the usual massive cup-like structure common to all shrikes, bits of rag being utilized where obtainable. The site is usually the centre of a low thorny bush. A few nests were found on road-side trees; these were placed where branches unite with the main stem, and were from 10 to 14 feet from the ground. Were I remaining here another season, I am sure I could obtain as many clutches as I desired. Five would seem to be the complement of eggs, though I have taken six occasionally. The eggs are of the usual shrike type, but of two varieties, one with a salmon pink ground, the other greenish. The former is the commoner.

*Sylvia affinis.* THE INDIAN LESSER WHITE-THROATED WARBLER.

Apparently a few of these little birds remain to breed. I found one nest on the 13th May, containing 4 incubated eggs and another on the 31st, with 4 young. The nest was rather a flimsy structure of twigs, lined with bents and a little hair. They were both placed in low thorn bushes but not difficult to see.

*Ptyonoprogne rupestris.* THE CRAG MARTIN.

Fairly often seen flying about the cliffs of the valleys near Quetta. I took four fresh eggs from a nest on the 31st May. It was attached to a rock some

12 feet from the ground, was saucer-shaped, made of mud and lined with fine grass, roots and feathers.

*Anthus trivialis.* THE TREE PIPIT.

A few are to be found round Quetta. I got two nests on the 21st June, one containing three incubated eggs, the other two young just hatched and a third just coming out. The nests were placed in a hollow on the ground, well sheltered and nicely lined with flower-down and other soft material.

*Emberiza stewarti.* THE WHITE-CAPPED BUNTING.

Found in numbers round Quetta, but somehow I was very unsuccessful with them. I only got one clutch of three eggs, on the 29th June, my man shooting the bird. He informed me the nest was situated on the ground.

R. M. BETHAM, MAJOR,
*The 101st Grenadiers.*

QUETTA, *6th October* 1906.

## No. XIX.—DESTRUCTION OF MOSQUITOES AND THEIR LARVÆ BY FISH AND LIME.

It is well known that in all tropical countries stagnant water, wherever found, is a sure breeding place for mosquitoes. Not long ago I occupied a house, in the Punjab, which was infested by these pests. On searching for their breeding place I found it in an open cistern which had been built to contain water for the garden. The cistern was about eight or nine feet long by five broad, and five deep, and the water in it was quite brown from the mosquito larvæ it contained. To destroy these, I placed in the cistern about fifty or sixty of the little silvery fish named "Chilwa" (*Cheela argentea*) which I netted in a neighbouring stream. In a week or so these fish had completely cleared the water of larvæ, and not only that, but every mosquito which sat on the water for the purpose of depositing its eggs, was instantly devoured.

The Chilwa is a surface feeder, and is one of the most eager fly takers in India. A mosquito hovering over the surface of the water even, is jumped at and unerringly secured at a distance of an inch or so before it can settle.

This fish is easily procured all over India. In the Deccan, and in the South of India it is known by the name of "Roopchal." If these little fish were introduced into patches of stagnant water, which cannot easily be drained, and protected, there would be an end to *Anopheles* in that neighbourhood.

I made a further search in the same compound to discover, if possible, more breeding places. I soon found these in two rows of fifty water gurrahs, which had been placed on each side of the house as fire buckets, for the house had a thatched roof. A good handful of lime in each gurrah, well stirred up, not only immediately killed all of the mosquito larvæ, of which there were hundreds in each pot but most effectually prevented the mosquitoes from using the gurrahs as breeding places again. After this my house became quite free from mosquitoes.

I think the Chilwa fish should certainly be used as mosquito destroyers, in the way I have described, but they should be protected from net, men, and anglers, for they are easily caught with the simplest tackle.

For the destruction of mosquito larvæ in gurrahs, fire buckets and such like, a good handful of lime is more efficacious, in its action, and certainly cheaper than kerosene oil. The lime water would not readily evaporate, whereas kerosene oil is volatile, costly, and requires frequent renewing. In the case of fire buckets lime would be harmless, but water mixed with even a small quantity of kerosene oil would probably increase the flames, instead of quenching them.

I was led to try the Chilwa experiment, by having often observed these fish, which I know to be surface feeders, fly takers, and destroyers of all sorts of animalculæ, rising at and taking mosquitoes, especially about sunset when these insects swarm, and with regard to the lime, it is a matter of common knowledge that fish, and minute animal life cannot exist for a moment in lime water.

H. OSBORN, LIEUT.-GENL., I.A.

NAGGAR, KULLU, PUNJAB, *3rd October* 1906.

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## No. XX.—A CLUMSY KILLER.

At a time when the various ways adopted by the *Felidæ* of killing their prey is attracting so much attention, it perhaps would not be out of place to describe the *modus operandi* of *Ursus torquatus* (The Himalayan black Bear) as witnessed by me on one occasion.

I was out in quest of pheasants and on crossing a ridge, heard a lot of shouting and yelling, mingled with the bellowing of a luckless cow. Thinking a panther had arrived on the scene, I handed my shot gun to my shikari and taking my rifle, rushed down the hill as fast as I could go and on reaching the "nullah" saw a red cow struggling along, some distance below, with something black hanging on to its quarters. Guessing what it was, but not daring to fire, for fear of hitting the cow, which would have been a crime, almost equal to murdering a man, in a Hindu State, I rushed on. I lost sight of the cow and her assailant round a bend, but caught them up very shortly after and found the cow lying on its side, struggling and bellowing and the bear gnawing away at a hind leg.

I had turned the corner and almost ran into the bear, which was more surprised than I was, and giving vent to a startled "wouf" half stood up on his hind legs. I did not wait to consider but let off both barrels into his chest knocking him over backwards, practically dead. I then turned to the wretched cow and found she had one leg broken and two huge pieces of flesh taken from her flank, while her stomach and quarters were lacerated and pouring with blood from scars and holes made by the bear's claws and teeth. Fortunately for the poor cow, which otherwise would have been permitted to linger on in agonies, till loss of blood or starvation released it from its pains, the village was only half a mile distant and the cowherd, who had arrived on the scene,

said he would run down and tell the owner and so gave me and my Mahomedan shikari time to despatch it by twisting its neck round and bringing the back of an axe down behind its ears

Out of about a dozen fresh kills by bears that I have seen, only one, and that a fine big buffalo, was mauled about the neck and shoulders, otherwise all must have been killed in a similar manner to the one above described, *viz.*, caught by the quarters and literally torn to pieces when the bear got his victim down.

In some cases I believe the stomach is torn out, but of course I could not tell whether this had been done before or after death, though I have seen a pony, which ultimately escaped, frightfully torn between the thighs and all about the stomach.

One enormous old patriarch, which I was fortunate in bagging a few months ago, was a notorious cattle killer but a very clumsy operator, as he appeared to maim more than he ever killed. This was perhaps owing to his very blunt teeth, which were really only enlarged stumps, and he also lacked one eye and was simply skin and bone, with a coat more like the cattle he killed or mangled, with huge scars showing through the thin hair. In spite of his poor condition, he weighed 450lbs and had a girth of 45" round the chest and altogether was the thickest set bear I have ever seen, though not a long one. Females with cubs generally do more cattle-killing than any others, but some old males, when once they take to it, are regular fiends. It is evident a bear was never intended for killing animals from the filthy job he makes of it, very different from the bloodless business that a tiger's or panther's is. *U. arctus* (The Brown Bear) is a much cleaner killer, but then of course he restricts his depredations to goats and sheep, which he can kill with one blow of his powerful paw. I have only seen two fresh kills by brown bears and neither had a tooth or claw mark on them, though shepherds have told me that sometimes he carries them off alive, as they hear the sheep or goat bleating as he goes. I have never heard of a brown bear attacking cattle though he does not hesitate about eating a cow or a buffalo if he finds one dead. Both kinds are cannibals as well.

BHADARWA, KASHMIR, 12*th October* 1906. C. H. DONALD.

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## No. XXI.—A BEAR'S KILL IN A TREE.

With reference to Mr. Comber's query on page 518 of this Vol., the following experience which I had a few years ago, may be of interest. *Khubber* of a bear having killed a bullock being brought, I started off to try my luck, as of all animals I think a bear on his kill is the easiest to bag, for if away from a village, he seldom troubles to leave the kill at all, but, after his feed, lies up within a few yards of it. On this occasion I was annoyed to find, on approaching the place, half a dozen men with dogs making a frightful row, so swore at the man for bringing me on what I felt sure would be a wild goose chase, as no animal would stop with such a hullabaloo going on. He however appeared as

convinced to the contrary and said that they had made more row when he had caught the bull, but the bear would not budge and charged when they got near. Subsequent events proved him right and the bear an uncommonly nasty customer. We eventually got into a dense scrub jungle where it was impossible to see more than a couple of yards ahead and crawled along on hands and knees. I took 2 men with me and also had 2 dogs, a setter and a spaniel, on the chain behind. After we had gone about 20 yards I heard the well-known half snuffle or half grunt of an angered or frightened bear. Both my companions did record time back the way they had come and not liking the idea of a charge in such a place I followed suit, going backwards with both triggers full cock. I then decided to take the setter in with me as he had accompanied me on many bear shoots and leave the bipeds behind. I kept the dog to "heel" till I got to the place whence I had heard the bear and then sent him in. He went in all his hair on end and growling, but had not gone two yards when back he came and the bear after him. However I was ready for him and dropped him almost at my feet with a bullet in the head. He was a huge beast in his prime and in perfect condition and coat. The villagers soon arrived and hunted about for the kill which was finally discovered in the fork of a dry oak about 8 ft. off the ground. Why he should have taken the trouble to drag the bullock, the ordinary sized rat one sees in the hills, up the tree when there was such good cover down below, I cannot think. I have shot several bears on kills and have found they usually eat the entire animal when they have killed it and do not attempt to drag it at all. I never heard of one taking his dinner into a tree before or since and it would be interesting to hear if any other sportsman has seen or heard of a similar occurrence.

BHADARWA, KASHMIR, 12*th October* 1906. C. H. DONALD.

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## No. XXII.—A PANTHER PLACING ITS KILL UP A TREE.

In reply to a letter in the Journal of September 20th regarding a panther placing its kill up a tree, I came across a similar case about five years ago of a panther taking a Gyi (barking deer) on to a tree. The tree was, I think, a Tamarind, short bole and big fork, growing on the bank of a stream over which it was leaning. I was walking up the bed of the stream and passed right underneath without noticing it, and the men behind shouted to me. I turned round in time to see the panther disappearing. The kill was quite fresh, and the panther was evidently still at his meal on the fork of the tree when I passed underneath. The height above the bank must have been about eight or nine feet, but not perpendicular as in the case under reply, and the distance above my head was about four feet more.

KINDAT, UPPER BURMA, 31*st October* 1906. L. V. BAGSHAWE.

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## No. XXIII.—DO BATS CAPTURE AND EAT BIRDS?

It is a common morning occurrence to find, on the floors of verandahs, unceilinged rooms and out-houses, the remains of small birds (principally *Zosterops*.

*Cinnyris* and sundry 'Flower-Peckers') that have been devoured during the night. I have never observed the remains of insects or of any other animal associated with those of the birds. This work is usually, in Ceylon, credited to rats; but, from the conditions under which the remains are found and from the excreta associated with them, I am inclined to the belief that it should be attributed to bats of some kind. The fragments are dropped from positions that would be more convenient for bats than for the rodents, namely, beneath bare rafters well away from the walls of the building.

The excreta associated with the remains are very different from the compact pellets usually voided by rats. They are small, irregular, narrow and tapering at each end, of a soft moist consistency, and contain many fragments of bones.

I have not succeeded in surprising the animal (whatever it may be) at its meal. It is evidently a late feeder. The remains are seldom—if ever—found before midnight in my bungalow, though this may possibly be due to the presence of lights up to that time.

The destruction of small birds by these nocturnal assassins is considerable. I have gathered up the wings and feathers of three or four birds each morning for several months in succession from a single room. The bat (if bat it is) must systematically search the bushes in which the birds roost.

Suspicion rests upon bats of the genus *Megaderma*, the two species of which (*lyra* and *spasma*) both occur in Ceylon. The dentition of *Megaderma* is said (Fauna of British India, Mammalia, p. 294) to differ from that of the insectivorous bats; and *Megaderma lyra* is known to prey upon smaller bats, frogs and other small vertebrates, though no special mention is made of birds. *Vespertilio murinus*, also, is reported to kill and devour smaller bats kept in confinement with it; but this bat does not occur in Ceylon. I should be glad to hear if any observations on the possible bird-eating habits of bats have been made in India.

ROYAL BOTANIC GARDENS, PERADENIYA, CEYLON, *October* 1906. E. ERNEST GREEN.

## No. XXIV.—A WHITE MUNTJAC.

Whilst out shooting on August 25th in a South India jungle I came upon a white muntjac or barking deer only about fifty yards from me. As I was not far from a road I thought at first that it must be a tame goat which had strayed, and whilst debating in my mind what the animal could be it gave two short barks and disappeared in the jungle. We tracked it for some way and twice put it up, but being in very thick jungle I was unable to get a shot at it.

MUTTRA, INDIA. S. H. CHARRINGTON.

(*The above appeared in "The Field" of 29th September* 1906.)

## No. XXV.—CAUSE OF FEAR SHOWN BY TIGERS.

Capt. Montresor's note on "Cannibalism amongst . . . . . tigers" (Vol. XVI., No. 2, page 543) emboldens me to write on a subject that has long interested me and that is as to the cause of fear in tigers. Everyone who has spent any time in the jungle tracts of India must be familiar with the

fact that tigers as a rule exhibit fear, or perhaps more correctly extreme caution when they hear any sound, the origin of which is not at once apparent, and that the slightest sound is sufficient to cause a tiger feeding on or approaching a kill to disappear like a flash. There must be some reason for this, and I have put the question repeatedly to sportsmen and naturalists. I have never had a satisfactory elucidation and until recently no plausible explanation presented itself to me. Many have advanced the natural fear of man in animals, but this does not seem to me to solve the matter but rather beg the further question, "Why should tigers fear man?"

It has however lately occurred to me that one enemy a tiger has to fear, is another and more powerful tiger or even a weaker one with the advantage of surprise on its side. This would be specially so with females (being generally smaller and weaker) and with young ones.

The females would probably impart caution to their young and these would probably retain the habit of caution in after life.

The need for caution would be greatest when feeding, for being in movement, though slight, the tiger would be more visible, the noise in feeding would attract attention and also cover the noise of a stealthy approach, and finally the temptation to attack would be greater.

Now Capt. Montresor's note shows that the fear of such an attack must be a very real one and I therefore venture to offer this suggestion. Possibly it has been made before, but if so not to my knowledge or to that of the many I have consulted.

COIMBATORE, 16*th October* 1906. C. E. C. FISCHER.

## No. XXVI.—NOTE ON *CLANIA VARIEGATA*, SNELL.

Larva. The caterpillar is a worm-like cylindrical one with a large head of which the vertex is covered by the straight margin of segment 2; this segment 2 is covered dorsally by a hard shiny chitinous shield and is long; segment 3 is rather broader than segment 2 and telescopes over its hinder margin as does segment 4 over that of segment 3 also; the body is broadest at middle and decreases to anal end which is strongly down-curved, the anal flap or last segment being semi-elliptical in shape, large, convex and slightly pointed in the centre of hinder margin. The head is round, quite smooth, moderately shiny, with an erect hair or two about the eyes and one on each side of clypeus apex; this clypeus is angular; the colour of head is horny white, marbled with dark brown on clypeus and cheeks and in a central line over vertex. The spiracles are large with raised edges, oval, the colour of the body. The surface of the body is somewhat shiny on segments 2-4 and dull, elsewhere is strongly ridged or wrinkled transversely; there is a shiny, smooth, oval, slightly raised surface over each spiracle; there are some longitudinal irregular impressed lines and a few small tubercles at the hinder margins of the segments on the transverse ridges; segments 2--4 are smooth and unridged, of horny consistency, coloured like the head with a sub-

dorsal marbled dark-brown line which is broken up into minute spots on the front half of segment 2 ; these lines coalesce with a dark brown dorsal line on segment 4 and a lateral diffused brown band ; the rest of the larva is black-brown, reddish on segment 11 dorsally and lighter laterally on all segments. There are some fine erect hairs in two rows on segment 2 and some about the spiracles of that segment ; a sub-dorsal and supra-spiracular hair on all other segments. The prolegs are all small ; the true legs large, horny white, mottled with brown ; the labrum and antennæ white, jaws black. L. 36mm. ; B. 9mm.

Feeds on *Casuarina equisitifolia, Cassia, Acacia arabica*, &c., &c.

Pupa.

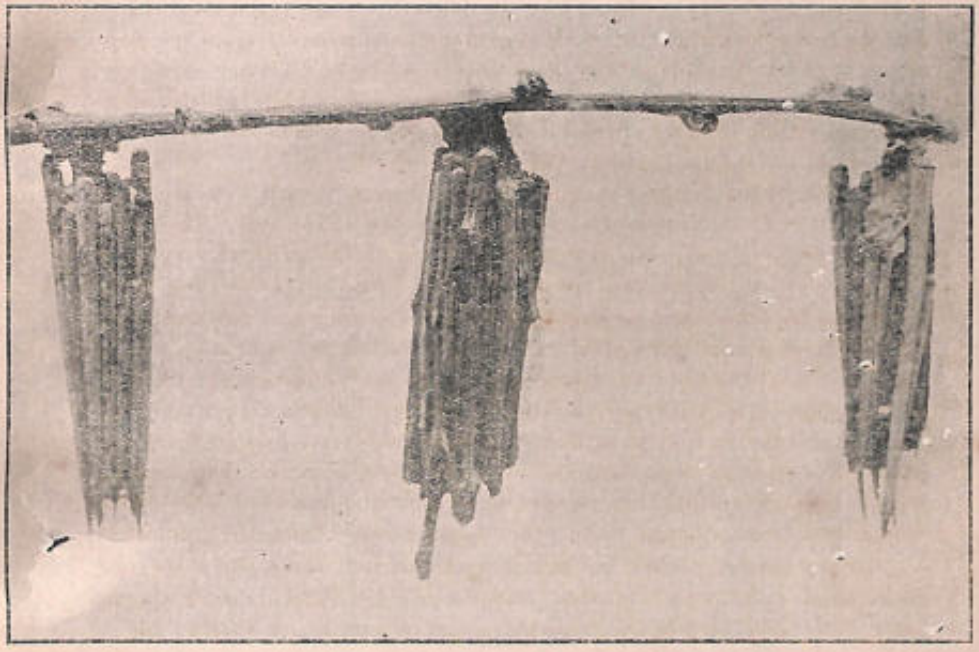
The pupæ of the male and female are very different though both enclosed in the stick-cocoon, otherwise the larval case. The male pupa is an abnormal looking noctuid one with very short wings, very swollen antennæ, broad at the base and more swollen on the outside margin than on the inner ; the wings only reach segment 7/8 ; the head is small and bowed and has a broad dorsal carination which comes to a point in front ; the vertex is in a plane at 90° to longitudinal axis of pupa ; segment 2 is in a plane at 45° to that axis and both margins are bent back towards thorax to form a point or angle in the dorsal line and there is a prominent carination along the dorsal line ; the thorax is considerably convex and the dorsal line slopes from its apex to segment 2 and segment 4, its hinder margin is a semi-elliptical curve ; the thorax is rather long ; the abdomen is circular in transverse section and bent down at the end where there are two short points ; the pupa is broadest across segment 2-3 and highest at thorax apex. The body surface is somewhat shiny, especially on thorax, and is transversely wrinkled ; the veins of wings are prominent ; there is a jaggedly toothed ridge on front margins of segments 10 to 12, not reaching the spiracles. Spiracles of segment 2 not visible ; the others are raised, broadly oval, shiny with an open slit dividing them into two unequal parts. Colour is dark red-brown, lighter on abdominal segment margins, very dark on segments 1-3 and wings. L. 15 mm. ; B. 4 mm.

The female pupa is a cylindrical body with a blunt point at the anal end and no vestige of what could ordinarily be called a head ; the front part is, ventrally, a mass of corrugated skin and, dorsally, segments 1 and 2 are not visible or distinguishable ; segments 1 to 5 are all contracted together ; the surface of the pupa is wrinkled transversely and has some deep irregularly-shaped pits in the lateral abdominal region ; the middle 5 segments are very large and distinct ; the spiracles are broad, flush, oval. The pupa is broadest at segment 11 and diminishes towards head. L. 19 mm. ; B. 9 mm.

Habits.

The larva makes a cocoon of sticks placed side by side parallel to the body and quite cylindrical in shape, the sticks being often of slightly unequal length, the inside being thickly coated with silk which holds the structure together. The inside lining is produced beyond the mouth of the stick-case and this free portion is used to attach the whole structure to the twigs, branches, &c., where the insect lives ; the

mouth of this free part can be drawn in and closed by the larva like a cloth bag with a string to close it let in all round ; the front legs are used for closing.



LARVAL CASES OF THE MOTH *CLANIA VARIEGATA*.

As the larva grows it enlarges the case by gnawing off new lengths of stick (always, nearly, dead pieces) which are let in between the others symmetrically for which purpose the web or lining is cut by the insect's jaws gradually the whole length down between two of the existing sticks. The web lining is of extraordinary toughness and is extremely difficult to tear. The larva never comes out of the cocoon or case but only protrudes the first four segments for feeding or building purposes ; it holds on to the twig, &c., by its true legs and thus moves about case and all. When full grown and about to pupate the case is attached strongly by the free part of the inside lining and closed ; the larva then turns its head towards the bottom end, and pupates. The pupa works its way out through the bottom end when ready to burst and forces itself three-quarters way out of the case in which position the male emerges. The female imago stays in the case, protrudes her end segments through the bottom of the case and is in that position fertilised by the male ; she never comes out, being soft-bodied and apterous. The female imago is a whitey-yellow grub with no distinct head, no legs, a few feathery golden-yellow scales about segments 2-5 (which segments together are only about equal in length to one of the central abdominal segments) and dorsally about segment 12 ; the scales of segments 2-5 are disposed laterally and ventrally, the dorsal portions of those segments being

shiny bare, and bright yellow-orange in colour; the middle segments are very large and dirty white in colour. L. 40 mm. for male cocoon and 50 mm. for female.

*Clania variegata* is one of the few moths that has only one brood a year here. The larva pupates about November and the imago may emerge about the month of April; but this depends upon the moisture in the atmosphere. A few emerge at odd intervals after February.

The male moth is a very strong flier and comes only rarely to light.

KARWAR, 20*th October* 1906. T. R. BELL, I.F.S.

## No. XXVII.—ABNORMAL ANTLERS OF THE CHITAL OR SPOTTED DEER (*CERVUS AXIS*).

I send herewith a photograph of an abnormal head of a cheetal shot by me recently in the Mandla jungles, C. P., on the 30th of April last.

The off antler measures 29½", the middle antler 30" and the near (additional) antler 20½". There are three distinct pedicles, three burrs and there was skin in between all the three antlers. It will be noticed that the additional antler has two tines and the lengths of the three brow antlers are, off 10¼", middle 10¾", near 6¾".

The body of the animal was exceptionally large :—

| | | | | | |
|---|---|---|---|---|---|
| Length from tip of nose to root of tail along curves | ... | ... | ... | ... | 73½" |
| Height at shoulder... | ... | ... | ... | ... | 39" |
| Girth behind foreleg | ... | ... | ... | ... | 45" |

J. A. FIELD, LIEUT., R.E.

JUBBULPORE, C. P., *5th November* 1906.

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## No. XXVIII.—THE OOLOGY OF INDIAN PARASITIC CUCKOOS.

In No. 2 of Vol. XVII Mr. Stuart Baker mentions my obtaining an egg of *Cuculus poliocephalus* in the nest of *Oligura castaneicoronata*. It was, as he wrote, obtained on the 6th of July but the elevation given is not correct. It was found at Tonglu which is 10,000 ft. high.

CHAS. M. INGLIS.

BAGHOWNIE FTY., DARBHANGA.
*26th October* 1906.

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## No. XXIX.—A STRANGE FOSTER-MOTHER.

My wife has a pet pigeon (female), the male bird having disappeared some two years ago. She lays some two eggs about every six weeks or two months and patiently sits on them, but of course in vain.

A few weeks ago my wife was given two quite young grey palm squirrels which she placed in the cage with the pigeon, which proceeding the bird naturally strongly objected to. A few mornings ago however my wife went to the cage as usual to feed them, and seeing only the pigeon, hunted high and low for the squirrels, but not finding them she returned to the cage and when she disturbed the pigeon she found much to her surprise a squirrel under each wing and the eggs under her. Ever since then the squirrels always sleep under the pigeon's wings. When I went into my wife's room a few minutes ago one of the squirrels was comfortably settled under a wing of the pigeon.

F. YOUNG.

KOLHAPUR, *31st October* 1906.

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## No. XXX.—NESTING OF THE HOBBY (*FALCO SEVERUS*) IN INDIA.

Dr. Blanford in the "Fauna of British India, Birds," Vol. III, page 423, says that the nest of the hobby has not been taken in India, so it may be of interest to some of the readers of the Journal to hear that I found a nest in Hursil in Tehri Garhwal, about 30 miles from the source of the Ganges, at an elevation

of about 8,500 feet, with four half-fledged youngsters in it, in July, and again two young ones were brought to me by a villager here last September, showing that *Falco severus* does breed in India.

C. H. DONALD.

BHADARWA (KASHMIR STATE), 19*th May* 1902.

[The above note was kept back, and subsequently mislaid, as there was some doubt at the time as to whether the Hobby referred to was *F. severus* or *F. subbuteo*. The author has since ascertained that it is the former that breeds regularly in the Himalayas and writes that he came across two nests this year with fully fledged young. Mr. K. C. Macdonald recorded the first authentic account of the nesting of this bird in Vol. XVI, p. 518 of our Journal.

EDITORS.]

## No. XXXI.—A LIVE TAKIN (*BUDORCAS TAXICOLOR*).

(*With an illustration.*)

I am sending you a photograph of a young male Takin (*Budorcas taxicolor*) in the hope that it may prove of interest to the Society.

BUDORCAS TAXICOLOR, JUV.

This animal was given by the Tongsa Penlop of Bhutan to Mr. J. C. White, C.I.E., Political Officer, Sikhim. It died the day after the photograph was taken.

F. M. BAILEY, LIEUT.

BRITISH TRADE AGENCY, GYANTSE (TIBET), *30th October 1906.*

[Regarding this same animal Mr. R. L. Lydekker wrote as follows to the

*Field* of 13th October 1906 with an accompanying reproduction of another photograph :—

"The photograph of a young takin (*Budorcas taxicolor*) from the Sikhim district has been kindly given me by Mr. Claude White, Commissioner of that province. It is of great interest, as being the first photograph of this curious ruminant ever taken; while the animal it represents is, I believe, the first example of its kind ever seen alive by a European. The animal was captured by natives and brought to Mr. White's camp, where it lived for some time, and appeared so healthy that strong hopes were entertained of the possibility of transporting it to England. Unfortunately, it died suddenly, it is supposed from having eaten the aconite which abounds in some parts of the district. When the photograph was taken, the young takin was believed to be less than a year old, the horns being mere straight prongs; nevertheless many of the characteristic features of the species are shown, especially the shaggy coat, the thick, clumsy limbs, and the comparatively short, rounded ears.

From the small size of the latter, as compared with those of the scrub-dwelling serow, it is natural to suppose that the takin is an inhabitant of open country. This, Mr. White informs me, is actually the case, the creatures going about in pairs (or threes) on the open zone of the mountains immediately below the snow level. It is reported to be extremely fierce in disposition—much more so than even the serow—and that the natives are frequently wounded, if not killed, when they stalk the creature. So far as Mr. White is aware, no European has ever seen a live takin in its native haunts, much less shot one. This, I presume, is due to the country it inhabits being inaccessible to sportsmen.

One of the two skins recently presented by Mr. White to the British Museum (mention of which has previously been made in the *Field*) shows that the female takin has four teats, thereby agreeing with the serows, gorals, and musk-oxen. This serves to confirm the view that these four groups of ruminants are nearly related. From the serows and gorals the takin and the musk-ox differ by the extreme shortness of the cannon bones—a feature shared with the Rocky Mountain white goat, which may be regarded as another member of the same assemblage serving to connect the takin and musk-ox with the serows and gorals. Very important is the fact that in the caverns of California occur remains of fossil ruminants which are probably more or less intermediate between some of the living groups."

EDITORS.]

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## No. XXXII.—BREEDING GROUNDS OF THE COMMON LOCUST.

There has been so much speculation about the breeding grounds of the migratory locust (*Acridium peregrinum*) that it may be worth while to record the fact that it has been breeding this year among the low hills, and also I am

told on the plains, in the immediate vicinity of Kurrachee. I first came across mobs of hoppers on the 28th of September. They covered a space of 5 or 6 feet square and were all proceeding more or less in the same direction, tumbling over each other. I brought some home and kept them until they got their wings, which they did from 24th September onwards, after the third moult. They were less than ¾ of an inch long when I got them and had probably cast their skins twice. If they were a fortnight old then, and I do not think they can have been more, their larval life had lasted six weeks. I may mention that there had been heavy rain on 27th August and 1st and 8th September, which perhaps hatched the eggs.

KURRACHEE, 16*th November* 1906. E. H. AITKEN.

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## No. XXXIII.—THE SMALL CIVET CAT IN SIND.

It may be worth noting even in the Journal of the Bombay Natural History Society that the little Civet Cat (*Viverricula malaccensis*) has been found in Sind. Blanford says that it occurs in all India, except Sind, the Punjab and the Western parts of Rajputana, and Murray does not mention it in his Vertebrate Zoology of Sind, although he describes some more noticeable animals of the occurrence of which in the Province I can find no record. My suspicions about the Civet Cat were first aroused by an account I received from a native of a wild cat, which he called *Mushki Bilo* (to convert any common Indian word into Sindhi you put an O to the end of it) and of which he said that the fragrance was so permanent that, if a dog killed one, its mouth was scented for some time after. I set inquiries on foot in all directions until I had satisfied myself that a civet of some species was known about Sukkur and central Sind. At last I found that Mr. D. G. Ommanney, District Superintendent of Police in Hyderabad, had killed one near that city. He was kind enough to send me the skin to see, which left no doubt. It was a fine specimen of *V. malaccensis*. Its proper native name is *Khathori* or *Kashturi* (the same word as Castor) *Bilo*.

KURRACHEE, 16*th November* 1906. E. H. AITKEN.

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## No. XXXIV.—A MALFORMED BLACKBUCK HEAD.

The description at page 519, Vol. XVII (No. 2) of the Society's Journal, of a malformed blackbuck head, reminds me of one I personally came across some years ago, to be exact, on 27th March 1887.

It was near Songadh in Kathiavad and my shikari said he saw a buck lying under a solitary tree in an open plain. The distance was too great for my vision even with glasses, but I had faith in my shikari and promptly started for the tree.

The last 300 yards I accomplished painfully in the attitude of the serpent of the Scriptures after the fall, leaving portions of my anatomy on my trail.

When I reached the vicinity of the tree I much marvelled that the buck, who was on the other side, concealed, did not become aware of the fact of my

proximity, and I half thought I had been pursuing a myth. On peering round the trunk of the tree, however, I saw a very emaciated buck with one crumpled horn (the right) who uttered a feeble 'baaa' but made no effort to get up.

On closer inspection I found that the horn had grown in a curve right round and penetrated the centre of the eyeball which it had destroyed, and continued its growth inward towards the brain. There was a large sloughing wound, with caries of the bone, about 3 inches in diameter, and the poor beast was in the last extremity of weakness and on the verge of death. I put it out of its pain, and on examination found that the right testicle was much atrophied and distorted while the scrotum showed the cicatrix of an old wound.

KOLHAPUR, 18*th November* 1906. W. B. FERRIS, Col.

## No. XXXV.—ABNORMAL SAMBAR HORNS.

As it may be of interest I send you a photograph of a couple of abnormal sambar horns.

That on the right was shot in Assam ; the other was killed by a tiger in the Western Duns.

GAYA, 30*th May* 1906. F. FIELD.

## No. XXXVI.—MALFORMED SAMBAR AND GAUR HORNS.

The illustrations given below and in the accompanying plate are further interesting examples of malformation in horns.

The Sambar (No. 1) is especially so as it shows a third horn growing on a separate pedicle. It was shot by me some 20 years ago here at Koppa.

No. 1.

The young bull bison (No. 2) with the malformed head was shot some 20 years ago by a native shikari.

No. 3 is the head of a bull bison shot by Mr. F. I. Parton at Koppa.

All the illustrations are from excellent photographs which were most carefully taken by Miss Brett.

O. SCOT SKIRVING.

KOPPA, MYSORE PROVINCE, *July* 1906.

No. 2.

No. 3.

MALFORMED GAUR HORNS.

## No. XXXVII.—NOTE ON THE ARABIAN GAZELLE (*GAZELLA ARABICA*).

For some four or five years now I have kept a small herd of these pretty little animals in the large compound of the Aden prison. They have bred regularly from the first year, but the deaths which take place in the herd from one cause or another prevent the numbers rising inconveniently.

This gazelle resembles closely the Indian chinkara, but is on the whole smaller and lighter built: there is a patch of brown colour on the bridge of the nose which is absent in the head of a chinkara from Deesa which I have by me: the horns are like the chinkara's, both male and female. They make charming pets, and my herd all come to a whistle every morning for their corn, and I am in the habit of asking people in to see them arrive at a gallop as soon as they hear the whistle.

The bucks are very pugnacious, and the present master of the herd has killed two rivals this year, a great loss, as both were fine bucks and had been reared in the prison. In both cases the base of the skull was fractured. The does conceal the fawn when first born in a depression in the ground. Both bucks and does are in the habit of scraping deep soup plate-like hollows in the ground in which they lie at night, and the whole herd have a great preference for spending the night near the military guard at the prison gate or close by the beat of the warders on night duty in the interior of the prison.

The young fawn lying in a depression as described is almost certain to escape ordinary observation. With chin extended on the ground and ears flattened to the side of the neck, it will allow you to handle it freely for the first few days of its life, but after about the fourth day will spring from its form and make off like a hare. The mothers seem to distinguish very definitely between strangers and those whom they know, as they will allow any of the prison staff to approach and handle the fawn without any further demonstration than a few snorts. With strangers and dogs it is necessary for the party to carry light whips, as the little antelope charges right home and the horns of the doe are as sharp as spears.

One of the old does when she has a new arrival and has hidden it will wait about the prison gate jealously inspecting arrivals, and if they shew any intention of approaching her treasure, she charges at once. Even with me this doe is very savage at such times, though, as a rule, she will feed from my hand.

Every morning at daybreak the herd takes a long gallop round and round the compound. They gallop one behind the other, the buck being, as a rule, the last. I have noticed that when alarmed and galloping away they erect a ruff of hair on the buttocks. Is this meant to assist their comrades in following them in rapid flight by rendering them more conspicuous?

The early morning gallop is interesting. It is always done daily, and there must be some reason for it beyond pure lightheartedness. Is it possibly the custom of these animals when wild to leave their sleeping ground in this way to avoid beasts of prey? They seldom seem to move at night.

Besides the antelopes, my little collection now includes some Arabian chukor, the cocks of which pay attention to the fowls; it also includes several wild hares which are kept in a large pen with some tame rabbits.

S. E. PRALL, MAJOR, I. M. S.

ADEN, 10*th November* 1906.

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## No. XXXVIII.—BREEDING OF THE COMMON OR GREY QUAIL (*COTURNIX COMMUNIS*) AND THE DESERT LARK (*ALŒMON DESERTORUM*).

Last Christmas I met Mr. Lowsley, of the P. W. D., who is employed in looking after the Sind Irrigation Canals, at a shoot in Upper Sind, and asked him if he would kindly get me a clutch or two of Black Partridge (*Francolinus vulgaris*) eggs, which he promised to do. Towards the end of April of the present year, he sent me a clutch of nine eggs, which he said were those of the partridge. On opening the box I saw at a glance that they could be nothing else than Quails' eggs, and on inspecting them came to the conclusion that they were those of the Common or Grey Quail (*Coturnix communis*). To make sure I sent some of them to Mr. Stuart Baker, who confirmed my judgment. Mr. Lowsley did not see the nest *in situ*, the eggs being brought to him by a boy, who reported having found them while cutting grass. The exact place where they were taken is unknown to me, but I believe it was in the Jacobabad District. As little or nothing is recorded regarding the nidification of this bird, I report my experience for what it is worth.

When in Karachi last cold weather, I located the Desert Lark (*Alœmon desertorum*) in the sand wastes in the near neighbourhood of that place. I asked Mr. Barnes, of the Commercial Bank, to try and obtain some eggs for me in the season, which he very kindly did. He and Mr. Bell, I.F.S., went out together and, I believe, found several nests. Mr. Barnes informs me that the bird makes a nest in a bush and not on the ground like other larks. He took some nests for me along with the bushes in which they were situated, but unfortunately they got destroyed before I saw them. The eggs of the bird are not of the lark type at all, those I have look more like eggs of the Wire-tailed Swallow (*Hirundo smithii*) in marking, though of course they are larger and not so oval in shape. The ground colour is china white, and three appears to be the complement of eggs.

R. M. BETHAM, MAJOR,
(101*st Grenadiers*).

KARACHI, 15*th November* 1906.

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## No. XXXIX.—THE LARGE RED FLYING-SQUIRREL (*PTEROMYS INORNATUS*) AND WALNUTS.

It may be of interest to those who took part in the controversy last year as to whether the holes bored in wild walnuts are attributable to the action of nutcrackers, wood-peckers or rodents, to learn that I have lately had ample

opportunities of seeing for myself, and can now safely back my original theory, that flying-squirrels (*Pteromys* sp.) are the culprits.

I have a tame one, which is hard at work on a table beside me, as I write, and I send for the inspection of the Members, the result of three or four nights' labour to enable them to judge for themselves, whether the boring in these nuts is similar to that of those sent by General Osborn in the first instance, the holes in which were assigned to the agency of the Himalayan Nutcracker (*Nucifraga hemispila*).

It takes the squirrel between one and two hours steady gnawing to make the hole, and then it gets at the kernel with its lower incisors, working the nut round and round in its paws, while the teeth are busy inside.

It has a curious trick of concealing each nut after it has finished with it under a piece of cloth or paper, but only walnuts are thus treated and no other kind of food; cake, bread, fruit and everything else is simply left where it happens to have finished with them, but every particle of walnut, however small, is carefully hidden away, and then seemingly it forgets all about its treasures, as an hour or two later it will be quite ready to start on a fresh one, but never thinks of returning to the old one unless it runs up against it by mistake, when it will take a few bites and then again carefully hide away what remains in a different spot.

As an engaging pet the flying squirrel would be hard to beat, with one drawback, and that is, it gets most lively at a time when everyone else wants to sleep.

C. H. DONALD.

BHADARWA, KASHMIR, 12*th November* 1906.

[The walnuts sent by Mr. Donald though of a thinner shelled variety than those sent originally by General Osborn, have exactly the same shaped holes in them, and we think this evidence finally settles the fact that the holes in these walnuts were bored by Flying Squirrels and *not* by the Himalayan Nutcrackers.

EDS.]

## No. XL.—THE STUDY OF BIRDS.

I have often been told by our younger or more inexperienced members, who are anxious to take up the study of the birds of their neighbourhood, that they find great difficulty in understanding the descriptions of them in books owing to the fact that they are not familiar with the technical designations of the different tracts or groups of feathers. They understand of course the wing or the back, but when the description relates to the "secondaries," "primary coverts," "scapulars," and such like, they fail to follow the meaning of it. Many, who would otherwise derive much amusement from ornithology, are consequently deterred from following up their desire to become acquainted with the birds they come across by reason of the impossibility of identifying them. Eha's excellent little book, "The Common Birds of Bombay," will go far to help the beginner, as technical description is entirely avoided, but for those who wish to go a step further it is necessary to learn the terms by which the various feathers are known, and this with a very little study is not a complicated matter

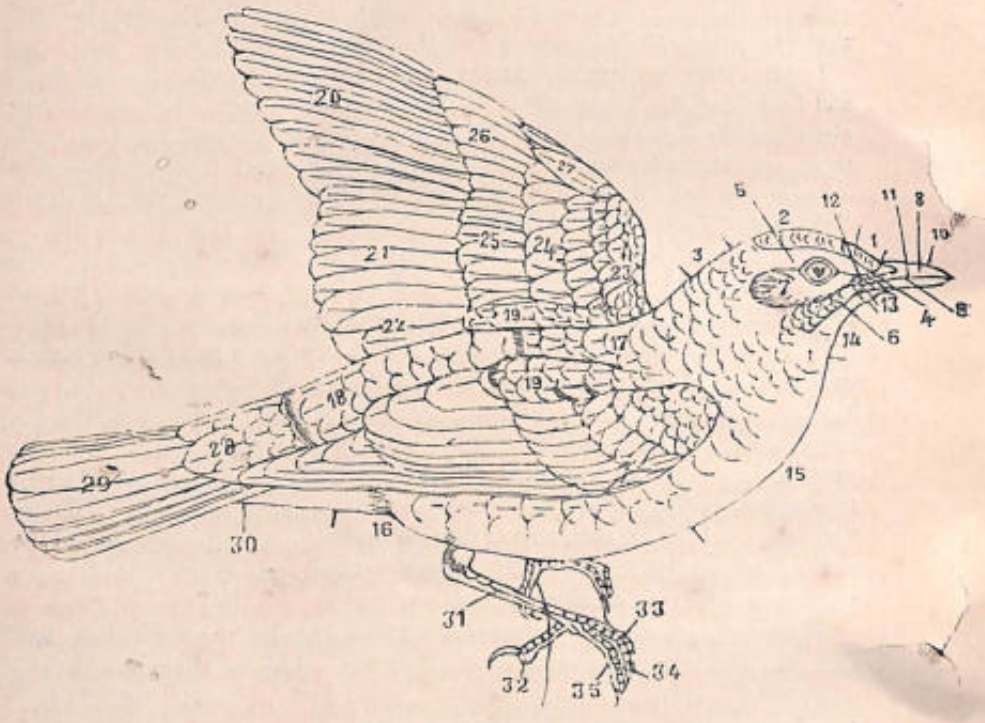


*Diagram of a Bird, to illustrate the terminology of the Plumage and Limbs.*

1. Forehead.
2. Crown.
3. Nape or occiput.
4. Lores (space in front of eye).
5. Superciliura.
6. Cheeks.
7. Ear-coverts.
8. Upper mandible or maxilla.
9. Lower mandible.
10. Culmen or upper profile of maxilla.
11. Commissure or line of junction of the two mandibles.
12. Rictal bristles or vibrissæ.
13. Chin.
14. Throat.
15. Breast.
16. Abdomen.
17. Back.
18. Rump.
19. Scapulars.
20. Primaries (the earlier or outermost 9 or 10 quills of the wing).
21. Secondaries (wing-quills springing from the radius and ulna).
22. Tertiaries.
23. Lesser wing-coverts.
24. Median wing-coverts.
25. Greater wing-coverts.
26. Primary wing-coverts.
27. Winglet or bastard-wing.
28. Upper tail-coverts.
29. Tail-feathers or rectrices.
30. Under tail-coverts.
31. Tarsus.
32. Hind toe or first toe or hallux.
33. Inner or second toe.
34. Middle or third toe.
35. Outer or fourth toe.

For the purpose of assisting members we reproduce a clear and simple diagram of a bird giving the names of the feathers generally used in describing the plumage. The figure is taken from the preface of the four volumes of the "Fauna of British India, Birds," by Mr. E. W. Oates and the late Dr. Blanford.

BOMBAY, *30th November 1906.* E. COMBER.

# PROCEEDINGS

## OF THE MEETING HELD ON 4TH OCTOBER 1906.

A meeting of the members of the Bombay Natural History Society took place at the Society's Rooms on 4th October 1906, the Revd. F. Dreckmann, S.J., presiding.

### NEW MEMBERS.

The election of the following 23 new members since the last meeting was duly announced :—

Rev. M. B. Carleton, M.D. (Subathu, Punjab); Mr. S. R. Hignell, I.C.S. (Daltonganj, E. I. Ry.); Mr. W. D. Hall (Bombay); Mr. W. H. Brady (Bombay); The Mess President, 32nd Pioneers (Ambala); Lieut.-Col. C. J. Bamber, I.M.S. (Simla); Mr. A. L. Hetherington, B.A., F.C.S. (Rangoon); Mr. J. K. Williams (Nasik); The Honorary Secretary, Officers' Mess, R.F.A., Hyderabad (Hyderabad, Sind); Capt. J. G. Berne, R.A.M.C. (Jubbulpore, C.P.); Mr. B. D. Richards (Bombay); Mr. E. Priestly (Thana); Major A. W. Newbold (Kohat); Lieut. J. Catto, I.M.S. (Manipur); Capt. T. W. H. Jones (Poona); Mr. R. Barton Wright (Sivaganja P. O., Madura Dist.); Mr. Percy C. Evans (Bindgei, Lankat, Sumatra); Capt. R. Steen, I.M.S. (Gyantse, Tibet); Mr. J. E. H. Hasted (Madras); Mr. S. W. Smyth (Kindat, Upper Burma); Mr. Wm. Skilling (Mussoorie); Lieut. W. H. Ralston (Tientsin, North China); and Capt. N. W. Mackworth, I.M.S. (Tientsin, North China).

### CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary, Mr. W. S. Millard, acknowledged receipt of the following :—

| Contributions. | Description. | Contributors and Locality. |
|---|---|---|
| A small collection of otoliths or carbones of fishes. | ..... | Mrs. S. Joyce, Bombay. |
| 1 Sea Snake ... ... ... | *Enhydrina valakadien* ... | Mr. C. E. Rhenius, Ramnod, Madura District. |
| 8 Snakes ... ... ... | *Zaocys nigromarginatus*, *Lycodon aulicus*, *Simotes sp.*, *Polyodontophis collaris*, &c. | Major A. Begbie, Calcutta. |
| 32 Bird skins ... ... | ..... | |
| 1 Snail shell... ... ... | *Achatina fulica* ... ... | |
| 1 Skin and skull of the Himalayan Palm Civet (juv). | *Paradoxurus grayi*... ... | Mr. G. B. Scott, Naini Tal. |
| A number of fresh water and Marine Shells. | ..... | M. E. Dalgliesh, Tirhoot, Bengal and Japan. |
| 5 Eggs of Tibetan Partridge. | *Perdix hodgsoniæ* ... ... | Lieut. F. M. Bailey, Gyantse, Tibet. |
| 1 Egg of Ibisbill ... ... | *Ibidorhynchus stutheri* ... | |
| 2 Eggs of Beverizoff's Rose Finch. | *Carpodacus severtzoffi* ... | |
| 2 Eggs of beautiful Rose Finch. | *Propasser pulcerrimus* ... | |
| 2 Tibetan Snow-Cock ... | *Tetrogallus tibetanus* ... | |
| 5 Eggs of Eastern Twite ... | *Acanthis brevirostris* ... | |

| Contributions. | Description. | Contributors and Locality. |
|---|---|---|
| 1 Russell's Viper ... ... | *Vipera russelli* ... ... | Captain O. Donoghue, R.A.M.C. (through Col Monks, I.M.S.), Burma. |
| 1 Tree Snake ... ... | *Dipsas multimaculata* ... | |
| 2 Common Kraits (Burma variety). | *Bungarus candidus*... ... | |
| 3 Banded Kraits ... ... | *Bungarus fasciatus*... ... | |
| 1 Krait and other snakes ... | *Bungarus walli* ... ... | Capt. F. Wall, I.M.S., Fyzabad. |
| 1 Common Wryneck ... | *Iynx torquilla* ... ... | Mr. L. H. Savile, Bombay. |
| 1 Green Keelback Snake ... | *Macropisthodon plumbicolor* | Capt. G. McPherson, I.M.S., Poona. |
| 1 Snake and 10 Lizards ... | ..... | Lt. H. R. Watson, Aden. |
| 5 Russell's Viper (alive) ... | *Vipera russelli* ... ... | Mr. K. R. Rane, Andheri, Salsette. |
| 1 Tree Viper (alive) ... | *Lachesis gramineus* ... | Mr. P. Gerhardt, Karla, Deccan. |
| 1 Cricket ... ... ... | *Schizodactylus monstrosa*... | Capt. Cobden. |
| Malformed Sambur and Cheital Horns. | ..... | Mr. C. E. C. Fischer, I.F.S., North Coimbatore Forest. |
| 1 Snake (alive) ... ... | *Tropidonotus piscator* ... | Mr. K. R. Rane, Andheri, Salsette. |
| 2 Burmese Pheasants ... | *Calophasis burmanniens* ... | Mr. E. W. Oates, Burma. |
| 1 Burmese Silver Pheasant. | *Gennæus lineatus* ... ... | |
| 2 Arrakan Hill Partridges... | *Arboricola intermedia* ... | |
| 1 Burmese Hill Partridge ... | *Arboricola rufigularis* subsp. *tickelli* | |
| 1 Brown-breasted Hill Partridge. | *Arboricola brunneipectus* ... | |
| 1 Ground-snake (juv). ... | *Macropisthodon plumbicolor* | Mr. T. Mathias, Poona. |
| A few Land Shells ... ... | ..... | Lt. R. Hill, Kashmir. |
| 1 Cobra (alive) ... ... | *Naia tripudians* ... ... | Mr. A. E. Sherring, Bombay. |
| 1 Indian Monitor (alive) ... | *Varanus bengalensis* ... | Mr. H. P. Paranjpe, Bassein Fort. |
| 3 Lizards ... ... ... | *Ophiops beddamii* ... ... | Rev. E. Blatter, S.J., Khandalla |
| 2 Mice (alive) ... ... | ..... | Mr. E. Comber, Nasik. |

Minor contributions from Mr. A. E. Lowrie, Lieut. H. F. Salt, R.H.A., Mr. O. Steffner, Mr. S. E. F. Jenkins, Mr. A. B. DeSouza, Capt. H. Orr, Capt. M. F. Foulds, R.A.M.C., Mr. F. Gleadow, Capt. E. C. Maddock, I.M.S., Lieut. H. R. Watson, Col. W. B. Bannerman, I.M.S., Mr. W. F. Jardine and Mr. F. Prevost.

## CONTRIBUTIONS TO THE LIBRARY.

Agricultural Ledger, 1905, No. 7, and 1906, No. 1; Flint Implements of the Fayum, Egypt, by H. W. Seton-Karr, from the author; Memoirs of the Asiatic Society of Bengal, Vol. I, Nos. 1 to 15; Proceedings of the Agricultural Conference held at Bombay; Report of the Chief Inspector of Mines in India for 1905; Circulars and Agricultural Journal of the Royal Botanic Gardens, Ceylon, Vol. III, Nos. 16, 17 and 18; Annual Report of the Indian Museum, Industrial Section, for 1905-1906; Journal and Proceedings of the Asiatic Society of Bengal, Vol. II, Nos. 4, 5 and 6; The Canadian Entomologist, Vol. XXXVIII; Transactions and Proceedings of the New Zealand Institute.

1905; Report on the Administration of the Government Museum and Connemara Public Library, 1905-1906; The Indian Forester, Vol. XXXII, Nos. 7 and 8; New Mollusca, from the Persian Gulf, etc., On Malluvium; Memoirs of the Department of Agriculture in India, Vol. I, Nos. 1, 2 and 3; A Note on the Life History of *Hoploceramby spinicornis*; Notes on the Malayan Pigs; The Mammals of Engano Island, West Sumatra; Mammals collected by Dr. W. L. Abbott in the Karimata Islands, Dutch East Indies, and Contributions from the United States National Herbarium, Vol. X, Parts I and II.

### PAPERS READ.

Some remarks on the decadence of Estuary Fishing, as an industry in the Konkan, by W. A. Wallinger.

The Rev. F. Dreckmann, in moving a vote of thanks to Mr. Wallinger who had so kindly come down from Dharwar to read this paper, said how this Society from a scientific point of view hoped with Mr. Wallinger that Government may shortly find it possible to introduce some legislation to protect the small fry and so prevent the danger of the extermination of species of fish which is at present apparently threatened. Such legislation is at present in force in England and on the Continent of Europe, which from time to time has prescribed that the meshes of nets must not be smaller than a stipulated size. The thanks of the Society are also due to Mr. Wallinger for the excellent miniature examples exhibited of the nets at present used by the Estuary fishers in the Kolaba District and for the specimens of fishes which he had collected and were now on the table before them.

The following papers were also read:—A note on an edible Puff-ball from the Thana District, by Lieut.-Colonel K. R. Kirtikar, I.M.S. (Ret.), F.L.S.; Some new birds' nests from Tibet, with notes from Colonel A. E. Ward and Lieut. F. M. Bailey, by H. Macnaghten, B.A.; A Mouse-Hare, by Major G. S. Rodon; and Locusts, Bears and Dogs, by Major G. S. Rodon.

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## PROCEEDINGS

### OF THE MEETING HELD ON THE 13TH DECEMBER 1906.

A meeting of the members of the Bombay Natural History Society took place at the Society's Rooms on the 13th December, 1906, Mr. John Wallace, C.E., presiding.

### NEW MEMBERS.

The election of the following 26 new members since the last meeting was duly announced :—

Mr. N. E. Marjoribanks, I.C.S. (Madras); Mr. A. W. Marshall (Bombay); Major J. Shakespear (Manipur); Capt. F. W. Barrett (Muttra); Mr. C. I. Ainslie (Bombay); Major R. M. Lowis (Umballa); Lieut. J. C. Pickersgill-Cunliffe (Diyatalawa, Ceylon); Mr. J. Gerard Bendien (Bombay); Mr. O. C. Ollenbach (Dehra Dun, U. P.); Mr. E. S. Drury (Thayetmyo, Burma); Mr.

Edward D. Haffenden (Mandalay, Burma); Mr. D. C. Boles (Meerut); Mr. J. A. Field, R.E. (Jubbulpore, C. P.); Major H. S. Wood, I.M.S. (Calcutta); Mr. F. A. Grant (Thayetmyo, Burma); Capt. Robt. A. Lloyd, I.M.S. (Jhelum, Punjab); Khan Shree Fatehdin Khan, Chief of Manavadar (Manavadar, Kathiawar); Mr. J. R. Martin, I.C.S. (Sukker, Sind); Mr. O. Steffen (Bombay); Mr. H. Uehlinger (Bombay); Lieut.-Col. H. E. Banatvala, I.M.S. (Khandwa, C. P.); Capt. W. H. Cox, I.M.S. (Santa Cruz); Mr. H. H. G. Mitchell (Madras); Mr. N. V. Holberton, I.F.S. (Toungoo, L. Burma); Mr. R. W. M. MacMillan (Rajahmundry, Godavari Dist.) and Mr. J. B. Merser Adam, B.F.S. (Pyinmana, U. Burma).

## CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary, Mr. W. S. Millard, acknowledged receipt of the following :—

| Contributions. | Description. | Contributors. |
|---|---|---|
| 1 Shikra ... ... | *Astur badius*... ... ... | Capt. W. D. Keys, I.M.S. |
| Some fresh water shells ... | *Lemnæa auricularia* ... | Lieut. R. Hill. |
| 1 Phoorsa (alive) ... ... | *Eevis carinata* ... ... | Major O. A. Smith. |
| 1 Sand Snake ... ... | *Eryx johnii* ... ... ... | |
| 1 Mud Turtle ... ... | ..... | Mr. F. G. Hutchinson. |
| 1 Longeared Bat ... ... | *Plecotus auritus* ... ... | Capt. R. Skeen, I.M.S. |
| 1 Tree-frog (alive) ... ... | ..... | Mr. C. M. Sykes. |
| 1 Chukor Partridge, albino. | *Caccabis rhucar* ... ... | Capt. R. R. Nicholl. |
| 1 White-collared Ouzel ... | *Merula albicincta* ... ... | Mr. J. C. Bond. |
| 1 Grey-headed Ouzel ... | *Merula castanea* ... ... | |
| 3 Eggs of the Kashmir Wren | *Anorthura neglecta*... ... | Col. A. E. Ward. |
| 2 Eggs of the Skylark ... | *Alauda arvensis* ... ... | |
| 4 Eggs of Tickell's Willow Wren | *Phylloscopus affinis* ... ... | |
| 1 Box of Butterflies... ... | ..... | Lieut. L. S. Fenton. |
| 3 Shark's jaws ... ... | ..... | Lt. S. H. Stevenson, R.I.M. |
| 2 Flying Fishes ... ... | *Exocatus bahiensis* ... ... | Mr. W. F. Jardine. |
| 1 Lemur (alive)* ... ... | *Lemuridæ jam.* .. ... | Mr. W. R Scroggie. |
| 2 Snakes (Aden Hinterland) | ..... | Lieut. H. R. Watson. |
| 2 Rats (Aden) ... ... | *Tatera sp* ... ... ... | Major S. Prall, I.M.S. |
| 1 Snake (alive) (Mooltan)... | *Lytorhynchus paradoxus* ... | Major O. A. Smith. |
| 1 Green Tree Snake (alive. | *Dryophis myeterizans* ... | Revd. F. Dreckmann, S.J. |
| A number of Moths... ... | ..... | Mr. E. E. Green. |
| 1 Bat ... ... ... ... | *Megaderma lyra* ... ... | Mr. A. M. Primrose. |
| Some Butterflies ... ... | ..... | Mrs. Jackson. |
| 1 Photograph of young Takin | *Budorcas taxicolor*... ... | Lieut. F. M. Bailey. |
| 1 Green Keelback Snake (alive). | *Macropisthodon plumbicolor* | Col. W. B. Bannermann, I.M.S. |
| 2 Mouse-Hares ... ... | *Ochotona macrotis* ... ... | Col. A. E. Ward. |
| 1 Mouse-Hare ... ... | *Ochotona auritus* ... ... | |
| 1 Tibetan Hare ... ... | *Lepus tibetanus* ... ... | |
| 1 Hare skull... ... ... | *Lepus oiostolus* ... ... | |
| 2 Bats... ... ... ... | ..... | Revd. F. Dreckmann, S.J. |
| 2 Mice ... ... ... | ..... | |
| 2 Wild Dogs' skins... ... | *Cyon dukhunensis* ... .. | Mr. A. P. Percival, I.F.S. |
| 3 Green Tree Vipers (alive). | *Lachesis gramenius*... ... | Mr. P. Gerhardt. |
| 4 Skulls of the brown Bear. | *Ursus arctus*... ... ... | Mr. C. H. Donald. |
| 1 Skin of Hodgson's Hawk-Eagle. | *Spizaetus nepalensis*... ... | |

* Sent to the Victoria Gardens.

| Contributions. | Description. | Contributors. |
|---|---|---|
| 3 Bats (skins) ... ... | *Megaderma lyra* ... ... | Mr. A. M. Primrose. |
| 1 Bat (skin) ... ... ... | *Scotophilus* sp. ... ... | |
| 27 Lizards, new to our collection. | *Stenodactylus orientalis* ... | The Trustees of the Indian Museum (in exchange). |
| | *Alsophylax tuberculatus* ... | |
| | *Gymnodactylus scaber* ... | |
| | *Gymnodactylus kachhensis* ... | |
| | *Gymnodactylus stoliczkae* ... | |
| | *Gymnodactylus Rhasiensis* ... | |
| | *Agamura cruralis* ... ... | |
| | *Agamura persica* ... ... | |
| | *Gonatodes indicus* ... ... | |
| | *Hemidactylus turcicus* ... | |
| | *Hemidactylus persicus* ... | |
| | *Hemidactylus giganteus* ... | |
| | *Hemidactylus platyurus* ... | |
| | *Gehyra mutilata* ... ... | |
| | *Gecko monarchus* ... ... | |
| | *Phelsuma andamanense* ... | |
| | *Draco taeniopterus* ... ... | |
| | *Otocryptis bivittata* ... | |
| | *Gonyocephalus suberistatus* ... | |
| | *Acanthosaura major* ... | |
| | *Japalura variegata* ... | |
| | *Japalura planidorsata* ... | |
| | *Salea horsfieldii* ... ... | |
| | *Calotes jubatus* ... ... | |
| | *Calotes crisatellus* ... ... | |
| | *Calotes gigas* ... | |
| | *Calotes mystaceus* ... ... | |
| Some Fishes, Shells and Marine specimens. | ..... | |
| 1 Rat (alive) ... ... | *Mus rattus* var. *rufescens* ... | Engr. Lieut. S. H. Stevenson, R.I.M. |
| 1 Common Monaul Pheasant | *Lophophorus refulgens* ... | |
| 1 Great Himalayan Barbet | *Megalaemamarshallorum* ... | Lt.-General W. Osborn. |
| 2 Himalayan Snail Shells... | *Helicarion* sp. ... ... | |
| Cheetal or spotted deer horns | *Cervus axis* ... ... ... | Mr. J. Lee Stewart. |
| Some Butterflies from Chitral. | ..... | Capt. W. H. Evans, R.E. |

Minor Contributions: Col. G. E. Hyde Cates, Mr. G. D. Eykyn, Mr. F. A. Prevost, Col. W. B. Ferris, Mr. H. O. Shoubridge, Mr. W. L. Palmer, Mr. J. M. Tarachand and Mrs. A. H. A. Simcox.

## CONTRIBUTIONS TO LIBRARY.

Flora of the Presidency of Bombay, Vol. II., Part 3, by Dr. Theodore Cooke, C.I.E., from the Author; Canadian Entomologist, Vol. XXXVIII, No. 9; Annales du Musee du Congo, Tome I, Fascicule II; Three Bulletins of the Haarlem Colonial Museum, Useful Indian Plants, 1894, 1895-6—from J. G. Bendien, Consul for Netherlands; Agricultural Ledger, No. 2, 1906; The Indian Forester, Vol. XXXII, No. 9; Bulletin, Madras Government Museum, Vol. V, No. 2; The Agricultural Journal of India, Vol. I, Part IV; Indian Insect Pests, by H. Maxwell-Lefroy, from the Author; Records of the Geo-

logical Survey in India, Vol. XXXIV, Part 2; Administration Reports of the Royal Botanic Gardens, Ceylon, 1905, Part IV; Bird Notes and News, Vol. II, Nos. 2 and 3; The Mammals collected by Dr. W. L. Abbott in the Rhio-linga Archipelago, by G. S. Miller; Bulletin de la Societe Royale de Botanique de Belgique, Annee 1904-95; Department of Agriculture, Bombay, Bulletin No. 27; Memoirs of the Department of Agriculture in India, Vol. I, No. 4; Note on the Chilgoza Forests of Zob and Takht-i-Suliman Forest Bulletin, No. 7, by E. P. Stebbing; Notes on the Influence of Forests on the Storage and Regulation of Water Supply, Forest Bulletin, No. 9, by S. Eardley Wilmot.

## EXHIBITS.

Mr. H. S. Symons exhibited a snare which was used by the natives for snaring quail. It was obtained at Aligaum near Poona.

Lieut. P. Beaumont (South Lancashire Regiment) exhibited an exceptionally fine Chital or spotted-deer head which was greatly admired. The horns measured 38½ inches in length, 30½ widest span (outside) and 25½ from tip to tip. The stag was obtained in April last by Mr. Beaumont in the Central Province jungles.

## PAPERS READ.

1. Importance of a knowledge of the Biting Flies of India, by Col. W. B. Bannerman, I.M.S.
2. On a new species of Grey Duck from Burma, by E. W. Oates.
3. Destruction of Mosquitoes and their larvæ by Fish and Lime, by General W. Osborn.
4. Do bats capture and eat birds? by E. E. Green, F.E.S., &c.
5. Abnormal antlers of the Chital (*Cervus axis*), by Lieut. J. A. Field, R.E.
6. A live Takin (*Budorcas taxicolor*), by Lieut. F. M. Bailey.
7. Breeding grounds of the Common Locust, by E. H. Aitken.

JOURNAL
OF THE
BOMBAY
Natural History Society.

Vol. XVII. BOMBAY. No. 4.

# A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

ILLUSTRATED BY COLOURED PLATES AND DIAGRAMS.

BY MAJOR F. WALL, I.M.S., C.M.Z.S.

*Part IV—With Plate IV.*

(*Continued from page 273 of this Volume.*)

## *TROPIDONOTUS PISCATOR*, THE COMMON POND SNAKE OR CHEQUERED KEELBACK.

*Nomenclature.* (*a*) *Scientific.*—The generic name is from the Greek "*tropis*" a keel, and "*notos*" the back, in allusion to the ridges formed by the keels on the costal scales which, though a very characteristic feature, is by no means one peculiar to this snake and its allies.

The specific name "*piscator*" of Latin origin is not to my mind appropriate, since it seems to imply the practice of some art by which it is able to capture fish. Though aquatic in habit, its diet is usually batrachian; and though it does evince piscivorous tastes sometimes, it is in no way better endowed with the capability to catch fish than is any other water-snake. It is difficult therefore to see in what respect it resembles the fisherman. It certainly prefers the exercise of its natatory powers to imitating the patient inaction at the water's brink so commonly manifested by those who favour the piscatorial art. Its older and better known name "*quincunciatus*" from the Latin "quincunx"

is more fitting, for the commonest varieties bear spots or blotches arranged in longitudinal lines, so that those of one series alternate with those of the adjacent rows. The creature is thus beset with quincunxes (like the 5 on dice), and when the spots and intervals are alike in size, a veritable chess board pattern is the result.

*Vernacular.*—The more I strive to acquire the native names for snakes, the more hopeless it becomes. It is rarely that any two members of a crowd will give the same name to a snake, and it is almost as certain that the professional snake-catcher, with a huge local reputation, will call a snake by one name to-day and another to-morrow. In Cannanore the common types of this snake were called "Neer Kolee" and "Neer Mandallee", the former meaning "water-fowl" and the latter "water spotted snake"; but I was never able to discover by what means the one was discriminated from the other. The former was usually applied to small specimens, and the latter to large examples, especially the boldly spotted ones. In most languages it is simply called water-snake, as, for example, the Burmese "Yé mywé", the Tamil "Thanee pamboo", the Canarese "Neeru havu" and the Hindi "Pani ka samp". Doubtless, these names are applied also to many of the Homalopsids.

The Canarese also call it "holay havu" or stream-snake, and Russell's various colour varieties are "Dooblee", "Paragoodoo", "Naugealled Keaka", "Neeli Kœa", "Dora", and "Ourdia". (*See* addenda.)

*Dimensions.*—Nicholson* records a specimen 4 feet 3 inches, and Blanford† another of the same length. These are exceptional, for I have the measurements of 55 specimens, and the largest taped 3 feet 10½ inches. My notes refer to a host of other specimens in which the length is not noted on account of their meagre proportions. Of the 55 specimens referred to above, only 10 exceed 3 feet in length.

*Physiognomy and bodily configuration.*—The head is ovate, rounded from side to side, and the front narrow. The nostrils by their slitlike form and superior position approximate to those of the true fresh-water snakes (Homalopsids) and marine snakes (Hydrophids), as do also the eyes which are set with a decided inclination upwards; but the tail has not been modified to a corresponding degree towards the true

* "Indian Snakes," page 90.

† Journ., Asiat. Soc., Bengal, XXXIX, page 371.

aquatic type as one might expect, in adaptation to its natatory proclivities, but preserves the rounded contour typical of the terrestrial forms. The eye is moderately large, the iris flecked with gold or golden green, and a dense zone of gold demarcates the pupillary margin, and reveals the rotund conformation of the pupil. The neck is constricted sufficiently to be evident. The body closely ridged by the carination of the costal scales, is robust, rounded, and reduces in girth decidedly before the vent. The tail is ample in both sexes, being one-fourth to one-third the total length, and tapers gradually, the dorsal ridge being preserved almost to its extreme tip.

*Colour.*—The colour and markings of this snake are exceedingly variable, as a glance at our plate will, in some measure, serve to indicate.

The ground colour may be dull green, olive-green, olive-brown or brown of almost any shade, light or dark.

Some specimens are uniform, or almost uniform, in colour, but the majority show some chequering, and usually of 'black' which may occur in specks, spots, or blotches, and vary from a few marks confined to the sides of the neck and forebody, to a wholesale distribution chequering the entire body and tail. These marks are usually arranged quincuncially in 5 or 6 longitudinal rows, and the blotches in some examples are confluent, and so large that black becomes the prevailing colour.

Some specimens are decorated with a similar draught board pattern, but sombre hues replace the black, and sometimes buff or whitish tints form the most conspicuous chequering.

Again, some are specked, spotted, or blotched with red which may vary from salmon or rose pink to a brilliant scarlet like sealing-wax.

This lively ornamentation is as capricious in its distribution as the black above alluded to, and may vary from a few marks on the side of the neck and forebody to a profuse adornment of the whole dorsum. All these decorative hues are almost entirely confined to the basal half of each scale, and especially to their margins, where the scales overlap one another, so that they are seen to their best advantage when the snake under excitement dilates itself.

The crown of the head is similar to the dorsal ground colour and two black oblique streaks are almost always in evidence proceeding

from the eye (Günther says they are inconspicuous or absent in some specimens from Nepaul and Ceylon). The anterior passes as a subocular between the 5th and 6th or 6th and 7th supralabials to the margin of the lip. The posterior crosses the temporals, and the 8th supralabial to the gape or beyond. A more or less distinct black chevron, or a modification of such, is usually borne upon the nape.

Ventrally the colour is usually uniformly dull white or yellow, but many specimens, and especially those heavily blotched with black dorsally, bear black subterminal transverse bars, more or less complete on each scale. Where the ventrals meet the ultimate costal row in the flanks, may be seen a black, pink, or brilliant crimson streak. The throat and forebody are sometimes bright yellow or orange.

These brilliant colours are not seasonal, though Stoliczka * inclines to this belief, nor are they the prerogative of either sex. I have satisfied myself that they are present in the hatchling. To the best of my belief, I have only met with these gaudily attired specimens on the Malabar Coast of India and in Burmah. Our artist has shown the markings in the two bottom figures too regular, so that they are more suggestive of the conventional or wall-paper style of decoration than that bestowed by Nature. So numerous are the colour varieties of this species that it is most perplexing to know how best to describe and group them. Russell † figured no less than 7 examples, all of which he named differently and evidently considered distinct. Similarly, Daudin described as 5 different snakes, specimens which at the present day are merely considered varieties of a single species. Boulenger ‡ recognises 3 varieties, but includes all those from our Indian Region under one heading. At the time he wrote (1893) the British Museum collection contained only 17 specimens of this snake, and it is not surprising therefore that our most notable varieties escape mention. I have seen and examined, at the lowest computation, fully 200 of this species, and from many and distant parts of the Empire, and propose the following grouping of our numerous varieties:—

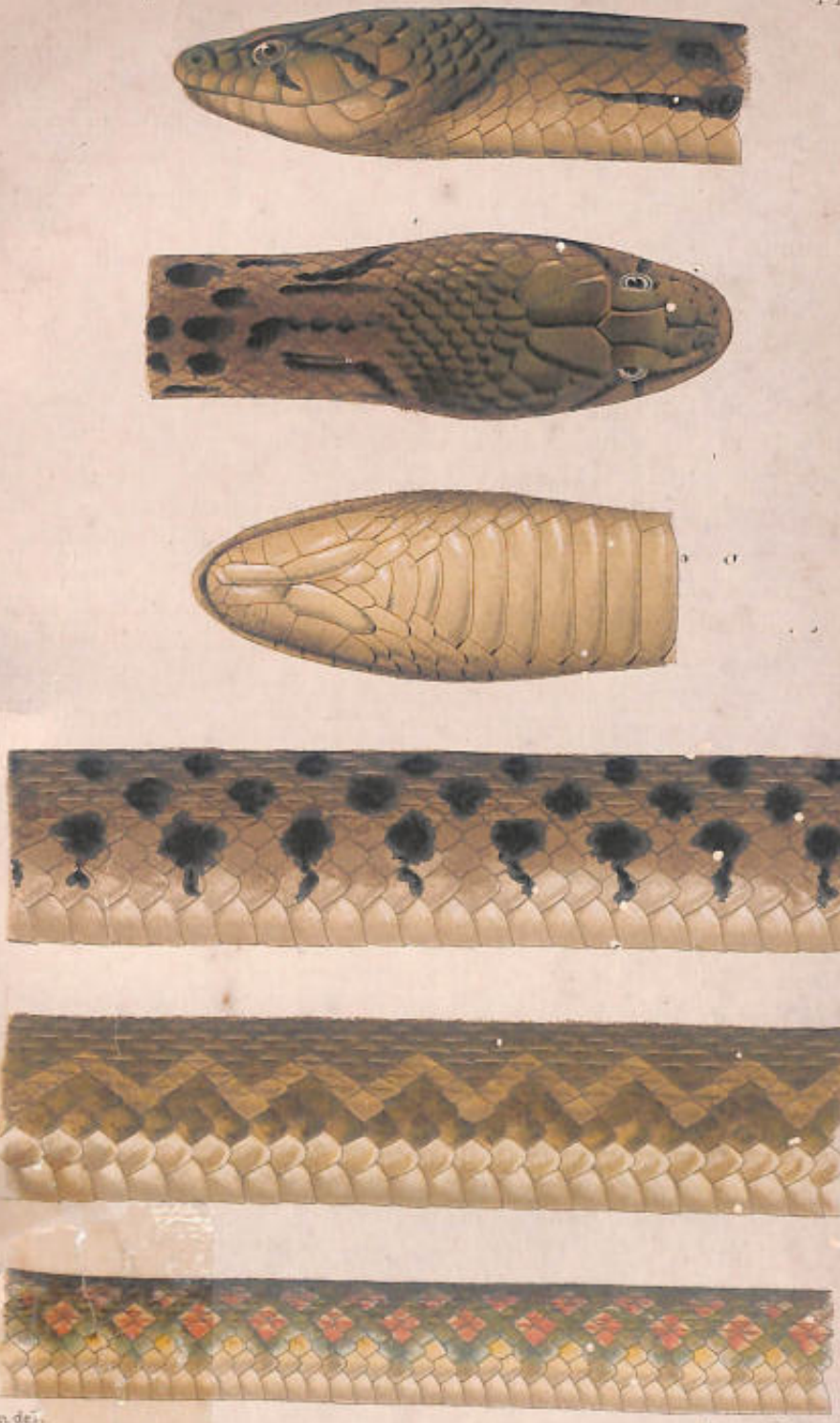
(*a*) *Unicolor.*—Without dorsal marks. Blanford § mentions such a specimen from Ajmere which he described as uniform olive-grey.

* Journ., Asiat. Soc., Bengal, Vol. XL., page 431.

† Indian Serpents.

‡ Cat., Snakes, Brit. Mus., Vol. I, page 284.

§ Journ., Asiat. Soc., Bengal, Vol. XLVIII, p. 126.



J. Green del.

Mintern Bros Chromo.

THE CHECKERED WATER SNAKE (Harmless)

Tropidonotus piscator.

I would place Boie's *Melanozostus* * here which he describes as "olivaceo pallide fuscus," making no allusion to dorsal marks or spots. This cognomen has reference to the black ventral bands, which may or may not be present in this type. I have seen many uniformly coloured, and think such specimens are to be found everywhere.

(*b*) *Lateralis.*—Without marks in mid-dorsum, but variously mottled, marbled, or spotted in the flanks. Fig. 2 of our plate shows such a specimen. Blanford † alludes to two males he obtained in the Central Provinces, which he describes as "olive without any dark mark, but with a row of well-marked buff spots down the sides." It is in my experience a common variety which, I believe, is to be found everywhere.

(*c*) *Punctatus.*—With small black or blackish spots. Russell ‡ figures one such specimen, but I have usually seen them with the spots arranged quincuncially, and not irregularly scattered as in his specimen. Günther's § variety $^{3}$ would, I think, come into this category. It is common everywhere.

(*d*) *Quincunciatus* (Schlegel).—With large black spots, often as large as the interspaces, or even larger, but arranged quincuncially so as to form a regular chess-board pattern. Fig. 1 in our plate shows a good example. Nicholson's ¶ variety "*a*" and his figure on Plate XIV refer to this type. It is one of the commonest varieties and to be found, I think, everywhere.

(*e*) *Anastomosatus* (Daudin).—Marked with a network pattern. Daudin ‖ thus describes it: "Supra cinereo flavescens, maculis parvis rotundis ingris lineis obliquis junctis, et reticulatus." With this I would unite the "braminus" of the same author, the only difference being that in the latter the spots are contained within the meshes of the reticulation, whereas in the former the spots are at the junction of the lines, and leave empty spaces. Russell ** shows both these types in his large volume. Günther †† describes it under his variety $^{\beta}$ as

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* Isis, p. 206.

† Journ. Asiat. Soc., Bengal, Vol. XXXIX, p. 371.

‡ Indian Serpents, Plate XVa, Vol. II.

§ Rept. of Brit. Ind., p. 261.

¶ Indian Snakes, p. 90.

‖ Nat. Hist. Rept., VII., p. 140.

** Loc. cit., Plates XX and XXXIII, Vol. I.

†† Loc cit., p. 261.

follows :—"The spots are, as it were, dissolved into a network of black lines with intermixed white dots."

(*f*) *Obscurus.*—Obscurely spotted, dappled, or chequered with sombre hues. Blanford * thus describes a specimen I refer to this type : "Almost uniform brown, having the dark spots nearly quite obsolete." I feel disposed, too, to place Günther's † *flavipunctata* here. It is a common form.

(*g*) *Mortuarius* (Daudin).—Quincuncially marked with sagittate black and cinereous grey marks. I am not sure that I have seen this type, but Russell ‡ figures a good illustration.

(*h*) *Umbratus* (Daudin).—Heavily blotched with black without quincuncial arrangement. Daudin thus describes it :—"Colare atro maculis dorsalibus obsolete flavescentibus." With this I would include the same author's *dora*. I see no difference between them. Russell § gives three good examples of the type. Blanford ¶ alludes to a female he captured in the Central Provinces which was evidently of this variety. I think Günther's ‖ variety γ from Ceylon should be included here, as it only differs in the tendency to form transverse bands. The type is a common one.

(*i*) *Ornata.*—Specked, spotted, or blotched with pink, orange, or vermilion. A good example is shown in Fig. 3 of our plate. Günther** mentions it as his variety α. Nicholson †† alludes to it as his variety *b*. Anderson ‡‡ mentions it from Yunnan. Stoliczka §§ refers to it too, as does also Theobald ¶¶. Günther says it occurs in almost every part of India, but I think I have only met with it on the Malabar Coast and in Burma, and Theobald remarks that the bright colouring, he thinks, is more developed in Burmese specimens than in those from Bengal. I obtained a modified example in Cannanore which demands special remark as the adornment was not in spots. The specimen was uniform

* Journ., Asiat. Soc., Bengal, Vol. XXXIX, p. 191.
† Loc. cit., p. 270.
‡ Loc. cit., Plate XXVIII, Vol. I.
§ Loc. cit., Plates III, V and XIV, Vol. II.
¶ Journ., Asiat. Soc., Bengal, Vol. XXXIX, p. 371
‖ Loc. cit, p. 260.
** Loc. cit, p. 259
†† Indian Snakes, p. 90.
‡‡ Ann. Zool. Yunnan, p. 821.
§§ Journ., Asiat. Soc., Bengal, Vol. XL, p. 431.
¶¶ Cat., Rept., Brit. Burma 1868, p. 47.

olive-green in the median dorsal region, but the flanks were ornamented with a deep continuous band of brilliant sunset crimson. These lively hues fade so rapidly in spirit that it does not surprise me that Boulenger makes no special reference to them.

(j) *Tytleri.*—Distinguished by longitudinal white, black-edged lines anteriorly. Both Blyth * and Theobald † allude to it, the latter under the title *Striolatus*. It appears to be peculiar to the Andamans.

*Distribution.* (a) *Geographical.*—I am not aware of any locality in our Indian Dominions below, say, 3,000 feet, except Sind, where it does not exist plentifully, and in most parts it must be conceded the distinction of being the commonest of all species. To the East it extends throughout the whole Malayan region, continental and insular, to Southern China, and Formosa. To the West its range appears to cease before Sind, since Murray does not mention it in his Vertebrate Zoology of that region.

*Local.*—It frequents the neighbourhood of water, and abounds in rivers, jheels, marshes and pools. During the hot weather, or in localities where the nature of the soil is arid and open, it is little in evidence, but clings to its favoured element. As soon as the rains burst, it becomes disseminated broadcast, and may be found wherever the vegetation offers convenient hiding at some distance from water, and it occasionally strays into the bungalow.

*Breeding.—The Sexes.*—Females average a greater length, and have shorter tails than males.

The shortest female to demonstrate her fertility, of which my notes bear record, was 2 feet $7\frac{7}{8}$ inches, and was obtained in Cannanore. This length, I think, establishes the sexual maturity of this species at 4 years of age. This agrees with the age I have estimated in some other Indian snakes, but the observations of Lenz on snakes in Europe led him to suppose they were sexually matured at 3 years of age. As this is an interesting point, I furnish my reasons for this statement. Taking the month of July, which I select because my notes in this month furnish me with the largest material upon which to make deductions, it will be seen from the annexed table that the lengths of many specimens which are closely approximate, leave gaps which seem clearly to demarcate the broods of successive years.

* Jourl., Asiat. Soc., Bengal, 1863, p. 88.

† Cat., Rept. Asiat. Soc. Mus., 1868, p. 55.

*Table showing length of specimens collected in July.* (*See* Addenda.)

| Number. | Length. | Locality. | Year. |
|---|---|---|---|
| 6 | 8¾″ to 10⅝″ | Fyzabad | 1905. |
| 2 | 1′-3″ to 1′-4¼″ | Burma | 1899. |
| 3 | 1′-3½″ to 1′-5″ | Cannanore | 1904. |
| 2 | 1′-8½″ to 1′-10¾″ | Burma | 1899. |
| 1 | 1′-9″ | Fyzabad | 1905. |
| 1 | 2′-4¾″ | Burma | 1899. |
| 1 | 2′-5½″ | Cannanore | 1904. |
| 1 | 2′-3½″ | Fyzabad | 1905. |
| 4 | 2′-7½″ to 2′-9½″ | Burma | 1899. |

The rate of growth will thus be seen to be about 4 to 6 inches a year.

*Season.*—The sexes seek one another's society for mating purposes during the cool season. Father Dreckman wrote to me of a pair he found "in copula" in the month of October at Khandalla, and my own female was captured under similar circumstances on the 3rd of January in Rangoon. The period of gestation in this specimen proved to be 55 days, the eggs being deposited at intervals between the 9th and 23rd of March; 14 of the 24 eggs, however, were voided between 9 and 11 a.m. on the 55th day (March 9). The protracted period of deposition I attribute to the enfeebled health of the parent consequent upon her captivity. Another specimen I captured at Cannanore close upon term discharged all her 57 eggs within a few hours.

On both occasions the eggs were extruded into water, and sunk in that element. The females were both found coiled above them, and Nicholson* mentions having noticed the same behaviour, but repudiates any idea that this was an attempt to incubate them, for the parent continued to remain so after the ova had shrivelled. I am of opinion that the mother probably incubates her eggs in a state of nature. Begbie† found 24 eggs of this snake in a big grass nest at the end of an adit bored in a canal bank, but I think the nest was prob-

* "Indian Snakes," p. 128.

† Bombay Nat. Hist. Journl., Vol. XVI, p. 516.

ably a water rat's which the reptile chanced upon, and appropriated to her own use. Notes of this character are of the utmost interest and importance. Information on the habits of snakes is extremely hard to elucidate.

*Eggs.*—Those I obtained in Cannanore were all much alike in size, shape, and tension, but those I acquired in Rangoon varied considerably. Some were tense, others flaccid, and they varied much in size, as may be inferred from their weights, which ranged from 1 drachm 28 grains to 2 drachms 37 grains. These variations were probably the result of impoverished health. Normally they are soft and white without gloss. When voided they are evidently surrounded with a glutinous pellicle, for they adhere firmly at any points where chance has placed them in apposition. The poles are isomorphous, the shape elliptical, and tension much like that of a ripe grape. In length they vary from $1\frac{5}{20}$ to $1\frac{11}{20}$ inches, and in breadth from $\frac{15}{20}$ to 1 inch.

*Period of incubation.*—How long these eggs take to hatch I have been unable to ascertain, as all attempts to incubate them have proved futile.

*Deposition.*—They are laid in the months of January, February and March usually, but Major Evans tells me he has killed some examples egg-bound as late as April in Burma. (*See* Addenda.)

*Young.*—When hatched, the young measure about $7\frac{3}{4}$ to 8 inches, or about one-sixth the length of a large adult.

This is one of the most prolific snakes I know, and ranks with the pythons and the Russell's viper in this respect.

Blanford describes a pair which he dislodged from beneath a large stone in a stream. They had evidently made their home there, and he remarks that they showed a disinclination to quit the spot. It is remarkable that though they were evidently cohabiting, the female was in an advanced state of egg-bearing, and this is on a par with the case of the two rat snakes alluded to in my last paper. This with other cases of a similar kind leads me to think that snakes possess a mutual love and attachment in no way inferior to that exhibited by many warm-blooded animals which preserve their conjugal relationship long past the term of sexual gratification. A history of the events known to me relative to the breeding of this snake is herewith appended in tabular form.

*Table of Breeding Events.* (*See* Addenda.)

| Stage of Development. | No. | Date. | Locality. | Authority. |
|---|---|---|---|---|
| Sexes "in copula"... | .. | October ... | Khandalla (Western Ghats). | Dreckman.* |
| Do. .. | ... | 3-1-00 ... | Rangoon ... | Self. |
| Impregnated follicles. | ... | 14-11-03... | Cannanore ... | Do. |
| Do. ... | ... | 18-11-03... | Do. ... | Do. |
| Do. ... | ... | 24-11-03... | Do. ... | Do. |
| Ova "in abdomina"... | 85 | ? ... | Central Provinces. | Blanford. † |
| Do. .. | 20 | 4-1-04 .. | Cannanore .. | Self. |
| Do. ... | 61 | 29-1-00 ... | Rangoon ... | Evans and self. |
| Do. ... | 41 | 1-2-00 ... | Do. ... | Do. |
| Do. ... | 36 | 1 to 16-3-00 | Mandalay ... | Do. |
| Do. ... | 47 | 20-2-06 ... | Fyzabad ... | Self. |
| Ova deposited ... | 20 | ? ... | Ceylon ... | Tennent. ‡ |
| Do. ... | 24 | 9 to 23-3-00 | Rangoon ... | Self. |
| Do. ... | 57 | 14-1-04 ... | Cannanore ... | Do. |
| Young hatching ... | 24 | 14-5-05 ... | Cawnpore ... | Begbie. § |
| Hatchling killed ... | ... | 23-3-04 ... | Cannanore ... | Self. |
| Do. ... | | ?-6-99 ... | Rangoon ... | Evans and self. |

*Identification.*—The foregoing remarks on colour should convince one that this will not aid the identification of this snake, especially too when it is a fact that several of the other species of the genus are singularly like some of the many colour varieties of this species.

There is no single scale characteristic peculiar to this snake upon which to rely in determining its identity, so that a combination of features must be looked for to indicate the species. First of all the rows of scales at midbody must number 19; next 2 supralabial shields must touch the eye; the anal shield must be divided, and there must be a pair of internasal shields. Should these 4 points co-exist, its identity may be considered established.

*Disposition.*—With the exception of the *Echis*, I think it is the most vicious snake I know. It is ever ready to bite, and strikes with great determination and rapidity, fastening itself with such tenacity that I have known it necessary to prize apart the jaws to disengage its hold. Even hatchlings exhibit this ill-temper, and I remember well on one occasion being bitten several times before I effected the capture of an 8-inch baby. (*See* Addenda.)

* In epistola.

† Journ., Asiat. Soc., Bengal, Vol. XXXIX, p. 371.

‡ "Ceylon," p. 197.

§ Journ., Bombay Nat. Hist. Soc., Vol. XVI, p. 516.

Sometimes, but by no means always, this snake, when irritated, erects itself, and while dilating its body, very markedly flattens its forepart in cobra fashion. It is strong and active, and its movements brisk and rapid on land and in water. This is one of the snakes that I have seen actually jump clean off the ground. *Apropos* of this remarkable feat, I interrogated a Bangalore *sampwallah* with a view to ascertaining the identity of a snake made mention of in a Canarese Dictionary as "Haramandalatha havu" or jumping snake, which I thought might prove to be the hamadryad. To my surprise and satisfaction, however, the next day he reproduced a "piscator" which he assured me was the jumping snake, and he was most assiduous in provoking the snake to exhibit its saltatory powers for my benefit, but though I have seen this snake jump and actually clear the ground, I cannot say that I did so on this occasion. However, it erected itself in an amazing manner, and, literally, threw itself forward in a manner that could only be described as a series of jumps.

*Food.*—Its main diet is batrachian, usually frogs being ingested, doubtless because they are so plentiful and so easy of capture. Fish, however, are frequently taken. (*See* Addenda.) I have found as many as 8 or 9 tadpoles in the stomach of a young specimen. They seem to feed voraciously, and in Cannanore on several occasions one was brought to me wriggling at the end of a fish hook which had been baited with a frog by native urchins. I have never seen one attempt to constrict its victim, nor does it wait till they are dead; but if advantageously seized, it commences to swallow at once, so that the frog, when this happens to be the unfortunate, continues to squeal piteously for some time after engulfment."

*Description.—Rostral.*—Touches 6 shields, making 6 sutures, of which those formed by the anterior nasals are twice or nearly twice the length of those made by the internasals. *Internasals.* (*See* Addenda.)—A pair. The suture between them equal to or nearly equal to that between the præfrontal follows; subequal to the internaso-præfrontal suture. *Præfrontals.* (*See* Addenda.)—A pair. The suture between them rather larger than the præfronto-frontal. In contact with internasals, postnasal, loreal, præocular, supraocular, and frontal. *Frontal.*—Touches 6 shields, of which the supraoculars make sutures fully twice those formed with the parietals; breadth subequal to the supraoculars; length rather more than supra-

ocular. *Nasals* two, the slitlike nostril meets the dividing suture at an angle to form a γ, and is thus contained wholly in the anterior shield. In contact with the 1st and 2nd supralabials. *Loreal* one, as high as broad. *Præoculars* one. *Postoculars* 3 normally (rarely 2 to 5). *Temporals*—Two anterior, the inferior touching the 7th and 8th supralabials. *Supralabials* 9. The 4th and 5th touching the eye. *Anterior sublinguals* smaller than the posterior. *Infralabials* 7. 5 touch the anterior sublinguals; the 5th, 6th and 7th touch the posterior. The 6th is the largest; the 7th pentagonal, and in contact with 3 scales behind; the suture between the 1st is one-third to one-fourth that between the anterior sublinguals. *Scales*—2 heads lengths from head 19, midbody 19, 2 heads lengths before vent 17. The step where the 19 becomes 17 occurs behind the midpoint of the body, and the 4th row from the ventrals disappears, being absorbed into the row above or below. Keels are present on all scales but the lowest 2 to 5 rows anteriorly, and 1 to 2 rows posteriorly, and end after the supracaudals have become four. They are present in all the supracaudals at the base of the tail. Apical facets present in pairs. The last row is the largest, and the vertebral row is not enlarged. *Ventrals*—Rounded 125 to 150 (Boulenger). *Anal* divided. *Subcaudals* 70 to 90 (Boulenger), paired.

*Dentition.*—In a specimen recently acquired this is as follows :—

*Right side.*—Maxillary 22. Palato-pterygoid 12 + 26. Mandibular 25.

*Left side.*—Maxillary 23. Palato-pterygoid 13 + 27. Mandibular 24.

These numbers include, of course, the gaps in the various arrays, which are seldom perfect at any one time. This is the only correct way of numbering the teeth, for as one drops out, its place is soon re-occupied by another from the reserve tracts. These are very interesting. One runs along the base of each row, and contains a very large number of teeth of various sizes lying loosely attached in the mucous membrane, the largest closest to the teeth they are destined to replace. The maxillary and mandibular tracts lie along the inside of their dental series, but the palato-pterygoid along the outer aspect.

The teeth are all vertically compressed and convex on two faces, which meet to form ridges, so that in section they are exactly like a deep lens. The ridges lie laterally in all the teeth excepting those situated at the back of the maxillary and mandibular arrays where the teeth are turned

on their own axes so that the ridges lie anteriorly and posteriorly. The teeth in the maxillary series are directed backwards, and present a slight inclination inwards. The palato-pterygoid are directed straight backwards, and the mandibular at first directed backwards, gradually acquire a strong inclination inwards. Further, the maxillary array is isodont in its greater length (*i.e.*, has teeth of equal size). A few of the most anterior are, however, progressively smaller, and the two last occurring after an interval are very much enlarged. These enlarged teeth have been already figured in the second of these papers (Vol. XVII, facing page 2), and are in this species intermediate between those shown in figs. 1 and 2 of that paper. The palato-pterygoid series are isodont, as are also the mandibular, excepting a very few in the extreme forefront, which are shorter.

(*To be continued.*)

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## ADDENDA.

Since writing the above I have the following remarks to add:—

(1) Willey says it is called "Diya polonga" in Ceylon (Spol. Zeylan. April 1906, p. 233).

(2) My notes in Fyzabad last year are wonderfully similar for this month. Of specimens actually measured, I had 16 varying from 9½ to 12¼ inches, 2 measured respectively 1'-3" and 1'-5⅝", 2 others were 1'-9½" and 2'-0⅝", and 1 was 2'-4½".

(3) I am able to confirm this so far as Assam is concerned, for I have had 6 females heavily eggbound this month (April) containing respectively in abdomina 39, 44, 51, 53, 21 and 34 eggs of dimensions showing that they would very shortly have been discharged.

(4) In the administration report of the Government Museum, Madras, for 1896-7 I notice a female laid 36 eggs in captivity on the 26th of February 1897.

(5) *Apropos* this remark I quote from last year's experiences in my note-book 19th July 1906—"I have had two hatchlings to-day, and both moved very rapidly, did their utmost to escape me, struck out viciously and repeatedly at a stick, and both literally jumped so as to clear the ground without doubt more than once." Again 20th July 1906—"Another hatchling to-day jumped, and was most ferocious. I got badly bitten in my endeavours to grasp it. Its incessant contortions,

great activity, and the antics it indulged in to avoid capture, including jumping, made it a most difficult snake to manage."

(6) I notice Annandale (in Memoirs of the Asiatic Society of Bengal, Vol. 1, No. 10, p. 195) says: "Their food consists wholly or chiefly of fish, and they do not, as a rule, molest the large tank frogs (*Rana tigrina*) which may sometimes be seen sitting side by side with them on stones in the water." This statement has caused me to refer to my notes again. I find 5 specimens last year in Fyzabad had fed: two of these contained a single frog each, another a single toad, another two frogs (*Rana tigrina*), and another one frog and three toads, so that these records support my former observations.

(7) Mr. E. E. Green writes to me that he recently obtained a specimen with the internasals confluent into one shield.

(8) I have once seen four præfrontals in a single row across the snout.

# THE IMPORTANCE OF BLOOD-SUCKING FLIES AS TRANSMITTERS OF DISEASE TO MAN AND ANIMALS.

BY

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(*Read before the Bombay Natural History Society on the 13th December 1906.*)

The importance of knowing something about biting flies is manifest when one realises that many tropical diseases are conveyed from one man to another, and one beast to another by means of their bites. For instance, it has been common knowledge since the days of David Livingstone that in Africa a destructive disease among horses and cattle was due to the bites of the Tsetse-fly (*Glossina morsitans*). A few years ago Colonel David Bruce, R.A.M.C., discovered the cause of this disease to be a parasite (*Trypanosoma brucei*) living in the animal, which parasite was sucked up by the Tsetse-fly along with its meal of blood, and transferred by it to the body of the next animal it attacked. This parasite belongs to the Protozoa, the lowest order in the animal kingdom, and lives in the blood of the wild game in South Africa. In them it appears to cause no disease, but when transplanted by means of the biting fly to domestic animals it produces a fatal disease, which becomes so prevalent that it was found impossible to keep farm stock in the affected regions until all the wild game, which acted the part of reservoirs of the parasite, had been destroyed. Later still the same observer found that a parasite, in all respects similar to this Tsetse-fly protozoon, was the cause of the fatal disease of human beings in Uganda known as Sleeping Sickness. In the blood of patients suffering from this disease exists a minute eel-like organism (*Trypanosoma gambiense*) furnished with a fin-like membrane along the back and a flagellum in front, which ultimately makes its way into the cerebro-spinal fluid and produces the well known symptoms of this terrible disease. It has been discovered that the trypanosome is taken up by a Tsetse-fly (*Glossina palpalis*) as it sucks the blood of a patient, and that it then may be transferred by the fly to the blood of a healthy individual should such happen to be bitten by it within a short time afterwards. It was further discovered that Sleeping Sickness was

found in epidemic form only where the *Glossina palpalis* was present, and that patients removed to an area free from this Tsetse-fly did not prove the starting point of an epidemic. In other words, where no Tsetse-flies were present, there no cases of Sleeping Sickness were found.

Now this has a very special interest for the Bombay Presidency, for the trade between the West Coast ports and East Africa is growing rapidly, and it is certain that sooner or later cases of Sleeping Sickness will be imported. Is it likely that such cases will prove the starting points of an epidemic in India? The answer will depend on the presence or absence of flies in India capable of transmitting the disease from one person to another. Are there any Tsetse-flies in India? No one knows, and it is most important to find out.

With this object I wrote in January last year to the Superintendent, Indian Museum, Calcutta, Nat. Hist. Section, to enquire whether Tsetse-flies or their allies existed in India. He replied, "I can only say that *Stomoxys* and *Glossina* are not at present known to occur in India. Very little however *is* known about Indian Diptera outside the recent work on *Culicidæ*, they have been little collected, and they are only now beginning to attract the attention of collectors." In February 1905 I applied to the Entomologist with the Government of India who very kindly sent me a note which, he said, "practically gives all I know of the Indian species." Under the head of *Tabanidæ* he mentions "*Chrysops dispar*, F., recorded as attacking cattle in Baluchistan, and said to be common in India generally. In Bigot's Catalogue of Eastern Diptera (Journal, Asiatic Society of Bengal, Vol. LX, p. 265), seven species of *Chrysops* are recorded as occurring in India, with 3 species of *Pangonia*, 2 species of *Hæmatopota* and 29 species of *Tabanus*." As regards the *Muscidæ* he says, "Bigot gives no species of *Stomoxys* from India, but one from Ceylon (*St. calcitrans*). I should imagine this will be found also in India. *Glossina* he does not quote from the East at all."

Mr. Lefroy also kindly sent his Fieldman to Bombay to hunt for biting flies, but as the hot season had just set in he did not succeed in finding any. Subsequently he wrote to me that he had found *Stomoxys* and several species of *Tabanidæ* in Assam, and he sent a lot of pupæ by post for the purpose of making experiments. These, however, unfortunately all hatched out in transit and arrived dead. In

September 1905 the Fieldman was kindly again placed at my disposal, and on the very morning of his arrival discovered *Stomoxys* in the Laboratory compound. Since then we have found *Stomoxys calcitrans* common in Bombay during the damp months after the monsoon, though it disappears at other seasons.

Since then Mr. Lefroy has issued a Circular for the use of the Civil Veterinary Department describing what ought to be done in regard to the investigation of Biting Flies in India, and I cannot do better than quote from it.

"*The Investigation of Biting Flies in India.*

"There are three main points in this inquiry which require to be worked out from the entomological side before much progress can be made in determining how far insects transmit diseases in India: these are (1) the identity of the flies that bite cattle, horses and man; (2) the life histories of these flies; (3) their distribution in India.

"(1) Biting-flies belong to several distinct groups; excluding mosquitoes (*Culicidæ*) and the smaller biting-flies (*Psychodidæ*, *Chironomidæ*, etc.), there are the *Hippoboscidæ* (Horse-flies), *Muscidæ* (Tsetse, Stomoxys, &c.), the *Tabanidæ* (Gad-flies).

"Of these, the Indian *Hippoboscidæ* so far collected or sent in are now being classified in Germany; a named reference collection of these will soon be available in India; of the *Muscidæ*, *Stomoxys calcitrans* or a closely allied species is known, as well as a very peculiar form only once found, which will be sent to the British Museum for classification as soon as possible. It is probable that others remain to be found. The *Tabanidæ* are a very large group, of which many have been collected, and it is hoped these may be named at the British Museum almost at once. The life histories of these insects are yet little known, but any measures of checking them as well as an understanding of their distribution must depend upon this knowledge. The life history of one Tabanid is known to conform to that of the group in general as known elsewhere, the life history of *Stomoxys* is known; and there is little doubt that the *Hippoboscidæ* in India have the same absence of larval stage as they have elsewhere. No more is known at present, and it will be impossible to rear flies artificially for purposes of experiment until more is known.

"Of distribution, very little is known accurately; the Stomoxys of Quetta is not known to be the same as that of Assam; the *Tabanidæ*

are common in forest lands, but the distribution of no one species is known."

From the point of view of the Sanitarian then it is most important that we should get to know something about the biting-flies of Bombay and India generally, but the Veterinary Department also have a very direct interest in the question, for there is a disease of horses, camels and cattle quite common in India called Surra which is caused by a trypanosome (*T. evansi*) exactly like that causing Sleeping Sickness, and no doubt spread by some blood-sucking fly. It has not yet been definitely decided what fly is implicated in the spread of this disease but it is quite within the bounds of possibility that a fly that can spread Surra might be capable of transmitting Sleeping Sickness as well.

This disease called Surra is very destructive to horses and ponies in Cavalry regiments and must cost the Government many thousands of rupees annually in this way.

It is of great importance then that an effort should be made to find out which particular fly is the cause of the spread of this disease and for this purpose we require to know (*a*) the seasonal prevalence of Surra in each place where it exists; (*b*) whether any particular fly is present at these seasons and absent during the rest of the year; (*c*) whether there exist for Surra, "fly-belts" similar to those described in Uganda in the case of Sleeping Sickness. It is pleasing to be able to record that the Bombay Government are fully alive to the importance of this matter and have sent out a circular asking Forest Officers and others to assist in the collection of biting flies. Here I think our Society by means of its widespread membership may be able to render valuable help in collecting flies and reporting on their seasonal prevalence, and also on the seasonal prevalence of Surra. It is fortunate for us that we have only Surra to study and not the dread Sleeping Sickness, and long may this endure, but till we know something about the Diptera of India we can never say with certainty that it is impossible for this disease to take root among us.

Within the last few days the discovery of *Glossina tachinoides* has been reported from the Dthala valley in the Aden Hinterland by Capt. R. Markham Carter, I.M.S.,* where he found it first on the banks of the Tiban river in belts of Tamarisk, Babul and Euphorbia jungle.

* Brit. Med. Journal, 1906, Vol. II, p. 1393.

It was identified as the above species by Newstead of the Liverpool Tropical School.

This is the first time that a Tsetse-fly has been reported outside of Africa, and though this is not the species that is responsible for the propagation of Sleeping Sickness, yet it gives rise to an uncomfortable feeling that perhaps a similar discovery may be made in India.

# ADDITIONAL CUCKOO NOTES.

By

E. C. Stuart Baker, f.z.s.

(*In continuation of the paper on "The Oology of Indian Parasitic Cuckoos" from page 696 of this Volume.*)

## Cuculus canorus.

### *The Common Cuckoo.*

In my original article on this bird I said that Cashmere was the home of the Cuckoos *par excellence*, but when I wrote this I had not stayed in Shillong for a hot weather, and I must now retract what I said, for, as a home of Cuckoos generally, I do not think there can be any place to compare with the Khasia Hills. During the present season I have taken and had brought to me no less than 59 eggs of *Cuculus canorus* and have made notes on 56 of these, with the result that much must be modified that I have already written in the article referred to.

About the 25th March this year (1906) the Cuckoo began to call, and within a week a dozen birds might sometimes be heard calling together, their melodious notes resounding in every ravine and on every hill alike. This went on steadily throughout April and May and the early part of June. About the middle of this month their cries lessened considerably and often the notes were discordant, and, by the latter part of the month, most birds who still continued to call had their voices cracking.

They were, however, to be constantly heard up to the 23rd, then they ceased almost entirely, though a casual bird would be heard at long intervals up to the 28th June, and the last Cuckoo call heard was on the 3rd July.

The following table shows the nests selected by the Cuckoo in which to place its eggs, the dates on which they were got, and the size of the eggs :—

381.—*Cisticola cursitans.*

| | | Inches. | |
|---|---|---|---|
| 1 | ... ... ... | ·97 × ·72 | 3-5-06 |
| 2 | ... ... | ·87 × ·70 | 31-5-06 |
| 3 | ... ... ... | ·92 × ·68 | 2-6-06 |
| 4 | ... ... ... | ·93 × ·65 | 2-6-06 |
| 5 | ... ... ... | ·88 × ·69 | 11-6-06 |
| 6 | ... ... ... | ·92 × ·70 | 12-6-06 |

| | | inches. | | | |
|---|---|---|---|---|---|
| 7 | ... ... ... | ·92 | × | ·64 | 16-6-06 |
| 8 | ... ... ... | ·93 | × | ·64 | 16-6-06 |
| 9 | ... ... ... | 1·00 | × | ·71 | 16-6-06 |
| 10 | ... ... | ·93 | × | ·68 | 16-6-06 |
| 11 | ... ... ... | ·90 | × | ·68 | 16-6-06 |
| 12 | ... ... ... | ·87 | × | ·67 | 16-6-06 |
| 13 | ... ... ... | ·86 | × | ·66 | 16-6-06 |
| 14 | ... ... ... | ·92 | × | ·69 | 20-6-06 |
| 15 | ... ... ... | ·91 | × | ·71 | 21-6-06 |
| 16 | ... ... ... | 1·01 | × | ·70 | 22-6-06 |
| 17 | ... ... ... | 1·03 | × | ·70 | 24-6-06 |
| 18 | ... ... ... | ·90 | × | ·64 | 5-7-06 |
| 19 | ... ... ... | ·92 | × | ·68 | 9-7-06 |
| 20 | ... ... ... | ·90 | × | ·70 | 19-7-06 |
| 846.—*Anthus striolatus.* | | | | | |
| 1 | ... ... ... | ·97 | × | ·66 | 20-5-06 |
| 2 | ... ... ... | 1·01 | × | ·65 | 22-5-06 |
| 3 | ... ... ... | ·94 | × | ·66 | 28-5-06 |
| 4 | ... ... ... | ·93 | × | ·64 | 31-5-06 |
| 5 | ... ... ... | ·96 | × | ·66 | 11-6-06 |
| 6 | ... ... ... | ·92 | × | ·67 | 22-6-06 |
| 7 | ... ... ... | ·94 | × | ·68 | 25-6-06 |
| 8 | ... ... ... | ·92 | × | ·67 | 1-7-06 |
| 9 | ... ... ... | 1·01 | × | ·71 | 3-7-06 |
| 10 | ... ... ... | ·80 | × | ·61 | 4-7-06 |
| 847.—*Anthus rufulus.* | | | | | |
| 1 | ... ... ... | ·93 | × | ·71 | 9-6-06 |
| 2 | ... ... ... | ·94 | × | ·66 | 16-6-06 |
| 3 | ... ... ... | ·93 | × | ·65 | 17-6-06 |
| 460.—*Suya khasiana.* | | | | | |
| 1 | ... ... ... | ·93 | × | ·70 | 30-5-06 |
| 2 | ... ... ... | ·87 | × | ·70 | 11-6-06 |
| 3 | ... ... ... | ·90 | × | ·65 | 12-6-06 |
| 4 | ... ... ... | ·97 | × | ·72 | 15-6-06 |
| 5 | ... ... ... | ·96 | × | ·66 | 30-6-06 |
| 6 | ... ... ... | ·96 | × | ·70 | 30-6-06 |
| 7 | ... ... ... | ·92 | × | ·71 | 10-7-06 |
| 458.—*Suya cringera.* | | | | | |
| 1 | ... ... ... | ·94 | × | ·66 | 24-6-06 |
| 2 | ... ... ... | ·86 | × | ·67 | 25-6-06 |
| 124.—*Pomatorhinus phayrii.* | | | | | |
| 1 | ... ... ... | 1·00 | × | ·64 | 17-4-06 |
| 2 | ... ... ... | ·90 | × | ·67 | 17-4-06 |

| | | inches. | |
|---|---|---|---|
| 475.—*Lanius nigriceps.* | | | |
| 1 | ... ... ... | ·92 × ·66 | 1-7-06 |
| 2 | ... ... ... | ·94 × ·64 | 1-7-06 |
| 594.—*Niltava sundara.* | | | |
| 1 | ... ... ... | ·99 × ·68 | 20-4-06 |
| 379.—*Orthotomus sutorius.* | | | |
| | ... ... ... | ·94 × ·65 | 24-4-06 |
| 466.—*Prinia inornata.* | | | |
| 1 | ... ... ... | ·90 × ·66 | 12-7-06 |
| 142.—*Pellorneum mandellii.* | | | |
| 1 | ... ... ... | ·85 × ·69 | 10-6-06 |
| 235.—*Liothrix luteus.* | | | |
| 1 | ... ... ... | 1·04 × ·75 | 15-6-06 |
| 372.—*Tribura luteiventris.* | | | |
| 1 | ... ... ... | ·96 × ·71 | 25-6-06 |
| 130.—*Pomatorhinus maclellandi.* | | | |
| 1 | ... ... ... | 1·0 × ·66 | 9-6-06 |

From this it is seen that the tiny Fan-tail Warbler, *Cisticola cursitans*, is the favourite foster-parent, and the others range thus :—

*Cisticola cursitans* ... ... ... ... ... ... ... 20
The Rufous Fan-tail Warbler.

*Anthus striolatus* and *rufulus* ... ... ... ... ... 13
Blyth's Pipit and the Indian Pipit.

*Suya khasiana* and *cringera* ... ... ... ... ... 9
Austen's Hill Warbler and the Brown Hill Warbler.

*Pomatorhinus maclellandi* and *phayrii* ... ... ... ... 3
Maclelland's and Phayre's Scimitar Babler.

*Lanius nigriceps* ... ... ... ... ... ... 2
The Black-headed Shrike. *Liothrix luteus.* The Red-billed Hill Tit. *Orthotomus sutorius.* The Tailor bird. *Prinia inornata.* Common Wren Warbler. *Pellorneum mandellii.* Mandelli's Tit Babbler. *Tribura luteiventris.* The Brown Bush Warbler. Each one egg.

Of course the little Fan-tail swarms in these Hills and their nests may be found in every patch of suitable grass land, which is no doubt, in part, the reason why the Cuckoo selects its nest, but anything more curious than the sight of one of these tiny nests containing a huge Cuckoo's egg on the top of two or three of the Warbler's own tiny productions is hard to imagine.

On one occasion I found two eggs in such a nest, leaving practically no room for the Warbler to get in and out. Of course when the young Cuckoo is hatched, he first turns out the eggs of his adopted parents or their children, if these are already hatched,

and then sets to work to grow fat at their expense. In a week he fills the nest and in three he has destroyed all its shape and symmetry and sits encased in a sort of basket-work of grass, and as he distends more and more he eventually bursts the walls altogether and rests on a pad of grass attached to the surrounding blades. I have had two young Cuckoos brought in to me about three quarters grown in the remains of such nests and they looked, as I have already said, as if they had had baskets plaited over them. How such tiny birds as the Fantail Warbler and allied species can rear such a voracious giant, seems incredible, but I must say that both the youngsters brought in to me were extremely fat, speaking volumes for the energy and devotion of their little fosterers.

The Pipits' nests undoubtedly rank next in demand; and must be very great favourites, as neither *rufulus* nor *striolatus* are very common here; yet of the fourteen nests of the latter and six of the former, which I have taken this year, no less than 13 have had Cuckoos' eggs in them.

Both Austen's Hill Warbler (*Suya khasiana*) and the Brown Hill Warbler (*S. crinigera*) are extremely common in the Khasia Hills, perhaps even more so than the Rufous Fantail Warbler (*Cisticola cursitans*), but though I must have seen some 250 nests of the Suyas, there have been Cuckoos' eggs in only 9 of them against 26 in the Cisticolas' nests.

This is very curious, as the nests are much of the same kind, *i.e.* small grass purses, and I should have thought that the Fantail Warbler was the better concealed of the two.

Other birds' nests seem only to be taken as a *pis aller* when the favourite ones are not available.

Both *Niltava sundara* and *Stoparola melanops* are quite common birds and one would have thought them very suitable fosterers, yet one egg in a nest of the former is all we have found.

The result of this year's work has in one respect confirmed what was said in my previous article to the effect that we must take it for granted that the Cuckoo lays its eggs on the ground and then places it in the nest selected for its reception. In no case have I found a nest in any way damaged by the Cuckoo, and often the only way it was possible for the egg to have been deposited in the nest without considerably spoiling it would have been in this manner.

Twice only during the year have we taken two eggs of the Cuckoo in the same nest, and, in both cases, the two eggs were so much alike that it is almost certain they must have been laid by the same bird.

Of the 59 eggs taken this year, in six cases only has the egg been found in a nest without *any* eggs of the fosterer. On the other hand, we have often found fresh Cuckoos' eggs with hard set ones of the foster-parent, showing that the Cuckoo must have found and left some at least of the eggs belonging to the owner of the nest when depositing its own eggs.

At the same time it is more than probable that they often destroy one or more of the eggs before depositing their own, as I have generally found that when nests contain a Cuckoo's egg the eggs of the fosterer number somewhat less than a full clutch.

The measurements of the eggs taken this year endorse very closely my average given for previous years, but increase the length by ·01″, as these eggs average ·93″ × ·67″ against ·91″ × ·67″, making a total average for close on 100 eggs of ·92″ × ·67″. No less than 8 eggs measure one inch or more in length out of this year's lot, but on the other hand one of them is smaller than any I have previously taken, measuring only ·80″ × ·61″. No egg has exceeded in breadth that taken by Colonel Rattray and only one has equalled it, this being a very large egg measuring 1·04″ × ·75″, the largest egg both ways I have ever seen. In regard to colouration I have this year taken many types which are quite new to me, the following of which are the principal. The first type is, ground colour a very deep yellow pink, more or less profusely spotted, speckled and blotched throughout with indefinite markings of reddish-brown. In nearly all the eggs of this type the markings are most numerous towards the larger end, where they sometimes form a ring or cup, never very well marked.

These eggs grade into the common cream-coloured type with definite spots and specks, which are so commonly found in this country.

The darkest forms are extremely like eggs of *Bringa* and some of *Dicrurus*.

Another type, of which I have some half a dozen specimens, has the ground practically white, perhaps with the faintest tinge of pink, and the markings consist of well-defined, tiny specks of deep reddish brown, with here and there a small blotch and more rarely a scriggly line or

larger blotch. The marks are always, in this type, disposed in a dense ring round the larger end and very sparse elsewhere.

Somewhat similar to this is a type in which the tint is a blue green instead of pink, but the markings are even more definite though smaller, and have many minute lines and scriggles mixed with the spots and specks. They are disposed in the same way as in the last type.

The most curious type of all is one having a stone-green ground colour and marked with purple-red fairly profusely everywhere, but more so towards the larger end, where they may form a ring or cup.

I have also an egg which was taken in the nest of *Liothrix luteus* and which by itself would have been taken for an egg of a *Petrophila*.

The only other conspicuous type is also a single egg, pure white with a few very faint but rather large blotches of pale red.

In shape my eggs vary from the rather squat oval, already described by me in this Journal, to a long graceful oval; undoubtedly, however, my last 50 are proportionately far longer and more gracefully shaped than the first 50 which passed through my hands.

To the list of birds already noted in my article as acting as fosterer we must add :—

| | | |
|---|---|---|
| 1. | *Pomatorhinus maclellandi.* | Maclelland's Scimitar Babbler. Baker. |
| 2. | *Pomatorhinus phayrii.* | Phayre's Scimitar Babbler. Baker. |
| 3. | *Pellorneum mandellii.* | Mandell.'s Tit Babbler. Baker. |
| 4. | *Liothrix luteus.* | The Red-billed Liothrix. Baker. |
| 5. | *Cisticola cursitans.* | The Rufous Fan-tail Warbler. Baker. |
| 6. | *Suya khasiana.* | Austen's Hill Warbler. Baker. |
| 7. | *Orthotomus sutorius.* | Tailor bird. Baker. |
| 8. | *Prinia inornata.* | The common Wren Warbler. Baker. |
| 9. | *Tribura luteiventris.* | The Brown Bush Warbler. Baker. |
| 10. | *Lanius nigriceps.* | The Black-headed Shrike. Baker. |
| 11. | *Anthus striolatus.* | Blyth's Pipit. Baker. |

Making a total of 31 Indian birds in whose nest the Cuckoo's egg has been taken.

### CUCULUS SATURATUS.

### *The Himalayan Cuckoo.*

I have practically nothing to add to what has already appeared about the oology of this bird, although it is extremely common in these Hills, commencing to call here very early in April and continuing up to the end of June. It is curious that so few of its eggs should have been brought in, as it is quite as common as *canorus* (The Common Cuckoo)

and haunts every ravine in the vicinity of Shillong. The main reason for the want of success is probably that whereas *canorus* frequently selects nests of birds who build in conspicuous places, *saturatus* seems almost invariably to select the nests of birds which build in holes and hollows, in ravines and dark places. A ravine, with rocky banks, which runs past my bungalow was haunted continually for three months by *many* of these birds and in this I found two eggs which I put down to the Himalayan Cuckoo. The first of these was taken in the nest of *Stoparola melanops* (The Verditer Flycatcher) on the 17th May. This egg is of the same general type in shape and texture as those I have already described, but in colour is a very pale pink with a sort of flush of darker pink at one end and a very few tiny specks of black scattered here and there over the whole egg.

The three Flycatcher's eggs were strongly marked specimens, broad ovals, with well defined smaller ends, quite different to the supposed Cuckoo's egg.

An egg taken in the nest of *Pomatorhinus ruficollis* (the Rufous-necked Scimitar Babbler) is exactly like those already described, but the markings are of bright reddish. This was taken on the 3rd June in a ravine near that above mentioned.

The second egg taken in that ravine was found on the 17th June in a nest of *Niltava sundara* (The Beautiful Niltava) built in a hole in some rocks just below my bungalow. I had known for some time that the birds were building there and also that some Himalayan Cuckoos were taking a great interest in their work, but I quite failed to find the nest. It, however, was eventually found by one of my chaprassies placed under a rock actually on the ground, whilst I had carefully searched the many suitable hollows in the rocky scarp above. It contained one *Niltava's* egg, one pure white with a speck or two of black like the normal eggs of the Himalayan Cuckoo, and a third egg which I can put down to nothing in particular, but which is probably merely an abnormal egg of the Flycatcher itself. Colonel Rattray has also been so good as to send me a beautiful typical egg of this bird taken in the nest of *Ianthia rufilata* together with two eggs of the foster-parent.

CUCULUS POLIOCEPHALUS.

*The Small Cuckoo.*

Since I finished my article on this little Cuckoo I have obtained considerably more information about it.

From Japan I have received no less than 14 of its eggs from Mr. Alan Owston, taken in every instance in the nest of *Cettia cantans*. These eggs vary very little in depth of colouration, all being of the type obtained first by Osmaston, and Owston tells me that he has never heard of a white egg of this Cuckoo. From Mr. Masson, of Darjeeling, who has been so good as to collect for me during 1906, I have received four most lovely eggs all taken in the nests of an *Horornis*—two probably *pallidus* and two probably *brunescens*. These are also of the same type as Osmaston's, but are of a brighter, more chestnut brick-red than any I have previously had pass through my hands. Masson's eggs were taken on the 3rd, 20th and 24th of June and 3rd July, respectively.

A most interesting note sent with the first of these eggs is worth reproducing. He writes: "I found a nest of *Horornis* in the morning which then contained two eggs of that bird, but, as I noticed a Cuckoo hovering about the nest, I did not interfere with it. In the afternoon I returned to inspect and found this rufous egg, which I now send you, in addition to the two which were there in the morning; it cannot be a *Horornis* egg, as not only is it much brighter and redder in colour but it is considerably larger."

From Garwhal I have received very valuable information from Mr. S. L. Whymper, who has also generously given me one of the eggs, about which he writes: "As you are interested in Cuckoos I write to tell you that I found to-day (June 20th) a really remarkable coloured egg of one of these birds. It is purple, exactly the colour of that egg of *Horornis pallidipes* you sent me. It was in a nest of *Phylloscopus affinis* which I had marked down about a hundred yards from my hut and which contained three eggs of the rightful owner—white ones, not spotted. I think the Cuckoo must have made a mistake and thought the nest was that of *Horornis pallidus*, which is quite common lower down." On the 26th Mr. Whymper again writes: "I think we have made a discovery, that purple egg is the egg of *Cuculus poliocephalus*. We found the nest of *Pnœpyga squamata* with three eggs in it, but not having my gun with me, and wanting the bird itself, I left them until the following day. When I went back the next day to the Wren's nest, there were only two Wren's eggs in it and one of these purple eggs, the Cuckoo who put it there evidently thinking exchange no robbery."

"I shot the Wren on its return and then thinking it just possible the Cuckoo might return, left my man with the gun to watch, and within ten minutes he shot a *Cuculus poliocephalus* alongside the nest. Of course this is not proof, but it comes near it."

"I should mention that since the 20th, when I found the first nest, I had discovered that *C. poliocephalus* was about, and had shot one to make certain, although its call is so unmistakeable."

The egg sent me by Mr. Whyte-er is quite different in colour to any others I have seen,—in fact it is, just as he says, almost exactly the same in colour as a rather pale *Horornis* egg, perhaps a little redder and less purple than most of the latter. It is a rather clumsy egg, nearly elliptical in shape but very squat, with one end somewhat larger than the other, but both equally obtuse. It is faintly mottled with a darker shade of its own colour. In size it measures ·8″ × ·61″.

CUCULUS MICROPTERUS.*

*The Indian Cuckoo.*

No oviduct egg has as yet been got of this bird, but all the evidence obtainable confirms Colonel Rattray's identification of this bird's eggs. I have had a few more sent me and have taken one myself this year. About Shillong itself *micropterus* does not occur at all, and in the fine series of *canorus* eggs obtained this season round the station *there has not been a single blue egg*, but as soon as my collectors worked the ravines where *micropterus* was common and *canorus*, if not altogether absent, at least very rare, they obtained a blue Cuckoo's egg in a nest of *Niltava sundara* together with three eggs of the fosterer.

HIEROCOCCYX SPARVEROIDES.

*The Large Hawk Cuckoo.*

During the past season (1906) I have been fortunate in obtaining no less than four blue eggs of this Cuckoo. The eggs were obtained,

* Mr. J. D. D. LaTouche in the *Ibis* for January 1907 has the following remarks on an egg of this bird taken from the oviduct:—"A female which I shot on May 26th, 1901, had an egg ready for laying in the oviduct; unfortunately it was smashed to bits by the shot. In colour it was pinkish white, with round specks and spots of rich red and deep carmine about the larger end, the rest of the shell having only a few isolated spots. The general appearance, so far as could be judged from the fragments, was somewhat like some eggs of *Buchanga lacocogys*."

This description does not correspond well with our supposed blue eggs of *micropterus*, but does not necessarily mean that the blue eggs are *not* those of that bird. We have equally startling differences proved to exist in the types of eggs of *C. poliocephalus*, and, again, the wonderful variations in the eggs of *Cacomantis* are quite as remarkable.

two in nests of *Liothrix luteus*, one in that of *Lanius cristatus*, and one in the nests of *Suya khasiana*, the latter containing also four eggs, of the rightful owner, of the blue type.

One of the eggs was sent to Colonel Rattray and compared with his authentic eggs, with which it agrees well, but none of the four taken here have the same curious corrugations and furrows that Colonel Rattray's eggs have; these, however, may be abnormal, and I do not place much weight on their being present or absent. The texture is the same—close, fine, and hard, with a considerable gloss, and is absolutely different to that of the supposed eggs of *micropterus*.

It is interesting to note that two out of the four eggs brought to me were said by the Khasias to be Sparrow Hawk's eggs, and I find that in their language both the Sparrow Hawk and the Hawk Cuckoo are called by the same name. A skin of the latter when shewn to the Khasias who brought the eggs was at once spotted and called a hawk. In one case the finder swore that he saw the Sparrow Hawk (?) on the nest and only frightened it off as he went to take eggs.

*Sparveroides* never seems to come up as high as Shillong; but in the lower country, where these eggs were obtained, they are quite common.

The eggs were taken between the 29th May and 1st July. Three measure 1·01″ × ·74″, ·97″ × ·73″ and ·95″ × ·78″, but the measurements of the egg sent to Colonel Rattray were not noted. The third egg is a rather squat oval, the other two longer and well pointed towards the smaller end.

### Hierococcyx varius.

### *The Common Hawk Cuckoo.*

Dr. Coltart sent me in July a most remarkable set of 10 eggs found in a nest of *Crateropus canorus*, of which only one egg was that of the Babbler and the nine others were all Cuckoo's eggs, either of *Coccystes jacobinus* or of this Cuckoo. It is impossible to say with any certainty to which they belong, but the majority of them, at any rate, are probably eggs of the Hawk Cuckoo.

They were not laid by one bird, as they vary extremely in shape and size, though not in colour.

### Cacomantis passerinus.

### *The Indian Plaintive Cuckoo.*

Since my notes on the bird's oology were compiled, a great deal of interesting matter has been added to our knowledge.

Professor Burnett, of Hyderabad, Deccan, has found many eggs in nests of *Prinia socialis*, and in some instances, has left the eggs to be hatched, and watched the young bird until old enough to identify. The following most interesting account was written by him for the Journal and then generously handed over to me together with some eggs :—

"There is a very common parasitic Cuckoo in this neighbourhood which answers, as far as one can judge from its habits and appearance on the wing, to the description of *Caccomantis passerinus* given in the 'Fauna of British India,' except in this respect, that its eggs, instead of being 'a pale blue, blotched and speckled towards the large end with reddish brown and purple,' are normally of a pink or terra-cotta colour and are unmarked by blotches or spots. This difference in colour might be accounted for by their having been deposited, whenever I have happened to find them, in the nest of *Prinia socialis* with its deep copper-coloured eggs. Last nesting season I found in my own and neighbouring gardens seven of the Cuckoo's eggs. Three I took, one was robbed, another was eaten by ants, and the remaining two hatched out. Both the young birds, however, came to an untimely end —one within three days of its being hatched, through some unknown foe, the other when almost full grown through a cat which managed to get at it in spite of a cage which had been specially made for its protection.

"At other times I have come across three instances of *Prinia socialis* feeding young Cuckoos of the same kind when full grown. In two of these cases the Cuckoo was able to fly quite well and appeared capable of looking after itself though ready enough to accept the ministrations of its very small and fussy foster-parents. In the third case the young Cuckoo had been placed in a wicker-cage in a verandah, and the foster-parents passed backwards and forwards through the bars of the cage.

"The circumstances under which the seven Cuckoo's eggs referred to above were found, certainly seem to confirm what has now, I believe, become the generally accepted view, *viz.*, that Cuckoos lay their eggs on the ground and then carry them to the nests of the birds they victimize.

"*Prinia socialis* in this neighbourhood affects both the types of nest it is known to build, *i.e.*, the tailor-bird type and the purse type. In neither of these could *Caccomantis passerinus* lay an egg.

"It seems not unlikely, too, that the fact that *Prinia socialis* is so frequently made the foster-mother, is not simply due to propinquity nor a mere matter of convenience. It may well be that a hen Cuckoo reared in the nest of a *Prinia socialis* goes of 'propria persona' as Chaucer, himself a bird lover, would say, to the nest of *Prinia socialis* to get her own young fostered.

"The young Cuckoo used to be held up to universal contempt for the base ingratitude which he was supposed to show in ousting his fellow-nestlings from the common home. It seems, however, more likely that it is the foster-parents who make away with their own young to provide more room for the fosterling. Their instinct tells them that there cannot be room for all, and it is the weakest that have to suffer. The wonderful correctness of their instinct is fully borne out by the way in which the stitches of a tailor-made nest burst one by one before the rapidly increasing bulk of the young Cuckoo, even when only half grown."

The above was written on the 5th of May 1906 and referred to the previous year's work.

In October 1906 Professor Burnett again wrote to give me some more information on the same subject.

He says: "I have only found two nests myself this year containing Cuckoo's eggs, though several of my neighbours have found them. I did not disturb these, as I wished to bring one up if possible, and have so far succeeded as to have one now nearly three weeks old in a cage in my verandah. He is fed by the foster-parents through the bars, but of course they wont be able to continue doing this for ever. Mine is not the only bird, as the Agent of the Hyderabad branch of the Bank of Bengal has also one, and there was a third which has escaped.

"All the eggs of *Caccomantis passerinus* found this year were of exactly the same type and in the nests of *Prinia socialis*, none being taken here in *Orthotomus* or *P. inornata* as far as I have heard.

"According to my observations, again, this year the Cuckoo has usually deposited her eggs in a nest already occupied, but I cannot say for certain about this, as most of those I have seen were found by other people. Also it is the foster-parent who turns out her own young. They have to make room and turn out within 24 hours of the Cuckoo being hatched. Finding them on the ground we put them back three or four times in two nests, but it was no good; they were regularly turned out again."

This young bird died when about seven weeks old and was then sent to me for identification, and is undoubtedly *Caccomantis passerinus* in *adult* plumage and of the curious phase which has the underparts concolourous with the back, but paler.

The skin is incomplete and the under-plumage more or less absent, so that whether the whole or only parts of the under-plumage was grey or not, it was impossible to see.

The following notes by Mr. T. Florenzo, of the Bank of Bengal, Hyderabad, further confirms Professor Burnett; he writes: "Nest of *Prinia socialis* found 11th July 1906 containing four eggs. Three of these eggs were of *Prinia socialis* while the fourth was a Cuckoo's, *Caccomantis passerinus*. The Cuckoo's egg was half as large again as the other and of a lighter colour, except at the large end, where the colour was about the same as the *Prinia socialis* egg. Two of the eggs were hatched on the 15th July. I did not visit the nest on the 16th July, as it was a very wet day, but on visiting the nest on the 17th July the young Cuckoo was the sole possessor of the nest. I could find no trace of the other birds or eggs.

"The Cuckoo left the nest, full fledged, on the 4th August."

Again on the 22nd August he writes: "The Cuckoo left the nest on 4th instant and I sent the notes to Bombay on the 6th, up to which time I had not seen it since leaving the nest. I, however, saw it on several occasions after that with the two foster-parents in attendance and feeding it.

"The last day on which I saw them together was the 14th instant, and I am quite satisfied it was a *Caccomantis*. Mr. Stubbs, one of the accountants at the Bank, saw it on the 15th. I found another nest of *Prinia socialis* with a similar egg, but unfortunately the nest was robbed, probably by a lizard."

Four eggs were sent me by Professor Burnett, out of which one is that of *Prinia socialis*—abnormal certainly, but identifiable by its texture, which is quite different to that of any Cuckoos.

The three *bonâ fide* Cuckoo's eggs are of three types.

One is a very dull, muddy-coloured egg of the type described in detail in my former notes as having been received from the Irvine collection. The ground is a very pale greeny-grey stone colour suffused with reddish at either end and profusely speckled with minute dots of reddish, which tend to form a ring at the larger end. This egg gives

me the impression that it is a form intermediate between the common types already described and the terra-cotta eggs which form the normal type in the Deccan. The second egg has a beautiful pink ground thickly covered with terra-cotta and reddish speckles and blotches which coalesce in a thick ring at the larger extremity. This egg nearly approaches the normal Deccan egg, of which my third is a representative. This is a beautiful terra-cotta with a darker ring of the same as in the other eggs.

The three eggs measured, respectively, ·72″ × ·52,″ ·74″ × ·53″ and ·71″ × ·51″; in texture, shape, &c., they agree with the eggs already described.

From Belgaum Mr. T. R. Bell has been so good as to send me yet another series of three eggs, all laid in the nest of *Cisticola cursitans*. Two of these have a white ground and one a blue ground, and agree well with the eggs already described. They measure ·72″ × ·51,″ ·72″ × ·52″ and ·69″ × ·51″.

Professor Burnett's suggestions open up three most interesting points in connection with the eggs of parasitic Cuckoos.

First is the question whether the colouration of the egg has any relation to the colour of the egg of the foster-parent selected.

To commence with, we have the broad fact that our Cuckoos which lay blue eggs—that is, *Hierococcyx varius* and the genus *Coccystes*—practically invariably deposit their eggs in the nests of such birds as themselves lay blue eggs. All over India fosterers of this description are available in considerable numbers and there is no need for further adaptation, and accordingly we find there is none, and no one has ever taken an egg of the above Cuckoos of any other colour but blue; of course there are rare exceptions to the usual fosterers selected, such as the egg of *Coccystes jacobinus* found in the nest of *Garrulax leucolophus*, but these exceptions are too few to have any influence either on eggs or parent.

As regards the Common Cuckoo (*Cuculus canorus*), it is difficult to say definitely that adaptation is going on, for we find every type of egg laid *almost* indiscriminately in the various fosterers generally accorded the honour of bringing up the young bird.

Here in the Khasia Hills the fosterer most often selected is the little Fantail Warbler (*Cisticola cursitans*) and certainly the most common type of egg is like a gigantic edition of the Warbler's egg. On the

other hand the fosterer next often chosen is the Pipit (either *rufulus* or *striolatus*), and although I have taken one Cuckoo's egg which might have been mistaken for a Pipit's, so clearly did it resemble those of that bird, this is the only one of that type I have seen in these Hills.

It is possible that the want of discrimination displayed by the Common Cuckoo as to where it should put its egg, has resulted in the marvellous variety of types and colours found in it. At the same time it is possible that the egg is more or less adapting itself to local requirements in those localities in which any one fosterer greatly predominates. To accord with this it is, however, necessary to presume that Cuckoos are regular in their migratory habits and visit the same breeding range one generation after another.

Authentic eggs of the Himalayan Cuckoo (*Cuculus saturatus*) resemble the fosterers most often selected.

The small Cuckoo (*Cuculus poliocephalus*) lays two types of eggs which may be called a pink type and a white type. Now it appears that the white type is never found in Japan where the Cuckoo *invariably* places its egg in the nest of *Cettia*, a Warbler whose eggs only differ slightly in size, shape and texture and not at all in colouration from that of the Cuckoo. Here in India records show four eggs of the pink type laid in the nests of *Horornis* and one in the nest of *Oligura*, both genera laying eggs which somewhat resemble that of the Cuckoo.

In Cashmere, where the fosterers selected are generally such as lay pure white or white faintly spotted eggs, the white type is the dominant one and the pink type is rare. Mr. S. L. Whymper has lately taken this type twice in the nests of fosterers laying white eggs, but these eggs were found in a place adjacent to which *Horornis* was very plentiful, and we may justly assume that *Horornis* is the popular fosterer there. Of course also, both of Mr. Osmaston's eggs of the pink type were taken in nests of the white-browed Shortwing (*Drymoichares cruralis*) which lays pure white eggs, but here again it has since been found that Warblers of the *Horornis* group are the favourite fosterers.

On the whole, therefore, it may be taken as probable that the small Cuckoo lays eggs which adapt themselves to their surroundings. The Indian Cuckoo (*Cuculus micropterus*) lays very pale blue eggs and select most often fosterers, such as *Trochalopterum linatum* and *Larvivora brunnea*, which also lays blue eggs. Here the colour of the Cuckoo's

eggs would certainly seem to have adapted itself to that of the type of fosterer's egg with which it is generally found.

Of the genus, *Hierococcyx*, the Large Hawk Cuckoo, which in the Eastern Hills places its eggs in the nest of the Large Spider Hunter (*Arachnothera magna*), in perhaps four cases out of five has an egg which very closely resembles that of its foster-parent and is roughly speaking an olive brown. But this bird in the Khasia Hills and also in the Himalayas would seem to place its eggs in the nests of birds of the *Garrulax* group, *Myiophoneus* or others which lay blue or blue spotted eggs, and accordingly we also find that it has developed a blue egg which resembles the olive type in nothing but shape and texture.

The Common Hawk Cuckoo (*Hierococcyx varius*), as already said, has arrived at complete adaptation and invariably places its deep blue eggs in nests of fosterers which lay the eggs of a similar colour.

As regards the Small Hawk Cuckoo (*Hierococcyx nisicolor*) it appears to deposit its eggs, as a rule, in the nest of birds which lay eggs by no means conspicuous and which do not differ *greatly* in colouration from its own egg, but our knowledge at present does not enable us to say that it has any predilection for any particular foster-parent for its young.

We then come to the genus *Caccomantis*, Professor Burnett's friend, and here are confronted by one of the most remarkable instances of what appears to be adaptation. Normally the bird in the South of India, Belgaum and Kanara, where it is most common, and also in the Nilgiris, lays its eggs in the nests of the Fantail Warbler (*Cisticola cursitans*), the common Tailor-bird (*Orthotomus sutorius*) and the Indian Wren Warbler (*Prinia inornata*). Now all three of these species lay eggs which are white or blue in ground colour and are more or less spotted; accordingly the Cuckoo has developed an egg of the same description which is an enlarged facsimile of the Tailor Bird's eggs and not very strikingly different from those of other birds. In the Deccan, however, the Plaintive Cuckoo has deserted these fosterers and relies on the Ashy Wren Warbler (*Prinia socialis*) to bring up its young; accordingly the eggs seem to be in the course of adaptation to its requirements, and whilst some are intermediate in colouration between the normal Southern Indian egg and the terra-cotta type, and appear to show incomplete adaptation, the majority are of a terra-cotta colour which is inconspicuously different from that of the eggs of the *Prinia*.

Knowledge as to the eggs of other species of Indian Cuckoos is not yet sufficient to allow of generalization.

On the whole, therefore, Indian Cuckoos would appear to adapt themselves more or less to producing eggs which to some extent resemble those of the birds they select as foster-parents to their young. How this adaptation is evolved is difficult to guess at. We see birds sitting in complete happiness on eggs at least four times as big as their own productions and as little like them in shape and colour as it is possible to conceive. Why, then, the necessity for adaptation? Presumably it must be admitted that here and there birds are possessed of superior intellect sufficient to enable them to see the differences between their own eggs and the imposters, and on seeing such differences destroy the latter. In this way such Cuckoo's eggs as approach most nearly in colouration to those of the foster-parents would survive, whilst those which greatly differ would gradually be eliminated.

In Professor Burnett's first article quoted, he says he thinks it more probable that the foster-parent turns out the young than that the young cuckoo itself does this. It has, however, been practically ascertained for certain that it is the young Cuckoo who is the culprit, and he has been seen more than once in the very act of ejecting his unfortunate fellow nestlings. Moreover, the young Cuckoo has been especially built by nature to perform this act of ejectment and has his back suitably formed and is given powerful legs and thighs as a nestling, though the latter develop but little afterwards. As to his opinion that the Cuckoo generally deposits its eggs in a nest already occupied, this is probably correct. In many instances this year the Cuckoo's egg has been found deposited on the top of the fosterer's, and though the Cuckoo's egg has sometimes been found to be fresh whereas the others showed more or less signs of incubation, the reverse has been extremely rare.

### CACCOMANTIS MERULINUS.

### *The Rufous-bellied Cuckoo.*

I have had two very remarkable eggs sent to me which I would attribute to this bird if they are Cuckoo's eggs at all.

These two eggs and another of the same description were taken in May this year (1906) in the Gooma Reserve, Goalpara, Assam, and were all found in the nests of *Æthopyga seheriæ*, the Himalayan Yellow-backed Sun-bird. The eggs, which were sent me—one by

Mr. A. M. Primrose and one by Mr. Charles Inglis—are very much alike, and are certainly quite unlike the *seheriæ* eggs with which they were found, but I have taken eggs of *seheriæ* myself in Hungrum and elsewhere which exactly resemble these supposed Cuckoo's eggs.

All three nests contained two Sun-bird's eggs in addition to the third different egg. The Sun-bird's eggs have pure white grounds and are fairly profusely and boldly blotched and speckled with dark grey-brown with other spots underlying of rather pale grey. They are clear, smart looking eggs, whereas the supposed Cuckoos are quite the reverse. The latter have very dull yellowish white grounds with very profuse but smudgy markings of light sienna brown, a few of the blotches being rather darker and more grey. They measure ·66″ × ·46″ and ·62″ × ·47″ and are much larger than the Sun-bird's egg, which only measures on an average ·55″ × ·44″; at the same time I have specimens of this Sun-bird's eggs in my collection quite as large as these supposed Cuckoo's eggs.

COCCYSTES JACOBINUS.

*The Pied Crested Cuckoo.*

I have received the following interesting account from Mr. J. Lindsay Hervey, of Dharbanga, about the depositing of an egg of this Cuckoo in the nest of the Jungle Babbler (*Crateropus canorus*) :—

"I first noticed the Babbler's nest on the morning of the 27th June 1906; it was situated about ten feet up on a guava tree in the garden here and well concealed in a thick clump of leaves. The Babbler was sitting tight and the nest contained two eggs, unmistakeably *Babbler's*, both these eggs I marked with a pencil and put back into the nest. I again visited the nest next morning and found that a third egg had been laid, this egg I also marked. I then retired a little way off (about fifteen yards) to another guava tree and began watching a pair of *Orthotomus sutorius* that were hopping about among the leaves and evidently selecting a nesting site. When I had been watching them about five minutes I heard two or three Babblers making a great noise in the tree under which was the Babbler's nest; turning round to see what caused the alarm I saw a *Coccystes jacobinus* seated on a twig near the nest and the Babblers hopping about around it chattering in great excitement: the Cuckoo then hopped on to the nest and the Babblers made off. Breathlessly I watched what would happen next, and a second or so later the Cuckoo flew down to the foot of the tree where

I lost sight of it in the long grass, but almost immediately afterwards it again flew up to the nest and remained about a half minute and then flew away. I then walked up to the foot of the tree and looking down to where the Cuckoo had settled I saw to my astonishment an egg on the ground. On examining it I found that it was one of the Babbler's eggs that I had marked. Leaving the egg on the ground I got up to the nest and found to my delight that there were three eggs in the nest, two of them the marked Babbler's eggs and the third this large round one unmarked and undoubtedly a Cuckoo's. On removing the nest one of the Babbler's eggs unfortunately got broken. I cannot say whether the Babbler's egg was removed first and then the Cuckoo's egg put in, or *vice versa*."

I have taken a considerable number of eggs of this Cuckoo this year, and in addition to the fosterers already mentioned must be added (1) the Chestnut-bellied Rock Thrush (*Petrophila erythrogastra*), (2) the Eastern Yellow-winged Laughing Thrush (*Trochalopterum chrysopterum*), (3) The Black-headed Shrike (*Lanius nigriceps*) and (4) The Orange-headed Ground-Thrush (*Geocichla citrina*).

### Coccystes coramandus.

### *The Red-winged Crested Cuckoo.*

I have taken the eggs of this fine Cuckoo this year (1906) in the nests of the Rufous-chinned Laughing Thrush (*Iantho-cincla rufigularis*) twice, the Yellow-winged Laughing Thrush, and a Scimitar Babbler (*Pomatorhinus maclellandi*).

# THE FLORA OF ADEN.

By

E. Blatter, S.J.

Aden is the only part of Arabia which, regarding its flora, has been explored in a somewhat satisfactory way. As early as 1846 Edgeworth paid a short visit to Aden and collected 42 plants, which, later on, he described in the Journal of the Asiatic Society of Bengal. In 1847 J. D. Hooker starting on his expedition to the Himalayas came to Aden, and a second time in 1851 when he returned to England in company with Dr. Thomson. Each time he collected as much as a short visit allowed him to do. In 1860 Thomas Anderson, of the Bengal Medical Service, published his "Florula Adenensis" in the Supplement to Vol. V. of the "Journal of the Proceedings of the Linnean Society." He had made two excursions in Aden when on his journey to England in 1859. The material collected during his explorations along with the plants gathered in former years by J. D. Hooker, Colonel Madden, and the German traveller Schomburgk, enabled him to describe 94 species. Since that time our "Bombay Libraries" keep deep silence about any further finds in Aden; the same blank we notice in our Herbaria, and it is only a few years ago that the "Bombay Natural History Society" was presented with an excellent collection of Aden plants by Col. W. S. Birdwood, who had spent some years in a military capacity at Aden. His specimens are almost throughout complete, admirably prepared, and well preserved. When I had already finished a list of the plants contained in Birdwood's Herbarium, I came across a recent contribution to the flora of Aden by K. Krause[1]. In his catalogue we find, of course, the plants mentioned by Thomas Anderson, and, besides, some 80 species which partly had been published in various journals, partly are preserved in the Botanical Museum of Berlin. Amongst the latter, there is a collection made by T. M. Hildebrandt in 1872 when he started from Aden on his journey to Somaliland, another one by Ellenbeck in 1899, and a third one by W. Busse in 1903. Schweinfurth visited Aden three times, *viz.*, in March 1881, December 1888, and in November 1889. The results

[1] K. Krause, Beitræge zur Kenntniss der Flora von Aden. (Sonderdruck aus Engler's Bot. Jahrbüch., Vol. XXXV, Heft 5.)

of his travels are contained in the *Bulletin de l'Herbier Boissier*. In 1884, 1885 and 1886 the French traveller Deflers collected a good many plants in Aden and Little Aden. There appeared a list of the species collected by him in the *Bulletin de la Société Botanique de France*, 1885 and 1887. Krause, making use of the publications as well as of the herbaria, gives in his "Beitræge" the names of 178 plants, of which 8, however, are found only in Little Aden. We are much indebted to Birdwood, as his herbarium enables us to give a more complete catalogue of the interesting flora of Aden.

After having enumerated the species we intend to add some biological and plant-geographical notes. (An asterisk before the name of a plant means that the species has not been examined by me.)

## MENISPERMACEÆ.

**1. Cocculus leæba,** DC. Syst. veg. I, 529.—*Cebatha et Leæba*, Forsk. Fl. æg.-arab. p. 171-172.—*Menispermum leæba*, Delil. Fl. æg. ill. 30. desc. t. 51. f. 2. 3.—*Menispermum edule*, Vahl. Symb. I. 80.—*Cocculus ellipticus*, DC. Syst. veg. I. 526. *Cocculus glaber*, W. & A. Prodr. p. 13.

Distrib.—Gujarat, Sind, Punjab, Afghanistan, Middle and S. Arabia, Abyssinia, Kordofan, Nubia, Egypt, Senegambia, Cape Verd Islands.

**2. Cocculus sp.**

For want of sufficient material I have not been able to specify this plant.

## CRUCIFERÆ.

**3. Farsetia longisiliqua,** Dene, Ann. Sc. Nat. Ser. II. IV. 69.—I consider this plant to be identical with *F. stylosa*, Anders. Journ. Linn. Soc. V. Suppl. p. 1, and *Mathiola stylosa*, Hochst. et Steud. in Schimp. Pl. Arab. Fel. n. 860.

Distrib.—Arabia, Socotra, Erythrea, Nubia, Egypt.

**4. Diplotaxis pendula,** DC. Syst. II. 630; Prodr. I. 222.—*Sisymbrium pendulum*, Desf. Fl. atl. 2. p. 82. t. 156.—*Sisymbrium hispidum*, Vahl. Symb. II. 77.—*Diplotaxis harra*, Boiss. Fl. Or. I. 388. —*Diplotaxis crassifolia*, DC. Syst. II. 629.—*Diplotaxis hispida*, DC. Syst. II. 630.

Distrib.—Arabia, Persia, Palestine, Egypt, Abyssinia, Northern Africa, Sicily, Spain.

## CAPPARIDACEÆ.

5. **Cleome quinquenervia,** DC. Prodr. I. 239.—*Cl. pentanervia*, Ait. Cat. Pl. and Sind. Pl. p. 9.

DISTRIB.—Arabia, Persia, Afghanistan, Sind.

6. **Cl. papillosa,** Steud. Nom. Bot. ed. 2. I. 382.—*Cl. gracilis*, Edgew. in Journ. Asiat. Soc. Bengal XVI. p. 1212.—*Cl. scaposa*, DC. Prodr. I. 239.—*Cl. ehrenbergiana*, Schweinf., Fl. Æthiop. 68.—*Cl. radula*, Fenzl. in Flora 1844, p. 312.—*Cl. cordata*, Ehrbg. ined. in herb. arab.—*Cylindrocarpus cordata*, Kl. ined. ibid.

DISTRIB.—Kordofan, Nubia, Abyssinia, extending through Arabia to N. W. India, Socotra.

7. **Cl. brachycarpa,** Vahl. in DC. Prodr. I. 240.—*Cl. ornithopodioides*, Forsk. Fl. veg.—Arab. Cat. N. 402.—*Cl. vahliana*, Fres. in Mus. Senckenb. II. 110. Ait. Cat. Pb. and Sind Pl. p. 9.—*Cl. ruta*, Cambess, in Jacq. Voy. Bot. p. 19, t. 19. Ait. Cat. Pb. and Sind. Pl. p. 9.—*Cl. diversifolia*, Hochst. et Steud. in Schimp. Fl. Arab. Fel. n. 762.—*Cl. parviflora*, R. Br. in Salt Voy. Abyss. p. 65.

DISTRIB.—Kordofan, Abyssinia, Nubia, Arabia, N. W. India

8. **Cl. paradoxa,** R. Br. in Salt. Voy. Abyss. App. 65.—*Cl. venusta*, Fenzl. in Flora 1844, p. 312.—*Cl. muricata*, Edgew. Journ. Asiat. Soc. Bengal, XVI. p. 1212.—*Dianthera grandiflora*, Kl. in Peter's Reise nach Mozambique, Bot. I. 161. *Cl. grandiflora*, Ehrbg. ined. in herb. arab. et abyss.

DISTRIB.—Kordofan, Abyssinia, Nubia, Arabia.

9. **Cl. pruinosa,** Anders. Journ. Linn. Soc. V. Suppl. p. 3.

DISTRIB.—Aden (endemic).

10. **Cl. brachystyla,** Defl. Bull. Soc. Bot. Fr. XXXIV, p. 65. —*Cl. hispida*, Ehrbg. Herb. arab. ined.

DISTRIB.—Ketumbal, Shugra, Somaliland.

11. **Cl. polytricha,** Franch. in Morot, Journ. de Bot. I. 41, —*Cl. hispida*, Defl. in Bull. Soc. Bot. Fr. XXXIV. 64.

DISTRIB.—Aden, Saihut (Mahra-coast).

12. **Dipterygium glaucum,** Dene. in Ann. Sc. Nat. ser. 2. IV. 67.—*Pteroloma arabicum*, Hochst. et Steud. in Schimp. Fl. Arab. Fel. n. 851.

DISTRIB.—Nubia, Abyssinia, Kordofan, Arabia, N. W. India.

Birdwood has a specimen which he considers to be specifically different from the above species. It grows on sand, whilst *D. glaucum*

is found near rocks. There are marked differences between the two plants with regard to branching and foliage, but fresh specimens are required in order to decide the question.

13. **Mærua thomsoni,** Anders. Journ. Linn. Soc. V. Suppl. p. 5. Distrib.—Aden (endemic).

14. **M. crassifolia,** Forsk. Fl. æg.-arab. p. 113. Aschers. et Schweinf. Fl. d' Eg. p. 43.—*M. uniflora,* Vahl. Symb. I. p. 36; DC. Prodr. I, 254.

Distrib.—Palestine, Egypt, Nubia, Lybia, Kordofan, Arabia, Senegambia.

15. **M. ovalifolia,** Cambess, in Jacq. Voy. Bot. 1844, p. 23, t. 24.—*M. arenaria,* Hook f. and Th. in Fl. B. I. I. 171. Trim. Fl. Ceyl. I. 58.—*Niebuhria oblongifolia,* Royle, Ill. Him. Bot. p. 73. —*Capparis heteroclita,* Roxb. Fl. Ind. II. 570.

Distrib.—W. India, Arabia.

16. **Cadaba rotundifolia,** Forsk. Fl. æg.-arab. p. 68; DC. Prodr. I. 244.—*Strœmia rotundifolia,* Vahl. Symb. I. 19.

Distrib.—Nubia, Abyssinia, Erythrea, Kordofan, Socotra, S. Arabia.

17. **C. glandulosa,** Forsk. Fl. æg.-arab. p. 68.; DC. Prodr. I. 244.—*Strœmia glandulosa,* Vahl. Symb. I. 20.—*C. monopetala,* Edgew. Journ. Asiat. Soc. Bengal XVI. p. 1212.

Distrib.—Nubia, Abyssinia, Kordofan, Arabia.

18. **C. longifolia,** DC. Prodr. I. 244.—*Strœmia longifolia,* R. Br. in Salt's Abyss. App. 64.—*C. scandens,* Pax in Engler's Bot. Jahrb. XIV. 301.

Distrib.—Nubia, Abyssinia, Sennaar, Erythrea, S. Arabia.

19. ***C. farinosa,** Forsk. Fl. æg.-arab. p. 68; DC. Prodr. I. 244.—*Strœmia farinosa,* Vahl. Symb. I. 20. *Streblocarpus Fenzlii,* Parl. in Webb. Fragm. Fl. Æthiop. p. 24.

Distrib.—Nubia, Abyssinia, Kordofan, Usambara, Arabia, Senegambia.

20. **Capparis galeata,** Fresen. in Mus. Senckenb. II. 111. —*C. spinosa,* L. var. *galeata,* Hook. f. & Thoms. in Fl. B. I. I. 173.—*C. cartilaginea,* Dene. in Ann. Sc. Nat. ser. 2. III. 273.—*C. uncinata,* Edgew. Journ. Asiat. Soc Bengal, XVI. p. 1213.

Distrib.—Egypt, Nubia, Abyssinia, Socotra, Zanzibar, Arabia, Sind.

21. ***C. decidua,** (Forsk), Pax in Engl.-Prantl, Natuerl. Pflanzenf. III. 2. p. 231.—*Sodada decidua,* Forsk.-Fl. æg.-arab. p. 81.

—*C. aphylla*, Roth. Nov. pl. sp. p. 238; DC. Prodr. I. 240.—*C. sodada*, R. Br. in Denh. Trav. p. 255.

DISTRIB.—Darfur, Egypt, Nubia, Abyssinia, Socotra, Arabia, Punjab.

RESEDACEÆ.

22. **Reseda amblyocarpa**, Fresen. Mus. Senckenb. I. 108. DC. Prodr. XVI. 580.—*R. lurida*, Muell.-Arg. Monogr. Reseda., p. 152, tab. 7, fig. 106.—*R. quartiniana*, A. R. Tent. fl. Abyss. I. 13.

DISTRIB.—Abyssinia, Erythrea, South Arabia.

POLYGALACEÆ.

23. **Polygala erioptera**, DC. Prodr. I. 326.—*P. triflora*, Anders. Journ. Linn. Soc. V. Suppl., p. 6.—*P. oligantha*, A. Rich. Tent. Fl. Abyss. I. 38.—*P. arabica*, Edgew. Journ. As. Soc. Bengal, XVI. p. 1213.—*P. irregularis*, Defl. Bull. Soc. Bot. Fr. XXXII. 346.

DISTRIB.—Cape Verd, Senegambia, Kordofan, Abyssinia, Erythrea, Nubia, Egypt, Arabia, Punjab, Bengal.

24. ***P. thurmanniana**, Chodat, Monogr. Polygal, p. 346.

DISTRIB.—Aden (endemic).

CARYOPHYLLACEÆ.

25. **Polycarpæa corymbosa**, Lam. Tab. Encyc. et Method. II. 129 (1800).—*Achyranthes corymbosa*, L. spec. 296.—*Lahaya corymbosa*, Schult., Syst. V. 404.—*Polycarpæa indica*, Lam. Journ. Hist. Nat. II. 8.—*Polycarpæa eriantha*, Hochst., Rich. Fl. Abyss. I. 303.—*Polycarpæa fallax* and *P. humifusa*, J. Gay, mss. in Herb. Kew.

DISTRIB.—Tropical Asia, Africa, America, and Australia.

26. **P. spicata**, Wight, ex Arnott in Ann. Nat. Hist. III. 99.—*P. staticæformis*, Hochst. et Steud. ex Fenzl in Gen. pl. 161. Webb. Frag. Fl. Æth. 40.

DISTRIB.—Egypt, Abyssinia, Nubia, Arabia, Sind, Gujarat.

27. ***P. fragilis**, Del. Fl. d'Eg. p. 24, tab. 24, fig. 1, DC. Prodr. III, 374.

DISTRIB.—Northern Africa, Egypt, Nubia, Arabia.

28. **Sphærocoma hookeri**, Anders. Journ. Linn. Soc. V. Suppl., p. 7, tab. 3.—*Psyllothamnus beevori*, Oliv. in Hook, Ic. pl. ser. III, V. p. 77, tab. 1499.

DISTRIB.—Aden, Soturba.

29. **Gypsophila montana**, Balf. Proc. Roy. Soc. Edinb. XI. p. 501, var. *diffusa*, Balf.

DISTRIB.—Socotra, Somaliland, Yemen.

is found near rocks. There are marked differences between the two plants with regard to branching and foliage, but fresh specimens are required in order to decide the question.

13. **Mærua thomsoni,** Anders. Journ. Linn. Soc. V. Suppl. p. 5. DISTRIB.—Aden (endemic).

14. **M. crassifolia,** Forsk. Fl. æg.-arab. p. 113. Aschers. et Schweinf. Fl. d' Eg. p. 43.—*M. uniflora,* Vahl. Symb. I. p. 36; DC. Prodr. I, 254.

DISTRIB.—Palestine, Egypt, Nubia, Lybia, Kordofan, Arabia, Senegambia.

15. **M. ovalifolia,** Cambess, in Jacq. Voy. Bot. 1844, p. 23, t. 24.—*M. arenaria,* Hook f. and Th. in Fl. B. I. I. 171. Trim. Fl. Ceyl. I. 58.—*Niebuhria oblongifolia,* Royle, Ill. Him. Bot. p. 73. —*Capparis heteroclita,* Roxb. Fl. Ind. II. 570.

DISTRIB.—W. India, Arabia.

16. **Cadaba rotundifolia,** Forsk. Fl. æg.-arab. p. 68; DC. Prodr. I. 244.—*Strœmia rotundifolia,* Vahl. Symb. I. 19.

DISTRIB.—Nubia, Abyssinia, Erythrea, Kordofan, Socotra, S. Arabia.

17. **C. glandulosa,** Forsk. Fl. æg.-arab. p. 68.; DC. Prodr. I. 244.—*Strœmia glandulosa,* Vahl. Symb. I. 20.—*C. monopetala,* Edgew. Journ. Asiat. Soc. Bengal XVI. p. 1212.

DISTRIB.—Nubia, Abyssinia, Kordofan, Arabia.

18. **C. longifolia,** DC. Prodr. I. 244.—*Strœmia longifolia,* R. Br. in Salt's Abyss. App. 64.—*C. scandens,* Pax in Engler's Bot. Jahrb. XIV. 301.

DISTRIB.—Nubia, Abyssinia, Sennaar, Erythrea, S. Arabia.

19. ***C. farinosa,** Forsk. Fl. æg.-arab. p. 68; DC. Prodr. I. 244.—*Strœmia farinosa,* Vahl. Symb. I. 20. *Streblocarpus Fenzlii,* Parl. in Webb. Fragm. Fl. Æthiop. p. 24.

DISTRIB.—Nubia, Abyssinia, Kordofan, Usambara, Arabia, Senegambia.

20. **Capparis galeata,** Fresen. in Mus. Senckenb. II. 111. —*C. spinosa,* L. var. *galeata,* Hook. f. & Thoms. in Fl. B. I. I. 173.—*C. cartilaginea,* Dene. in Ann. Sc. Nat. ser. 2. III. 273.—*C. uncinata,* Edgew. Journ. Asiat. Soc. Bengal, XVI. p. 1213.

DISTRIB.—Egypt, Nubia, Abyssinia, Socotra, Zanzibar, Arabia, Sind.

21. ***C. decidua,** (Forsk), Pax in Engl.-Prantl, Natuerl. Pflanzenf. III. 2. p. 231.—*Sodada decidua,* Forsk.-Fl. æg.-arab. p. 81.

—*C. aphylla*, Roth. Nov. pl. sp. p. 238; DC. Prodr. I. 240.—*C. sodada*, R. Br. in Denh. Trav. p. 255.

DISTRIB.—Darfur, Egypt, Nubia, Abyssinia, Socotra, Arabia, Punjab.

RESEDACEÆ.

22. **Reseda amblyocarpa**, Fresen. Mus. Senckenb. I. 108. DC. Prodr. XVI. 580.—*R. lurida*, Muell.-Arg. Monogr. Reseď., p. 152, tab. 7, fig. 106.—*R. quartiniana*, A. R. Tent. fl. Abyss. I. 13.

DISTRIB.—Abyssinia, Erythrea, South Arabia.

POLYGALACEÆ.

23. **Polygala erioptera**, DC. Prodr. I. 326.—*P. triflora*, Anders. Journ. Linn. Soc. V. Suppl., p. 6.—*P. oligantha*, A. Rich. Tent. Fl. Abyss. I. 38.—*P. arabica*, Edgew. Journ. As. Soc. Bengal, XVI. p. 1213.—*P. irregularis*, Defl. Bull. Soc. Bot. Fr. XXXII. 346.

DISTRIB.—Cape Verd, Senegambia, Kordofan, Abyssinia, Erythrea, Nubia, Egypt, Arabia, Punjab, Bengal.

24. ***P. thurmanniana**, Chodat, Monogr. Polygal, p. 346.

DISTRIB.—Aden (endemic).

CARYOPHYLLACEÆ.

25. **Polycarpæa corymbosa**, Lam. Tab. Encyc. et Method. II. 129 (1800).—*Achyranthes corymbosa*, L. spec. 296.—*Lahaya corymbosa*, Schult., Syst. V. 404.—*Polycarpæa indica*, Lam. Journ. Hist. Nat. II. 8.—*Polycarpæa eriantha*, Hochst., Rich. Fl. Abyss. I. 303.—*Polycarpæa fallax* and *P. humifusa*, J. Gay, mss. in Herb. Kew.

DISTRIB.—Tropical Asia, Africa, America, and Australia.

26. **P. spicata**, Wight, ex Arnott in Ann. Nat. Hist. III. 99.—*P. staticæformis*, Hochst. et Steud. ex Fenzl in Gen. pl. 161. Webb. Frag. Fl. Æth. 40.

DISTRIB.—Egypt, Abyssinia, Nubia, Arabia, Sind, Gujarat.

27. ***P. fragilis**, Del. Fl. d'Eg. p. 24, tab. 24, fig. 1, DC. Prodr. III, 374.

DISTRIB.—Northern Africa, Egypt, Nubia, Arabia.

28. **Sphærocoma hookeri**, Anders. Journ. Linn. Soc. V. Suppl., p. 7, tab. 3.—*Psyllothamnus beevori*, Oliv. in Hook. Ic. pl. ser. III, V. p. 77, tab. 1499.

DISTRIB.—Aden, Soturba.

29. **Gypsophila montana**, Balf. Proc. Roy. Soc. Edinb. XI. p. 501, var. *diffusa*, Balf.

DISTRIB.—Socotra, Somaliland, Yemen.

30. ***Cometes abyssinica,** R. Br. in Wall, Pl. as. var. I, p. 18, tab. 18.—*C. apiculata,* Done. Ann. Sc. Nat. II. p. 244.—*Ceratonychia nidus,* Edgew. Journ. Asiat. Soc. Bengal XVI., p. 1215.

Distrib.—Egypt, Nubia, Abyssinia, Erythrea, Arabia.

PORTULACACEÆ.

31. **Portulaca quadrifida,** L. DC. Prodr. III. 354.

Distrib.—Upper and Lower Guinea, Abyssinia, India.

MALVACEÆ.

32. **Abutilon fruticosum,** Guill. et Perr. Fl. Seneg. I. 73.—*A. denticulatum,* Planch, in Herb. Hook.—*A. microphyllum,* A. Rich. Tent. Fl. Abyss. I. 70.—*Sida kotschyi,* Hochst. mss.—*S. gracilis,* R. Br. in Salt's Abyss. App. 65.—*S. denticulata,* Fresen. in Mus. Senckenb. I, p. 182.

Distrib.—Canaries, Trop. Africa, Palestine, Arabia, India, Ceylon.

33. **Hibiscus micranthus,** L. Mant. p. 308; DC. Prodr. I. 453.—*H. rigidus,* L. f. Suppl. 310.—*H. clandestinus,* Cav.—*H. ovalifolius,* Vahl. Symb. I. p. 50.—*H. intermedius.* Hochst. in Schimp. Pl. Abyss. n. 2211.—*H. parvifolius,* Hochst, l. c.—*H. versicolor,* Schum. et Thonn. Pl. Guin. 311.—*Urena ovalifolia,* Forsk, Fl. æg.-arab. p. 124.

Distrib.—Tropical Africa, Arabia, India. Ceylon.

34. **H. welshii,** Anders. Journ. Linn. Soc. V. Suppl. p. 8.—*Cienfugosia welshii,* Guerke, Herb. Berol.

Distrib.—Aden (endemic).

STERCULIACEÆ.

35. **Sterculia arabica,** Anders. Journ. Linn. Soc. V. Suppl. p. 9.—*S. triphaca,* R. Br. Pl. Jav. n. 228.—*S. abyssinica,* R. Br. in Salt's Voy. Abyss. App.

Distrib.—Socotra, Yemen, Hadramout.

36. **Melhania denhamii,** R. Br. in Denh. et Clapp, Voy. App. 233.—*Erotera bracteosa,* Guill. et Perr. Fl. Seneg. I. 80, t. 17.—*Melhania kotschyi,* Hochst. Pl. Nub.—*M. bracteosa,* Boiss. Fl. Orient. I. 841.—*Cardiostegia kotschyi,* Presl. Epimel, Bot. 249.

Distrib.—Tropical Africa, Arabia, Beluchistan, Sind.

TILIACEÆ.

37. **Grewia populifolia,** Vahl. Symb. I. 33. DC. Prodr. I. 511.—*Chadara tenax,* Forsk. Fl. æg.-arab. p. 114.—*G. betulæfolia,*

Juss. in Ann. Mus. IV. 92. pl. 4, f. 1.—*G. reticulata*, Hochst. Pl. Schimp. Abyss.—*G. ribesiæfolia*. Hochst. Pl. Schimp. Abyss.—*G. membranacea*, Rich. Fl. Abyss. I. 90.

Distrib.—Tropical Africa, Senegambia, Mauritius, Egypt, Arabia, Persia, Sind, W. India, Ceylon.

38 **Corchorus antichorus**, Ræuschel, Nom. Bot. ed. 3, p. 158.—*Antichorus depressus*, L. Mant. p. 64; DC. Prodr. I. 504.—*Corchorus microphyllus*, Fresen. in Mus. Senckenb. II. 156.—*C. humilis*, Munro, Hort. Agrensis, App. p. 35.—*Jussiæa edulis*, Forsk. Fl. æg.-arab. p. 210.

Distrib.—Tropical Africa, Arabia, Afghanistan, Sind, Deccan.

39. **C. trilocularis**, L. Mant. (1767), p. 77. DC. Prodr. I. 504.

Distrib.—Tropical and S. Africa, Arabia, Afghanistan, Sind.

40. **C. olitorius**, L. Sp. Pl. (1753) p. 529. DC. Prodr. I. 511.

Distrib.—All tropical regions.

## ZYGOPHYLLACEÆ.

41. **Tribulus terrestris**, L. Sp. Pl. (1753) p. 387; DC. Prodr. I. 703.—*T. albus*; Poir.; DC. I. 703.—*T. humifusus*, Schum. et Thonn. Guin. Pl. 215.—*T. kotschyanus*, Boiss. Diag. Ser. I. 111.—*T. mollis*, Ehrenbg. in Schweinf. Fl. Æthiop. 29.—*T. exercucians*, Wawr. et Peyr. Sert. Beng. 17.—*T. lanuginosus*, L. Sp. Pl. p. 387.

Distrib.—Tropics of the Old World, Southern Europe, Australia, Sind, Deccan.

42. **Zygophyllum simplex**, L. Mant. (1767), p. 68; DC. Prodr. I. 705.—*Z. portulacoides*, Forsk. Fl. æg.-arab. p. 88.

Distrib.—Tropical and S. W. Africa, Egypt, Palestine, Nubia, Arabia, Sind.

43. **Fagonia cretica**, L. Sp. Pl. (1753), p. 386. DC. Prodr. I. 704.—*F. arabica*, L. Sp. Pl. p. 386.—*F. glutinosa*, Delile, Fl. Ægypt. 86. t. 28.—*F. latifolia*, Delile, l. c.—*F. parviflora*, Boiss. Diag. Pl. Or. Ser. I. fasc. VIII. 121-124.—*F. kahirana*, Boiss. l. c.—*F. thebaica*, Boiss, l. c.—*F. armata*, R. Br. in Salt's Abyss. App. 64.—*F. mysorensis*, Roth. Nov. Sp. 215.

Distrib.—Both shores of the Mediterranean, in extra-tropical Africa, warmer dry parts of Asia, Western N. and S. America.

44. **F. parviflora**, Boiss. Diag. Pl. Or. Ser. I. VIII. p. 124, var. *brevispina*, Schweinf. Bull. Herb. Boiss. VII. App. II. p. 5.

Distrib.—Nubia, Egypt, Abyssinia, Arabia, S. Persia.

45. **F. glabra**, Krause, Beitr. z. Fl. v. Aden in Engl. Bot. Jahrb. XXXV. Bot. Heft 5. p. 42.

DISTRIB.—Aden (endemic).

BURSERACEÆ.

46. **Balsamodendron opobalsamum**, Kth. in Ann. Sc. Nat. II. 348.—*Commiphora opobalsamum*, Engl. in DC. Prodr. IV. 16. var. *gileadense*, Engl. in DC. Prodr. IV. 16.—*Amyris opobalsamum*, Forsk. Fl. æg.-arab. p. 79.—*Balsamodendron gileadense*, Kth. Berg. in Bot Zeit. 1862, 163.—*B. ehrenbergianum*, Berg. l. c.

DISTRIB.—Nubia, Arabia.

RHAMNACEÆ.

47. ***Zizyphus spina Christi**, Willd. Sp. Pl. I. 1105; DC. Prodr. II. 20.—*Rhamnus nabeca*, Forsk. Fl. æg.-arab. p. 204.—*Z. africana*, Mill, n. 4.—*Z. napeca*, Lam. dict. III. p. 320.—*Z. jujuba*, Defl. (not Lamk.) Bull. Soc. Bot. Fr.

DISTRIB.—Egypt, Lybia, Nubia, Abyssinia, Arabia, Socotra, Punjab, Senegambia.

48. **Zizyphus lotus**, Lam. dict. III. p. 316.—*Rhamnus lotus*, L. Sp. 281.

DISTRIB.—Both shores of the Mediterranean, Palestine, Arabia.

VITACEÆ.

49. **Vitis quadrangularis**, Wall. Cat. (1828) 5992.—*Cissus quadrangularis*, L. Mant. p. 39.—DC. Prodr. I. 628.—*C. tetraptera*, Hook. f. Fl. Nigrit. 263.—*C. edulis*, Dalz. in Hook. Kew Journ. Bot. IX. (1857), p. 248.—*C. triandra* and *C. bifida*, Schum. et Thonn. Guin. Pl. 81.

DISTRIB.—E. Africa, India, Ceylon, Java, Malaya.

MORINGACEÆ.

50. **Moringa aptera**, Gaertn. Fruct. II. 315. DC. II. 478.—*Hyperanthera*, Forsk. Fl. æg.-arab., p. 67.—*M. arabica*, Pers. Syn. I. 460.

DISTRIB.—Egypt, Nubia, Erythrea, Kordofan, Sennaar, Arabia.

LEGUMINOSÆ.

51. **Crotalaria lupinoides**, Hochst. in Herb. Kotschy Pl. Nub. n. 41.

DISTRIB.—Egypt, Nubia, Erythrea, Kordofan, Yemen.

52. **C. leptocarpa**, Balf. f. Proc. Roy. Soc. Edinb. XXXI. p. 66, tab. XIV. — *C. dubia*, Balf. f. Proc. Roy. Soc. Edinb. XI. p. 508.

Distrib.—Socotra, Somali-coast.

53. ***C. schweinfurthii**, Defl. Bull. Soc. Bot. Fr. XXXII. p. 348.

Distrib.—Aden (endemic).

54. **Argyrolobium arabicum**, Jaub. et Spach, III. Pl. Or. I. p. 115.—*Cytisus arabicus*, Done. Ann. Sc. Nat. ser. II, IV. p. 78.

Distrib.—Yemen, Island of Neymen in the Red Sea.

55. **A. roseum**, Jaub. et Spach, Illustr. I. 116.—*A. kotschyi*, Boiss. Diagn. VI. 32.—*Cytisus roseus*, Comb. in Jacq. Voy. Bot. IV. 35. t. 40.—*A. ornithopodioides*, Jaub. et Spach. Ann. Sc. Nat. ser. II, XIX. p. 51.

Distrib.—N.-W. India, Beluchistan, Persia.

56. **Indigofera paucifolia**, Del. Fl. d'Eg. p. 127, t. 37, fig. 2; DC. Prodr. II. 224.—*I. erythrantha*, Hochst. in Schimp. Hb. Abyss., n. 2178.—*I. oblongifolia*, Forsk. Fl. æg.-arab. p. 137.—*I. argentea*, Roxb. Fl. Ind. III. 374.—*I. heterophylla*, Roxb. mss.

Distrib.—Java, Ceylon, India, Beluchistan, Arabia, Abyssinia, Nubia, Kordofan, Socotra, Senegambia.

57. **I. parvula**, Del. in Caill. Voy. 38, t. 3, fig. 1.

Distrib.—Abyssinia, Nubia.

58. **I. semitrijuga**, Forsk. Fl. æg.-arab. p. 137; DC. Prodr. II. 230.—*I. burmannii*, Boiss. Fl. Or. II. p. 189, et Suppl. p. 172.—*I. somalensis*, Vatke Oester. Bot. Zeitschr. XXVI. p. 201.

Distrib.—Abyssinia, Nubia, Kordofan, Sennaar, Erythrea, Egypt, Arabia, Sind.

59. **I. arabica**, Jaub. et Spach, III. Pl. Or. V. p. 89, tab. 479.

Distrib.—Yemen, Hadramout.

60. **I. argentea**, L. Mant. II. p. 243; DC. Prodr. II. 224.—*I. glauca*, Lam. Encycl. III. 246.—*I. articulata*, Gouan. Ill. et Obs. 49.—*I. tinctoria*, Forsk., Ægypt. 138.

Distrib.—Kordofan, Egypt, Nubia, Abyssinia, Arabia, Sind, W. India.

61. **Tephrosia apollinea**, Link., Enum. Hort. Berol. II. 252, DC. Prodr. II. 254.—*Galega apollinea*, Del. Fl. d'Eg. 144, t. 53, fig. 5.

Distrib.—Egypt, Nubia, Lybia, Abyssinia, Socotra, Arabia, Beluchistan.

62. **T. pogonostigma**, Boiss. Fl. Or. II. 193.—*T. arabica*, Steud.

Nom. Bot. ed. II., II. p. 666.—*Pogonostigma arabicum*, Boiss. Diagn. Pl. Or. ser. I. II. p. 39.

DISTRIB.—Yemen, Erythrea.

63. **Taverniera glauca**, Edgew., Journ. Asia. Soc. Bengal, XVI. p. 1214.

DISTRIB.—Abyssinia.

64. **Alhagi maurorum**, Desv.; DC. Prodr. II. 352.—*A. maurorum* has a silky ovary, whilst *A. camelorum* has a glabrous one; cf. Prain in Journ. As. Soc. Beng. V. 66 (1898), p. 377.

DISTRIB.—Nubia, Egypt, Syria.

65. **Rhynchosia minima**, DC. Prodr. II. 386, var. **memnonia**, Cooke. Fl. Bombay Pres. I. 389.—*R. memnonia*, DC. Prodr. II. 386. —*R. pulverulenta*, Stocks in Kew Journ. Bot. IV. 147.—*Glycine memnonia*, Del. Fl. d'Eg. p. 100, tab. 38, fig. 3.

DISTRIB.—Sind, Arabia, Tropical and S. Africa.

66. **Poinciana elata**, L. Mant. p. 16. DC. Prodr. II. 484—*Caesalpinia elata*, Sw. Obs. 166.

DISTRIB.—Nubia, Abyssinia, Erythrea, Arabia, India

67. **P.** sp.

68. **Cassia obovata**, Collad. Hist. Cass. 92, t. 15, A.—*C. senna*, L. Sp. Pl. 539. (*ex parte*)—*C. obtusa*, Roxb. Hort. Beng. 31.—*Senna obtusa*, Roxb. Fl. Ind. II. 344.—*C. burmanni*, Wight in Madras Journ. VI. t. 5.—*C. aschrek*, Forsk. Fl. æg.-arab., p. 86.

DISTRIB.—W. India, Arabia, Palestine, Egypt, Nubia, Erythrea, Abyssinia, Kordofan, Sennaar, Senegambia, Angola.

69. **C. holosericea**, Fresen. in Flora I. 54. *Senna ovalifolia*, Batka. Monogr. Senn. t. 4.—*C. pubescens*, R. Br. in Salt, Abyss. App. 64.—*C. schimperi*, Steud. Nom. Bot. ed. II., I. p. 307.—*C. cana*, Wenderoth in Linnæa, XII. 22.

DISTRIB.—Tropical Africa, Arabia, Sind.

70. **C. angustifolia**, Vahl., Symb. Bot. I. 29.—*C. lanceolata*, Wall. Cat. 5318, Royle Ill. t. 37, W. & A. Prodr. 288.—*Senna officinalis*, Roxb. Fl. Ind. II. 346.

DISTRIB.—Tropical Africa; found also in India, but not indigenous.

71. ***C. adenensis**, Benth. Trans. Linn. Soc. XXVII. p. 553.—*Senna hookeriana*, Benth. Monogr. Senn. p. 52.—*Cassia lanceolata*, Defl. Bull. Soc. Bot. France.

DISTRIB.—Aden, Hadramout.

72. **Acacia eburnea,** Willd. Sp. Pl. IV. p. 1081 ; DC. Prodr. II, p. 461.—*Mimosa eburnea*, L. f. Suppl. 437.

Distrib.—East Himalayas, Punjab, Ceylon, Afghanistan, Arabia.

73.* **A. edgeworthii,** Anders. Journ. Linn. Soc. V. Suppl. p. 18.—*A. erioloba*, Edgew. Journ. Asiat. Soc. Beng. XVI. p. 1215.

Distrib.—Yemen.

74. **A. hamulosa,** Benth. Lond. Jour. Bot. I. p. 509.—*A. asak*, Willd. Sp. Pl. IV. p. 1077.

Distrib.—Erythrea, Yemen, Hadramout.

75. **A. spirocarpa,** Hochst. in Schimp. Pl. Abyss. n. 658 et in A. Rich. Tent. Fl. Abyss. I. p. 239.

Distrib.—Abyssinia, Nubia, Sennaar, Kordofan, Erythrea, Arabia.

76. **A. nubica,** Benth. in Lond. Journ. Bot. 1842, 498.—*A. aucheri*, Benth. in Lond. Journ. Bot. 1842, 498.—*A. pterygocarpa*, Hochst., Benth. in Journ. Bot., 1846, 96.

Distrib.—Abyssinia, Nubia.

77. **A. arabica,** Willd. Sp. Pl. IV. p. 1085. DC. Prodr. II. p. 461.—*Mimosa arabica*, Lam.—*M. nilotica*, Forsk. Fl. æg.-arab. p. lxxvi. *A. vera*. Willd. Sp. Pl. IV, p. 1056.

Distrib.—Ceylon, Western India, Punjab to Behar, Arabia, Syria, Egypt, Nubia, Lybia, Abyssinia, Trop. Africa, Natal.

78. **A. mellifera,** A. Rich. Tent. Fl. Abyss. I. p. 241.—*Mimosa unguis cati*, Forsk.—Fl. æg.-arab. p. 176.—*M. mellifera*, Vahl Symb. III. p. 103.—*Inga mellifera*, Willd. Sp. Pl. IV. p. 1006.

Distrib.—Nubia, Abyssinia, Kordofan, Erythrea.

COMBRETACEÆ.

79. **Terminalia sp.** Ellenbeck (Krause).

LOASACEÆ.

80. **Kissenia spathulata,** R. Br. in Herb. Mus. Br.—*Fissenia capensis*, Endl. Gen. Pl. Suppl. II., p. 76.

Distrib.—Yemen, Hadramout, Somaliland, Namaland, Damaraland.

CUCURBITACEÆ.

81. **Cucumis prophetarum,** L. Cent. Amœn. Acad. IV. 295 ; DC. Prodr. III. p. 301.—*C. arabicus*, Delile, in Cat. Hort. Monsp. —*C. anguinus*, Forsk. Fl. æg.-arab. p. 168.—*C. amarus*, Stocks.

Distrib.—Sind, Beluchistan, Arabia, Abyssinia, Nubia, Egypt.

82.* **C. pustulatus,** Hook. in Oliv. Fl. trop. Afr. II. p. 544.

Distrib.—Somaliland, Abyssinia, Erythrea, Yemen.

Nom. Bot. ed. II., II. p. 666.—*Pogonostigma arabicum*, Boiss. Diagn. Pl. Or. ser. I. II. p. 39.

DISTRIB.—Yemen, Erythrea.

63. **Taverniera glauca**, Edgew., Journ. Asia. Soc. Bengal, XVI. p. 1214.

DISTRIB.—Abyssinia.

64. **Alhagi maurorum**, Desv.; DC. Prodr. II. 352.—*A. maurorum* has a silky ovary, whilst *A. camelorun* has a glabrous one; cf. Prain in Journ. As. Soc. Beng. V. 66 (1898), p. 377.

DISTRIB.—Nubia, Egypt, Syria.

65. **Rhynchosia minima**, DC. Prodr. II. 386, var. **memnonia**, Cooke. Fl. Bombay Pres. I. 389.—*R. memnonia*, DC. Prodr. II. 386.—*R. pulverulenta*, Stocks in Kew Journ. Bot. IV. 147.—*Glycine memnonia*, Del. Fl. d'Eg. p. 100, tab. 38, fig. 3.

DISTRIB.—Sind, Arabia, Tropical and S. Africa.

66. **Poinciana elata**, L. Mant. p. 16. DC. Prodr. II. 484—*Caesalpinia elata*, Sw. Obs. 166.

DISTRIB.—Nubia, Abyssinia, Erythrea, Arabia, India

67. **P.** sp.

68. **Cassia obovata**, Collad. Hist. Cass. 92, t. 15, A.—*C. senna*, L. Sp. Pl. 539. (*ex parte*)—*C. obtusa*, Roxb. Hort. Beng. 31.—*Senna obtusa*, Roxb. Fl. Ind. II. 344.—*C. burmanni*, Wight in Madras Journ. VI. t. 5.—*C. aschrek*, Forsk. Fl. æg.-arab., p. 86.

DISTRIB.—W. India, Arabia, Palestine, Egypt, Nubia, Erythrea, Abyssinia, Kordofan, Sennaar, Senegambia, Angola.

69. **C. holosericea**, Fresen. in Flora I. 54. *Senna ovalifolia*, Batka. Monogr. Senn. t. 4.—*C. pubescens*, R. Br. in Salt, Abyss. App. 64.—*C. schimperi*, Steud. Nom. Bot. ed. II., I. p. 307.—*C. cana*, Wenderoth in Linnæa, XII. 22.

DISTRIB.—Tropical Africa, Arabia, Sind.

70. **C. angustifolia**, Vahl., Symb. Bot. I. 29.—*C. lanceolata*, Wall. Cat. 5318, Royle Ill. t. 37, W. & A. Prodr. 288.—*Senna officinalis*, Roxb. Fl. Ind. II. 346.

DISTRIB.—Tropical Africa; found also in India, but not indigenous.

71. ***C. adenensis**, Benth. Trans. Linn. Soc. XXVII. p. 553.—*Senna hookeriana*, Benth. Monogr. Senn. p. 52.—*Cassia lanceolata*, Defl. Bull. Soc. Bot. France.

DISTRIB.—Aden, Hadramout.

72. **Acacia eburnea,** Willd. Sp. Pl. IV. p. 1081 ; DC. Prodr. II, p. 461.—*Mimosa eburnea*, L. f. Suppl. 437.

Distrib.—East Himalayas, Punjab, Ceylon, Afghanistan, Arabia.

73.* **A. edgeworthii,** Anders. Journ. Linn. Soc. V. Suppl. p. 18.—*A. erioloba*, Edgew. Journ. Asiat. Soc. Beng. XVI. p. 1215.

Distrib.—Yemen.

74. **A. hamulosa,** Benth. Lond. Jour. Bot. I. p. 509.—*A. asak*, Willd. Sp. Pl. IV. p. 1077.

Distrib.—Erythrea, Yemen, Hadramout.

75. **A. spirocarpa,** Hochst. in Schimp. Pl. Abyss. n. 658 et in A. Rich. Tent. Fl. Abyss. I. p. 239.

Distrib.—Abyssinia, Nubia, Sennaar, Kordofan, Erythrea, Arabia.

76. **A. nubica,** Benth. in Lond. Journ. Bot. 1842, 498.—*A. aucheri*, Benth. in Lond. Journ. Bot. 1842, 498.—*A. pterygocarpa*, Hochst., Benth. in Journ. Bot., 1846, 96.

Distrib.—Abyssinia, Nubia.

77. **A. arabica,** Willd. Sp. Pl. IV. p. 1085. DC. Prodr. II. p. 461.—*Mimosa arabica*, Lam.—*M. nilotica*, Forsk. Fl. æg.-arab. p. lxxvi. *A. vera*. Willd. Sp. Pl. IV, p. 1056.

Distrib.—Ceylon, Western India, Punjab to Behar, Arabia, Syria, Egypt, Nubia, Lybia, Abyssinia, Trop. Africa, Natal.

78. **A. mellifera,** A. Rich. Tent. Fl. Abyss. I. p. 241.—*Mimosa unguis cati*, Forsk.—Fl. æg.-arab. p. 176.—*M. mellifera*, Vahl Symb. III. p. 103.—*Inga mellifera*, Willd. Sp. Pl. IV. p. 1006.

Distrib.—Nubia, Abyssinia, Kordofan, Erythrea.

COMBRETACEÆ.

79. **Terminalia sp.** Ellenbeck (Krause).

LOASACEÆ.

80. **Kissenia spathulata,** R. Br. in Herb. Mus. Br.—*Fissenia capensis*, Endl. Gen. Pl. Suppl. II., p. 76.

Distrib.—Yemen, Hadramout, Somaliland, Namaland, Damaraland.

CUCURBITACEÆ.

81. **Cucumis prophetarum,** L. Cent. Amœn. Acad. IV. 295 ; DC. Prodr. III. p. 301.—*C. arabicus*, Delile, in Cat. Hort. Monsp. —*C. anguinus*, Forsk. Fl. æg.-arab. p. 168.—*C. amarus*, Stocks.

Distrib.—Sind, Beluchistan, Arabia, Abyssinia, Nubia, Egypt.

82.* **C. pustulatus,** Hook. in Oliv. Fl. trop. Afr. II. p. 544.

Distrib.—Somaliland, Abyssinia, Erythrea, Yemen.

83. **Corallocarpus velutinus**, Benth. & Hook. f. Gen. Pl.I. 831. *Æchmandra velutina*, Dalz. & Gibs. Bomb. Fl. p. 100.

Distrib.—Tropical Africa, Persian Gulf, Sind.

84. ***C. glomeruliflorus**, Schweinf. mss. Sammlung arabisch-æthiopischer Pflanzen (Kraus).—*Rhynchocarpa courboni* Defl. in Bull. Soc. Bot. Fr. XXXII. p. 349.—*Phialocarpus glomeruliflorus*, Defl. in Bull. Soc. Bot. Fr. XLII, p. 304.—*Corallocarpus Gijef*, Schweinf. in Herb. Berol. (Krause).

Distrib.—Yemen.

85. **Citrullus colocynthis**, Schrad. Linnæa XII. 414.—*Cucumis colocynthis*, L. Sp. Pl. ed. I. p. 1011.

Distrib.—India, Ceylon, W. Asia, Arabia, Africa, Spain.

FICOIDEÆ.

86. **Trianthema crystallina**, Vahl. Symb. I. p. 32; DC. Prodr. III. 352.—*Papularia crystallina*, Forsk. Fl. æg.-arab. p. 69. —*T. triquetra*, Rottl.—*T. sedifolia*, Visian. Pl. æg. t. 3.

Distrib.—Tropical Africa, Asia, Australia.

87. **T. pentandra**, L. Mant. 79.—*T. obcordata*, Wall. Cat. 6837 F.—*P. govinda*. Wall, Cat. 6838.

Distrib.—Western Asia, Africa.

88. **Orygia decumbens**, Forsk. Fl. æg.-arab. p. 103, DC. Prodr. III. 455.—*Glinus trianthemoides*, Heyne in Roth. Nov. Sp. 231. *Glinus mucronata*, Klotzsch in Peter's Reise nach Mossamb. Bot. 140, t. 25.—*Portulaca decumbens*, Vahl. Symb. I. 33.—*Talinum decumbens*. Willd. Sp. Pl. II. 864.—*Axonotechium triantemoides*, Fenzl. in Ann. Wien. Mus. I. 354.

Distrib.—From the Punjab and Sind to Mysore and Coimbatore, Beluchistan, Arabia, Africa.

89. **Mollugo cerviana**, Seringe in DC. Prodr. I. 392.—*M. umbellata*, Seringe, l. c.—*Pharnaceum serviana*, L. Sp. Pl. ed. I. p. 388.

Distrib.—Asia, Africa, Australia.

90. **Limeum indicum** Stocks ms. ex T. Anders. in Journ. Linn. Soc. V. Suppl. 30.

Distrib.—Nubia, Arabia, Sind, Punjab.

UMBELLIFERÆ.

91. **Ptychotis arabica**, Anders. Journ. Linn. Soc. V. Suppl. p. 21.

Distrib.—Yemen.

RUBIACEÆ.

92. **Oldenlandia schimperi**, Anders. Journ. Linn. Soc. V. Suppl. p. 21.—*Kohautia cæspitosa*, Schnizlein in Fl. XXV., Beibl. I. n. 10, p. 145.—*Kohautia schimperi*, Steud. et Hochst. in Herb. Schimp. Arab. 879.—*Hedyotis schimperi*, Presl. in Drege Pl. Cap. exsicc., and Bot. Bem. p. 85 (1844)—*Kohautia arabica*, Hochst.—*Oldenlandia retrorsa*, Boiss. Fl. Or. III. 12.

Distrib.—Nubia, Abyssinia, Kordofan, Zansibar, Socotra, Arabia, Beluchistan.

COMPOSITÆ.

93. **Vernonia atriplicifolia**, Jaub. & Spach. Ill. Pl. Or. IV. p. 94, t. 359.—*V. spathulata*, Schultz. Bip. ex Aschers. in Schweinf. Beitr. Fl. Æthiop. p. 162.—*V. arabica*, Dene. ex Boiss. Fl. Or. III. 154.—*Chrysocoma spathulata*, Forsk. Fl. æg.-arab. p. 147.

Distrib.—Nile-Land, Arabia.

94. **Iphiona scabra**, Dene. in Ann. Sc. Nat. ser. II, II. p. 263. DC. Prodr. VI. 475.

Distrib.—Soturba, Shores of Red Sea, Egypt, Arabia.

95. **Pulicaria glutinosa**, Jaub. et Spach. Ill. Pl. Or. tab. 348.—*Platychæte glutinosa*, Boiss. Diag. Pl. Or. ser. I, XI. p. 5 et Fl. Or. III. 208.—*Varthemia arabica*, Anders. Journ. Linn. Soc. V. Suppl. p. 22.

Distrib.—South-Arabia.

96. **Dicoma schimperi**, O. Hoffm. in Engl.—Prantl Natuerl. Pflanzenf. IV. 5, p. 339.—*Hochstetteria schimperi*, DC. Prodr. VII. p. 287.

Distrib.—Nubia, Arabia, Sind.

97. **Launæa lactucoides**, O. Hoffm. in Engl.—Prantl. Natuerl. Pflanzenf. IV. 5, p. 370.—*Heterachæna massaviensis*, Fresen. in Mus. Senckenb. III. p. 74.—*Brachyramphus lactucoides* Anders. Journ. Linn. Soc. V. Suppl. p. 23.—*Lactuca massaviensis*, Schultz. Bip. in Herb. Schimp. Abyss. II. n. 1045, III. n. 1462.—*Sonchus massaviensis*, Schultz. Bip. in Schweinf. Beitr. Fl. Æthiop. p. 160.—*Zollikoferia massaviensis*, Boiss. Fl. Or. III. p. 825.

Distrib.—Somaliland, Abyssinia, Nubia, Arabia.

98. **L. nudicaulis**, Less. Synops. p. 139.—*Microrhynchus nudicaulis*, Less.; DC. Prodr. VII. 180.—*M. fallax*, Jaub. & Spach. Ill. Pl. Or. t. 276.—*Zollikoferia nudicaulis*, Boiss. Fl. Or. III. 824.—*Chondrilla nudicaulis*, Linn. Mant. 273.—*Lactuca nudicaulis*, Murray.—

*L. obtusa*, Clarke Comp. Ind. 261.—*Prenanthes patens* and *P. dichotoma*, Wall. Cat. 3258, 3275, F.—*P. obtusa*, Ham. in Wall. Cat. 3276.—*P. procumbens*, Roxb. Fl. Ind. III. 405.—*Brachyramphus obtusus*, DC. Prodr. VII. 177.

Distrib.—From Bengal and Behar to the Punjab, ascending the Western Himâlayas to 8,000 feet; in Kumaon, Sind, Deccan, Afghanistan and westwards to the Atlantic.

99.* **Lactuca goræensis**, Schultz. Bip. in Flora 1842, p. 422.—*Brachyramphus goræensis*, DC. Prodr. VII. p. 177.—*Sonchus goræensis*, Lam. dict. III. p. 367.— *Sonchus ciliatus*, Perr.—*Microrhynchus octophyllus*, Hochst. in Kotschy Pl. Nub. n. 406.

Distrib.—Abyssinia, Kordofan, Erythrea, Yemen.

PLUMBAGINACEÆ.

100. **Statice axillaris**, Forsk. Fl. æg.-arab. p. 58. DC. Prodr. XII. 663.—*S. bovei*, Jaub. et Spach. Ill. Pl. Or. I. p. 157, t. 86.—*S. lanceolata*, Edgew. Journ. Asiat. Soc. Beng. XVI. p. 1218.

Distrib.—Nubia, Abyssinia, Erythrea, Somaliland, Socotra, Yemen.

101. ***St. cylindrifolia**, Forsk. Fl. æg.-arab. p. 59 ; DC. Prodr. XII. p. 664.

Distrib.—Erythrea, Socotra, Yemen.

SALVADORACEÆ.

102. **Salvadora persica**, L. Sp. Pl. ed. I. p. 122 ; DC. Prodr. XVII. p. 28.—*S. wightiana*, Planch in Thw. Enum. 190.— *S. indica*, Wight. Ill. II. 229, t. 181.—*S. crassinervia*, Hochst. in Schimp. Pl. Abyss. n. 2218.—*Cissus arborea*, Forsk. Fl. æg.-arab. p. 32.—*Embelia grossularia*, Retz Obs. IV. 24.

Distrib.—From the Punjab and Sind to Patna; in the Circars and North Ceylon, S. Persia, Arabia, Syria, Trop. Africa.

103. **Salvadora oleoides**, Dene. in Jacq. Voy. Bot. 140, t. 144.—*S. stocksii*, Wight Ill. II. 229, and Ic. t. 1621.—*S. indica*, Royle, Ill. 319.—*S. persica*, Anders. in Journ. Linn. Soc. V. Suppl. p. 30.

Distrib.—Punjab, Rajputana, Sind, Gujarat.

APOCYNACEÆ.

104. **Adenium obesum**, Roem. et Sch. Syst. IV. 411.—*Nerium obesum*, Forsk. æg.-arab. descr. p. 205.—*Pachypodium obesum*, G. Don. gen. syst. gard. IV. 80.—*Cameraria obesa*, Spreng. Syst. I. 641.

Distrib.—Yemen.

105. ***Adenium arabicum**, Balf. f. Trans. Roy. Soc. Edinb. XXX, p. 162.

DISTRIB.—Yemen.

Is 105 not identical with 104?

ASCLEPIADACEÆ.

106. **Glossonema boveanum**, Dene, in Ann. Sc. Nat. ser. II, IX. p. 335; DC. VIII. p. 554.—*Gomphocarpus pauciflorus*, Hochst. et Steud. in Schimp. Pl. Abyss. n. 920.—*Petalostema chenopodii*, R. Br. in Salt, Voy. Abyss. App. p. 64.

DISTRIB.—Upper Egypt, Nubia, Erythrea, Abyssinia, Yemen.

107. **Calotropis procera**, R. Br. in Ait. Herb. Kew, 2. ed. p. 78; DC. Prodr. VIII. p. 585.—*C. wallichii*, Wight, Contr. p. 53.—*C. hamiltonii*, Wight, Contr. p. 53.—*C. heterophylla*, Wall. Wight Contr. p. 54.—*C. procera*, Willd. Sp. Pl. I. p. 1263; Del. Frag. Fl. Arab. Petr. p. 13.—*Asclepias gigantea*, L. ex. synon. Prosp. Alpini.—*Apocynum syriacum*, Clus. hist. 2, p. 87.—*A. patula*, Auch. exsiccat. n. 1500, Kotschy, exsicc. n. 939.—*Asclepias gigantea*, Forsk, Fl. æg.-arab. p. 108.

DISTRIB.—Western and Central India, Ava, Persia, Tropical Africa.

108. **Steinheilia radians**, Dene. Etud. Asclép. in Ann. Sc. Nat. ser. II., ix. p. 339.—*Asclepias radians*, Forsk. Fl. æg.-arab. p. 49.

DISTRIB.—Yemen.

109. **Caralluma forskalii**, K. Schum. in Engl.—Prantl, Natuerl. Pflanzenfam. IV. 2. p. 277.—*Boucerosia forskalii*, Dene. Prodr. VIII. 648.— *Stapelia quadrangula*, Forsk. Fl. æg.-arab. p. 51. t. 6.

DISTRIB.—Yemen.

110. ***C. adenensis**, K. Schum. in Engl.—Prantl, Natuerl. Pflanzenfam. IV. 2. p. 277.—*Boucerosia adenensis*, Defl. Mém. Inst. d'Eg. III. 270.

DISTRIB.—Yemen.

BORAGINACEÆ.

111. **Echiochilon fruticosum**, Desf. Fl. Atl. I. p. 67, t. 47.—*Lithospermum divaricatum*, Sieb. Herb. Palæst.

DISTRIB.—Northern Africa, Egypt, Palestine, Arabia.

112. **Heliotropium strigosum**, Willd. Sp. Pl. I. p. 743; DC. Prodr. IX. p. 546.—*H. fruticosum*, Forsk. Fl. æg.-arab. p. 38.—*H. parvifolium*, Edgew. Journ. Asiat. Soc. Beng. XVI. p. 1216.—*H.*

*bicolor*, Hochst et Steud. in Schimp Pl. Abyss. n. 569.—*H. tenuifolium*, R. Br.

DISTRIB.—Australia, Malaya, India, W. Asia.

113. **Heliotropium zeylanicum**, Lam, Encycl III, p. 94.—*H. paniculatum*, Heyne in Herb. Rottler.—*Tournefortia subulata*, Hochst. in DC. Prodr, IX. p. 528.—*H. subulatum*, Hochst. Herb. Nub. n. 103 and in DC. Prodr. IX. p. 523.—*Tournefortia royleana* and *edgeworthii*, DC. Prodr. IX. 527, 529.—*T. zeylanica*, Wight. Ill. t. 170.—*Messerschmidia hispida*, Benth. in Royle Ill. 360.

DISTRIB.—W. India, from the Punjab to the W. Deccan Peninsula, Arabia, Tropical Africa.

114. **Heliotropium pterocarpum**, Hochst. et Steud. in Schimp. Pl. Abyss. n. 835 ; DC. Prodr. IX, 552.

DISTRIB.—Socotra, Erythrea, Yemen.

115. **Heliotropium ophioglossum**, Stocks. Aitch. Cat. Fl. Punjab, p. 94.—*H. stylosum*, Franch. Sert. Somal. in Mission Révoil, p. 45, t. 4.

DISTRIB.—Sind, Beluchistan, Arabia, Somaliland.

116. ***H. lignosum**, Vatke in Oester. Bot. Zeitschr, 1875, p. 167.

DISTRIB.—S. Arabia, S. Persia.

117. ***H. adenense**, Guerke, Herb. Berol. (Krause).

DISTRIB.—Aden (endemic).

118. **Arnebia hispidissima**, DC. Prodr. X. 94.—*Anchusa hispidissima*, Sieb. H. æg.—*Strobila hispidissima*, G. Don. Gen. Syst. IV. 327.—*Anchusa asperrima*, Del. Fl. d'Eg. p. 7, n. 210.—*Dioclea hispidissima*, Spreng. Syst. veg. I. 556.—*Echiochilon hispidissimum*, Tausch in Fl. 1829, 643.—*Lithospermum hispidissimum*, Lehm. Ic. t. 39.

DISTRIB.—Nubia, Kordofan, Abyssinia, Egypt, Arabia, Sind, Upper Gangetic Plain, Rajputana.

## CONVOLVULACEÆ.

119. **Convolvulus glomeratus**, Chois. DC. Prodr. IX. 401.—*C. arabicus*, Hochst. in Schimp. exsicc. II. (1843) n. 784.—*Ipomœa auricoma*, A. Rich, Tent. Fl. Abyss. II. 67.

DISTRIB.—Abyssinia, Erythrea, Socotra, Arabia, Beluchistan, Sind, Punjab.

120. **Convolvulus sericophyllus**, Anders. Journ. Linn. Soc. V. Suppl. p. 25.—*C. somalensis*, Franch. Sert. Somal, p. 43.

DISTRIB.—Somaliland.

121. **Ipomœa biloba**, Forsk. Fl. æg.-arab. 44.—*I. maritima*, Br. Prodr. 486.—*I. pescaprœ*, Roth. Nov. Sp. 109.—*Convolvulus pescaprœ*, Linn.—*C. maritimus*, Lam. Encycl. III. 550.—*C. bilobatus*, Roxb. Hort. Beng. 14, and Fl. Ind. I. 485—*Batatas maritima*, Bojer Hort. Maurit. 225.

DISTRIB.—Seashore of both hemispheres throughout the Tropics.

122. **Breweria latifolia**, Benth. in Gen. Pl. II.—*Cressa latifolia*, Anders. Journ. Linn. Soc. V. Suppl. 25.—*Seddera latifolia* Hochst. et Steud. in exsicc. itin. n. 884 and Fl. 1844, I. Beil. p. 8, tab. 5; DC. IX. 440.—*Breweria evolvuloides*, Vatke in Linnæa 1843, p. 523.

DISTRIB.—Punjab, Sind, Socotra, Arabia, Erythrea, Nubia, Abyssinia.

## SOLANACEÆ.

123. **Lycium europæum**, L. Syst. Pl. ed. II. p. 28.—*L. indicum*, Wight. Ic. t. 1403.—*L. mediterraneum*, Dunal in DC. Prodr. XIII. p. 523.—*L. sævum*, *orientale*, and *persicum*, Miers. Ill. S. Am. Pl. II. 95, t. 64. fig. B.—*L. intricatum*, Boiss; Dunal in DC. Prodr. XIII. p. 525.—*L. arabicum*, Schweinf; Boiss. Fl. Or. IV. 289.

DISTRIB.—Mediterranean region, Arabia, Socotra, W. India.

## SCROPHULARIACEÆ.

124. **Linaria macilenta**, Dene. in Ann. Sc. Nat. ser. II. ii. p. 252; DC. Prodr. X. 271.

DISTRIB.—Erythrea, Yemen.

125. **Schweinfurthia pterosperma**, A. Braun, in Monatsber. Kœn. Akad. Wissensch. Berlin 1866, p. 872, t. 1.—*Orontium arabicum*, Ehrenbg. ex Herb. Schweinf.—*Anarrhinum pedicellatum*, Anders. Journ. Linn. Soc. V. Suppl. 26.—*Schweinfurthia pedicellata*, Benth. et Hook. Gen. Pl. II. p. 934.—*Antirrhinum pterospermum*, A. Rich. Tent. Fl. Abyss. p. 115.

DISTRIB.—Somaliland, Nubia, Erythrea, Socotra.

126. **Anticharis glandulosa**. Aschers. in Monatsber. Akad. Wissensch. Berlin 1866, 880.—*Distemon glandulosus*, Ehrbg. et Hempr. ex Aschers. Monatsber. Akad. Wissensch. Berlin 1866, 881.—*Anticharis arabica*, Anders. Journ. Linn. Soc. V. Suppl. p. 27.

DISTRIB.—Sind, Arabia, Socotra, Somaliland, Erythrea, Abyssinia, Nubia, Upper Egypt.

127. **Lindenbergia sinaica**, Benth. Scroph. Ind. p. 22. DC. Prodr. X. 377.—*Bovea sinaica*, Done. in Ann. Sc. Nat. ser. II. ii. p. 253.

DISTRIB.—Egypt, Nubia, Abyssinia, Somaliland, Arabia, Socotra.

128. **Campylanthus junceus**, Edgew. Journ. Asiat. Soc. Beng. XVI. p. 1217.

DISTRIB.—Yemen.

ACANTHACEÆ.

129. **Ruellia patula**, Jacq. Misc. Bot. II. 358. T. Anders. in Journ. Linn. Soc. IX. 460.—*Ruellia erecta*, Roth. Nov. Spec. 308.—*Dipteracanthus patulus*, Nees in Wall. Pl. As. Rar. III. 82. and DC. Prodr. XI. 126.—*D. erectus*, Nees in Wall. Pl. As. Rar. III. 82, and Cat. 7186.—*Petalidium patulum*, Dalz. & Gibs. Bomb. Fl. 185.

DISTRIB.—Ceylon, Deccan, Sind, Rajputana, Bundelkund, Arabia, Abyssinia, Ava.

130. **Blepharis edulis**, Pers. Syn. II. p. 180.—*Ruellia ciliaris*, L. Mant. p. 89.—*Acanthus edulis*, Forsk. Fl. æg.-arab., p. 135, t. 42.—*Ruellia persica*, Burm. Fl. Ind. p. 135, t. 42, fig. 1. *Acanthus imbricatus*, Edgew. Journ. Asiat. Soc. Beng. XVI. p. 1217.—*A. delilii*, Spreng. Syst. II. 819.—*Acanthodium spicatum*, Del. Fl. d'Eg. p. 97, t. 33, fig. 3.

DISTRIB.—Punjab, Sind, Beluchistan, S. Persia, S. Arabia, Somaliland, Kordofan, Abyssinia, Nubia, Egypt.

VERBENACEÆ.

131. **Bouchea marrubiifolia**, Schauer in DC. Prodr. XI. p. 558.—*Chascanum marrubiifolium*, Fenzl. in Kotschy Pl. Nub. n. 32.

DISTRIB.—Sind, Arabia, Egypt, Abyssinia, Nubia, Kordofan.

132. ***B. pterygocarpa**, Schauer in DC. Prodr. XI. p. 558.—*Chascanum lætum*. Fenzl. in Kotschy Pl. Nub. n. 230.

DISTRIB.—Yemen, Erythrea, Abyssinia, Kordofan, Nubia.

LABIATÆ.

133. **Ocimum gratissimum**, L. var. **suave**, J. D. Hook. Fl. Br. I. iv. p. 607.—*O. suave*, Willd, Enum. Hort. Berol. 629; Benth. in DC. Prodr. XII. 25.—*O. urticæfolium*, Roth. Catal. Bot. II. 52.—*O. menthæfolium*, Hochst. in Schimp. Herb. Abyss. n. 1860.

DISTRIB.—Tropical Africa, Madagascar.

134. **Lavandula setifera**, Anders. Journ. Linn. Soc. V. Suppl. p. 29.

Distrib.—Yemen.

135. **Orthosiphon pallidus**; Royle mss.; Benth. in Hook. Bot. Misc. III. p. 70; DC. Prodr. XII. 50.—*O. verticillatus*, Heyne in Herb. Rottl.—*O. inodorus*, Koen; Roxb. Ic. in. in. Herb. Kew.—*O. ehrenbergii*, Vatke in Linnæa XXXVII. 316.

Distrib.—North-Western India; from Kashmir and the Punjab to Behar and Travancore, Beluchistan, Arabia, Socotra, Erythrea, Abyssinia, Nubia.

NYCTAGINACEÆ.

136. **Bœrhaavia verticillata**, Poir. Dict. V. 56; DC. Prodr. XIII. 454.—*B. scandens*, Ehrbg. exs. Pl. Sinai.—*B. stellata*, Wight Ic. t. 875.—*B. dichotoma*, Vahl. Enum. Pl. I. 290.—*B. reparda*, Willd. Sp. Pl. I. p. 22.—*B. grandiflora*, Rich. Hohen. in Schimp. Pl. Abyss. n. 2309.

Distrib.—Carnatic, Travancore, Mysore, Konkan, Gujarat, Kathiwar, Sind, Western Punjab, Salt Range, Arabia, Erythrea, Abyssinia, Nubia, Egypt, Morocco, Senegambia.

137. **B. elegans**, Chois. in DC. Prodr. XIII. 453.

Distrib.—Punjab, Sind, Beluchistan, S. Arabia, Nubia.

AMARANTACEÆ.

138. **Ærua javanica**, Juss. Ann. Mus. XI. 131; DC. Prodr. XIII. 299.—*A. tomentosa*, Forsk, Fl. æg.-arab. 122.—*A. ægyptiaca*, Gmel, Syst. 1026.—*A. bovii*, Edgew. in Journ. Linn. Soc. VI. 206.—*A. incana*, Mart. in Nov. Act. Acad. Nat. Cur. XII. (1826), 291.—*Achyranthes alopecuroides*, Lamk.—*A. javanica*, Pers. Syn. I. 259.—*A. incana*, Roxb. Fl. Ind. I. 671.—*Illecebrum javanicum*, Ait. Hort. Kew, 289.—*Iresine javanica* and *persica*, Burm. Fl. Ind. 212, t. 65.—*Celosia lanata*, L. Sp. Pl. 298.

Distrib.—Java, Ceylon, India, Arabia, E. and W. tropical Africa, Cape Verd Islands.

139. **Saltia papposa**, Mog. in DC. Prodr. XIII. p. 325.—*Achyranthes papposa*, Forsk Fl. æg.-arab. p. 48.

Distrib.—Hadramout, Yemen.

CHENOPODIACEÆ.

140. **Suæda monoica**, Forsk. Fl. æg.-arab. p. 79; DC. Prodr. XII. 2. p. 156.—*S. nudiflora*, Thwaites Enum. 246.

DISTRIB.—South Deccan, Ceylon, Arabia, Somaliland, Abyssinia, Erythrea, Lybia, Nubia, Upper Egypt.

141. **S. vermiculata**, Forsk. Fl. æg.-arab. p. 70, and Ic. tab. 18, fig. B.—*S. mollis*, Del. Fl. d'Eg. p. 57.—*Salsola mollis*, Desf. Fl. Atl. I. 210.—*S. globulifolia*, Poir. Dict. VII, p. 298.

DISTRIB.—Canaries, Nubia, N. Africa, Arabia.

142. **S. fruticosa**, Forsk. Fl. æg.-arab. p. 70.—*Salsola fruticosa*, L.—*S. indica*, Wall. Cat. 6946, C.—*S. iana*, Edgew. in Hook. Journ. Bot. II. (1840) 286.

DISTRIB.—N.-W. India, Arabia, N. Africa, America.

143. **Traganum nudatum**, Del. Fl. d'Eg. p. 57.

DISTRIB.—Algeria, Egypt, Suez, Lybia, Nubia, Arabia.

144. **Halopeplis perfoliata**, Bunge ex Aschers. et Schweinf. Fl. Æthiop. p. 289 et ex Ung. Sternb. in Cesati, Passer, et Gibelli Comp. Fl. Ital. p. 329.—*Salicornia perfoliata*, Forsk. Fl. æg.-arab., p. 3.

DISTRIB.—Coast of the Red Sea.

145. **Salsola bottæ**, Boiss. Fl. Or. IV. p. 960.—*Caroxylon bottæ*, Mog. in DC. XIII. 2, 179.—*Halothamnus bottæ*, Jaub. et Spach. Ill. Pl. Or. 62, 2, p. 50, t. 136.

DISTRIB.—S. Arabia.

146. **S. forskalii**, Schweinf. Bull. Herb. Boiss. 1896. App. II. p. 160.—*Caroxylon imbricatum*, Mog. in DC. XIII, 2177.—*Salsola imbricata*, Forsk. Fl. æg.-arab. p. 57, n. 90, and Ic. t. 8, fig. C.

DISTRIB.—Nubia, Erythrea, S. Arabia.

147. **Anabasis ehrenbergii**, Schweinf. in Boiss. Fl. Or. IV. p. 970, and in Bull. Herb. Boiss. 1896, App. II. 161.

DISTRIB.—Nubia, S. Arabia.

## ARISTOLOCHIACEÆ.

148. **Aristolochia bracteata**, Obs. Bot. fasc. 5, p. 29, n. 80.—*A. bracteolata*, Lam. Encycl. I. 258.—*A. mauritiana*, Pers. Enchir. II. 527.—*A. kotschyi*, Hochst. ex. A. Rich. Tent. Fl. Abyss, II. 237.—*A. maurorum* and *abyssinica*, Klotzsch in Monatsber. Berl. Akad. 1859, 598.—*A. crenata*, Ehrbg. ms. in herb. Berol.

DISTRIB.—Ceylon, Deccan, Bundelkhund, Sind, Arabia, Abyssinia, Sennaar, Trop. Africa, Sandwich Islands.

## EUPHORBIACEÆ.

149. **Phyllanthus maderaspatensis**, L. Sp. Pl. 982.—*P. andrachnoides*, Willd. Sp. Pl. IV ; 575.—*P. obcordatus*, Willd. Enum.

Hort. Berol. Suppl. 65.—*P. javanicus*, Poir.; Spreng. Syst. III. 21.—*P. anceps*, Herb. Heyne.—*P. linearis*, Herb. Madr.—*P. malabaricus*, Herb. Wight.—*P. niruri*, Wall. Cat. 7894.

Distrib.—Australia, China, Java, Ceylon, drier parts of India, S. Arabia, Somaliland, Kordofan, Erythrea, Abyssinia, Nubia, Angola, Guinea, Senegambia, Cape Verd.

150. **Jatropha spinosa**, Vahl. Symb. I. 79.—*Croton spinosus*, Forsk. Fl. æg.-arab., p. 153—*J. aculeata*, Muell.—Arg. in DC. Prodr. XV. 1083.

Distrib.—S. Arabia, Coast of N. Somaliland.

151. **Chrozophora obliqua**, A. Iuss. Tent. Euph., 28. DC. Prodr. XV. 749.—*C. tinctoria*, Muell. Arg. in DC. Prodr. XV. 749.—*C. oblongifolia*, A. Iuss. l. c.—*Croton obliquus*, Vahl. Symb. I. 78.—*C. oblongifolius*, Del. Fl. d'Eg. p. 139.—*C. argenteus*, Forsk. Fl. æg.-arab. p. 75.—*C. tinctorium*, Wall. Cat. 7716, G.

Distrib.—Punjab, Kashmir, Sind, S. Arabia, Socotra, Somaliland, Kordofan, Abyssinia, Lybia, Nubia, Egypt.

152. **Euphorbia arabica**, Hochst. et Steud. in Schimp. Pl. Abyss. n. 756; DC. Prodr. XV. 33.

Distrib.—Yemen, Abyssinia, Nubia.

153. **E. cuneata**, Vahl. Symb. II. p. 53; DC. XV. p. 97. Anders. Journ. Linn. Soc. V. Suppl. p. 35.—*E. fruticosa*, Edgew. Journ. Asiat. Soc. Beng. XVI. p. 1219.

Distrib.—Somaliland, Erythrea, Yemen.

154. **E. schimperi**, Presl. Bot. Bemerk. p. 109; DC. Prodr. XV.—*E. tirucalli*, Forsk. Fl. æg.-arab. p. 112.

Distrib.—Somaliland, Socotra, Arabia, Abyssinia, Nubia.

155. **E. systyla**, Edgew. Journ. Asiat. Soc. Beng. XVI, p. 1218. Anders. Journ. Linn. Soc. V. Suppl. p. 35; DC. Prodr. XV. 98.

Distrib.—Coast of N. Somaliland, Tehama.

156. **E. granulata**, Forsk Fl. æg.-arab. p. 94; DC. Prodr. XV. 33.—*E. forskalii*, var. B and G, I. Gay in Webb. Phyt. Canar. III. 242.—*E. fragilis*, Dene. in Ann. Sc. Nat. ser. II. (1834), 241.—*E. arillata*, Edgew. in Journ. Asiat. Soc. Beng. XVI. p. 1218; Anders. in Journ. Linn. Soc. V. Suppl. p. 34.—*E. ægyptiaca*, var. *indica*, Boiss. in DC. Prodr. XV. 35.—*E. thymifolia*, Wall. Cat. 7710 E.—*Anisophyllum forskalii*, Klotzsch et Garcke in Bot. Reise. Pr. Wald. Bot. 25.

Var. *glabrata*, Muell. Arg. in DC. Prodr. XV. 34.

DISTRIB.—Punjab. Rohilkhund, Malwa, Sind, Afghanistan, S. Persia, Arabia, N. Somaliland, Kordofan, Nubia, Egypt, Canaries, N. Africa.

157. **E. adenensis,** Defl. Bull. Soc. Bot. Fr. IX. p. 67.

DISTRIB.—Hadramout, Yemen.

158. **E. polycnemoides,** Hochst. in Kotschy Pl. Nub. n. 184.

DISTRIB.—Usambara, Kordofan, Abyssinia.

URTICACEÆ.

159. **Forskohlea tenacisssima,** L. Mant. p. 72 ; DC. Prodr. XVI. 1. 235[55].—*F. latifolia,* Retz. Obs. 51.—*Caidbeja adhærens,* Forsk. Fl. æg.-arab. p. 82.

DISTRIB.—Western Punjab, Sind, Afghanistan, Arabia, N. Africa, Teneriff, S. E. Spain.

160. **F. viridis,** Ehrbg. in Wedd. Monogr. Urt. p. 537 ; DC. Prodr. XVI. 235[56].

DISTRIB.—Socotra, S. Arabia, Abyssinia, Erythrea, Soturba.

GNETACEÆ.

161. **Ephedra foliata,** Stapf, Arten der Gatt. Eph. in Denkschr. der Mathem. Naturwiss. Classe d. Kais. Akad. d. Wissensch. (1889), 49, t. 2.

Var. **ciliata,** Aitch. Fl. Kurum Valley, 187.—*E. foliata,* Aitch. Bot. Afghan Bound. Comm. 11?.—*E. pedunculuris,* Boiss. Fl. Or. V. 717.

DISTRIB.—Western Punjab, Sind, Afghanistan, Turkestan, S. Persia, Syria.

AMARYLLIDACEÆ.

162. **Pancratiun tortuosum,** Herb. in Ann. Nat. Hist. IV. (1840), p. 28.—*P. tortifolium,* Boiss Diag. Pl. Or. ser. I. XIII. 18.

DISTRIB.—Nubia, Arabia.

163. **P. maximum,** Forsk. Fl. æg.-arab. p. 72.

DISTRIB.—Nubia, S. Arabia.

LILIACEÆ.

164. **Albuca yerburyi,** Ridley Journ. of Bot., 1884, p. 370.

DISTRIB.—Aden (endemic).

COMMELINACEÆ.

165. **Commelina albescens,** Hassk. in Schweinf. Beitr. Fl. Æthiop. 210.—*C. striata,* Wall. Cat. 8981 (in part).—*C. schimperiana* and *multicauli.*, Hochst. in Schimp. Herb. n. 1242 and n. 2268.

DISTRIB.—Sind, Beluchistan, Arabia, Trop. Africa.

NAIADACEÆ.

166. **Cymodocea ciliata**, Ehrbg. ex Aschers, in Sitzungsber. Ges. Naturf. Fr. Berl. 1867, p. 3.—*Thalassia ciliata*, Kœn. Ann. Bot. II. 97.—*Posidonia serrulata*, Thw. Enum. 333.—*Zostera ciliata*, Forsk. Fl. æg.-arab. p. 157.

Distrib.—Indian and Pacific Oceans.

167. **C. serrulata**, Aschers. & Magn. in Sitzungsb. Ges. Nat. Fr. Berl. 1867, p. 3.—*Posidonia serrulata*, Spreng., Syst. I. p. 181.

Distrib.—Indian and Pacific Oceans.

CYPERACEÆ.

168. **Cyperus conglomeratus**, Rottb. Descr. et Ic. Pl. p. 21, t. 15, fig. 7.—*C. jeminicus*, Rottb. Descr. et Ic. Pl. p. 25, t. 8, fig. 1.—*C. pungens*, Bœck. in Linnæa, XXXV. 537—*C. proteinolepis*, var. *pumila*, Bœck l. c. 523.

Distrib.—Sind, S. Persia, Arabia, Erythrea, Abyssinia, Nubia, Egypt, Senegambia.

169. **C. effusus**, Rottb. Descr. et Ic. Pl. p. 22, t. 12, fig. 3.—*C. proteinolepis*, Steud. Syn. Cyp. 15.—*C. conglomeratus*, var. *effusus*, Boiss. Fl. Or. V. 369.—*C. conglomeratus*, var. *major*, Bœck in Linnæa XXXV. p. 544.—*C. densus*, R. Br. in Salt Abyss. Append. 62.

Distrib.—Sind, Arabia, Erythrea, Abyssinia, Upper Egypt.

170. **C. falcatus**, Nees et Ehrbg. in Bœk. Cyp. I. 150.—*C. cruentus*, Rottb. Descr. et Ic. Pl. p. 21, t. 5, fig. 1, 4.

Distrib.—S. Arabia, Erythrea, Nubia, Upper Egypt.

GRAMINEÆ.

171. **Paspalum pennatum**, Hook. f. Fl. Br. I. VII. 16.—*Panicum pennatum*, Hochst. in Fl. XXXVIII. (1854), 197.

Distrib.—Sind, Beluchistan, Arabia, Abyssinia.

172. **Panicum colonum**, L. Syst. Ed. X. 870.—*P. arabicum*, Nees ex Steud. Nom. Ed. II. ii. 251, Syn. Gram. 63.—*P. brizoides*, L. Mant. I. 184.—*P. cæsium*, Nees in Hook. and Arn. Bot. Beech. Voy. 235.—*P. confertum*, Herb. Rottl. ex Wall. Cat. n. 8687, B.—*P. daltoni*, Parlat. ex Webb in Hook. Niger Fl. 185.—*P. hæmatodes*, Presl. Fl. Sic. I. 43.—*P. numidianum*, Presl. Cyp. et Gram. Sic. 19.—*P. tetrastichum*, Forsk. Fl. æg-arab. p. 19.

Distrib.—All warm countries.

173. **P. turgidum**, Forsk, Fl. æg-arab, p. 18. Del. Fl. d'Eg. Ill. 51, t. 9, fig. 2; Schweinf. Beitr. Fl. Æthiop, p. 301.

Distrib.—Central India, Sind, Beluchistan, Arabia, Socotra, S. Persia, Egypt, Abyssinia, Nubia.

174. **Tricholæna teneriffæ**, Parl. in Webb. & Berth. Hist Nat. Canar. III. 425.—*P. micrantha*, Schrad. in Sch. Mant. II. 163.—*Panicum plumosum*, Presl. Fl. Sic. I. 43.—*P. saccharoides*, Trin. Gram. Panic. 245.—*P. teneriffæ*, R. Br. Prod. Fl. Nov. Holl, p. 39.—*P. villosum*, Presl. Gram. & Cyp. Sic. 18.—*Saccharum teneriffæ*, L. f. Suppl. 106.

Distrib.—Western Punjab, Sind, Arabia, N. Africa, Canaries, Sicily.

175. **T. leucantha** Hochst. in Schimp. Fl. Abyss. n. 1818.—*P. leucanthum*, A. Rich. Tent. Fl. Abyss. II. 372.

Distrib.—Erythrea, Yemen.

176. **Setaria verticillata**, Beauv. Essai Agrost. p. 51.—*S. nubica*, Link. Hort, Berol. I. 220.—*S. respiciens*, Hochst. ex Mig. Fl. Ind. Bot. III. 467.—*P. adhærens*, Forsk. æg.-arab. 20.—*P. verticillatum*, L. Sp. Pl. ed. II. 82.—*P. viride*, Desf. Fl. Atl. I. 58.—*Pennisetum respiciens*, A. Rich. Tent. Fl. Abyss. II. 379.

Distrib.—Temperate and tropical regions.

177. **S. viridis**, Beauv. Essai Agrost. 51.—*S. villosa*, Beauv.—*P. cynosuroides*, Scop. Fl. Carn. ed. II. i. 50.—*P. psilocaulum*, Steud. Syn. Gram. 50. *P. viride*, L. Syst. ed. X. 870.—*Pennisetum viride*, R. B. Prodr. 195.

Distrib.—Temperate and subtropical regions of the Old World.

178. **Pennisetum ciliare**, Link. Hort. Bot. Berol. I. 213.—*Cenchrus ciliaris*, L. Sp. Pl. 302.—*Pennisetum enchroides*, A. Rich. in Pers. Syn. Pl. I. 72.—*Cenchrus pennisetiformis*, Hochst. et Steud. ex Boiss. Fl. Or. V. 445.—*Panicum vulpinum*, Willd. Enum. Hort. Berol. 1031.

Distrib.—Warmer regions of the Old World.

179. **Andropogon foveolatus**, Del. Fl. d'Eg. p. 16, t. 8 fig. 2.—*A. strictus*, Roxb. Fl. Ind. I., 260.—*A. orthos*, Schult. Mant. II. 455.—*A. monostachyus*, Spreng, Pugill. Pl. Nov. II. 9.—*A. ramosus*, Heyne ex Wall. Cat. n. 8802.

Distrib.—Coromandel, Circars, Central Provinces, Chota Nagpore, Bengal, Punjab, Sind, Arabia, S. Persia, Erythrea, Abyssinia, Nubia, Egypt, Cape de Verd Islands, Canaries.

180. **Aristida adscensionis**, L. Sp. Pl. ed. I. p. 82.—*A. cærulescens*, Desf. Fl. Atlant. I. 109, t. 21, fig. 2.—*A. ciliata*,

Nees ex A. Rich. Tent. Fl. Abyss. II. 392.—*A. gigantea*, L. F. Suppl. 113.—*A. paniculata*, Forsk. Fl. æg.-arab. 25.—*A. pumila*, in Ann. Sc. Nat. ser. II. iv. (1835) 85.

DISTRIB.—Most warm countries.

181. **A. plumosa**, Linn. Sp. Pl. ed. II. 1666.—*A. brachypoda* and *forskahlii*, Tausch. in Fl. (1836) 506; Boiss. Fl. Or. V. 495.—*A. lanata*, Forsk. Fl. æg.-arab. 25.—*A. raddiana*, Savi in Mem. Moden. (1837) 198; Steud. Syn. Gram. 143.—*Arthratherum plumosum*, Nees. Fl. Afr. Austr. I. 182.

DISTRIB.—Western Tibet, Kurdistan, Afghanistan, Turkestan, Persia, Syria, Abyssinia, Egypt, N. Africa.

182.* **A. caloptila**, Boiss. Fl. Or. V. 497.

DISTRIB.—Egypt, Arabia, S. Persia.

183. **A. hirtigluma**, Steud. Nomencl. Bot. ed. II. ii. p. 231.—*A. ciliata*, Steud. et Hochst. ex Steud. Nom. Bot. ed. II. i. 131.—*A. paradisiaca*, Edgew. in Journ. Asiat. Soc. Beng. XVI. 1219.—*Arthratherum hirtiglume* and *pogonoptilum*, Jaub. & Spach., Ill. Pl. Or. IV. 52.—*A. schimperi*, Nees, Fl. Afr. Austr. 178.

DISTRIB.—Punjab, Peshawar, Sind, Arabia, Erythrea, Somaliland, Abyssinia, Nubia, Egypt, Tunis.

184. **Sporobolus glaucifolius**, Hochst. in Fl. XXV. (1842), I. Bieb. 123.—*Vilfa scabrifolia*, Hochst. ex Edgew. in Journ. Linn. Soc. VI. (1862), 196.—*Agrostis barbata*, var. *senegalensis*, Pers. Syn. I. 76.

DISTRIB.—Punjab, Sind, Trop. Africa.

185. **S. spicatus**, Kunth. Revis. Gram. I. 67, Enum. Pl. I. 210.—*Vilfa spicata*, Beauv. Agrost. 16.—*Agrostis spicata*, Vahl. Symb. I. 9; Del. Fl. Ægypt. 20, t. 10, f. 1.—*A. virginica*, Forsk. Fl. æg.-arab. 20.

DISTRIB.—Deccan, Arabia, Egypt, Trop. Africa.

186. **S. sp.**

187. **Pynodon dactylon**, Pers. Syn. I. 85.

DISTRIB.—All warm countries.

188. **Pappophorum brachystachyum**, Jaub. & Spach. Ill. Pl. Or. IV. 34, t. 324—*P. vincentianum*, Schmidt ex Duthie, Grass. N.-W. India 35.

DISTRIB.—Punjab, Rajputana, Arabia, N. Africa.

189.—**Eragrostis ciliaris**, Link. Enum. Hort. Berol. I. 192.

Var. **brachystachya**, Boiss. Fl. Or. V. 582.—*E. arabica*, Jaub. Spach., Ill. Pl. Or. IV. 31, t. 322.—*E. riparia*, Nees in Herb. Royle.

Distrib.—In all tropical countries.

190. **E. cynosuroides**, Beauv. Agrost. 71, 162.—*Poa cynosuroides*, Retz. Obs. IV. 20; Del. Fl. Ægypt. 159, t. 10.—*Leptochloa bipinnata*, Hochst. in Fl. XXXVIII. (1855) 422.—*Cynosurus durus*, Forsk. Fl. æg.-arab. 71.

Distrib.—Plains of India, Sind, westward to Syria and N. Africa.

191. **E. major**, Host. Gram. Austr. IV. 14, t. 24.— *E. poæoides*, Trin. in Mem. Acad. Petersb. ser. VI. i. (1831) 404.—*Poa flexuosa*, Roxb. Fl. Ind. I. 339.—*P. multiflora*, Forsk. Fl. æg.-arab. 21.—*Briza eragrostis*, L. Sp. Pl. 70.

Distrib.—Ceylon, India, S. Europe, tropical and sub-tropical Asia.

192. **E. mucronata**, Benth. et Hook. Gen. Pl. III. p. 1186.—*Uniola mucronata*, L. Sp. Pl. ed. II. p. 104.—*Desmazeria unioliolides*, Defl. Voy. en Yemen p. 220.—*Triticum repens*, Thw., Enum. Pl. Zeyl. 376.—*Halopyrum mucronatum*, Stapf. in Hook. Ic. Pl.

Distrib.—Ceylon, India, Arabia, E. Tropical Africa.

193. **Æluropus villosus**, Trin. ex C. A. Mey, Verz. Pfl. Cauc. 18.—*A. mucronatus*, Aschers. in Schweinf. Beitr. Fl. Æthiop. 297.—*A. niliacus*, Steud. Nom. ed. II. I. 30.—*A. arabicus*, Steud. Nom. ed. II. 50.—*Calotheca arabica*, *niliaca*, and *repens*, Spreng, Syst. Veg. I. 347, 348.—*Festuca mucronata*, Forsk. Fl. æg.-arab. 22.

Distrib.—Deccan Peninsula, Ceylon, Punjab, Sind, Arabia, Afghanistan, Persia, Reg. Casp., Reg. Mediterr.

194. **A. littoralis**, Parl. Fl. It. I. 461.

Distrib.—Arabia, Egypt, N. Africa.

195. **Tetrapogon villosus**, Desf. Fl. Atlant. II. p. 389, t. 255.—*Chloris villosus*, Pers. Syn. I. 87.—*C. tetrapogon*, Beauv. Agrost. 158.

Distrib.—Punjab, Rajputana, Sind, S. Arabia, S. Persia, Erythrea, Abyssinia, Egypt, Morocco, Canaries.

196. **Eleusine ægyptiaca**, Desf. Fl. Atlant, I. 85.—*E. mucronata*, Stokes Mat. Med. I. 150.—*Dactyloctenium ægyptiacum*, Willd. Enum. Hort. Berol. 1029.—*Cynosurus ægyptius* L. Sp. Pl. 72.—*Cenchrus ægyptius*, Beauv. Agrost. 157.

Distrib.—Warna regions of the Old World, introduced into the New.

(*To be continued.*)

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

Horace Knight, del. Hentschel-Colourtype.

# THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

By

L. C. H. Young, B.A., F.E.S., F.Z.S.

## PART III.

*(With Plate C.)*

*(Continued from page 423 of this Volume.)*

We now come to a different section of the family—the Apaturinæ—by far the most difficult from the systematic point of view that we shall have to deal with in this series and one of the most difficult in the whole of the Lepidoptera.

In the tabulation of genera given above I have differentiated 4 genera—**Charaxes, Cupha, Cyrestis** and **Apatura.** But there is really only one strongly marked division—that which separates **Charaxes** from the remainder. In subdividing the latter it is necessary to rely upon characters of secondary importance. In the great genus **Apatura** in which, as constituted here, there are at least seventy-five Indian species and possibly many more, there is of course considerable structural variation. Unfortunately, the species follow each other in such close sequence, and the variation has occurred in such similar directions along each parallel line of development that it is impossible to subdivide by characters that correspond to the obvious superficial relationships.

### Genus Cupha.

This genus contains about a dozen Indian species, all of which are some shade of dull orange-yellow, with darker and lighter markings and having a more or less oblique, ill-defined, macular, pinkish-mauve band crossing both wings on the underside.

Only one species is at all generally distributed in Peninsular India, *viz.*, **C. phalantha**—a species which, as already mentioned, bears a remarkable superficial resemblance to a Fritillary.

**Cupha phalantha,** Drury. Male and female. Orange-yellow, with the following brown-black markings on the forewing. The outline of a square spot in the middle and an irregularly shaped one at the end of the cell (the centres being hardly darker than the ground colour), 3 spots beyond and 3 spots below the cell between the veins,

2 transverse rows of from 4 to 7 spots each, beyond the middle, subterminal waved lines, dentate and more or less confluent towards the apex, and a marginal row of spots on the veins. On the hindwing, a few indistinct markings on the disc, a row of 5 or 6 beyond middle, and terminal and subterminal lines and marginal spots as in the forewing.

Underside much paler, the spots and lines of the upperside imperfectly indicated by brown linear markings. The spots in and at the end of cell, the space immediately beyond it, and the costa to beyond middle more or less suffused with pinkish-mauve.

The inner row of spots beyond middle margined outwardly by a pale pinkish band, and the area beyond it more or less suffused with pinkish-mauve, except towards the apex of the forewing.

*Larva.*—" Cylindrical, moderately thick, very smooth, with an oily gloss, and bears six longitudinal rows of sharp branched spines. The head is unarmed. The colour varies from dark-brown to pale yellowish-green, with a white or yellowish spot at the base of each spine. It feeds on one or more species of *Flacourtia*." Davidson and Aitken. Journal, B. N. H. S., Vol. V, page 269.

*Expanse.*—2" to 2½".

Genus CYRESTIS.

The species illustrated here, commonly known as the map butterfly, is of a very striking and peculiar appearance. In structure, however, it closely resembles the preceding and those which immediately follow, and the other species of the genus are far less remarkable.

**Cyrestis thyodamas,** Boisd.—Of very slendery and delicate appearance. Head and thorax pale olive-brown, with 3 longitudinal darker stripes. Wings white, more or less suffused along the costa and apical half of the outer margin of the forewing and the inner margin of the hindwing with olive brown. Three very fine and irregular dark brown lines crossing both wings, sometimes branching, 2 before middle and 1 beyond it, a stronger line beyond these outlined outwardly on the hindwing and on the lower third on the forewing with slightly metallic slatey-blue. Between this and the three incomplete olive-brown to dark-brown subterminal lines there are on the forewing 3 brownish spots towards apex with white centres and 3 yellowish-brown spots with white centres and sometimes dark purple towards the anal angle, while on the hindwing this space is more or less

suffused with ochreous-yellow. Anal angle of the hindwing yellow, marked with pinkish and slatey-blue lines.

*Larva.*—"Slender-cylindrical and smooth, with 2 long curved, divergent filaments or soft horns on the head, a single stouter sword-shaped one on the back at the 5th or 6th segment curved backward and serrated on its inner edge and another on the last segment curved forwards and serrated on its outer edge. Colour fine reddish-brown, with a broad green band on the side from the 5th to the last segment. Feeds on *Ficus indica*. Davidson and Aitken. J., B. N. H. S., Vol. V, page 351.

*Expanse.*—2″ to 2½″.

Genus APATURA.

The best way of subdividing this large genus is by the markings of the underside. In the cell of the forewing there are normally to be found the following spots—a subquadrate spot at the end of the cell, another about the middle, and traces of a third near the base. These are very clearly shown in *A. garuda* (*vide* Plate C, 17, 17*a*). These spots are not always so clearly marked, and in those species in which the outer margin of the cell is incomplete, the lower half of the spot at the end has, as it were, overflowed and become distorted in shape. In practice, however, they can always be traced, and on this basis the genus may be subdivided as follows :—

1. Species in which the spaces between the spots and beyond the cell are white or pale yellow, the dark spots being reduced and almost linear ... ... ... ... ... (*Neptis.*)
2. Species in which the spots are well developed, the spaces beyond them being of the generally ground colour of the wing or hardly paler ... (*Euthalia.*)

On Plate C 3 species of each section are figured.

(1) *A. Neptis.*

**Apatura leucothoë**, L.—Dark brownish-black. *Forewing*: an elongate white spot, filling the greater part of the cell, showing suffused traces only of the median spot, a triangular white spot beyond the cell. A curved band of six to seven quadrate spots beyond it between the veins, but having no spot between veins 4 and 5, a subterminal row of white spots more or less broken in the middle and sometimes traces of pale lines before and beyond it: cilia whitish black on the veins.

*Hindwing* with a broad white band across the disc, a narrower macular band beyond it, and traces not always present of pale lines on either side of it.

*Underside* shining orange-brown, the white spots and bands as in the forewing outlined with brown. The pale wavy lines referred to always distinctly shown.

*Expanse.*—1" to 2½". A very variable insect of wide distribution. The outer row of white spots of the forewing and its continuation as a macular band on the hindwing is sometimes hardly traceable. (Plate C., fig. 12.)

*Larva.*—Cylindrical, pale green, a small dark lateral spot on 6th segment; head, 3rd, 4th, 6th and 12th segments armed with fleshy spines, those on the 4th longest; face and tips of spines pinkish. A promiscuous feeder.

**Apatura perius**, L.—Upperside very similar to the last, from which, however, it can be readily distinguished by the outer margins of the median spot in the cell, being always distinctly traceable and by the presence of a spot between veins 4 and 5 beyond the cell.

*Wings* broader, outer margin highly waved.

*Underside* paler yellow, the macular band beyond the cell preceded by a row of black spots in a greyish suffusion.

*Expanse.*—2" to 2¾". (Plate C, fig. 14.)

*Larva.*—Cylindrical, pale green, yellowish-brown beneath, spiracles and head black. Thickly covered by 2 subdorsal and 2 lateral rows of brownish spines. Feeds on species of Glochidion.

Other species not figured which the beginner might meet with in a first season are, (1) **A. jumbah**, Mre., very similar to **leucothoë**, but the outer macular band of the hindwings always absent on both sides. *Underside* rich golden brown, with a pinkish suffusion. (2) **A. inara**, Dbld., with only a small quadrate white spot at the end of the cell on the upperside, some suffused orange spots towards apex of forewing, and the outer macular band of the hindwing represented by a narrow orange band. (3) **A. cama**, Mre., with no spot in the cell on the upperside and without the orange band on the hindwing possessed by the last species.

**Apatura hordonia**, Stoll.—Similar to **leucothoë** in form and general superficies, but the white markings replaced by bright yellow, the bands of spots have lost their macular character by fusion and become

broad yellow bands, the actual extent of the yellow area being very variable. The outer row of spots in the forewings is lost except in a few local forms, in which the yellow area has been curtailed, and there is room for a pale narrow subterminal line.

Black, forewing with a broad yellow fascia along the middle of the wing from base to beyond middle more or less indented along the upper margin of the cell at the end and about the middle, a broad transverse yellow fascia across the apex, and another from vein 4 to the middle of the inner margin, a narrow terminal yellow line.

*Hindwing* with a broad yellow transverse band across the middle of the wing and a narrower one beyond it.

*Underside* much paler, the markings less distinctly indicated. The ground colour, especially near base, thickly irrorated with pinkish-grey.

*Expanse.*—1″ to 1¾.″ (Plate C, fig. 13.)

*Larva.*—Appears to occur in two forms, and has been described in our Journal by Messrs. Davidson, Bell and Aitken, Vol. X, page 250.

It feeds on *Acacia* and *Albizzia*.

*A. Euthalia.*

**Apatura nais**, Forst.—Bright reddish-orange. Forewing with a large subquadrate black spot at the end of the cell with indications of a reddish centre. A large black patch beyond and below it from base of vein 4 to 2, obscurely defined on its inner margin. A broad macular transverse band from the middle of the costa to vein 4 beyond middle, a subterminal blackish line sometimes joined by suffusion along the veins to the broad black-brown margin. Cilia white, broadly blackish on the veins. Hindwings with a black triangular fascia on the costa before the middle, a macular band of spots beyond middle and broad blackish margin. The extent of the black-brown markings varies, and is much reduced in dry season forms.

*Underside* pale pinkish-orange, suffused over the basal and apical thirds of the forewing, and the whole of the hindwing with pinkish-brown. Terminal and median spots in the cell prominent pinkish-red with black margins. A pale chrome transverse band before apex of forewing and a median irregularly shaped band of the same colour on the hindwing. A subterminal row of brownish-black spots across both wings, each spot with a pale suffusion beyond it. Two reddish-pink dark outlined spots in the cell of the hindwing and some pink markings near base.

*Expanse.*—2½" to 2¾". (Plate C, fig. 16.)

*Larva.*—Light green with a dorsal row of large purplish-brown spots, and ten pairs of very long much branched green spine extended laterally. Feeds on mango and other trees.

A very distinct insect which cannot be mistaken for any other.

**Apatura garuda**, Mre.—Anal angle of hindwing acute, produced to a point. Dull olive-brown. Outlines of the median and terminal cell spots and traces of the basal one very distinct dark brown. Traces of a dark spot, sometimes two, below the cell. An indistinct curved dark line from the costa beyond the cell to vein 4 and then straight to middle of the inner margin and continued on the hindwing. The space beyond it paler, sometimes whitish between veins 4 to 7. A wavy suffused dark subterminal line on both wings. A quadrate outlined spot in the cell of the hindwing, another at the end of the cell, and sometimes one above it.

Underside similar, but paler, especially towards base and outer margin, all the markings much more distinct, the pale spot beyond middle developing into a macular band of white spots as far as vein 2 and traces of 2 white spots on the costa beyond near apex.

♀. Similar to the male, but the wings fuller and more rounded, the pale markings beyond the cell in the forewing always forming a white macular band at least to vein 4.

*Expanse.*—2⅝" to 3". (Plate C, 17 male, 17*a* female.)

*Larva.*—Cylindrical. Bright green with a dorsal yellow line. Ten pairs of long delicate much branched green spines extended laterally. The insect reposes along the midrib of the leaves, and the spines are so placed as to simulate the veins of the leaf. Feeds on mango, cashewnut trees, etc.

**Apatura camilla**, Mre.—Male.—Apex of forewing and anal angle of hindwing acute, the latter produced. Glossy velvet black, paler towards outer margin and with two to three white spots before apex. Underside rich iridescent brown, the cell spots distinctly marked with reddish-brown centres, a pale triangular mark on costa about middle and 3 white spots between the veins before apex, a macular subterminal line of dark spots in a pale suffusion. Hindwing as forewing.

Female.—Apex of forewing truncate and anal angle of the hindwing rounded. Dull yellowish-brown. Cell spots of both wings distinct

darker brown, an irregular waved line from the middle of the costa across both wings darker brown, the area within it more or less suffused with brown, the area beyond it paler. A wavy brownish suffusion beyond this, containing in the upper half of the forewing 4 white dotlike spots, and on the hindwing a dark brown spot between veins 2 and 3. Indistinct wavy subterminal and terminal lines. Underside similar to the upper, but the markings more distinct with patches of mauve suffusion on the subterminal line.

Cilia of both sexes whitish between the veins.

*Expanse.*—$1\frac{3}{4}$" to 2". (Plate C, 15 male, 15*a* female.)

*Larva.*—Slender, tapering at each end, greenish, pale yellow on the back except the dorsal line, a yellow spiracular line on each side. The head, 2 branched spines on the second segment, and 2 simple ones on the anal segment black.

There is another species exactly similar to this, but without the white spots on the forewing (**Apatura parisatis** Wstw.) found in Assam and N.-E. India.

A species more akin to **A. garuda** which the beginner might also very probably come across is **A. lubentina**, G.

This is a most beautiful insect, of a deep dark ivy-green colour, glossy and almost iridescent in some lights with a vermilion black outlined spot in the cell of forewing and 2 outer rows of vermilion spots on the hindwing. In the male there is a row of small bluish-white spots beyond the middle joined by another row from the apex which in the female are replaced by a broad macular transverse band of quadrate bluish-white spots.

The larva feeds on the common parasitic plant known as the Indian mistletoe which so often grows on the mango trees.

# NOTES ON SMALL MAMMALS IN KASHMIR AND ADJACENT DISTRICTS.

By

Col. A. E. Ward.

Since my last communication, which appeared in the Journal of April 23rd, 1906, a certain amount of progress has been made. Once again I have sent to Ladak, and hope that a fairly thorough search has brought to light what can be obtained from that district.

No new discoveries were made amongst the Mouse-hares, but several *Ochotona aurita* were got. One of these came from the Nubra valley. Mr. Bonhote is writing a note on this rodent, and we may definitely consider that it is not connected with *macrotis*, which is the large-eared Mouse-hare. (Page 457, "Fauna of British India.")

The specimen of *aurita* from the Nubra differed slightly in colour from those from the shores of the Pangong, being lighter.

A list of Mouse-hares was given in my last notes.

Of the subfamily *Cricetinæ*, to which the voles and hamsters belong, the following have been collected :—

*Microtus brachelix*—Widely distributed in Kashmir.

„ *fertilis*—Apparently rarely found.

„ *imitator*— Do.

„ *blythi*—Found in Baltistan and Ladak.

„ *stracheyi*—Found in Ladak.

*Cricetus phœus*—Found at Shushal, Ladak.

*Microtus brachelix* inhabits, as a rule, the lower ranges up to about 9,000′, and is very common at about 7,000′.

*M. fertilis* and *M. imitator* have only been found at altitudes of 10,000′ to 11,000′.

*M. blythi* from 13,500′ to 15,000′.

*M. stracheyi* lives at still higher elevations ; the specimens came chiefly from about 15,000′.

The little grey Hamster, in Ladak at any rate, does not seem to live at an altitude less than about 13,000′; probably, in the Gilgit district it may be found lower down.

Amongst the rats we have—

*Mus nitidus* from Poonch.

*Mus vicerex.*—The common rat of Kashmir and parts of Poonch, &c.

*Nesocia hardwickii* from Poonch.

*Nesocia bengalensis.*—The Indian Mole-rat inhabits the fields in Kashmir.

*Mus mettada.*—The Soft-furred Field-rat is not often secured.

Regarding the Mice I have still nothing definite to write, and the same remark applies to the Shrews.

Of Hares, *Lepus tibetanus*, the Afghan Hare, appears to be plentiful in the Nubra valley, and *L. oiostolus*, the Woolly Hare, comes from Shushal and other places in Ladak.

Of the *Mustelidæ*, the following have been collected :—

*Mustela flavigula.*—The Indian Marten.

*Mustela foina.*—The Beech Marten from Baltistan and Kashmir proper.

*Putorius canigula.*—The White-nosed Weasel; this is evidently the common weasel of the N.-W. Himalayas.

*Putorius alpinus.*—The Pale Weasel is common in the Nubra, and found occasionally in the Ladak Road in the Indus Valley.

Other weasels will probably be obtained during future research.

Of the smaller Cats, a live specimen of *Felis manul*, Pallas' Cat, was purchased in Leh ; it came from the Nubra.

Other Cats are *Felis chaus*, the Jungle Cat, and *Felis torquata*, the Waved Cat.

If I receive any further information from the British Museum about the mice, or in the event of finding any interesting animals not as yet included in my notes, I will again venture to write.

# "WHAT IS A SPECIES?"

BY

R. S. HOLE, F.L.S., F.E.S.

1. The introduction of the word species into natural history as the unit of classification is due to Linnæus, but there appears to be considerable difference of opinion as to the exact meaning which he attached to the word.

In the *Origin of Species* Darwin notes: "Nor shall I here discuss the various definitions which have been given of the term species. No one definition has satisfied all naturalists; yet every naturalist knows vaguely what he means when he speaks of a species."* Clearly, then, an accurate idea of the conception of a species, as generally entertained by naturalists from the time of Linnæus to that of Darwin, is not to be found in the literal interpretation of the famous Linnean or of any other definition.

2. From what we know of the knowledge possessed by aboriginal and savage races, may we not safely infer that the principal facts regarding natural history on which the Linnean definitions of species and variety were primarily based, and which must have been accepted as true from a very early period, were as follows:—

(1) Numerous distinct kinds (or species) of plants and animals exist, which can be readily distinguished by appreciable differences or characters.

(2) Cultivating plants and breeding animals shows that, throughout the Natural Kingdom, "like begets like", that, with plants, as with animals, although the immediate offspring of any individual usually differ slightly from their parents and each other, they, on the whole, invariably resemble their parents and each other very closely. As the distinguishing marks of each species are thus transmitted unchanged from parents to their immediate offspring, the species appears to be fixed and constant.

(3) As organisms which are known to be closely related invariably resemble each other closely, it is inferred that organisms which are very much alike must be nearly related.

3. Must we not look to these ideas for an explanation of the fact that, in the early days of natural history classification, a distinction was made between the so-called *Artificial* and *Natural Systems*, and also of the fact that the system was called *natural* which resulted in all those organisms being placed in the same group which, on the whole, resembled each other more than they resembled any other organism, and which were therefore considered to be very closely related? May we not account for the species being selected by the early systematists as the most convenient unit for classification in natural history by the fact that it was recognized as the smallest unit which could be readily distinguished from all other units, and which appeared to be fixed and constant, the individuals included in the species being able to propagate their like from generation to generation?

* *Origin of Species*, 6th Ed., p. 50.

4. That the essence of the Linnean conception depends on such ideas is also shown by the following quotations from well-known botanical works: "It is believed that with the general advance of science . . . it is at once more philosophical and more practically convenient, as well to the general botanist in the higher branches of the science, as to the more superficial amateur, to retain for the meaning of a species the limits affixed by the original principles of Linnæus . . . . A SPECIES comprises all the individual plants which resemble each other sufficiently to make us conclude that they are all, or *may have been* all, descended from a common parent. These individuals may often differ from each other in many striking particulars . . but these particulars are such as experience teaches us are liable to vary in the seedlings raised from one individual. When a large number of the individuals of a species differ from the others in any striking particular, they constitute a VARIETY . . A variety can only be propagated with certainty by grafts . . or any other method which produces a new plant by the development of one or more buds taken from the old one . . A real *species* will always come true from seed." * And, again:

"Linnæus laid down that each species consists of similar individuals which are related together by their origin, and which are the unaltered descendants of a common ancestor or pair of ancestors. It does not affect the value of the definition that Linnæus considered these ancestors to be creations of the '*infinitum ens*'; but it is very important that he recognized existing organisms as the continuation, the rejuvenated portion of one and the same living being, so that the species is not a figment of the human mind, but is something which actually has an objective existence. . . . Each species has its special features or characteristics, and all individuals possessing these specific marks are said to belong to the same species. Specific characteristics are hereditary, and are transmitted unaltered to the descendants. There are, however, some plant characteristics which are not inherited, but which may appear or not according as the individual develops in this or that place. . . . They form the foundation for the existence of the variety, according to Linnæus."†

5. From the above we might be led to infer that modern naturalists are generally agreed regarding their conception of a species, but in point of fact nothing is further from being the case, as will be gathered from the two following quotations:—

(*a*) "The systematic species are the practical units of the systematists and florists, and all friends of wild nature should do their utmost to preserve them as Linnæus has proposed them," ‡ and

(*b*) "My friend, Professor E. Ray Lankester, . . is inclined to think that we should discard the word species not merely momentarily but altogether. Modern zoology having abandoned Linnæus, conception of

* *Handbook of the British Flora*, by George Bentham, 1866, pp. 6, 7 and 11.

† *Natural History of Plants*, by A. Kerner, Eng. Ed., 1895, Vol. II pp. 486-487.

‡ *Species and Varieties, their Origin by Mutation*, by Hugo De Vries, 1905, p. 12.

'species' should, he considers, abandon the use of the word. In his opinion the 'origin' of species was really the abolition of species, and zoologists should now be content to describe, name, draw, and catalogue *forms*. Furthermore, the various groups of forms briefly defined above should be separately and distinctly treated by the zoologist, without confusion or inference from one to the other. The systematist should say, 'I describe and name certain forms, *a*, *b*, etc.;' and then he or another may write a separate chapter, as it were:—'I now show that the forms *ab*, *ac*, *ad* (form names) are syngamic;' at another time he may give reason for regarding any of them as related by epigony."*

6. It is not clear why Prof. Lankester considers the Linnean conception untenable, but apparently he considers this a necessary consequence of the abandonment of the Linnean doctrine of special creation. Such an attitude, however, appears to be hardly justified by the facts.

It is surely a remarkable fact that Linnæus and the systematists who followed him recognized that the highest ideal which systematic botanists could strive to attain was the elaboration of a natural system of classification with the species as its unit, and which, as Darwin himself says, was in reality "founded on descent with modification†." He says: "With species in a state of nature, every naturalist has, in fact, brought descent into his classification, for he includes in his lowest grade—that of species—the two sexes; and how enormously these sometimes differ in the most important characters is known to every naturalist . . . The naturalist includes as one species the various larval stages of the same individual, however much they may differ from each other and from the adult, as well as the so-called alternate generations of steenstrup, which can only in a technical sense be considered as the same individual . . . As descent has universally been used in classing together the individuals of the same species . . . may not this same element of descent have been unconsciously used in grouping species under genera, and genera under higher groups, all under the so-called natural system? I believe it has been unconsciously used; and thus only can I understand the several rules and guides which have been followed by our best systematists‡."

Professor Poulton also in his abovementioned address remarks: "As regards the work done by the systematist, we find that Darwin did not agree with those of his friends who thought that a belief in evolution would entirely alter its character." Thus he wrote to Hooper, September 25th, 1853:—"In my own work I have not felt conscious that disbelieving in that mere *permanence* of species has made much difference one way or the other; in some few cases (if publishing avowedly on the doctrine of non-permanence) I should *not* have affixed names, and in some few cases should have affixed names to remarkable varieties."§

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* *Presidential Address to the Entomological Society of London*, 20th Jan. 1904, p. xc.

† *Op. cit.*, p. 346.

‡ *Op. cit.*, p. 349.

§ *l. c.* pp. lxxxviii—lxxxix.

This surely indicates that the pre-Darwinian systematists, however incorrect may have been the definitions of a species framed by them, did not essentially differ from Darwin as regards what they, in actual practice, recognized as a species. Is it not possible that both Darwin and one of the earlier systematists, when considering whether two forms should be ranked as distinct species or as varieties, might finally have solved the problem in essentially the same way, *viz.*, by considering whether, or not, the differences between them were such as experience had proved, or as might by analogy be inferred, to occur among the immediate offspring of a single individual?

Do not the above considerations force us to the conclusion that a species is an actual entity, the character of which is independent of any theory of evolution?

That this is so can scarcely be more strikingly demonstrated than by the fact that both Darwin and De Vries recognize the Linnean conception of a species as a practical unit for natural history classification. Seeing that the vast majority of what are universally accepted as species are now, in nature, found to be fixed and constant, just as was the case in the time of Linnæus, this is no more than we should be naturally led to expect.

Was it not with the object of emphasizing this all-important fact that Linnæus, in his famous definition, describes species as remaining unchanged since they were created by the "Infinitum Ens"?

But by thus emphasizing the characteristic fixity of species he obviously attempted, not only to define a species, but to define as well how and when each species originated—an altogether different thing.

7. It is to be regretted that many modern definitions appear to rather increase than to diminish our difficulties in arriving at a clear conception of this well-styled "elusive" term. Some authors propose to distinguish species, as morphologic, physiologic and so on, according to the basis of discrimination. It is not clear, however, on what purely morphological ground the male and female of many organisms can possibly be included in the same species and the same difficulty would occur in the case of those organisms which assume entirely different forms at different periods of their life history, *e.g.*, *Puccinia graminis*. Moreover, if this is not done, by destroying the base on which our natural history classifications depend, we must necessarily alter the whole character of such classifications, which, to say the least, would be a very drastic measure. The following, again, is extracted from one of the most recent standard works on Physiology:—

"It has long been recognized that a species has no definite boundaries but is a conventional expression for a cycle of forms grouped around a type-centre*."

This seems to imply that while modern naturalists exercise their individual discretion in laying down the precise boundaries of species, they are agreed as to the main principles to be followed in doing so. A comparison of the opinions

* *Physiology of Plants* by Dr. W. Pfiffer, Eng. Ed., 1903, Vol. II., p. 911.

quoted above of two such eminent naturalists as Prof. Ray Lankester and De Vries, however, can hardly be held to justify such a conclusion.

8. Before proceeding further it may at once be asked whether the accurate defining of the word species is, or is not, of great practical importance. That it is of the greatest importance can, perhaps, be best shown by assuming that we abolish the term and the conception of species and adopt the only other obvious basis for classification, *viz.*, the degree of resemblance or difference between individual organisms ; in other words, let us adopt the suggestion of Professor Ray Lankester to "describe, name, draw, and catalogue forms." Then so long as organisms retain their power of reproduction, since no individual organism ever exactly resembles another, there would, in the first place, be no limit to the number of names which would be required ; secondly, only an exceedingly minute fraction of the total number of forms existing on the earth at any given period could ever be possibly described ; while, thirdly these descriptions would be useless for the purpose of identifying living forms after the death of the individuals to which they particularly refer, *i.e.*, they would be useless to our successors, and practically useless to ourselves. The undoubted fact that, within certain limits, all organisms *breed true*, appears thus to afford the only basis for a natural history classification which shall be of practical value. By discovering within what limits each different kind of organism breeds true, *i. e.* the characters which are always transmitted to its immediate offspring, we can alone hope to obtain and be able to define a unit, *viz.*, the species, which so far as we can see is permanent, and which, in consequence, can be recognized and studied by our successors. Also, by only giving a separate name to each such unit, instead of to each distinct form, the number of names which will be required is enormously reduced.

Moreover, until this unit, the species, has been accurately defined, our classifications cannot be considered to be established on a sound basis, for, until this is done, it is obviously impossible to decide whether, or not, we are unnecessarily increasing the number of names and wasting labour in describing unstable, ephemeral forms.

9. Granted it is advisable to define a species, the question remains, is it possible ? Seeing no reason why this should be impossible, I have drawn up the following tentative definitions and explanatory notes, which, while embodying what are believed to have been the central ideas of the Linnean conception, are thought to be also fairly in accordance with modern knowledge. It is hoped that their criticism will indicate what principles are capable of general acceptance. For the sake of brevity I have taken my illustrations in the explanatory notes from botany, but it is believed that the main principles embodied in the definitions are also applicable to zoology.

10. Before giving the definitions, a point which, although of the greatest importance, is frequently overlooked, must be noted, *viz.*, that a distinction must be made between organisms which live and are developed in a natural state,

or wild, and those which are living in a state of domestication or cultivation. Non-attention to this point is, undoubtedly, responsible for much of the confusion which surrounds the word species. Plants which, in the garden, breed true and give the impression of being constant forms and of constituting good species are not found as wild species in a state of nature. This may sometimes be due to their inability to survive in the struggle for existance to which they are exposed in nature, while, in other cases, if growing wild, their characters might undergo fundamental changes owing to their being fertilized by other wild plants. In any case, it must be recognized at the outset that the main object of natural history classification is to enable us to rapidly become acquainted with the principal groups of plants and animals indigenous in various countries, and it must be recognized that the species and its subdivisions refer to groups of plants as they exist and are found in nature. The following definitions then refer strictly to groups of organisms which exist wild in nature; similar terms may, of course, be used for analogous groups of cultivated plants or domesticated animals; but if so, in order to avoid confusion, they should be invariably distinguished by the adjective *artificial*, thus "artificial species" as opposed to "natural species."

DEFN. 1.—*A* SPECIES *is the smallest group of organisms existing wild in nature which can be readily distinguished from all other groups owing to the fact that the individuals composing it all possess in common certain well-marked characters (= specific characters) by which they can be distinguished from all other organisms.*

*The individuals also which compose the species are, when developed normally in a state of nature, always able to transmit their specific characters unchanged to the majority of their immediate offspring.*

DEFN. 2.—*A* SUB-SPECIES *is a group essentially similar to a species, but subordinate to it. The characters separating any two individuals belonging to different sub-species not being so great as those which separate individuals belonging to different species.*

DEFN. 3.—*A* VARIETY *is a group of organisms subordinate to a species. The differences between any two varieties of the same species are not constant*, i.e., *they are not always transmitted unchanged from the parent to the majority of its immediate offspring.*

DEFN. 4.—*A* RACE *is a variety of considerable fixity. The characters distinguishing the individuals which compose it from those constituting the rest of the species are frequently* (e.g., *in certain localities, or under certain conditions of existence*), *but not always, transmitted from the parent to the majority of its immediate offspring.*

*Note 1.*—The sub-species corresponds to the French *petite espice*, and is in all essential characteristics identical with a species. Owing to the enormous number of forms to be dealt with, a Flora, whose object is to help as far as possible those who wish to quickly acquire a knowledge of the principal types of plants indigenous in a very extensive area, must avoid minute detail, and

hence, in such large Floras, only the more distinct and easily recognised species can be described at length, while the sub-species can only be very briefly dealt with, or are perhaps merely mentioned by name. At the same time it must be remembered that the sub-species are important units which must be described in detail in small local Floras. Every species and sub-species must receive a distinct name, while races and varieties will not be named. These will merely be designated by letters or numbers. (This is, of course, not in accordance with many modern Floras, in which no distinction is drawn between sub-species, races and varieties, all sub-divisions of the species being indiscriminately termed varieties.)

*Note 2.*—The male and female forms of some organisms differ widely from each other, while an organism may present an entirely different appearance at different stages of its life-history or at different seasons. However great such differences may be, all forms of one and the same organism must, of course, be included in the same species.

*Note 3.*—There is no logical ground for restricting the use of the term *heredity* to the phenomenon of sexual reproduction only, or for considering that organisms which can only reproduce themselves asexually are therefore unable to constitute a true species. The words "always able to transmit" in definition I while indicating constancy under varying conditions of existence are also intended to imply that, while organisms capable of both sexual and asexual reproduction cannot constitute a species if they only transmit their essential characters truly by asexual reproduction, organisms only capable of asexual reproduction are not thereby precluded from forming a true species.

*Note 4.*—As regards a decision of the question whether, or not, particular organisms constitute a species, sub-species, variety or race, the fact that they are hybrids is of no significance. These words merely define groups of organisms as they exist, and are not concerned with the question as to how these groups originated.

*Note 5.*—The words "always able *et seq.*" in definition 1 may be considered to preclude the possibility of one species arising from another, and therefore not to be in accordance with modern ideas of evolution. Under the theory of descent with slow modification, however, there can never be an appreciable difference between the specific characters of parent organisms and those of the majority of their *immediate* offspring, hence the parents and the majority of their immediate offspring would always be included in the same species, as is proposed in the present definitions. If, on the other hand, we seek the beginnings of new species in the sudden variations known as mutations, or in such variations as may arise by the crossing of unlike forms, we have to consider two distinct questions: (1) the status of the parent organisms and (2) the status of their immediate offspring. So long as the parent organisms are always able to transmit their essential characters truly to the majority of their immediate offspring, they constitute a species, if, on the contrary, they are only able to produce a preponderance of new forms with new

specific characters, they no longer constitute a species, and cannot obviously long continue to exist in nature. The new forms must similarly be considered on their merits. If the individuals of such a form are found to occur in nature, possessing definite characters distinguishing them from all other organisms, and if they are always able to transmit such characters truly to the majority of their immediate offspring, they constitute a true species, otherwise they do not. It must, of course, be remembered that as a species is a group of organisms, a single individual can never constitute a species, but it may form the begnining or foundation of one.

*Note 6.*—The fact that certain organisms can interbreed and produce fertile offspring does not necessitate the combination of such organisms in one species or *vice versa*. This is shown by the fact that illegitimate unions between the different forms of flowers occurring in one and the same undoubted species, in dimorphic and trimorphic plants, produce very little fertile seed, while the plants raised from such seed are sterile, just as is so frequently the case in illegitimate unions between forms belonging to different species.

*Note 7.*—Attention has been paid during recent years to the cultivation of plants and the breeding of insects for long periods with the object of observing the kind and amount of variation which occurs among the offspring of one and the same individual, and of obtaining an idea of the process of evolution which has produced the forms now existing in nature. If, during such operations, among the offspring of an individual belonging to a natural species (A) a form is sooner or later found to occur which appears to exactly resemble another form which occurs wild in nature, and which has been classed as a distinct species (B), this in itself is no proof that (B) has directly descended from (A) in nature, for the organisms kept under observation have developed under artificial conditions, and it is conceivable that, in nature, (B) has arisen from a distinct species (C), under the influence of different conditions of existence through a different series of variations. Moreover, even if proof has been obtained that a certain group of individuals has descended from another group, this alone would not be a sufficient reason for combining them as one species, for, in the progress of time, the intermediate forms which once united the two groups may have disappeared, causing them to occur in nature as distinct species, separated by well-marked and constant differences.

*Note 8.*—For the correct classification of forms as species, sub-species, races or varieties a knowledge of the life-history, as well as of the appearance of the seasonal forms of individual organisms, and of the kind and amount of variation which may occur among the immediate offspring of one and the same individual, in nature, is essential.

The systematist, however, must rely for his determinations mainly on morphological characters, coupled with his knowledge of the development and variation of the few forms which have been studied. His conclusions therefore must be liable to error. If the present, or similar, principles are accepted however it will be possible to obtain *proof* whether, or not, his conclusions are

correct. Errors which have been committed can then be subsequently corrected, and this will ensure our classifications being built on a sound and reliable foundation. In the case of plants, for instance, such proof will be obtained from observations of the individuals raised from seeds or *brood-bodies* (under which term may be included all reproductive bodies arising asexually), these having been gathered from plants which have developed wild in nature. In accordance with the suggestions now made, these observations will be confined to such individuals, *i.e.*, to the *immediate offspring* of plants growing wild. The posibility of any character which may be regarded as fixed and constant in nature being affected by the artificial conditions of existence under cultivation is thus avoided. Moreover, any factor which, in nature, is capable of producing an hereditable variation, *i.e.*, pollination by neighbouring plants, will, of course, have taken effect before the seeds or brood bodies are matured, and the result will become manifest in the young plants produced from such bodies. As only a brief period will thus be required for each experimental culture, a large number of experiments can be carried through in a short period and results quickly obtained.

Some doubtful points may indeed be settled by a very few experiments. Thus in a case where two groups of forms have been classified as distinct species—if individuals of one group are commonly found in considerable numbers among the immediate offspring of individuals of the other group, the two forms are at once shown to belong to one and the same species.

Other points, such as to whether forms can be considered sufficiently constant to be ranked as undoubted species, *i.e.*, whether their distinguishing characters are fixed and constant under varying conditions of existence, require of course extensive series of observations. In such cases attention must be paid to the conditions under which the parent plants are existing in nature, such as, for instance, the presence of other plants by which they may have been fertilized, and hence the reproductive bodies must be gathered from individuals living in different localities. Then, again, the effect on the young plants of temperature, light, available moisture, soil, air currents and other factors which are known to affect the development and form of plants must be noted, and it must not be forgotten that the effect produced by any factor is probably dependent to a great extent on the particular stage of the plant's life-history during which it acts, the plant being more susceptible at some times than at others. Another important point to be remembered when studying the effect of various factors is that no real distinction exists between considerable variations occurring suddenly and slight variations which may be gradually accumulated and fixed. A high temperature, for instance, acting for a short time may cause a change which is only produced after a long period by a lower temperature.

11. Finally, it may not be superfluous to add that, for successful classification, the naturalist in the field must, as far as possible, work in combination with the naturalist in the museum or herbarium. The latter, for instance,

receive great help in his determinations from a study of the geographical distribution of various forms. He must also pay attention to such characters as enable the field naturalist to recognize various forms when living, in nature, and not alone to those which are usually available in museum or herbarium specimens. It would probably be difficult to find two species of trees belonging to the same genus so distinct and so easily distinguished in the forest as *Terminalia arjuna*, Bedd. and *Terminalia tomentosa*, W. & A.; yet systematists working with herbarium specimens find it difficult to separate them.

Cultural experiments in the case of trees require, of course, a considerable time, but more attention should be paid to the kind and amount of variations observable on one and the same individual tree which would aid the systematist in his selection of specific characters. Attention should also be paid, especially in the case of evergreen plants, to variations observable on one and the same individual at different seasons. Many evergreen parasites, such as *Leranthus*, when growing on deciduous species, for instance, would probably show considerable seasonal variations.

In experimental cultures particular attention would, of course, be paid to what may be recognized as "doubtful specific characters." Many which are usually included under the term *habit* may be so described, and which are known to be dependent to a great extent on the conditions under which the plants have developed, such as are, for instance, implied by the words annual, biennial, perennial, herb, undershrub, shrub, tree, erect, prostrate, climber, etc. Many curious undershrubs are known, *e.g.*, species of *Premna* which are separated chiefly on account of their habit from other species which are trees or large shrubs. Again, many species are known to occur both as erect trees or shrubs and also as climbers, but *Butea superba*, Roxb. is separated from *Butea frondosa*, Roxb,., mainly on account of its climbing habit.

# THE ORCHIDS OF THE BOMBAY PRESIDENCY.

By

G. A. Gammie, F.L.S.

## Part IV. (With Plate III.)

(*Continued from page 37 of this Volume.*)

### 9. PHAJUS.

An epiphyte. *Stems* clustered, pendulous, leafless after bearing flowers in the first season's growth. *Leaves* two ranked. *Flowers* white, in a close, terminal raceme, *bracts* nearly as long as the flowers, persistent, *sepals* and *petals* subequal, *lip* joined to the base of and embracing the foot of the column, *anther* incompletely 4-celled, *pollinia* 8, attached by fours to a large granular viscus.

1. Phajus albus, *Lindl.*, Fl. Br. Ind., p. 818.

*Stems* usually not more than a foot long, leafy throughout in the first year. *Leaves* soft in texture, blueish beneath, oblong or linear lanceolate, long pointed. *Raceme* 2 to 8 flowered, *bracts* up to 2½ inches long, narrowly boat shaped, acute; *sepals* and *petals* up to 3½ inches long, pure white, *lip* shovel-shaped, white with purple or red veins, *side lobes* narrow elongate, ciliate, *midlobe* broad, toothed, crisped and ciliate, *disk* with five crested ridges.

*Distribution.*—Localized on the Northern Konkan Ghats. Flowers during the rainy season.

Plate III.—*Phajus albus*, Fig. 1. Part of plant in flower. Fig. 2. Lip (enlarged). Fig. 3. Column (enlarged). Fig. 4. Anther cap (enlarged). Drawn by Mr. R. K. Bhide. The reproduction of the purple lines on the lip is coarse and unsatisfactory and does injustice to its real beauty.

3. *Phajus albus, Lindl.*—(Native name unknown). This beautiful epiphyte does not appear to be prevalent largely in the Konkans. Though Nairne cites "the Konkan" as its *habitat*, he does not specify whether it is found in the North or the South Konkan. Hooker, however, says that it is found on the Matheran Hill, probably on the authority of Mr. H. M. Birdwood. But in Mr. Birdwood's Catalogue of the Flora of Matheran and Mahableshwar (2nd Ed., 1897) against this plant the remark is:—"Mahableshwar. Rare. (Fairbank)." Matheran is not mentioned at all. I have not met with this orchid in the Thana and Ratnagiri Districts. Nor has my friend and old fellow-student Dr. Dalgado of Savantwadi, found it either in the "Wari Country" or in Goa. Near forty years ago, Dr. Narayan Daji, G.G. M.C., of Bombay, had

PHAJUS ALBUS, Lindl.

Fig. 1. Part of plant in flower. Fig. 2. Lip (enlarged).
Fig. 3. Column (enlarged). Fig. 4. Anther cap (enlarged).
Fig. 5. Pollen masses (enlarged).

the plant sketched. It was obtained from the Thana District, but the exact locality is not mentioned by him. But it is a proof positive that the orchid grows somewhere in the Thana District. I throw out this hint for future collectors.

Hooker notices that the plant is very variable in size of flower and colour of lip. Well may it be so, considering the variable heat and moisture of the rainy season, during which the plant shows its floral beauty. The flowers appearing as they do in the rainy season, on raceme terminating the leafy stem fall very gracefully. This graceful fall, Williams happily names as "nodding." As a rule the flowers, though not numerous, are yet showy of bright white petals, with the midlobe wavy fringed delicately at the margin and crimson streaked in the body; the lip is shovel-shaped as Hooker terms it.

This orchid is evidently a child of the Highlands through India. It is now referred to by Williams to genus Thunia, of which there is no mention made in Hooker's Flora of Br. India. To have thus dissociated *Phajus albus*, Lindl., from Hooker's genus Phajus is, I think, botanically correct. I say so because the species of Thunia are so readily distinguished from those of Phajus that there can be no doubt of the two genera being distinct. Williams observes that in the manner of growth and habit there are striking differences between the species of Thunia and Phajus, respectively. Thus, for instance, says Williams, the orchids of genus Thunia "have terete leafy stems which grow in fascicles; their leaves are deciduous; and their terminal drooping clusters of flowers are provided with large membranous bracts. The structure of the flowers closely resembles that of Phajus.

For the purpose of distinguishing the differential details between genus Thunia and genus Phajus we have the high and unquestionable sanction of Reichenbach. They are as follows:—"*Thunias* have a terminal inflorescence on the leafy shoots, whereas *Phajuses* have their inflorescences and theiro fascicles of leaves apart. *Thunias* have fleshy membranous leaves, *Phajuses* have plaited ones. *Thunias* have persistent, *Phajuses* deciduous bracts. *Thunias* have four, *Phajuses* eight pollen-masses. *Phajus* flowers get blue when dried, *Thunia* keep white or get brownish."

(*N.B.*—Here is a wrinkle for orchid collectors! K. R. K.) "You can make cuttings of *Thunias* as of a Dracæna, try it with *Phajus*!" So says Williams.

(*N.B.*—The interjection "!" means:—"Don't try; you are sure to fail in propagating the plant, if you try 'cuttings'"—K. R. K.)

This orchid is well worth introducing in the Konkan to a larger extent, as I believe that though it is a native of the hills, it is capable of growing in the lowlands of the Konkans.

Hooker's arrangement of the species of genus Phajus is based on the position of the scape, but he is doubtful whether such an arrangement will hold good. It is best therefore to refer *Phajus albus*, the species under description, to genus Thunia.

(K. R. K.)

## 10. JOSEPHIA.

Epiphytic, stemless, tufted herbs ; root fibres very stout. *Leaves* radical, rigidly coriaceous. *Flowers* very small, on the branches of panicled spikes, *sepals* broad, subequal, concave, connivent, *petals* narrower, *lip* adnate to the base of the column, erect, fleshy, concave ; lateral lobes small erect ; midlobe small, entire, papillose, with a basal callus uniting the side lobes. *Column* erect, broad, nearly as long as the sepals, shortly two winged above, foot 0 ; *anther* acuminate, 2-celled ; *pollinia* 4, oblong, subcaudate, attached to the rostellum by a viscus.

1.—JOSEPHIA LANCEOLATA, *Wight*. Fl. Br. Ind., V., 823.

*Leaves* petioled, linear oblong or lanceolate subacute, young clothed with hyaline sheaths. *Scape* 4 to 12 inches slender and its branches stiff ; *bracts* short, ovate appressed ; *flowers* $\frac{1}{8}$ inch broad, white tinged with purple ; *sepals* obtuse.

Inflorescence like that of a Statice. Wight, on Jerdon's authority, mentions the curious fact of the persistent continuously flowering spikes.

*Distribution.*—Western Ghats from the Konkan to Travancore ; Ceylon.

I do not know this plant and have copied the foregoing from Sir J. D. Hooker's description in the Flora of British India.

## 11. PHOLIDOTA.

*Pseudbulbs* densely clustered, ovate, dark green. *Leaf* solitary, thick and stiff, distinctly veined. *Raceme* from the base of the pseudobulb long stalked and pendulous, *bracts* semi-circular, closely two ranked, *sepals* concave, *lateral* joined at the base, *petals* flat, *lip* 4-lobed *column* winged, *pollinia* 4, subglobose, free or cohering in pairs by a viscus.

1.—PHOLIDOTA IMBRICATA, *Lindl.* Fl. Br. Ind., V., 845. Dalz. and Gibs., p. 262.

*Pseudobulbs*, up to 3 inches long, obtuse, somewhat angled. *Leaf* 6 to 12 inches long, elliptic lanceolate. *Raceme* about a foot long, *bracts* closely arranged, *dorsal sepal* orbicular, *lateral* boat-shaped, keel winged, *petals* linear oblong falcate, *lip* 4-lobed, side lobes broad rounded, terminal lobes 2, smaller.

*Distribution.*—On the Belgaum and N. Kanara Ghats and the Konkan, flowering in August.

Recorded also from the Tropical Himalaya, Khasia Mountains, Chittagong Burma, Andaman Islands, and Ceylon.

(*To be continued.*)

# BIRDS OF THE PROVINCES OF KASHMIR AND JAMMU AND ADJACENT DISTRICTS.

By

Colonel A. E. Ward.

Part IV.

(*Continued from page 729 of this Volume.*)

Order Columbæ. Fam. Columbidæ.—Pigeons and Doves.

(1272). *Crocopus chlorogaster.*—The Southern Green Pigeon. If this bird is to be obtained it will be in Jammu Province, but the specimens we have in the museum are without locality.

(1283). *Sphenocercus sphenurus.*—The Kokla Green Pigeon, during the breeding season is abundant in Kishtwar.

(1291). *Chalcophaps indica.*—The Bronze-winged Dove. I expect the specimens recorded by Adams were from Poonch and the outer ranges of the Punjab Mountains. There are none in Kashmir proper.

(1292). *Columba intermedia.*—The Indian Blue Rock-Pigeon.

(1293). *Columba livia.*—The Blue Rock-Pigeon. This is the common pigeon of Kashmir.

(1294). *Columba rupestris.*—The Blue Hill-Pigeon, is plentiful on the Ladak Road, at high altitudes of the side valleys of Kashmir, and in most of the norhern parts.

(1295). *Columba eversmanni.*—The Eastern Stock-Pigeon is rare and probably migrates across our frontiers.

(1296). *Columba leuconota.*—The White-bellied or Snow Pigeon, breeds in Kashmir at altitudes of about 10,000′ and upwards and extends far into the hills; during severe winters it descends to about 7,000′, but leaves for higher ground directly the weather is less severe.

(1297). *Dendrotreron hodgsoni.*—The Speckled Wood-Pigeon. A single bird was noted in the Liddar, June 1880 and again in 1904. In Kishtwar it is fairly common, it breeds in that district in June at about 8,000 feet.

(1298). *Palumbus casiotis.*—The Eastern Wood-Pigeon is very plentiful in the spring in the Murree hills; large flocks are to be seen in the autumn in Poonch, and it is found in Kashmir.

(1305). *Turtur ferrago.*—The Indian Turtle-Dove dwells in the wooded districts where it is common.

(1307). *Turtur suratensis.*—The Spotted Dove.

(1309). *Turtur cambayensis.*—The Little Brown Dove.

(1310). *Turtur risorius.*—The Indian Ring-Dove.

(1311). *Ænopopelia tranquebarica.*—The Red Turtle-Dove is rarely to be found.

Order Pterocletes. Fam. Pteroclidæ—Sand-Grouse.

(1316). *Pterocles arenarius.*—The Large Sand-Grouse.

(1317). *Pterocles fasciatus.*—The Painted Sand-Grouse is like the preceding sand-grouse only to be found in the province of Jammu.

(1320). *Pteroclurus alchata.*—The Large Pin-tailed Sand-Grouse. I have not seen this bird in the Jammu province but it probably occurs; it is not known in Kashmir.

(1321). *Pteroclurus exustus.*—The Common Sand-Grouse is found in the Jammu Province.

(1323). *Syrrhaptes tibetanus.*—The Tibetan Sand-Grouse is found in flocks in Ladak, and the eggs were taken by Capt. W. Leslie on the eastern borders of that district on 22nd, 23rd and 25th June.

ORDER GALLINÆ. FAM. PHASIANIDÆ.—The Game Birds.

(1324). *Pavo cristatus.*—The Common Peafowl, confined to the lower ground.

(1328). *Gallus ferrugineus.*—The Red Jungle-Fowl, confined to the outer ranges.

(1333). *Catreus wallichi.*—The Cheer Pheasant is found in Kishtwar and the hills in the Jhelum valley but not in Kashmir proper.

(1334) *Pucrasia macrolopha.*—The Koklas Pheasant is common. The variety *biddulphi* is noted from Western Kashmir (Fauna of B. I., Birds, Vol. IV).

(1336). *Gennæus albicristatus.*—The White-crested Kalij Pheasant is not found in the Kashmir vale but is abundant in the Murree Road, Kishtwar, &c.

(1342). *Lophophorus refulgens.*—The Monal is common ; the Bronze-backed Monal is at present only authenticated from Chamba, but is said to occur in Badrawar.

(1345). *Tragopan melanocephalus.*—The Western Horned Pheasant has become very rare in Kashmir, but is found in Poonch and Kishtwar, &c.

(1355). *Coturnix communis.*—The Common or Grey Quail visits Kashmir valley, and the eggs of this bird have been taken near Manarbal ; of course this quail is also a visitor to the plain portions of Jammu, &c.

(1356). *Coturnix coromandelica.*—The Rain Quail is a rare visitor but has been known to nest in Kashmir.

(1357). *Perdicula asiatica.*—The Jungle Bush-Quail is confined to the [illegible] of 6 boundaries and does not visit the main valley. [illegible]acts

(1358). *Perdicula argunda.*—The Rock Bush-Quail. If this bird is event[illegible]ged, found it will be in Jammu.

(1362). *Aboricola torqueola.*—The Common Hill-Partridge. I have [illegible]ded, informed that this bird has been found but have no specimens.

(1370). *Caccabis chucar.*—The Chukor is found almost throughout the whole of the country we are dealing with, the Ladak bird is light in its colouring.

(1372). *Francolinus vulgaris.*—The Black Partridge. Common in Poonch and Jhelum valley below Uri, but does not come into the main vale of Kashmir.

(1375). *Francolinus pondicerianus.*—The Grey Partridge is confined to the plains.

(1377). *Perdix hodgsonia.*—The Tibetan Partridge is a rare bird, but has been obtained near the Panjong Lake, and the eggs were taken near Tsaka Ladak on the 8th July, the nest contained 13 eggs.

(1378). *Tetraogallus himalayensis.*—The Himalayan Snow-Cock is common at high altitudes in Kashmir and Baltistan, &c.

(1379). *Tetraogallus tibetanus.*—The Tibetan Snow-Cock. This bird is found to the eastward of Ladak, the eggs were obtained at Troakpu-Kurbu close to the borders on 20th June at an altitude between 16,000 and 17,000 feet.

(1380). *Lerwa nivicola.*—The Snow-Partridge. I enter this bird in the list, as it is said to have been found within the limits of Kashmir and Jammu territories.

ORDER GRALLÆ. FAM. RALLIDÆ. (Rails, Crakes, &c.)

(1387). *Rallus indicus.*—Indian Water-Rail.

(1388). *Rallus aquaticus.*—The Water-Rail breeds in the Kashmir valley, nests have been found in the swamps in the main valley on several occasions.

(1391). *Crex pratensis.*—The Land-Rail appears to be very rare, but undoubtedly does visit Kashmir.

(1392). *Porzana parva.*—The Little Crake breeds in Kashmir.

(1393). *Porzana pusilla.*—The Eastern Baillon's Crake.

(1398). *Amaurornis fuscus.*—The Ruddy Crake breeds in Kashmir sometimes on the edges of the rice fields.

(1402). *Gallinula chloropus.*—The Moorhen.

(1404). *Porphyrio poliocephalus.*—The Purple Moorhen is a rare visitor to Kashmir. The only specimen I have myself secured was in December at Sudnora near the Wular Lake.

(1405). *Fulica atra.*—The Coot.

FAM GRUIDÆ. (Cranes).

(1409). *Grus antigone.*—The Sarus has been seen in the valley of Kashmir was fairly o occasions.

(1411). *Anthropoides virgo.*—The Demoiselle Crane is a winter visitor.

FAM. OTIDIDÆ.

(1413). *Otis tetrax.*—The Little Bustard. A single specimen was obtained the s Poonch-Rajan-Kashmir in December.

ORDER LIMICOLÆ. FAM. ŒDICNEMIDÆ.—(Plovers, Snipes, &c.)

(1425). *Œdicnemus scolopax.*—The Stone-Curlew.

FAM. GLAREOLIDÆ.—Swallow Plovers.

(1425). *Glareola orientalis.*—The Large Indian Pratincole or Swallow-Plover.

(1427). *Glareola lactea.*—The Small Indian Pratincole appears to be seldom met with in Kashmir, but is reported from the Wular Lake.

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(1427). *Glareola lactea.*—The Small Indian Pratincole appears to be seldom met with in Kashmir, but is reported from the Wular Lake.

FAM. PARRIDÆ.

(1429). *Hydrophasianus chirurgus.*—The Pheasant-tailed Jacana is a summer visitor, rarely found in the side valleys but common on the large swamps of Kashmir.

FAM. CHARADRIIDÆ.

(1431). *Sarcogrammus indicus.*—The Red-wattled Lapwing. A few of these birds are met with at elevations of about 5,000′ to 6,000′ in Kashmir, and now and again elsewhere.

(1436). *Vanellus vulgaris.*—The Lapwing or Peewit is a winter visitor.

(1437). *Chettusia gregaria.*—The Sociable Lapwing now and again can be obtained.

(1440). *Charadrius pluvialis.*—The Golden Plover is far from common. In my list when first drawn up I included also the Eastern Golden Plover, but have not yet got a specimen.

(1441). *Squatarola helvetica.*—The Grey Plover.

(1443). *Ægialitis mongolica.*—The Lesser Sand-Plover. I have not met with this bird in Kashmir, but it breeds in Ladak and probably is to be obtained in Kashmir.

(1447). *Ægialitis dubia.*—The Little Ringed Plover.

(1450). *Hæmatopus ostralegus.*—The Oystercatcher has been seen near the Wular Lake.

(1451). *Himantopus candidus.*—The Black-winged Stilt breeds in Kashmir.

(1452). *Recurvirostra avocetta.*—The Avocet.

(1453). *Ibidorhynchus struthersi.*—The Ibis-Bill. This bird breeds in the islands of the mountain rivers. I have failed to get the eggs, but have obtained the young.

(1454). *Numenius arquata.*—The Curlew.

(1455). *Numenius phæopus.*—The Whimbrel has been shot at Hokarsar, Kashmir, in December.

(1456). *Limosa belgica.*—The black-tailed Godwit. This bird is said to pass through Kashmir during migration.

(1460). *Totanus hypoleucus.*—The Common Sandpiper, breeds in Kashmir in June.

(1461). *Totanus glareola.*—The Wood Sandpiper.

(1462). *Totanus ochropus.*—The Green Sandpiper.

(1464). *Totanus calidris.*—The Redshank, is fairly common in the winter and spring.

(1465). *Totanus fuscus.*—The Spotted Redshank. A few specimens can be obtained in the winter.

(1466). *Totanus glottis.*—The Greenshank.

(1468). *Pavoncella pugnax.*—The Ruff and Reeve. I have shot a few specimens on the marshes of Kashmir in winter.

(1471). *Tringa minuta.*—The Little Stint.

(1475). *Tringa acuminata.*—Asiatic Pectoral Sandpiper, is a very rare visitor.

(1478). *Tringa alpina.*—The Dunlin.

(1482). *Scolopax rusticula.*—The Woodcock, breeds in Kashmir and Kishtwar.

(1484). *Gallinago cælestis.*—The Fantail Snipe. A few breed in the swamps of Kashmir and the eggs are easily obtained. I have found this snipe breeding in Ladak.

(1486). *Gallinago solitaria.*—The Himalayan Solitary Snipe, is common in the winter, most leave before the end of March. My collectors declare they found the eggs of this snipe, whatever they were they were broken to pieces when brought.

(1487). *Gallinago gallinula.*—The Jack Snipe.

(1488). *Rostratula capensis.*—The Painted Snipe, is a permanent resident in the valley of Kashmir.

ORDER GAVIÆ. FAM. LARIDÆ.—Gulls and Terns.

(1490). *Larus ridibundus.*—The Laughing Gull, is plentiful in the winter in Kashmir.

(1491). *Larus brunneicephalus.*—The Brown-headed Gull occurs in Kashmir in winter, and in the highlands of Ladak in summer.

(1495). *Larus cachinnans.*—The Yellow-legged Herring-Gull.

(1496). *Hydrochelidon hybrida.*—The Whiskered Tern.

(1503). *Sterna seena.*—The Indian River-tern.

(1506). *Sterna fluviatilis.*—The Common Tern.

ORDER STEGANOPODES. FAM. PHALACROCORACIDÆ.—Cormorants, &c.

(1526). *Phalacrocorax carbo.*—The Large Cormorant.

(1528). *Phalacrocorax javanicus.*—The Little Cormorant.

(1529). *Plotus melanogaster.*—The Indian Darter.

ORDER HERODIONES. FAM. IBIDIDÆ.—Ibis, Storks, Herons, &c.

(1541). *Ibis melanocephala.*—The White Ibis.

FAM. CICONIIDÆ.

(1547). *Ciconia nigra.*—The Black Stork is found during the early spring in Kashmir.

(1549). *Xenorhynchus asiaticus.*—The Black-necked Stork. There is a specimen in the Museum in Srinagar which was shot either in Jammu or Kashmir.

FAM. ARDEIDÆ.

(1555). *Ardea cinerea.*—The Common Heron. Large numbers are found all over the main valley.

(1559). *Herodias alba.*—The Large Egret.

(1560). *Herodias intermedia.*—The Smaller Egret.

(1561). *Herodias garzetta.*—The Little Egret. Breeds in Kashmir.

(1562). *Bubulcus coromandus.*—The Cattle Egret. Breeds in Kashmir.

(1565). *Ardeola grayi.*—The Pond Heron breeds in Kashmir.

(1568). *Nycticorax griseus.*—The Night Heron breeds generally in May and June in Kashmir.

(1570). *Ardetta minuta.*—The Little Bittern breeds in Kashmir.

(1574). *Botaurus stellaris.*—The Bittern is not common, and I have never come across it in the summer months.

ORDER ANSERES. FAM. ANATIDÆ.—Swans, Geese, Ducks.

Amongst the thousands of ducks shot in Kashmir, now and again we must expect to find exceptional visitors, but I think the list includes practically all that have been obtained, except perhaps *Erismatura leucocephala.*

(1577). *Cygnus olor.*—The Mute Swan is a rare visitor both to the Kashmir and Jammu Provinces.

(1579). *Anser ferus.*— The Grey Lag Goose visits Kashmir during the winter in thousands.

(1580). *Anser albifrons.*—The White-Fronted Goose. Fairly plentiful during certain winters, but rarely seen during others.

(1581). *Anser erythropus.*—The Lesser White-Fronted Goose is very rare, in fact the only recorded specimen was shot on the Wular some years ago.

(1583). *Anser indicus.*—The Barred-headed Goose breeds in large numbers in Ladak. I am assured this goose has been shot on the Kashmir swamps.

(1588). *Casara rutila.*—The Ruddy Sheldrake visits Kashmir in the winter and breeds in Eastern Ladak in the early summer, but personally I have never seen it in that district in large quantities.

(1592). *Anas boscas.*—The Mallard. A few stay in Kashmir during the summer and breed in the large swamps.

(1595). *Chaulelasmus streperus.*—The Gadwall.

(1596). *Nettium formosum.*—The Clucking Teal. I enter this bird on the strength of a single specimen shot on the Mir-gund.

(1597). *Nettium crecca.*—The Common Teal. I have never succeeded in finding eggs of this bird in Kashmir although my collectors have searched for many years, but I have seen this teal in June and July in the valley.

(1599). *Mareca penelope.*—The Wigeon is fairly common in winter.

(1600). *Dafila acuta.*—The Pintail. Most pass through Kashmir in September and October; a few remain, and during February and March this bird is numerous in the shallow marshes.

(1601). *Querquedula circia.*—The Garganey or Blue-winged Teal is common in September, October, February and March in Kashmir.

(1602). *Spatula clypeata.*—The Shoveller.

(1604). *Nette rufina.*—The Red-Crested Pochard. Large numbers are to be seen in winter, but chiefly in February.

(1605). *Nyroca ferina.*—The Pochard or Dun-bird.

(1606). *Nyroca ferruginea.*—The White-eyed Duck is very plentiful and breeds in Kashmir.

(1608). *Nyroca marila.*—The Scaup is now and again to be obtained in the winter.

(1609). *Nyroca fuligula.*—The Tufted Duck. Numbers are seen on the Wular, and on the Jhelum below Baramulla, particularly in March.

(1610). *Clangula glaucion.*—The Golden-eye has been shot in the Wular Lake and on Hokar Ser.

(1611). *Erismatura leucocephala.*—The White-headed Duck is not very plentiful, but is a yearly visitor to Kashmir.

(1612). *Mergus albellus.*—The Smew. I found this bird breeding on the Shyok river, and have frequently seen it on the Wular Lake.

(1613). *Merganser castor.*—The Goosander. I have shot this bird in the Wular, and seen it in the Indus.

(1614). *Merganser serrator.*—The Red-breasted Merganser is rarely to be found.

(1615). *Podicipes cristatus.*—The Great Crested Grebe. Rajah Sir Amar Singh sent me a specimen last year obtained by him in Kashmir.

(1616). *Podicipes nigricollis.*—The Eared Grebe. Doubtful.

(1617). *Podicipes albipennis.*—The Dabchick is resident in Kashmir.

# ON THE BEAN-GEESE.

By

Eugene W. Oates.

In a recent number of this Journal I published a brief article on the known species of bean-geese, and I brought to notice some conclusions on these birds which had been arrived at by Mr. Alphéraky in his work on the Geese of Europe and Asia.

My remarks have called forth a considerable amount of discussion. First, Mr. Alphéraky wrote a pamphlet which was printed for private circulation and which has been reprinted in our Journal. He subsequently wrote to the *Field* (December 29th, 1906). Mr. Buturlin, another Russian naturalist, wrote to the *Field* (November 17th, 1906), and then again to the Editors of our Journal. I felt constrained to reply to Mr. Buturlin's communication to the *Field* in the same paper, although it seemed to me that an English newspaper was not the proper vehicle for the discussion of a paper which originally appeared in an Indian Journal of Natural History. Lastly, Mr. Stuart Baker has written a note on the same subject in the Journal of this Society.

I do not know how much longer these gentlemen intend to write and discuss these geese, but it appears to me that the time has arrived when I may make some remarks which, on my part, I intend to be final.

I made serious allegations against Mr. Alphéraky with regard to his treatment of three species of bean-geese found in Eastern Asia. I also made complaint of sundry minor matters, which being more or less matters of opinion, I do not now propose to notice further.

The first species I shall deal with is *A. serrirostris*. Mr. Alphéraky figures the bill of this goose of a yellow colour and asserts that the bill is always described as yellow or orange. Swinhoe, who described this species for the first time, says that the colour is pinkish-red. There is no getting away from this description, nor is there room for any insinuation that Swinhoe was mistaken about this simple character. He distinctly states (*Ibis*, 1867, p. 392) that two birds had the bill of this colour.

Mr. Alphéraky, in his pamphlet, says: "Contrarily to Mr. Oates's statement, this goose is not only known from Swinhoe's description,

but from the writings of several authors." It seems hardly necessary to point out that these authors were all mistaken. This accumulation of evidence proves nothing but that these authors were not competent to identify their bean-geese. Mr. Alphéraky would have us believe that these authors had critically discussed the question and come to the deliberate conviction that their geese with yellow bills were *A. serrirostris* in spite of what Swinhoe had written. Nothing of the sort. Many of these authors called their birds *A. segetum*, as Mr. Alphéraky himself confesses. Others adopted the name of *A. serrirostris* from perhaps some hazy notion that there was a goose of that name in Eastern Asia. It is ridiculous to contend that these authors have proved anything, one way or the other.

I do not know to what it is due, but it is a fact that *A. serrirostris* has been lost sight of for many years. I have failed to find any writer, except Swinhoe, who has mentioned the occurrence of a pink-billed bean-goose in Eastern Asia. I have quoted a note written by Mr. Styan relating to this species, but he makes no mention of the colour of the bill, and the only reason I have for knowing that he wrote about this particular goose was that he sent a specimen to the British Museum which agrees in all respects with Swinhoe's type.

Mr. Alphéraky states that he received three specimens of a bean-goose from the Anadyr in Eastern Siberia, on the labels of two of which it was recorded that the bills in life were flesh-coloured. This colour, we may take it, agrees with the pinkish-red described by Swinhoe. Here at once were specimens which might reasonably be indentified with *A. serrirostris*, and Mr. Alphéraky might have congratulated himself on having rediscovered the species in its summer quarters. So far from doing so, he tells us that these geese puzzled him; he thought them over night and day and did not know what to do with them. At last, with the greatest reluctance, he put them down as *A. serrirostris*, not, however, as the plain genuine species described by Swinhoe but as aberrant or dimorphic examples of Mr. Alphéraky's *A. serrirostris* with the yellow bill.

The simple fact which has caused Mr. Alphéraky to make such a disastrous blunder about this species is that, when writing his book, he was in complete ignorance of what Swinhoe had written. He overlooked Swinhoe's description, and, as I have already shewn, there was no other writer who could furnish him with a hint that there

was a goose with a pink bill in China and Eastern Asia. It may appear incredible that Mr. Alphéraky should neglect to inform himself upon such a matter, but the inference is irresistible when the following circumstances are taken into consideration.

In the first place, he figures the bill of *A. serrirostris* of a yellow colour, without stating his reason for differing from Swinhoe. In the second place, he writes a very long article on this species, extending over six and a half quarto pages, without making a single allusion to Swinhoe, although this naturalist has said some very interesting things about this goose. In the third place, at the head of his article, he gives references to Swinhoe's writings in the *Ibis* (1860, p. 67 ; 1861, p. 344 ; 1862, p. 253), but omits the reference to *Ibis*, 1867, p. 392. The first three references given contain no information, but the fourth, the omitted one, is the one wherein Swinhoe fully describes *A. serrirostris* for the first and only time. In the fourth place, Mr. Alphéraky receives specimens of a goose from the Anadyr, as already stated, and not a suspicion crosses his mind that they tally with the goose described by Swinhoe.

If Mr. Alphéraky had known of Swinhoe's description of *A. serrirostris*, how can he obstinately hold to the opinion, how could he ever have formed the opinion, that this bean-goose has a yellow bill in life ? He must surely know that nothing can override an original description of a species and that no one is at liberty to alter or qualify it in any respect.

Mr. Buturlin has undertaken the defence of Mr. Alphéraky, but with little success. Referring to my paper he asks in the *Field* :— "But what is the figure 7 of the same work, named by Mr. Oates *Anser serrirostris*—I cannot guess—most certainly it is not that species." Probably by this time Mr. Buturlin has read Swinhoe's description and has discovered that I have figured the bill correctly. In his communication to our Journal, Mr. Buturlin suggests that Swinhoe is wrong, and he imputes to him a want of sagacity which would be deplorable in a child. He then adopts a very common form of argument and one which perhaps some persons think convincing. He states that he has shot scores and scores of a goose with a yellow bill ; that he has seen numbers of them caught by natives and that he always recorded the colours on the spot. Evidently Mr. Buturlin considers that these experiences fully qualify him to assert positively

that all these geese were *A. serrirostris*. Swinhoe may be thrust aside as of no consequence whatever. Mr. Buturlin further states that Swinhoe's papers are duly recorded by Mr. Alphéraky. I have shewn that the only really important paper of Swinhoe's has been omitted from Mr. Alphéraky's references, and my statement can be verified by any one who looks into the matter.

The second species I propose to deal with is *Anser oatesi*. I complained that Mr. Alphéraky had made no attempt to deal with it, but had dismissed it without remark or comment. He assigned it very doubtfully to *A. neglectus*, a species which there is no ground whatever for believing ever occurs in China or even in any part of Eastern Asia, and which, moreover, has a pink bill, whereas Mr. Rickett states that *A. oatesi*, to the best of his recollection, has a yellow bill. Mr. Alphéraky now states in his pamphlet that Mr. Rickett's description of *A. oatesi* was so vague that he understood at once that something was wrong with it, and he proceeds to quote just a few words of the descriptions as if it were the whole description. Thus quoted, it certainly may be considered very vague, but if my readers will turn to my paper, they will find the description quoted in full and they will hardly consider it unsatisfactory. It contains everything that is essential in the description of a bean-goose.

In my paper, I made a very brief remark about a second specimen of this species in the British Museum. I gave the measurement of the wing and the bill, and that was all. But this is enough to enable Mr. Alphéraky to assert *now* with absolute certainty that *A. oatesi* is nothing but *A. segetum*.

I need hardly say that *A. oatesi* is a species which has been repeatedly procured by Russian naturalists in its summer quarters in Siberia and that it is well known to Messrs. Alphéraky and Buturlin as *A. serrirostris*. The notes furnished by the latter gentleman, under the heading of *A. oatesi*, in his communication to our Society, render this point no longer doubtful.

The third species I wish to refer to is *A. mentalis*. I complained in my paper that Mr. Alphéraky quoted my description of this species, but, in doing so, suppressed the most essential part of it, *viz.*, the measurement of the wing and the dimensions of the bill. In his pamphlet he thus refers to my complaint:—"Mr. Oates further says that I have not devoted a single line to his original description of *mentalis*.

Misrepresentation such as this makes it difficult to conduct a discussion with Mr. Alphéraky.

*A. mentalis* is a huge goose with a yellow bill. It differs from *A. serrirostris* not only by reason of the colour of the bill, but by having the bill larger in all its dimensions. It differs from *A. oatesi* by its immensely larger size as exhibited by the body, wing and bill.

I now turn to Mr. Stuart Baker's note, and I am glad that he has been able to identify two of his Indian bean-geese with *A. middendorffi*. I hope he will take steps to have his third specimen properly identified. I note, that he asks me to furnish him and other field ornithologists with a key to the bean-geese. I am afraid that no better key is possible than the plate I have given, shewing the bills of all the known species at one glance. I certainly intended the plate to be the key to the species, and I am sorry it is not looked upon as such.

*March 30th*, 1907.

# THE FRESHWATER MOLLUSCA OF TIRHOOT, BENGAL.

By

GORDON DALGLIESH.

Below I give a list of a few species of freshwater shells which were collected for me in Tirhoot, Bengal. The list of course is extremely scanty, but I am endeavouring to get friends in India to collect me more, and if their efforts are successful I shall record them in the journal and send specimens to the Society's museum. From an economical point of view freshwater shells play an important part, quantities of lime being made from them, which is used for various purposes in the Indigo districts of Bengal, the commonest shells used for this purpose being *Vivipara bengalensis*, while other shells are used to collect the juice of the poppy in for the manufacture of opium, *Ampullaria globosa* being chiefly employed. The distribution of our Indian freshwater Mollusca is very imperfectly known and I was glad to see in a recent number of the journal an appeal to members to collect shells for the Society's museum. I regret that while I was in India I did not pay much attention to the Mollusca of the district I was in, as I feel sure the result would have been satisfactory.

## GASTEROPODA.

### Fam. VIVIPARIDÆ.

*Vivipara bengalensis* (Lmk.). This is the shell *par excellence* of Tirhoot, being exceedingly common in jheels and paddy fields. It is largely used in the manufacture of lime.

*Vivipara dissimilis* (Mull.). Common, but not so much so, as the last. It is found in more or less abundance in jheels and lakes.

*Vivipara crassa* (Hutton). Two specimens from Munjoul, 1902.

*Vivipara præmorsa* (Bens). One specimen from Munjoul, 1902.

### Fam. AMPULLARIIDÆ.

*Ampullaria globosa* (Swain). The large and handsome "Apple Snail" is found on the larger jheels and rivers, where the animal may often be seen floating on the surface of the water. The shell is used to collect opium in.

### Fam. LIMNÆIDÆ.

*Limnæa acuminata* (Lam.). Fairly common in ponds and rivers.

*Limnæa rufescens* (Gray). It is doubtful whether this should stand as a distinct species or merely a variety of *L. acuminata*. Mr. E. A. Smith, of the British Museum, wrote to me regarding it as follows:—"Gray's *Limnæa rufescens* I regard as a variety of *L. acuminata* (Lam.) differing only in being rather more slender with a longer spire, but all intermediate forms are met with." Two or three of this species or variety were sent to me along with *L. acuminata* and it was only lately I detected the difference in the two forms.

*Limnæa bulla* ( ). Scarce. A few specimens only.

*Planorbis compressus* (Hutton). This is, I believe, a widely distributed species in India. My few specimens were taken from the leaves of water lilies on one of the large jheels.

*Planorbis exustus* (Desh.). The above remarks will also apply to this species.

## PELECYPODA. (EULAMELLIBRANCHIATA).

### Fam. UNIONIDÆ.

*Unio flavidus* (Bens.). Common and found in the mud of lakes and jheels. Pearls of more or less value are sometimes obtained from this species.

*Unio cæruleus* (Lea.). This beautiful species is common and found in the same situations as the last.

*Unio marginalis* (Lam.). Found in the mud of rivers, but I cannot say whether it occurs commonly as I have seen only a few specimens.

*Unio corrugatus* (Smith). This is a common species, occurring with *U. flavidus* and *U. cæruleus*.

*Corbiculla occidens* (Bens.). This pretty little shell occurs abundantly in all jheels and lakes.

*Corbiculla* sp.? A very small bivalve was collected for me by my sister, Miss Aileen Dalgliesh, to whom I am indebted for the other shells mentioned in this paper, which I sent to the authorities of the British Museum. It was returned to me marked "*Corbiculla* sp.?"; no one evidently seeming to know to what species to assign it, neither can I find a specimen like it in the National collection. It may therefore be new. I give a description. Size small; shell orbicular, deeply furrowed; epidermis (? periostracum) glossy. Exterior olive green with bold radiating bands of greenish brown, middle band broader than the rest. Interior brownish pink, marked with white towards the apex. Teeth white. Length 7 mm. Two specimens. Locality Munjoul Lake, Tirhoot, Bengal. 1904.

# BIRDS OF THE KHASIA HILLS.

BY

E. C. STUART BAKER, F.Z.S., M.B.O.U.

(PART II.)

(*Continued from page 795 of this Volume.*)

ORDER PASSERES—(*contd.*)

Family MUSCICAPIDÆ.

558. HEMICHELIDON SIBIRICA.—The Sooty Flycatcher.

Has been observed in Shillong.

559. HEMICHELIDON FERRUGINEA.—The Ferruginous Flycatcher.

Resident in Shillong.

560. SIPHIA STROPHIATA.—The Orange-gorgeted Flycatcher.

A rare migrant.

562. SIPHIA ALBICILLA.—The Eastern Red-breasted Flycatcher.

Very common migrant. This little bird appears to find sufficient insects to feed on in the pine trees.

565. CYORNIS HODGSONI.—The Rusty-breasted Blue Flycatcher.

A rare resident. I have this year succeeded in taking its nest, a cup of moss placed on the branch of a pine tree and containing five eggs exactly like those of *tickelli* and *rubeculoides* but smaller.

566. CYORNIS HYPERYTHRUS.—The Rufous-breasted Blue Flycatcher.

An uncommon resident.

567. CYORNIS LEUCOMELANURUS.—The Slaty-blue Flycatcher.

Rare, probably resident.

569. CYORNIS MELANOLEUCUS.—The Little Pied Flycatcher.

A not rare resident.

570. CYORNIS ASTIGMA.—The Little Blue and White Flycatcher.

A constant resident, but I have not yet discovered its nest.

574. CYORNIS UNICOLOR.—The Pale Blue Flycatcher.

Rare, probably migrant.

575. CYORNIS RUBECULOIDES.—The Blue-throated Flycatcher.

A common resident, to be found in almost every ravine with sufficient cover.

577. CYORNIS MAGNIROSTRIS.—The Large-billed Blue Flycatcher.

A rare resident. Like the last bird frequents damp ravines with plentiful undergrowth and forest. Breeds in the same sort of place.

579. STOPAROLA MELANOPS.—The Verditer Flycatcher.

The most common resident Flycatcher, to be often seen in the Shillong gardens, nearly always in pairs. Has a rather sweet little song.

584. ANTHIPES LEUCOPS.—Sharpe's White-gorgeted Flycatcher.

A rare resident, at high elevations only.

586. ANTHIPES POLIOGENYS.—Brook's Flycatcher.

Recorded from Shillong.

590. ALSEONAX MUTTUI.—Layard's Flycatcher.

Resident, but not common.

592. CULICICAPA CEYLONENSIS.—The Grey-headed Flycatcher.

A common resident. Several of these little fly-catchers may often be seen in company hunting for insects. If disturbed, however, they separate, so they cannot be said to go in flocks.

593. NILTAVA GRANDIS.—The Large Niltava.

Resident, but rare.

594. NILTAVA SUNDARA.—The Rufous-bellied Niltava.

Not uncommon at high elevations and often descends to the plains—a rare thing with either of the other Niltavas.

595. NILTAVA MACGRIGORIÆ.—The Small Niltava.

A common resident, as low down as about 2,000 feet.

599. TERPSIPHONE AFFINIS.—The Burmese Paradise Flycatcher.

Resident, but rare, except on the borders of Sylhet and Cachar. I saw one bird with four long tail feathers on the Gowhatty road.

601. HYPOTHYMIS AZUREA.—The Indian Black-naped Flycatcher.

Common. In the mixed bamboo and scrub jungle below Cherrapoonji a dozen pairs may be met within an hour's walk.

603. CHELIDORHYNX HYPOXANTHUM.—The Yellow-bellied Flycatcher.

Very rare and keeps to the very highest ravines. I do not think that it is ever found below 4,000 feet, though in Lakhimpur we obtained it in the plains.

605. RHIPIDURA ALBICOLLIS.—The White-throated Fantail Flycatcher.

Very common. It is extraordinarily plentiful in ekra jungle all round the foot of the Hills.

## Family TURDIDÆ.

### Subfamily SAXICOLINÆ.

608. PRATINCOLA CAPRATA.—The Common Pied Bush-Chat.

Very common. I am inclined to think that a few of these birds may remain to breed. A Khasia collector had two skins labelled June.

610. PRATINCOLA MAURA.—The Indian Bush-Chat.

Very common.

614. OREICOLA JERDONI.—Jerdon's Bush-Chat.

Common and resident. During the cold weather it is, of course, quite common in the plains, but it ascends to Hills above some 3,000 feet in the breeding season.

### Subfamily RUTICILLINÆ.

631. HENICURUS GUTTATUS.—The Eastern Spotted Forktail.

Common on all streams.

633. HENICURUS IMMACULATUS.—The Black-backed Forktail.

Not uncommon. This little Forktail keeps far more to damp forest paths and open spaces than do the other species of the same genus.

634. HENICURUS LESCHENAULTI.—Leschenault's Forktail.

Rare. This seems to be its extreme south-western limit.

638. CHIMARRHORNIS LEUCOCEPHALUS.—The White-capped Redstart.

Common in winter and it is possible that a few stay and breed, as a pair were still haunting a reach of the Shillong stream in May this year.

639. RUTICILLA FRONTALIS.—The Blue-fronted Redstart.

A rare winter visitor.

641. RUTICILLA AUROREA.—The Daurian Redstart.

The same.

644. RUTICILLA RUFIVENTRIS.—The Indian Redstart.

Fairly common in winter.

646. RHYACORNIS FULIGINOSUS.—The Plumbeous Redstart.

Common in every stream. As in North Cachar I find that females and immature males number about 10 to every one mature male. It is resident on the higher streams. I have taken its nest this year.

652. CALLIOPE TSCHEBAIEWI.—The Tibet Ruby-throat.

Common in winter.

653. TARSIGER CHRYSÆUS.—The Golden Bush-Robin.

Very rare, probably resident.

654. IANTHIA RUFILATA.—The Red-flanked Bush-Robin.

Rare, doubtfully resident.

656. IANTHIA HYPERYTHRA.—The Rufous-bellied Bush-Robin.

A rare visitor.

659. NOTODELA LEUCURA.—The White-tailed Blue Robin.

Not rare in parts.

663. COPSYCHUS SAULARIS.—The Magpie-Robin.

Very common and getting more so now that birds are being to some extent protected.

664. CITTOCINCLA MACRURA.—The Shama.

Fairly common in forested parts.

Subfamily TURDINÆ.

674. MERULA FUSCATA.—The Dusky Ouzel.

A rare winter visitor.

675. MERULA RUFICOLLIS.—The Red-throated Ouzel.

A rather rare visitor.

676. MERULA BOULBOUL.—The Grey-winged Ouzel.

Rare, probably resident.

677. MERULA ATRIGULARIS.—The Black-throated Ouzel.

A very common visitor. Migratory Thrushes appear to be most common in October and November and again in March and April, moving lower down in the intervening months.

680. MERULA OBSCURA.—The Dark Ouzel.

A frequent winter visitor.

682. MERULA FEÆ.—Fea's Ouzel.

Rare, but possibly resident.

686. GEOCICHLA CITRINA.—The Orange-headed Ground-Thrush.

Common. It is found from practically the level of the plains well up to 5,000 feet as long as there is enough forest.

690. PETROPHILA ERYTHROGASTRA.—The Chestnut-bellied Rock-Thrush.

Rare. Breeds in the cliffs about Laitkynsew.

692. PETROPHILA SOLITARIA.—The Eastern Blue Rock-Thrush.

I have seen this bird in Shillong twice this winter.

701. OREOCINCLA MOLLISSIMA.—The Plain-backed Mountain-Thrush.

Very rare. Both this bird and the next are very retiring, undemonstrative birds, and with their quiet plumage may perhaps be overlooked and really less rare than they appear to be.

705. ZOOTHERA MARGINATA.—The Lesser Brown Thrush.

Rather rare. Both species of *Zoothera* are sure to be found here, but *Monticola* has not yet been recorded. They are resident or locally migratory where found.

Subfamily CINCLINÆ.

709. CINCLUS ASIATICUS.—The Brown Dipper.

Not rare in winter.

710. CINCLUS PALLASI.—Pallas's Dipper.

Not rare and resident. In the North-west Himalayas, Dippers appear to breed from December to March, but in North Cachar I found them breeding in March to May. Pallas's Dipper may be seen any day along the streams about Shillong, but I have not yet ascertained what time they breed here.

Family PLOCEIDÆ.

Subfamily PLOCEINÆ.

721. PLOCEUS MEGARHYNCHUS.—The Eastern Baya.

Common near the plains.

722. PLOCEUS BENGALENSIS.—The Black-throated Weaver bird.

Common.

723. PLOCEUS MANYAR.—The Striated Weaver-bird.

Rare. Breeds in the ekra and grass jungle bordering the Railway (Assam-Bengal Railway).

Subfamily VIDUINÆ.

726. MUNIA ATRICAPILLA.—The Chestnut-bellied Munia.

Common. This bird appears to be known locally as the Rice Sparrow.

727. UROLONCHA ACUTICAUDA.—Hodgson's Munia.

Common. This Munia is found in very large flocks in the rice fields as the grain is ripening and must do a great deal of damage.

735. UROLONCHA PUNCTULATA.—The Spotted Munia.

Common.

738. SPORÆGINTHUS AMANDAVA.—The Indian Red Munia.

Common. Does not appear to ascend much over 2,000 feet here.

Family FRINGILLIDÆ.

Subfamily FRINGILLINÆ.

751. HÆMATOSPIZA SIPAHI.—The Scarlet Finch.

Not rare and resident. These handsome birds are often caught and caged by Khasias. They appear easy to tame, but somewhat delicate birds to keep.

761. CARPODACUS ERYTHRINUS.—The Common Rose-Finch.

A common visitor.

776. PASSER DOMESTICUS.—The House-Sparrow.

Only found near the plains.

779. PASSER MONTANUS.—The Tree-Sparrow.

The common Shillong Sparrow.

780. PASSER CINNAMOMEUS.—The Cinnamon Tree-Sparrow.

Fairly common. Does not affect pine forests, but is seen about Shillong, where it breeds freely in the thatch of the bungalows. At least three pairs bred in my bungalow in April.

Subfamily EMBERIZINÆ.

790. EMBERIZA FUCATA.—The Grey-headed Bunting.

All Buntings are visitors.

791. EMBERIZA PUSILLA.—The Dwarf Bunting.

797. EMBERIZA AUREOLA.—The Yellow-breasted Bunting.

798. EMBERIZA SPODOCEPHALA.—The Black-faced Bunting.

Family HIRUNDINIDÆ.

807. CHELIDON NEPALENSIS.—Hodgson's Martin.

Breeds in the Shillong station, and I saw a nest in one of the bungalows. The Khasias also tell me that it breeds in some of their villages in the houses; I expect it will also be found to breed on cliffs.

809. COTILE SINENSIS.—The Indian Sand Martin.

Common. I saw Sand Martins of some kind on the race-course at Shillong, but could not say to what species they belonged.

813. HIRUNDO RUSTICA.—The Swallow.

814. HIRUNDO GUTTURALIS.—The Eastern Swallow.

Most birds are intermediate between these two forms.

815. HIRUNDO TYTLERI.—Tytler's Swallow.

A common visitor.

820. HIRUNDO STRIOLATA.—The Japanese Striated Swallow.

A single typical specimen of this species was obtained by one of my collectors at Lyetkynsew where a colony breeds, and two or three immature birds were also shot, and two clutches of eggs taken.

821. HIRUNDO DAURICA.—The Daurian Striated Swallow.

Breeds freely about Shillong, I believe in July, August and September. I have seen several nests but all empty, the young having flown.

Family MOTACILLIDÆ.

826. MOTACILLA ALBA.—The White Wagtail.

All Wagtails are winter visitors. They swarm on the Shillong plateau throughout the cold-weather months, forming nine-tenths of the bird population of the place at that time.

827. MOTACILLA LEUCOPSIS.—The White-faced Wagtail.

828. MOTACILLA OCULARIS.—The Streak-eyed Wagtail.

I think this is the most common of all the Wagtails, the conspicuous eye-streak being visible in a large proportion of the birds seen.

830. MOTACILLA HODGSONI.—Hodgson's Pied Wagtail.

832. MOTACILLA MELANOPE.—The Gray Wagtail.

834. MOTACILLA FLAVA.—The Blue-headed Wagtail.

837. MOTACILLA CITREOLA.—The Yellow-headed Wagtail.

Both this and the next are rather rare, and seem to pass through without making a stay in the Hills.

838. MOTACILLA CITREOLOIDES.—Hodgson's Yellow-headed Wagtail.

841. ANTHUS MACULATUS.—The Indian Tree-Pipit.

Fairly common, but not resident.

845. ANTHUS RICHARDI.—Richard's Pipit.

Rare.

846. ANTHUS STRIOLATUS.—Blyth's Pipit.

Common. I have seen six or seven nests of this bird taken here.

847. ANTHUS RUFULUS.—The Indian Pipit.

Very common and resident even on the highest peaks.

850. ANTHUS ROSACEUS.—Hodgson's Pipit.

Almost as common as the last, but not resident.

Family ALAUDIDÆ.

861 ALAUDA GULGULA.—The Indian Sky-Lark.

A very rare resident. I remember hearing the song of these birds in 1886 right up on a plateau near Shillong known as the Peak, about 6,000 feet elevation.

870. MIRAFRA ASSAMICA.—The Bengal Bush-Lark.

Common near the plains.

Family NECTARINIIDÆ.

Subfamily NECTARINIINÆ.

882. ÆTHOPYGA SEHERIÆ.—The Himalayan Yellow-backed Sun-bird.

These beautiful little birds, generally known as Humming birds, are resident, but only breed on the higher ranges, descending to the plains in winter.

887. ÆTHOPYGA IGNICAUDA.—The Fire-tailed Yellow-backed Sun-bird.

This Sun-bird and the two next are very plentiful in the cold weather but less so in the breeding season, when many locally migrate to the higher ranges of the adjoining hills.

888 ÆTHOPYGA GOULDIÆ.—Mrs. Gould's Yellow-backed Sun-bird.

890. ÆTHOPYGA SATURATA.—The Black-breasted Yellow-backed Sun-bird.

892. ÆTHOPYGA NEPALENSIS.—The Nepal Yellow-backed Sun-bird.

The most rare of the Sun-birds.

Subfamily ARACHNOTHERINÆ.

906. ARACHNOTHERA MAGNA.—The Large Streaked Spider-hunter.

A very common bird. Frequents gardens in the station where there are flowering shrubs. Found from the level of the plains up to the summit of the highest peak.

909. ARACHNOTHERA LONGIROSTRIS.—The Little Spider-hunter.

Not rare near Sylhet. This little spider-hunter does not ascend nearly so high as the last and is rare over 2,000 feet. It is also much more shy and retiring, and does not enter compounds of houses nearly so frequently.

911. CHALCOPARIA PHŒNICOTIS.—The Ruby-Cheek.

Not rare near the plains.

Family DICÆIDÆ.

912. DICÆUM CRUENTATUM.—The Scarlet-backed Flower-pecker.

Rather common at the foot of the plains near Sylhet.

914. DICÆUM CHRYSORRHŒUM.—The Yellow-vented Flower-pecker.

This bird is rather common in the orange groves about and below Cherrapoonji where the birds breed in the groves, attaching their nests to the orange trees

915. DICÆUM IGNIPECTUS.—The Fire-breasted Flower-pecker.

Rare. Was found breeding in the orange groves about Cherrapoonji.

917. DICÆUM OLIVACEUM.—The Plain-coloured Flower-pecker.

Very common. Is found at all heights where there is forest. It is peculiarly fond of haunting parasitic plants high up in big trees. During the breeding season it frequents lower trees and scrub, building its nest, as a rule, six to ten feet from the ground.

Family PITTIDÆ.

927. PITTA NEPALENSIS.—The Blue-naped Pitta.

Common. Pittas are resident. Some of the birds found here are *almost* indistinguishable from *P. oatesi*, and some we obtained in Dibrugarh cannot be separated. There are links from one extreme to the other to be obtained in that district.

935. PITTA CUCULLATA.—The Green-breasted Pitta.

Common near the Kopili.

ORDER PICI.

Family PICIDÆ.

Subfamily PICINÆ.

950. GECINUS OCCIPITALIS.—The Black-naped Green Woodpecker.

Very common. All Woodpeckers are conspicuous by their absence in the pine forests round Shillong, these trees being singularly free from insects of

all kinds; even fallen trees, quite rotten in condition, have no beetles or larvæ in them.

951. GECINUS CHLOROLOPHUS.—The Small Himalayan Yellow-naped Woodpecker.

Common.

960. HYPOPICUS HYPERYTHRUS.—The Rufous-bellied Pied Woodpecker.

Rare.

967. DENDROCOPUS MACII.—The Fulvous-breasted Pied Woodpecker.

Common.

973. IYNGIPICUS SEMICORONATUS.—The Darjeeling Pigmy Woodpecker.

I think this is the local form of pigmy Woodpecker, but *canicapillus* and *pygmæus* are both likely to be found here as they are common in North Cachar.

983. MICROPTERNUS PHÆOCEPS.—The Northern Rufous Woodpecker.

Common, breeding in the large globular ant's nest, which form such conspicuous globes high up in many trees.

992. CHRYSOCOLAPTES GUTTICRISTATUS.—Tickell's Golden-backed Woodpecker.

Common.

996. HEMILOPHUS PULVERULENTUS.—The Great Slaty Woodpecker.

Very common in the Jantia oak forests. Nearly always found in parties, numbering from four to six, flying from one tree to another in a regular follow-my-leader fashion.

Subfamily PICUMNINÆ.

1001. PICUMNUS INNOMINATUS.—The Speckled Piculet.

Rare, frequents low forest and scrub jungle.

1002. SASIA OCHRACEA.—The Rufous Piculet.

Common, keeps almost entirely to bamboo or mixed bamboo and scrub forest, breeding as a rule in dead bamboo.

ORDER ZYGODACTYLI.

Family CAPITONIDÆ.

1006. MEGALÆMA MARSHALLORUM.—The Great Himalayan Barbet.

Not rare. I have heard its loud wailing cry in Shillong but have never seen it. Barbets, like Woodpeckers, can find nothing to attract them in the pine forests which surround Shillong.

1009. THERESICERYX LINEATUS.—The Lineated Barbet.

Common, wherever there are suitable tree forests.

1012. CYANOPS ASIATICA.—The Blue-throated Barbet.

Common, up to 5,000 feet. It will be interesting to see if my *C. rubescens* replaces *asiatica* above 5,000 feet as it does in North Cachar.

1016. CYANOPS CYANOTIS.—The Blue-eared Barbet.

Common, nearly to the level of the plains. I found this bird breeding here early in February this year.

1017. CYANOPS FRANKLINI.—The Golden-throated Barbet.

Not rare but local. I have frequently heard this bird near Shillong where the tree forest commences.

1019. XANTHOLÆMA HÆMATOCEPHALA.—The Crimson-breasted Barbet or Coppersmith.

Common near the plains.

ORDER ANISODACTYLI.

Suborder CORACIÆ.

Family CORACIADÆ.

1023. CORACIAS AFFINIS.—The Burmese Roller.

Common. This local form is not true *affinis* but is nearer *affinis* than *indica*.

1025. EURYSTOMUS ORIENTALIS.—The Broad-billed Roller.

A pair may always be seen on the race-course, Shillong. Common near Jowai, where it breeds in the huge Simul trees standing in the oak forests.

Suborder MEROPES.

Family MEROPIDÆ.

1026. MEROPS VIRIDIS.—The Common Indian Bee-eater.

Common near Sylhet. I have never found this bird breeding in company in Assam as it does in other parts of India.

1027. MEROPS PHILIPPINUS.—The Blue-tailed Bee-eater.

Common near Gauhati.

1030. MELITTOPHAGUS SWINHOII.—The Chestnut-headed Bee-eater.

Common. Keeps very much to the larger streams, breeding in their sandy banks. Though not breeding actually in colonies many nests may sometimes be taken within half a mile of bank.

1031. NYCTIORNIS ATHERTONI.—The Blue-bearded Bee-eater.

Fairly common in forests. This fine Bee-eater seems to breed almost entirely in holes on road-side cuttings and consequently but few clutches of eggs ever get hatched, the Khasias digging them out to eat.

Suborder HALCYONES.

Family ALCEDINIDÆ.

1033. CERYLE VARIA.—The Indian Pied Kingfisher.

Common close to the plains, both on large and small streams, but only breeding on the larger.

1034. CERYLE LUGUBRIS.—The Himalayan Pied Kingfisher.

Replaces the last above 2,000 feet and sometimes breeds in banks of the smallest water courses.

1035. ALCEDO ISPIDA.—The Common Kingfisher.

Fairly plentiful on most streams.

1036. ALCEDO BEAVANI.—Beavan's Kingfisher.

I saw one of these birds at Borpani.

1043. PELARGOPSIS GURIAL.—The Brown-headed Stork-billed Kingfisher.

Rare.

1044. HALCYON SMYRNENSIS.—The White-breasted Kingfisher.

Common. Here, as elsewhere, this Kingfisher is to be found often far from water, living on insects, small reptiles, &c.

Suborder BUCEROTES.

Family BUCEROTIDÆ.

1051. DICHOCEROS BICORNIS.—The Great Hornbill.

Common in parts, especially in the Jantia Hills, near the Kopili.

1053. ANTHRACOCEROS ALBIROSTRIS.—The Indo-Burmese Pied Hornbill.

Common. This Hornbill feeds much on the ground both on fallen forest fruits and also on any odd animal food it can pick up.

1054. RHYTIDOCEROS UNDULATUS.—The Malayan Wreathed Hornbill.

Common. Near Sylhet certain trees are regularly *leased* as preserves for this bird, which is in great request as food for ladies who wish for large families. I have seen over a dozen birds procured in a day from such a preserve.

1057. ACEROS NEPALENSIS.—The Rufous-necked Hornbill.

A straggler only.

Suborder UPUPÆ.

Family UPUPIDÆ.

1066. UPUPA EPOPS.—The European Hoopoe.

Common non-resident. In Shillong, Hoopoes, instead of being the tame confiding birds they are in most parts of India, are extremely wild and shy.

1067. UPUPA INDICA.—The Indian Hoopoe.

Common and resident.

ORDER MACROCHIRES.

Family CYPSELIDÆ.

CYPSELUS ACUTICAUDA.—The Khasia Swift.

So far only obtained at Cherrapoonji. Practically nothing is known about this bird which was named by Blyth and was then overlooked or refused recognition by subsequent writers until Hartest procured another specimen and unearthed Hume's original description. On my arrival here I deputed two collectors to try and trace this bird, but for a very long time without any result. At last, in May, they came across a small colony breeding in the precipitous cliffs at a place called Laitkynsew near Cherrapoonji and succeeded in taking six nests—all there were—and in shooting six of the parent birds.

The Swift cannot be a common one as we have so far obtained no others and the Khasias say that they are very rare and are only found in the most rugged and precipitous places where they breed in very small colonies of from three to a dozen pairs, but the former more often than the latter.

In June all the birds disappeared and we failed ever to come across them.

1072. CYPSELUS LEUCONYX.—Blyth's White-rumped Swift.

I obtained a nest of this Swift in a nullah just below my house. It was placed in a split in a rock and was visible from outside and, as it was only about four feet from the bottom of the rock, easily obtainable. It contained two fully fledged young. The nullah was in thick pine forest with a scanty undergrowth of shrubs and ferns.

1074. CYPSELUS SUBFURCATUS.—The Malay House-Swift.

Common. Breeds in cliffs and not in houses like *affinis*.

1076. TACHORNIS INFUMATUS.—The Eastern Palm-Swift.

Common, breeding in the roof of houses when these are of thatch or bamboo leaves.

1077. CHÆTURA Sp.

I saw some Spine-tails hawking over the Shillong tank, they were probably *nudipes*, but were not near enough to identify.

Family CAPRIMULGIDÆ.

1090. CAPRIMULGUS MONTICOLA.—Franklin's Nightjar.

Rare. I have heard its call.

1093. CAPRIMULGUS MACRURUS.—The White-spotted Nightjar or Horsfield's Nightjar.

Common.

1095. CAPRIMULGUS INDICUS.—The Assam Jungle Nightjar.

Fairly common.

ORDER TROGONES.

Family TROGONIDÆ.

1101. HARPACTES ERYTHROCEPHALUS.—The Red-headed Trogón.

Not rare in low forested parts.

ORDER COCCYGES

Family CUCULIDÆ.

1104. CUCULUS CANORUS.—The Cuckoo.

Very common after the end of March, when its call may be heard all over the Hills.

1105. CUCULUS SATURATUS.—The Himalayan Cuckoo.

This bird is at least as common as *canorus*, perhaps even more so, but whereas I get very great quantities of *canorus*' eggs I get practically none of this Cuckoo's. Rattray and other observers have, of course, noted that this bird lays much later and it may be that they have not yet started (10th June), but they began calling early in April, and several of the birds now calling (June 20th) are beginning to lose their voices, a sure sign that the breeding season is on the wane.

1106. CUCULUS POLIOCEPHALUS.—The Small Cuckoo.

Appears to be rare.

1107. CUCULUS MICROPTERUS.—The Indian Cuckoo.

Very common, but keeps lower down in these Hills.

1108. HIEROCOCCYX SPARVERIOIDES.—The Large Hawk-Cuckoo.

Not rare. I have taken here one of Rattray's *Blue* type of eggs, from the nest of *Lanius nigriceps*.

1110. HIEROCOCCYX NISICOLOR.—Hodgson's Hawk-Cuckoo.

Not rare.

1115. CHRYSOCOCCYX XANTHORHYNCHUS.—The Violet Cuckoo.

Very rare. I have received specimens from the foot of the Hills near Sylhet. Keeps almost entirely to evergreen forest and frequents the tallest tree.

1116. Chrysococcyx maculatus.—The Emerald Cuckoo.

Not rare near Sylhet. Often several birds may be found in company.

1118. Coccystes jacobinus.—The Pied Crested Cuckoo.

Common. Although this and the next Cuckoo are such large and conspicuous birds, they are not often seen as they keep much to the interior of evergreen forests.

1119. Coccystes coromandus.—The Red-winged Crested Cuckoo.

Common. The Crested Cuckoo lay their eggs in the nests of *Garrulax* and allied Laughing Thrushes and do not seem to breed at any great elevation.

1120. Eudynamis honorata.—The Indian Koel.

Common. I am told this bird is common even at 6,000 feet in the rains, but I have not heard it as high as this.

1123. Rhopodytes tristis.—The Large Green-billed Malkoha.

Common. It has been brought to me in Shillong, where it is found in brush-covered ravines in pine forests.

1130. Centropus sinensis.—The Crow-Pheasant.

Common in suitable country.

1133. Centropus bengalensis.—The Lesser Crow-Pheasant.

As the last.

## Order PSITTACI.

### Family PSITTACIDÆ.

1135. Palæornis torquatus.—The Rose-ringed Paroquet.

In myriads near Gauhati, over which place it flies in huge flocks in the mornings and evenings. So dense are these flocks that 20 may be killed at a shot in spite of the height at which they fly.

1140. Palæornis rosa.—The Eastern Blossom-headed Paroquet.

Very common.

1145. Palæornis fasciatus.—The Red-breasted Paroquet.

Common.

1150. Loriculis vernalis.—The Indian Loriquet.

Common. This little parrot sometimes enters the pine forest about Shillong, as I have heard its shrill little cry several times and have once or twice seen it on the wing.

## Order STRIGES.

### Family STRIGIDÆ.

1152. Strix flammea.—The Barn-Owl.

Not common, but the Khasias tell me that a "White Owl" breeds in their houses sometimes, and it is probable this bird they refer to.

1153. Strix candida.—The Grass-Owl.

Common in suitable country. This Owl is sometimes put up by sportsmen out after Woodcock.

### Family ASIONIDÆ.

1165. Ketupa flavipes.—The Tawny Fish-Owl.

Common on the Kopili. This fine Owl may be seen perched on high trees growing by the water-side, whence it watches for fish very much as do the Fish

Eagles. It captures them also by swooping down in the same manner as they do. It seems to have no objection to day light.

1169. Bubo coromandus.—The Dusky Horned Owl.

Recorded from North Khasia Hills. I have seen no specimens.

1173. Scops giu.—The Scops Owl.

Rare. The mellow hoot-toot of Scops Owls may be heard all over the Hills, even in the pine forests, where, however, it is decidedly rare, during February March and April, their principal breeding months.

1175. Scops spilocephalus.—The Spotted Himalayan Scops Owl.

Rare.

1178. Scops bakkamœna.—The Collared Scops Owl.

Rare. I have received specimens from Cherrapoonji.

1183. Glaucidium cuculoides.—The Large Barred Owlet.

Common. Does not frequent pines and I have never heard its call near Shillong.

1186. Glaucidium brodiei.—The Collared Pigmy Owlet.

Common in forest land. This tiny Owl is such an adept at hiding itself that were it not for the constancy and peculiarity of its note, it would generally escape observation altogether.

## Order ACCIPITRES.

### Family VULTURIDÆ.

1191. Otogyps calvus.—The Black Vulture.

Common.

1195. Gyps tenuirostris.—The Himalayan Long-billed Vulture.

Common. I have not examined the skins of any Vultures procured in these Hills, and it is more than likely that others may be obtained here as well.

1196. Pseudogyps bengalensis.—The Indian White-backed Vulture.

Common. The unmistakeable colouring of the upper parts of this Vulture renders it easily distinguishable.

### Family FALCONIDÆ.

1213. Spizætus nepalensis.—Hodgson's Hawk-Eagle.

Recorded by Blyth.

1217. Spilornis cheela.—The Crested Serpent-Eagle.

Rather common. The Khansama of the Nungpo Dâk-bungalow informs me that a pair of these birds devastate his poultry yard and declared that they had once even attacked an exceptionally fine cock turkey. They are bold birds always and don't fear mankind.

1220. Butastur teesa.—The White-eyed Buzzard-Eagle.

Common near the plains.

1223. Haliætus leucoryphus.—Pallas's Fishing-Eagle.

Occasionally enters the Hills, following the course of the large streams.

1226. Polioætus ichthyætus.—The Large Gray-headed Fishing-Eagle.

Common below 2,000 feet. At this range this bird and the next overlap

one another, but though I have seen *humilis* right in the plains it is rare to find *ichthyætus* over 2,000 feet.

1227. POLIOÆTUS HUMILIS.—Hodgson's Fishing-Eagle.

Common above 2,000 feet. This little Eagle keeps almost entirely to the banks of streams, feeding entirely on fish or such small reptiles and animals as may be found on their banks. Its nest is usually placed on a high tree close to a river.

1228. HALIASTUR INDUS.—The Brahminy Kite.

Common near the plains and has been seen in Shillong itself.

1229. MILVUS GOVINDA.—The Common Pariah Kite.

Common near villages, etc., near the plains.

1230. MILVUS MELANOTIS.—The Large Indian Kite.

Replaces the last in some places In the higher ranges it appears to be the common form.

1235. CIRCUS CYANEUS.—The Hen-Harrier.

I have seen this bird and the next in the open country on the Kopili, where some Harriers undoubtedly breed.

1236. CIRCUS MELANOLEUCUS.—The Pied Harrier.

A pair frequent the Shillong race-course in the cold weather, hunting for frogs, mice and other small prey.

1237. CIRCUS ÆRUGINOSUS.—The Marsh-Harrier.

Winter visitors only.

1243. ASTUR PALUMBARIUS.—The Goshawk.

Once obtained by Hume.

1244. ASTUR BADIUS.—The Shikra.

Not uncommon.

1248. ACCIPITER VIRGATUS.—The Besra Sparrow-Hawk.

Not rare.

1260. FALCO SUBBUTEO.—The Hobby.

Occasionally met with.

1261. FALCO SEVERUS—The Indian Hobby.

Rare

1265? TINNUNCULUS ALAUDARIUS.—The Kestrel.

Fairly numerous. May be met with in Shillong itself, a pair always to be seen near the Sweet Falls.

## ORDER COLUMBÆ.

### Family COLUMBIDÆ.

1271. CROCOPUS PHŒNICOPTERUS.—The Bengal Green Pigeon.

Common near the plains.

1273. OSMOTRERON PHAYREI.—The Ashy-headed Green Pigeon.

Very common. Green Pigeons are very numerous in any forest which supplies the necessary fruit trees. This and Treron are perhaps the most common of all.

1278. OSMOTRERON BICINCTA.—The Orange-breasted Green Pigeon.
Common.

1281. TRERON NEPALENSIS.—The Thick-billed Green Pigeon.
Common.

1282. SPHENOCERCUS APICICAUDA.—The Pin-tailed Green Pigeon.
Common.

1283. SPHENOCERCUS SPHENURUS.—The Kokla Green Pigeon.
Common.

1284. CARPOPHAGA ÆNEA.—The Green Imperial Pigeon.
Not rare. The Imperial Pigeons keep almost entirely to evergreen forest, though solitary figs and other fruit trees will take them far out of their usual habitats.

1286. DUCULA INSIGNIS.—Hodgson's Imperial Pigeon.
Almost common. I have seen fully fifty of these birds at once on a single Ficus standing in oak forest on Jowai.

1304. TURTUR ORIENTALIS.—The Rufous Turtle-Dove.
Common in parts.

1307. TURTUR SURATENSIS.—The Spotted Dove.
Common.

1312. MACROPYGIA TUSALIA.—The Bar-tailed Cuckoo-Dove.
Rare.

ORDER GALLINÆ.

Family PHASIANIDÆ.

1324. PAVO CRISTATUS.—The Common Peafowl.
Formerly very common, now rare.

1327. POLYPLECTRUM CHINQUIS.—The Grey Peacock-Pheasant.
Common in suitable parts. This bird keeps so much to dense scrub jungle in ravines and evergreen forests and is so shy that it appears to be much more rare than it really is.

1328. GALLUS FERRUGINEUS.—The Red Jungle-fowl.
Common.

1339. GENNÆUS HORSFIELDI.—The Black-breasted Kalij Pheasant.
Common. The birds of these parts seem very small compared with North Cachar specimens, but a series is necessary for comparison.

1352. BAMBUSICOLA FYTCHII.—The Western Bamboo-Partridge.
Common.

1354. EXCALFACTORIA CHINENSIS.—The Blue-breasted Quail.
Fairly common. This little quail is sometimes trapped and kept in confinement by the Khasias; it appears to be very readily tamed.

1365. ARBORICOLA ATRIGULARIS.—The White-cheeked Hill-Partridge.
Fairly common. Other species of Wood-partridge will probably also be found here.

1372. FRANCOLINUS VULGARIS.—The Black Partridge.
Common near the Kopili. I have specimens here taken in Shillong which

would appear almost to be a different species, the female having all the rufous of the lower parts replaced with pure white.

1376. FRANCOLINUS GULARIS.—The Swamp-Partridge.

Common at the foot of the Hills.

ORDER HEMIPODII.

Family TURNICIDÆ.

1382. TURNIX PUGNAX.—The Bustard-Quail.

Very common.

1383. TURNIX DUSSUMIERI.—The Little Button-Quail.

Recorded.

ORDER GRALLÆ.

Family RALLIDÆ.

1389. HYPOTÆNIDIA STRIATA.—The Blue-breasted Banded Rail.

Common. Ascends to any height provided there is water for it.

1398. AMAURORNIS FUSCUS.—The Ruddy Crake.

Common, ascends to the highest peaks.

1399. AMAURORNIS BICOLOR.—Elwes's Crake.

I have taken two specimens, both males, trapped on their eggs.

1401. AMAURORNIS PHŒNICURUS.—The White-breasted Water-hen.

Common.

1402. GALLINULA CHLOROPUS.—Moorhen.

I saw two of these birds at Nongpoh.

1403. GALLICREX CINEREA.—The Water-Cock.

Common at the foot of the hills.

1404. PORPHYRIO POLIOCEPHALUS.—The Purple Moorhen.

Common at the foot of the hills.

1405. FULICA ATRA.—The Coot.

Common at the foot of the hills.

ORDER LIMICOLÆ.

Family ŒDICNEMIDÆ.

1418. ŒDICNEMUS SCOLOPAX.—The Stone-Curlew.

Ascends some way up the streams but it is not a hill bird by preference.

Family GLAREOLIDÆ.

1427. GLAREOLA LACTEA.—The Small Indian Pratincole.

Occasionally comes up the streams in search of food but never breeds in the district.

Family PARRIDÆ.

1428. METOPIDIUS INDICUS.—The Bronze-winged Jacana.

Innumerable near the plains of Sylhet and is found on suitable pieces of water up to 3,000 feet elevation.

1429. HYDROPHASIANUS CHIRURGUS.—The Pheasant-tailed Jacana.

Same as the last but does not ascend the Hills as high.

Family CHARADRIIDÆ.

1431. SARCOGRAMMUS INDICUS.—The Red-wattled Lapwing.

Common on the Kopili, where it breeds in some numbers in February and early March.

1435. HOPLOPTERUS VENTRALIS.—The Indian Spur-winged Plover.

Common on the Kopili. This is a most annoying bird when shooting on rivers as it keeps a few hundred yards ahead of the sportsman warning all game of his approach.

1447. ÆGIALITIS DUBIA.—The Little Ringed Plover.

A rare visitor.

1449. ÆGIALITIS PLACIDA.—The Long-billed Ringed Plover.

Even more rare.

1451. HIMANTOPUS CANDIDUS.—The Black-winged Stilt.

Common on the Kopili, on which stream I am sure it breeds, as I have shot it there in June and May.

Sub-family TOTANINÆ.

1460. TOTANUS HYPOLEUCUS.—The Common Sandpiper.

All Totanidæ are winter visitors except the last two.

1461. TOTANUS GLAREOLA.—The Wood Sandpiper.

1463. TOTANUS STAGNATILIS.—The Marsh Sandpiper.

1466. TOTANUS GLOTTIS.—The Greenshank.

1468. PAVONCELLA PUGNAX.—The Ruff and Reeve.

1471. TRINGA MINUTA.—The Little Stint.

1474. TRINGA TEMMINCKI.—Temminck's Stint.

1482. SCOLOPAX RUSTICULA.—The Woodcock.

This is the great game bird of these Hills during the cold weather, but they come in no great numbers, and four birds to one gun is a good day's work but seldom obtained. They come in October and the last birds leave again by the end of March.

1484. GALLINAGO CŒLESTIS.—The Common Snipe.

The Fantail or Common Snipe is perhaps less numerous than the Pintail.

1485. GALLINAGO STENURA.—The Pintail Snipe.

May be shot up to 5,500 feet in some numbers.

1486. GALLINAGO SOLITARIA.—The Himalayan Solitary Snipe.

Resident. A very rare bird; a few are shot and mistaken for small Woodcock.

1488. ROSTRATULA CAPENSIS.—The Painted Snipe.

Resident. This bird does not ascend the Hills to any height.

ORDER GAVIÆ.

Family LARIDÆ.

1491. LARUS BRUNNEICEPHALUS.—The Brown-headed Gull.

Rare on the Kopili.

1503. STERNA SEENA.—The Indian River-Tern.

Rarely ascends hill streams.

1504. STERNA MELANOGASTER.—The Black-bellied Tern.

Rarely ascends hill streams.

ORDER STEGANOPODES.

Family PHALACROCORACIDÆ.

1526. PHALACROCORAX CARBO.—The Large Cormorant.

Not common.

1527. PHALACROCORAX FUSCICOLLIS.—The Indian Shag.

Fairly common.

1528. PHALACROCORAX JAVANICUS.—The Little Cormorant.

Common. Both these and the next go as far up the streams as they can get fish, and this bird may even be seen sometimes on the lake in Shillong.

1529. PLOTUS MELANOGASTER.—The Snake-bird.

Common.

ORDER HERODIONES.

Family ARDEIDÆ.

1554. ARDEA MANILLENSIS.—The Eastern Purple Heron.

Rare. In the higher Hills the streams have no fish and very little insect or reptile life to form food for these birds.

1555. ARDEA CINEREA.—The Common Heron.

Rare. A single bird may sometimes be seen on the Shillong race-course which is well over 4,000 feet.

1558. ARDEA GOLIATH.—The Giant Heron.

Observed by Jerdon.

1561. HERODIAS GARZETTA.—The Little Egret.

Rare.

1562. BUBULCUS CORONANDUS.—The Cattle Egret.

Common.

1565. ARDEOLA GRAYI.—The Pond Heron.

Common. Is found as high as 5,000 feet.

1567. BUTORIDES JAVANICA.—The Little Green Heron.

Not rare. Ascends up to about 2,000 feet elevation. Is very common on the Kopili.

1568. NYCTICORAX GRISEUS.—The Night Heron.

I have heard this bird repeatedly, but never seen it. It occurs in Shillong.

1572. ARDETTA CINNAMOMEA.—The Chestnut Bittern.

Not rare, and ascends to a considerable height, to wherever there are suitable ponds or swampy places.

1573. DUPETOR FLAVICOLLIS.—The Black Bittern.

Common near Sylhet.

ORDER ANSERES.

Family ANATIDÆ.

The Ducks recorded are very few, but numerous other species are certain to pass through on migration.

1589. DENDROCYCNA JAVANICA.—The Whistling Teal.
Common near the plains.

1591. NETTOPUS COROMANDELIANUS.—The Cotton Teal.
Common near the plains.

1602. SPATULA CLYPEATA.—The Shoveller.
I shot one of these on the Kopili.

1606. NYROCA FERRUGINEA.—The White-eyed Duck.
Common. Comes up all the bigger streams in great numbers. On these it seems to live entirely on fish and is therefore quite uneatable.

## ORDER PYGOPODES.

### Family PODICIPEDIDÆ.

1617. PODICIPES ALBIPENNIS.—The Indian Little Gube or Dabchick.
Common. Ascends to the highest peaks as long as there is any still water obtainable and breeds at all ranges.

# DESCRIPTIONS OF INDIAN MICRO-LEPIDOPTERA.

BY

E. MEYRICK, B.A., F.R.S., F.E.S.

## IV.

(*Continued from page* 754 *of this Volume.*)

### EPIBLEMIDÆ.

*Lobesia eolopa*, n. sp.

♂ ♀. 10-12 mm. Head and thorax ochreous mixed with brown. Abdomen dark grey. Forewings elongate, narrow at base, gradually dilated, costa slightly arched, apex obtuse, termen slightly rounded, oblique; pale ochreous, with a few scattered blackish strigulæ; costa strigulated with blackish; basal patch irregularly suffused with brown sprinkled with blackish, outer edge obtusely angulated in middle, followed on dorsum by a dark grey triangular blotch reaching more than half across wing; central fascia brown, mixed with blackish on upper half, posterior edge with a large irregular prominence below middle; a small dark fuscous spot on costa at ⅔, surrounded with some brown suffusion; a more or less defined triangular spot of dark grey suffusion on dorsum before tornus, whence an irregular line of blackish-grey scales proceeds towards costa; a suboval brown transverse blotch resting on lower half of termen; a small brown apical spot: cilia pale ochreous, with a brown basal line. Hindwings dark grey, in ♂ thinly scaled throughout, in ♀ towards base only; cilia grey, with darker basal line.

Ten specimens, Maskeliya and Peradeniya, Ceylon; Bombay; from November to May (Pole, Green, Young). Closely related and similar to the European *L. permixtana*, but in that species the ♂ has white hindwings. Veins 3 and 4 of hindwings appear to be connate in ♂ but closely approximated in ♀.

*Articolla*, n. g.

Antennæ in ♂ simple. Palpi moderate, porrected, densely scaled. Thorax with posterior crest. Posterior tibiæ clothed with rough projecting scales above and beneath. Forewings with small tufts of raised scales; 8 and 9 stalked. Hindwings with 3 and 4 stalked, 5 approximated, 6 and 7 stalked.

Allied to *Platypeplus*, from which it differs by the stalking of 8 and 9 of forewings.

*Articolla cyclidias*, n. sp.

♂. 13-14 mm. Head and palpi dark grey, crown light ochreous or reddish. Thorax fuscous, dorsally more or less ochreous, sides dark fuscous. Abdomen dark grey, anal tuft whitish-ochreous. Forewings elongate-triangular, costa gently arched, apex obtuse, termen slightly rounded, rather oblique; dark fuscous, sprinkled with blackish; a narrow patch of pale ochreous suffusion on dorsum from ⅓ to beyond middle; a large roundish ochreous-whitish blotch occupying apical ⅓ of wing, containing a central spot of ochreous suffusion,

costal and terminal edges with some dark fuscous dots : cilia dark fuscous mixed with ferruginous, with a blackish basal line. Hindwings and cilia dark grey.

Three specimens, Maskeliya, Peradeniya, and Matale, Ceylon, in October, January, and April (Pole, de Mowbray, Green).

*Eucosma cerographa*, n. sp.

♂. 10-12 mm. Head and palpi pale yellowish-ochreous. Thorax pale ochreous mixed with blackish. Abdomen dark grey, apex pale ochreous. Forewings elongate, moderate, posteriorly somewhat dilated, costa gently arched, apex obtuse, termen slightly rounded, oblique ; light yellowish-ochreous, with several pairs of irregular glistening ochreous-whitish transverse striæ, enclosing a few fine scattered black scales, and separated on costa by small blackish spots and strigulæ ; basal patch ill-defined, blackish, with acute angular projections on costa and dorsum and in middle ; central fascia represented by a subquadrate blackish spot on middle of costa, and a group of undefined blackish marks before tornus ; cilia pale yellowish-ochreous, with a blackish apical patch. Hindwings and cilia dark grey.

Eight specimens, Maskeliya, Ceylon, in March and April (Pole).

TORTRICIDÆ.

*Cacoecia cumulata*, n. sp.

♂ ♀. 11-15 mm. Head, palpi, and thorax brown-reddish sprinkled with whitish-ochreous. Abdomen grey. Forewings suboblong, costa anteriorly strongly arched, prominent and dilated with rough scales in middle, concave on posterior half, apex obtuse, termen vertical, rounded beneath ; brown-reddish, with some scattered blackish scales, and several oblique irregular transverse whitish-ochreous striæ : cilia whitish-ochreous, with a brown-reddish line. Hindwings and cilia grey, in ♀ darker ; 3 and 4 stalked.

Twenty specimens, Maskeliya, Madulsima, Kadugannawa, Ceylon ; Coorg (3,500 feet) ; from February to May, and in August and September (Pole, de Mowbray, Green, Vaughan, Newcome).

*Epagoge probolias*, n. sp.

♂ ♀. 10-14 mm. Head and thorax whitish-ochreous, partially tinged with brownish-ochreous. Palpi pale ochreous, more or less infuscated basally, second joint broadly rough-scaled above and beneath. Forewings elongate, costa gently arched, apex obtuse, termen faintly sinuate, oblique ; whitish-ochreous, more or less strigulated with brownish or fuscous ; markings ochreous-fuscous ; basal patch indicated chiefly by an oblique transverse spot from dorsum near base, reaching half across wing ; central fascia entire, oblique, nearly of equal width throughout, posterior edge suffused on lower half, often followed in middle by a distinct dark fuscous or black dot ; costal patch semioval : cilia whitish-ochreous, with a fuscous line. Hindwings pale grey, strigulated with darker ; cilia grey-whitish, with a grey shade.

Fifteen specimens, Maskeliya, Ceylon ; Travancore, Palni Hills (6,000 feet), Coorg (3,500 feet) ; from January to April, and in September (Pole, de Mowbray, Campbell, Newcome).

*Drachmobola* n. g.

Antennæ in ♂ shortly ciliated. Palpi moderate, porrected, second joint rough-scaled beneath. Forewings with tufts of scales on surface, and dorsal projecting tufts; 7 to termen, 8 and 9 out of 7. Hindwings with 3 and 4 connate, 5 approximated, 6 and 7 stalked.

Allied to *Epagoge* and to the following genus.

*Drachmobola periastra*, n. sp.

♂♀. 12-13 mm. Head, thorax, and abdomen whitish-ochreous. Palpi ochreous-whitish. Forewings elongate-oblong, costa moderately arched, apex round-pointed, termen concave, little oblique; pale ochreous, more or less strigulated with deeper ochreous; basal patch, central fascia, and a narrow terminal fascia more or less obscurely indicated by undefined deeper yellow-ochreous suffusion; about twenty scattered variable small silvery-metallic spots, mostly arranged along dorsum and in four irregular curved or bent transverse series; sometimes a large tornal patch of rather dark fuscous suffusion: cilia pale ochreous, suffused with brownish-ochreous towards tornus. Hindwings ochreous-whitish, posterior half suffused with pale fuscous and strigulated with darker; a patch of ferruginous-ochreous suffusion on tornus, containing three small silvery-metallic spots and sometimes partly suffused with dark fuscous.

Fifteen specimens, Khasi Hills, in June.

*Spatalistis* n. g.

Antennæ in ♂ simple. Palpi moderately long, porrected, second joint rough-scaled above and beneath. Forewings with tufts of scales on surface, in ♂ sometimes with expansible brush of hairs from towards costa anteriorly, but without membranous fold; 3 and 4 stalked, 7 to termen. Hindwings with 3 and 4 stalked, 5 approximated, 6 and 7 closely approximated towards base.

Type *S. rhavica*.

*Spatalistis paryphæa*, n. sp.

♂♀. 14-17 mm. Head and thorax pale yellowish, mixed with ferruginous-orange, in ♀ sometimes partly infuscated. Palpi pale ferruginous. Abdomen whitish ochreous, in ♀ more or less greyish-suffused. Forewings elongate-oblong, costa gently arched, apex pointed, termen concave, rather oblique, in ♂ with expansible brush of hairs towards costa anteriorly; ferruginous-reddish, somewhat mixed with pale yellowish towards dorsal half posteriorly, suffused with fuscous on basal half and along costa posteriorly and termen, and sometimes wholly except a small round yellow spot in disc at ⅔; oblique striæ of purplish-leaden suffusion, seldom forming distinct spots and alternating with incomplete series of dots of blackish raised scales: cilia pale yellow, on costa and dorsum ferruginous, at tornus suffused with grey. Hindwings pale greyish-ochreous, anteriorly semitransparent, apex suffused with fuscous; cilia whitish-ochreous, more brownish-tinged towards base.

Eight specimens, Khasi Hills, in June.

*Spatalistis cyanoxantha*, n. sp.

♂♀. 8-10 mm. Head and palpi orange-yellow. Thorax orange suffused with brown. Abdomen grey. Forewings elongate-oblong, costa gently arched, apex round-pointed, termen concave, oblique; orange strigulated with darker, suffused with fuscous except towards costa and termen; two spots at base and four angulated transverse series of about four rounded leaden-blue-metallic spots each, alternating with some small blackish tufts; some pale golden metallic dots on posterior half of costa and termen: cilia clear yellow, beneath tornus orange becoming fuscous on dorsum. Hindwings rather dark grey; cilia grey, round apex and upper half of termen whitish-yellowish.

Three specimens, Maskeliya, Ceylon, from April to June (de Mowbray, Pole).

*Spatalistis hormota*, n. sp.

♂♀. 15-17 mm. Head, palpi, and thorax light ochreous-yellowish. Abdomen whitish-ochreous. Forewings oblong, costa moderately arched, apex round-pointed, termen concave, rather oblique; light ochreous-yellowish, finely strigulated with deeper ochreous; a slender slightly incurved deep yellow-ochreous streak, sometimes sprinkled with a few dark fuscous points, from apex of wing to $\frac{2}{3}$ of dorsum, continued along dorsum to near base: cilia pale whitish-yellow, with traces of an ochreous line. Hindwings whitish-ochreous, posteriorly broadly suffused with fuscous-ochreous, apex more fuscous; cilia whitish-ochreous, round apex and upper part of termen whitish-yellowish.

Twenty specimens, Khasi Hills, in June and July.

*Spatalistis rhopica*, n. sp.

♂♀. 14-16 mm. Head, palpi and thorax light yellowish. Abdomen grey. Forewings suboblong, costa moderately arched, apex round-pointed, termen concave, rather oblique; pale yellowish, finely strigulated with light ochreous; about seven oblique transverse series of silvery-metallic dots; small discal tufts above middle at $\frac{1}{3}$ and $\frac{2}{3}$, sometimes tipped with dark ferruginous-fuscous; often a large deep ferruginous semiovate blotch extending along dorsum from $\frac{1}{3}$ to beyond tornus, posteriorly reaching more than half across wing and with an oblique projection inwards, but this blotch is sometimes wholly absent: cilia whitish-yellowish, at tornus sometimes ferruginous or dark grey. Hindwings whitish-fuscous or grey, posteriorly more or less suffused with brown or dark fuscous; cilia grey, round apex and upper half of termen whitish-yellowish, basal half more or less ferruginous-tinged.

Fifteen specimens, Khasi Hills, in June.

*Diactenis*, n. g.

Antennæ in ♂ moderately ciliated. Palpi moderate, porrected, second joint above with rough projecting scales diminishing to apex. Forewings with raised scales on surface; 1b simple, 3 and 4 closely approximated from angle, 7 to termen, cell in ♂ very short and narrow. Hindwings $\frac{1}{2}$, cilia $1\frac{1}{2}$; 3 and 4 separate, cell open between 4 and 6, 4 and 5 rising as branches of parting-vein from near base, 6 and 7 as branches of upper margin of cell from before middle.

Apparently allied to *Tortrix*, but the narrow hindwings with long cilia, the reduction in the cell and consequent increase in length of veins, and the curious scale-distribution make it seem abnormal.

*Diactenis pteroneura*, n. sp.

♂ ♀. 8-10 mm. Head and thorax ochreous-white, more or less tinged with yellow-ochreous. Abdomen grey, apex whitish-ochreous. Forewings suboblong, costa moderately arched, more strongly in ♂, apex obtuse-pointed, termen obliquely rounded; whitish-ochreous, pellucid between veins except towards margins, veins fringed with ochreous and dark fuscous scales; a more or less developed suffused spot of ochreous and blackish scales on or towards dorsum at ⅓; upper half of central fascia more or less defined, ochreous, suffused with blackish on costa; a more or less indicated curved transverse series of blackish specks in disc posteriorly; costa posteriorly sometimes dotted with dark fuscous: cilia whitish-ochreous, on costa mixed with dark fuscous. Hindwings pellucid, veins fringed with whitish and grey scales, apex and termen more or less suffused with grey; cilia ochreous-whitish.

Ten specimens, Maskeliya and Madulsima, Ceylon; Coorg (3,500 feet); from February to October (Pole, Vaughan, Newcome).

*Paratorna*, n. g.

Antennæ in ♂ minutely ciliated. Palpi moderate, second joint curved, ascending, with tolerably appressed scales, terminal joint moderate, oblique. Anterior tibiæ and tarsi very short, stout. Forewings with tufts of raised scales, apex obliquely rounded and termen prominent, so that apparent apex is on vein 5. Hindwings with 3 and 4 stalked, 5 approximated, 6 and 7 closely approximated towards base.

Related to *Oxygrapha*.

*Paratorna dorcas*, n. sp.

♂ ♀. 12-16 mm. Head and thorax reddish-brown. Abdomen dark fuscous. Forewings elongate, costa strongly arched throughout in a continuous even curve from base almost to tornus, somewhat roughened with scales towards middle; varying from pale whitish-fuscous to dark red-brown, more or less strigulated with ferruginous or variably mottled with reddish-fuscous, always with a dark reddish-fuscous streak along costa throughout from base to tornus; sometimes a thick dark fuscous streak along dorsum, or a large dark fuscous rounded dorsal blotch extending from base to tornus and reaching more than half across wing; sometimes some scattered silvery-white dots, a transverse silvery-white mark in disc before middle, and an oblique mark before apex, apparently only in ♂; sometimes several dots of raised black scales in disc: costal cilia ferruginous-orange throughout from base to apparent apex, beneath this fuscous. Hindwings dark fuscous; cilia grey, base darker, round apex whitish or orange-tinged.

Eighteen specimens, Khasi Hills, in June. This is a highly variable species, but easily recognised.

PHALONIADÆ.

*Meridarchis bryodes*, n. sp.

♂♀. 19-21 mm. Head and thorax whitish tinged with green, and somewhat sprinkled with grey. Palpi white, basal and lower half of second joint blackish-grey. Abdomen grey. Forewings elongate, rather narrow, somewhat dilated, costa slightly arched, apex obtuse, termen slightly rounded, rather oblique; green-whitish, sprinkled with dark grey; costa and termen dotted with blackish; a blackish transverse bar on end of cell, parallel to termen; a spot of dark grey suffusion on dorsum towards tornus; an irregular ill-defined subterminal line of dark grey suffusion from $\frac{2}{3}$ of costa to tornus: cilia grey barred with whitish. Hindwings and cilia light grey.

Two specimens, Khasi Hills, in June.

GELECHIADÆ.

*Ypsolophus ochrophanes*, n. sp.

♂♀. 11-13 mm. Head and thorax light ochreous-yellow, crown centrally greyish-tinged. Palpi blackish-grey sprinkled with whitish, tuft long, terminal joint ochreous-whitish, anterior edge blackish. Antennæ whitish-ochreous, ringed with blackish. Abdomen grey. Forewings elongate, narrow, costa moderately arched, apex round-pointed, termen very obliquely rounded; ochreous-yellow; dorsal half of wing, a patch on costa beyond middle, a cloudy subterminal line, and a streak along termen more or less irrorated with fuscous, sometimes largely suffused together; discal stigmata blackish: cilia ochreous-yellowish. Hindwings light grey, veins dark grey; cilia whitish-grey.

Seven specimens, Ambulangoda and Puttalam, Ceylon; Pusa, Bengal; from August to November (Pole, Maxwell-Lefroy).

*Ypsolophus eridantis*, n. sp.

♂♀. 17-20 mm. Head and thorax ochreous-whitish irrorated with light fuscous, thorax sometimes partially suffused with rather dark fuscous. Palpi dark fuscous sprinkled with whitish, tuft long, terminal joint white with three black lines. Antennæ pale greyish-ochreous dotted with dark fuscous. Abdomen whitish-ochreous irrorated with fuscous. Forewings elongate, rather narrow, slightly dilated, costa gently arched, apex obtuse, termen hardly sinuate, oblique; light greyish-ochreous irrorated with fuscous and sometimes a few blackish scales, sometimes yellowish-tinged; costa obliquely strigulated with blackish from base to beyond middle; stigmata formed by blackish irroration, plical beneath first discal, usually also an additional dot in disc at $\frac{1}{4}$, and sometimes one beneath second discal; a row of blackish dots along posterior part of costa and termen: cilia greyish-ochreous, with an antemedian blackish interrupted line. Hindwings grey, darker posteriorly; cilia light ochreous-grey.

Seven specimens, Pusa, Bengal, in April and May (Maxwell-Lefroy).

STENOMIDÆ.

*Agriophara rhombota*, n. sp.

♂♀. 28-38 mm. Head and thorax pale whitish-ochreous with a few dark fuscous specks. Palpi whitish-ochreous, towards base dark grey. Antennæ

Apparently allied to *Tortrix*, but the narrow hindwings with long cilia, the reduction in the cell and consequent increase in length of veins, and the curious scale-distribution make it seem abnormal.

*Diactenis pteroneura*, n. sp.

♂♀. 8-10 mm. Head and thorax ochreous-white, more or less tinged with yellow-ochreous. Abdomen grey, apex whitish-ochreous. Forewings suboblong, costa moderately arched, more strongly in ♂, apex obtuse-pointed, termen obliquely rounded; whitish-ochreous, pellucid between veins except towards margins, veins fringed with ochreous and dark fuscous scales; a more or less developed suffused spot of ochreous and blackish scales on or towards dorsum at ¼; upper half of central fascia more or less defined, ochreous, suffused with blackish on costa; a more or less indicated curved transverse series of blackish specks in disc posteriorly; costa posteriorly sometimes dotted with dark fuscous: cilia whitish-ochreous, on costa mixed with dark fuscous. Hindwings pellucid, veins fringed with whitish and grey scales, apex and termen more or less suffused with grey; cilia ochreous-whitish.

Ten specimens, Maskeliya and Madulsima, Ceylon; Coorg (3,500 feet); from February to October (Pole, Vaughan, Newcome).

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Antennæ in ♂ minutely ciliated. Palpi moderate, second joint curved, ascending, with tolerably appressed scales, terminal joint moderate, oblique. Anterior tibiæ and tarsi very short, stout. Forewings with tufts of raised scales, apex obliquely rounded and termen prominent, so that apparent apex is on vein 3. Hindwings with 3 and 4 stalked, 5 approximated, 6 and 7 closely approximated towards base.

Related to *Oxygrapha*.

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♂♀. 12-16 mm. Head and thorax reddish-brown. Abdomen dark fuscous. Forewings elongate, costa strongly arched throughout in a continuous even curve from base almost to tornus, somewhat roughened with scales towards middle; varying from pale whitish-fuscous to dark red-brown, more or less strigulated with ferruginous or variably mottled with reddish-fuscous, always with a dark reddish-fuscous streak along costa throughout from base to tornus; sometimes a thick dark fuscous streak along dorsum, or a large dark fuscous rounded dorsal blotch extending from base to tornus and reaching more than half across wing; sometimes some scattered silvery-white dots, a transverse silvery-white mark in disc before middle, and an oblique mark before apex, apparently only in ♂; sometimes several dots of raised black scales in disc: costal cilia ferruginous-orange throughout from base to apparent apex, beneath this fuscous. Hindwings dark fuscous; cilia grey, base darker, round apex whitish or orange-tinged.

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Two specimens, Khasi Hills, in June.

GELECHIADÆ.

*Ypsolophus ochrophanes*, n. sp.

♂♀. 11-13 mm. Head and thorax light ochreous-yellow, crown centrally greyish-tinged. Palpi blackish-grey sprinkled with whitish, tuft long, terminal joint ochreous-whitish, anterior edge blackish. Antennæ whitish-ochreous, ringed with blackish. Abdomen grey. Forewings elongate, narrow, costa moderately arched, apex round-pointed, termen very obliquely rounded; ochreous-yellow; dorsal half of wing, a patch on costa beyond middle, a cloudy subterminal line, and a streak along termen more or less irrorated with fuscous, sometimes largely suffused together; discal stigmata blackish: cilia ochreous-yellowish. Hindwings light grey, veins dark grey; cilia whitish-grey.

Seven specimens, Ambulangoda and Puttalam, Ceylon; Pusa, Bengal; from August to November (Pole, Maxwell-Lefroy).

*Ypsolophus eridantis*, n. sp.

♂♀. 17-20 mm. Head and thorax ochreous-whitish irrorated with light fuscous, thorax sometimes partially suffused with rather dark fuscous. Palpi dark fuscous sprinkled with whitish, tuft long, terminal joint white with three black lines. Antennæ pale greyish-ochreous dotted with dark fuscous. Abdomen whitish-ochreous irrorated with fuscous. Forewings elongate, rather narrow, slightly dilated, costa gently arched, apex obtuse, termen hardly sinuate, oblique; light greyish-ochreous irrorated with fuscous and sometimes a few blackish scales, sometimes yellowish-tinged; costa obliquely strigulated with blackish from base to beyond middle; stigmata formed by blackish irroration, plical beneath first discal, usually also an additional dot in disc at $\frac{1}{4}$, and sometimes one beneath second discal; a row of blackish dots along posterior part of costa and termen: cilia greyish-ochreous, with an antemedian blackish interrupted line. Hindwings grey, darker posteriorly; cilia light ochreous-grey.

Seven specimens, Pusa, Bengal, in April and May (Maxwell-Lefroy).

STENOMIDÆ.

*Agriophara rhombota*, n. sp.

♂♀. 28-38 mm. Head and thorax pale whitish-ochreous with a few dark fuscous specks. Palpi whitish-ochreous, towards base dark grey. Antennæ

light greyish-ochreous. Abdomen pale whitish-ochreous. Forewings elongate, costa gently arched, apex obtuse, termen hardly rounded, little oblique ; pale whitish-ochreous, with scattered dark grey specks ; an ill-defined longitudinal streak of dark grey suffusion from base of costa through middle of disc to $\frac{3}{4}$ ; three angulated transverse lines of grey suffusion, first two little defined and often reduced to costal marks, third usually distinct, running from $\frac{3}{4}$ of costa to dorsum before tornus, strongly curved or bent ; plical and second discal stigmata blackish, plical linear, second discal often transverse ; a series of blackish dots along posterior part of costa and termen : cilia pale whitish-ochreous, with grey subbasal shade. Hindwings ochreous-grey-whitish, towards tornus sprinkled with grey ; cilia grey-whitish, with dark grey subbasal shade.

Fourteen specimens, Khasi Hills and Silchar, Assam, from June to August (Antram). Larva yellowish-red, sides yellow-orange ; subdorsal stripe broad, blackish ; head and 2 black ; feeds between spun leaves of the tea-bush, and when foliage is stripped will attack the bark, doing great damage (Antram).

ELACHISTIDÆ.

*Batrachedra psilopa*, n. sp.

♂♀. 8-10 mm. Head pale whitish-ochreous. Palpi whitish-ochreous, second joint with two rings, and terminal joint with two broad bands of blackish irroration. Antennæ whitish-ochreous ringed with fuscous. Thorax whitish-ochreous sprinkled with dark grey. Abdomen whitish-ochreous. Forewings very elongate, extremely narrow, rather short-pointed ; pale ochreous, more or less evenly sprinkled with fuscous or dark fuscous ; plical stigma elongate, blackish ; several more or less indicated blackish dots on posterior part of costa and termen : cilia pale greyish-ochreous. Hindwings ochreous-grey ; cilia pale greyish-ochreous.

Seven specimens, Maskeliya, Ceylon, from February to July (Pole).

*Rhadinastis phœnicopa*, n. sp.

♂♀. 16-18 mm. Head, palpi and thorax reddish-ochreous. Antennæ dark fuscous, basal joint reddish-ochreous. Abdomen dark fuscous. Forewings narrow-lanceolate ; dark purplish-fuscous ; extreme base reddish-ochreous ; cilia dark fuscous. Hindwings and cilia dark fuscous.

Three specimens, Maskeliya, Ceylon, in July, November, and December (Pole)

*Stathmopoda antidelta*, n. sp.

♂♀. 7-10 mm. Head and thorax dark shining purplish-bronze, face shining whitish-bronze. Palpi pale yellowish, anterior edge of terminal joint dark fuscous. Antennæ grey, basal joint yellowish. Abdomen dark bronze, segmental margins grey, on sides white, beneath wholly silvery-white. Posterior tibiæ and tarsi blackish banded with white, above tufted with rough scales and bristles. Forewings elongate, narrow, widest at $\frac{1}{3}$, thence narrowed to pointed apex ; dark purplish-bronze-fuscous ; two whitish-ochreous or pale ochreous-yellowish spots, first on dorsum before middle, subquadrate, reaching more than half across wing, second on costa at $\frac{2}{3}$, triangular, nearly reaching tornus : cilia dark bronzy-fuscous. Hindwings and cilia dark bronzy-fuscous.

Seven specimens, Maskeliya and Puttalam, Ceylon, in February, March and June (Pole).

*Aeloscelis trilozias*, n. sp.

♂ ♀. 9-12 mm. Head prismatic shining ochreous-whitish, crown ochreous-yellow. Palpi whitish-yellow, second joint sometimes with some blackish scales. Antennæ whitish ringed with fuscous. Thorax yellow-ochreous or orange, sometimes irrorated with blackish-grey. Abdomen greyish-ochreous tinged with orange. Posterior tibiæ with expansible whorls of long bristles. Forewings narrow-lanceolate ; ochreous-orange, usually partially and sometimes largely suffused with grey ; three slender oblique white streaks, more or less margined beneath or posteriorly with dark grey suffusion, first from before $\frac{1}{4}$ of costa to $\frac{1}{3}$ of dorsum, second from $\frac{2}{3}$ of costa to near dorsum at $\frac{2}{3}$, third curved downwards, from beneath costa about $\frac{3}{4}$ to costa almost at apex : cilia ochreous-orange, becoming paler and fuscous-tinged towards tornus. Hindwings grey ; cilia pale greyish-ochreous.

Twelve specimens, Maskeliya, Ceylon, in February, April, June and July (Pole). I note that *Aeloscelis theoris*, Meyr., is however properly referable to *Stathmopoda*.

PLUTELLIDÆ.

*Gracilaria zachrysa*, n. sp.

♂ ♀. 14-15 mm. Head and thorax deep purple, face silvery-white. Palpi whitish, spotted beneath with ferruginous, apical half of terminal joint dark fuscous. Antennæ whitish-grey ringed with dark grey. Abdomen dark grey. Middle tibiæ thickened with purple scales, tarsi white dotted with ferruginous. Forewings very narrow, parallel-sided, pointed, acute ; ferruginous-ochreous, along dorsum strigulated with deep purple, elsewhere suffused with bright deep purple ; a bright yellow patch along costa from $\frac{1}{4}$ to near apex, reaching more than half across wing, lower edge with triangular deep purple indentation about middle of wing, costa with a few fine blackish dots : cilia dark grey. Hindwings and cilia dark grey.

Five specimens, Maskeliya, Ceylon, from March to June (Pole).

*Gracilaria prismatica*, n. sp.

♂ ♀. 13-15 mm. Head and thorax greyish-ochreous, mixed with dark grey, face prismatic. Palpi greyish-ochreous, suffusedly irrorated with dark fuscous. Antennæ greyish-ochreous ringed with dark grey. Abdomen dark grey, beneath shining whitish-ochreous. Middle tibiæ greyish-ochreous irrorated with blackish, thickened and tufted beneath, tarsi white. Forewings sublinear, gradually pointed ; dark greyish-ochreous, with prismatic violet or blue reflections, strewn with numerous small fine blackish dots or strigulæ in longitudinal series ; larger blackish dots above dorsum before middle, and on costa in middle ; apex mottled with blackish : cilia grey, round apex with several rows of black points. Hindwings and cilia grey.

Six specimens, Maskeliya and Kandy, Ceylon, in May, June and September (Pole, de Mowbray, Green).

*Gracilaria syrphetias*, n. sp.

♂♀. 14-15 mm. Head and thorax light metallic greyish-bronze, face paler. Palpi pale ochreous, suffusedly banded with blackish irroration. Antennæ pale ochreous ringed with blackish. Abodmen shining dark grey, apex whitish-ochreous. Middle tibiæ bronzy-grey, thickened above with blackish scales, tarsi ochreous-whitish. Forewings sublinear, parallel-sided, moderately pointed; ochreous, densely and irregularly strigulated and mottled throughout with dark purple-fuscous: cilia dark grey, round apex with rows of blackish points. Hindwings and ciiia dark grey.

Four specimens, Maskeliya, Ceylon, in July and October (Pole). Very similar to the Australian *G. euryonema*, but darker and much narrower-winged, and without the long hairpencils beside abdomen.

*Argyresthia icterias*, n. sp.

♂♀. 8-10 mm. Head white, face tinged with ochreous-yellowish. Palpi light ochreous. Antennæ whitish-ochreous ringed with blackish. Thorax white, patagia golden-bronze. Abdomen pale silvery-grey. Forewings narrow, elongate-lanceolate; 7 and 8 separate; whitish-brown, tinged with coppery-purplish, darker towards base, strigulated throughout with dark fuscous; an irregular attenuated white streak along dorsum to tornus, in ♀ little defined and suffused into ground colour, strigulated with dark fuscous, interrupted opposite middle of wing by a subquadrate dark fuscous spot; sometimes some irregular white marks along termen, and dots on costa posteriorly: cilia whitish-grey, round apex purplish-tinged and with rows of black points. Hindwings grey; cilia whitish-grey.

Sixteen specimens, Maskeliya, Ceylon, from February to June (Pole, de Mowbray).

*Xyrosaris maligya*, n. sp.

♂♀. 12-14 mm. Head, palpi, and thorax white, finely irrorated with fuscous or dark fuscous. Antennæ and abdomen grey. Forewings elongate, very narrow, gradually narrowed from before middle, apex round-pointed; light brownish, irregularly or wholly suffused with grey and whitish scales finely tipped with blackish, and strewn with minute raised black dots; indistinct spots of dark fuscous suffusion on costa and dorsum before middle, and on dorsum towards tornus; an interrupted transverse ridge of blackish scales at $\frac{2}{3}$; apex brownish with a slight reddish tinge: cilia grey, round apex with several black lines. Hindwings dark grey, basal third and cell transparent; cilia grey.

Six specimens, Maskeliya and Puttalam, Ceylon, in March, May, October and November (Pole).

*Prays peperitis*, n. sp.

♂♀. 9-14 mm. Head, palpi, and thorax pale grey, more or less mixed with dark fuscous. Antennæ dark fuscous. Abdomen dark grey, apex pale greyish-ochreous. Forewings elongate, narrow, costa gently arched, apex round-pointed, termen very obliquely rounded; 7 and 8 stalked; whitish, irrorated

and sometimes suffused with grey, and coarsely strigulated more or less closely throughout with dark fuscous or blackish: cilia grey. Hindwings rather thinly scaled, grey, becoming dark fuscous towards apex; cilia grey. Forewings beneath irregularly streaked or spotted with raised black scales towards base.

Seven specimens, Maskeliya, Ceylon, from March to May, and in October and November (Pole).

*Glyphipteryx argyromis*, n. sp.

♂ ♀. 6-7 mm. Head and thorax shining greyish-bronze. Palpi with six whorls of black white-tipped scales. Antennæ dark fuscous. Abdomen grey, beneath white. Forewings elongate, costa gently arched, apex round-pointed, termen faintly sinuate, oblique; 7 and 8 separate; shining golden-bronze; basal ⅓ occupied by a shining bluish-silvery-whitish patch, followed on dorsal half by some blackish suffusion; five bluish-silvery black-edged streaks from posterior half of costa, and two from dorsum towards tornus, nearly or quite uniting with first two costal streaks, first resulting fascia angulated, second slightly curved; a bluish-silvery dot on tornus, and one on termen beneath apex: cilia grey, with blackish basal and postmedian shades, indented beneath apex, on costal streaks spotted with white. Hindwings rather dark grey, cilia grey.

Ten specimens, Maskeliya, Ceylon, from February to April (Pole, de Mowbray.) The blue-whitish basal patch is a unique distinguishing character.

TINEIDÆ.

*Opostega euryntis*, n. sp.

♀. 7 mm. Head, palpi and thorax white. Antennæ ochreous-whitish, basal joint white. Abdomen whitish-ochreous. Forewings lanceolate; white; a broad dark fuscous transverse median band occupying more than ½ of wing, somewhat broadest on dorsum: cilia white. Hindwings and cilia pale grey.

One specimen, Coorg (3,500 feet), in June (Newcome).

*Opostega epactæa*, n. sp.

♂ ♀. 6-7 mm. Head and thorax white. Palpi and abdomen whitish ochreous. Antennæ whitish-ochreous, basal joint white. Forewings lanceolate; white; a dark grey dot on dorsum before middle of wing, sometimes faint; a more or less defined dark fuscous line along apical fourth of costa: cilia ochreous-whitish, tinged with fuscous round apex with two oblique blackish-fuscous lines in costal cilia directed forward to apex. Hindwing and cilia whitish-ochreous.

Six specimens, Maskeliya, Ceylon, in February and March (Pole).

*Opostega macharias*, n. sp.

♀. 6 mm. Head and thorax white. Palpi pale whitish-ochreous. Antennæ ochreous-whitish, basal joint white. Abdomen whitish-ochreous. Forewings lanceolate; white; a slender outwardly oblique somewhat incurved dark brown streak from middle of dorsum, reaching more than half across wing,

dilated in disc ; a dark brown line along posterior third of costa : cilia light brownish-ochreous, on costa with subbasal blackish line. Hindwings and cilia pale greyish-ochreous.

One specimen, Maskeliya, Ceylon, in March (Pole).

*Opostega atroa*, n. sp.

♂♀. 11-12 mm. Head white. Palpi whitish-ochreous. Antennæ light yellowish, basal joint white. Thorax white, with a postmedian transverse orange stripe. Abdomen whitish-ochreous. Forewings lanceolate ; shining white ; an irregular ochreous-orange streak along costa from base to apex, edged beneath with dark fuscous, more broadly posteriorly ; a variable ochreous-orange dorsal streak sometimes extending from ⅓ to tornus, sometimes reduced to a spot before middle, variably edged above with dark fuscous ; costal and dorsal streaks connected by a variable median dark fuscous fascia or line : cilia whitish-ochreous, round apex with an orange line. Hindwings and cilia whitish-ochreous.

Three specimens, Maskeliya, Ceylon, in December and January (de Mowbray; Pole).

*Opogona fumiceps*, Feld.

(*Opogona fumiceps*, Feld. Reis. Nov. pl. CXXXIX, 8.)

♂♀. 12-18 mm. Head dark fuscous, face bronzy-white. Palpi whitish. Antennæ ochreous-whitish, basal and next two or three joints dark fuscous. Thorax yellow, anterior third dark fuscous. Abdomen pale grey or greyish-ochreous. Forewings elongate-lanceolate ; bright yellow ; a thick dark fuscous streak along basal fifth of costa ; apical half beyond an irregular line from middle of costa to beyond middle of dorsum rather dark fuscous except a triangular yellow spot on costa towards apex ; small suffused dark fuscous spots beneath costa and on dorsum immediately beyond dividing line : cilia dark fuscous. Hindwings fuscous ; cilia pale fuscous.

Twelve specimens, Maskeliya, Ceylon, in February, April, May, July, November, and December (Pole, Green, Alston). This species is figured by Felder, but not described.

*Opogona trigonomis*, n. sp.

♂♀. 11-12 mm. Head and thorax dark brown, face and forehead shining whitish-bronze. Palpi whitish-fuscous. Antennæ fuscous-whitish, basal joint very long, fuscous. Abdomen bronzy-grey. Forewings lanceolate, apex somewhat produced ; yellow ; an elongate triangular dark brown spot occupying basal fifth of costa, and extending at base almost to dorsum ; apical half of wing rather dark brown, dividing line marked with a few blackish scales, straight, almost direct : cilia fuscous. Hindwings dark fuscous ; cilia fuscous.

Two specimens, Ambulangoda, Ceylon, in August (Pole).

*Opogona isoclina*, n. sp.

♂♀. 15-18 mm. Head pale bronzy, forehead and face shining ochreous-whitish. Thorax pale bronzy, becoming pale yellowish posteriorly. Palpi whitish-ochreous, externally tinged with fuscous. Antennæ pale whitish-

ochreous. Abdomen pale shining greyish-ochreous. Forewings lanceolate, apex somewhat produced ; shining brassy-yellow ; a very small purplish-fuscous spot on base of costa ; apical half pale shining purplish-bronze, with brassy reflections, its anterior edge marked with some dark fuscous scales and running obliquely from before middle of costa to dorsum near before tornus : cilia shining greyish-ochreous. Hindwings bronzy-grey ; cilia shining greyish-ochreous.

Two specimens, Palni Hills (6,000 feet), (Campbell).

*Opogona chloracma*, n. sp.

♂♀. 9-11 mm. Head and thorax dark bronzy-fuscous, forehead and face shining ochreous-whitish. Palpi whitish-ochreous, basal and second joints externally with a black streak. Antennæ ochreous-whitish. Abdomen bronzy-grey. Forewings narrow-lanceolate ; shining bronzy-fuscous, sometimes with faint purplish tinge; a small triangular whitish-ochreous apical spot, anterior edge subconcave, sometimes preceded by darker violet-fuscous suffusion ; cilia bronzy-fuscous, round apical spot whitish-ochreous. Hindwings and cilia bronzy-grey.

Sixteen specimens, Maskeliya, Ceylon, from April to September (de Mowbray Pole).

*Amathyntis*, n. g.

Head with appressed scales, side-tufts rough behind ; tongue obsolete. Antennæ $\frac{2}{3}$, in ♂ simple, basal joint moderate. Labial palpi moderately long, porrected, diverging, with appressed scales, second joint with two or three projecting lateral bristles, terminal joint shorter than second, obtuse. Maxillary palpi rather short, several-jointed, filiform. Posterior tibiæ clothed with long fine hairs. Forewings with 2 from towards angle, 7 to costa, 11 from before middle. Hindwings under 1, ovate-lanceolate, cilia $1\frac{1}{2}$ : 2-7 separate, nearly parallel.

An interesting genus which appears to form a direct connection between *Tinea* and *Opogona*.

*Amathyntis physatma*, n. sp.

♂♀. 11-12 mm. Head and thorax pale ochreous-yellowish. Palpi whitish-ochreous more or less suffused with dark fuscous externally except towards apex. Antennæ whitish-ochreous, somewhat infuscated above. Abdomen whitish-ochreous. Forewings elongate, narrow, long-pointed, acute ; glossy whitish-ochreous ; some scattered fuscous scales along fold ; an undefined longitudinal streak of fuscous irroration in posterior part of disc, expanded along termen in an undefined patch from apex to tornus : cilia pale whitish-ochreous. Hindwings and cilia ochreous-whitish.

Five specimens, Maskeliya, Ceylon, in January and February (Pole).

*Drimylastis*, n. g.

Head densely rough-haired ; tongue obsolete. Antennæ $\frac{2}{3}$, in ♂ simple, basal joint moderate, thickened with scales. Labial palpi moderate, porrected, loosely scaled, second joint with two or three long bristles, terminal

joint rather short, obtuse. Maxillary palpi long, filiform, folded. Posterior tibiæ clothed with long hairs above. Forewings with 1 b furcate, 2 from angle, 3 and 4 closely approximated at base, 7 and 8 out of 6, 7 to costa, 10 remote, 11 from ½. Hindwings 1, ovate-lanceolate, cilia 1 ; towards base a longitudinal transparent p tch in cell ; 2 remote, 3 and 4 stalked from angle, 5 absent, 6 and 7 long-stalked.

*Drimylastis telamonia*, n. sp.

♂ ♀. 10-11 mm. Head and thorax white. Palpi and antennæ dark fuscous. Abdomen grey. Forewings elongate, narrow, costa gently arched, apex round-pointed, termen extremely obliquely rounded ; white ; two small blackish marks on costa towards base ; a broad direct dark fuscous fascia rather before middle ; a small black spot on costa before ¾ ; some ochreous scales posteriorly in disc and, towards margins ; costa and termen round apex suffused with blackish irroration : cilia grey, irrorated with white and blackish, becoming whitish towards tornus. Hindwings grey ; cilia pale greyish-ochreous.

Three specimens, N.C. Province, Ceylon, in November (Pole).

*Tinea othello*, n. sp.

♂ ♀. 14-20 mm. Head and palpi blackish-fuscous. Antennæ slightly over 1, in ♂ stout, somewhat flattened, pale ochreous, base blackish-fuscous. Thorax whitish-ochreous, anterior edge blackish-fuscous. Abdomen pale ochreous. Forewings elongate, costa moderately arched, apex round-pointed, termen very obliquely rounded ; all veins separate ; pale yellowish-ochreous ; costa more or less suffused with fuscous anteriorly, sometimes very little, usually from base to about ⅔, darkest at base, sometimes whole costal half of wing tinged with fuscous : cilia pale yellowish-ochreous. Hindwings with all veins separate ; whitish-ochreous tinged with grey ; cilia whitish-ochreous, deeper towards base.

Twelve specimens, Puttalam, Peradeniya, Kandy, Ceylon, from July to March (Pole, Green). This belongs to the group which I have called *Chrysoryctis* ; but in view of gradational forms, I find it now impracticable to maintain *Chrysoryctis* as a distinct genus.

*Peritrana*, n. g.

Head rough-haired ; tongue absent. Antennæ ½, in ♂ shortly ciliated, basal joint moderate. Labial palpi moderately long, subascending, second joint loosely rough-scaled beneath, with two or three bristles at apex above, terminal joint shorter than second, smooth-scaled, obtuse. Maxillary palpi obsolete. Posterior tibiæ clothed with long hairs. Forewings with 1 b simple, 2 from ⅓, 3 from angle, 7 and 8 stalked, 7 to costa, 9 absent, 11 from before middle. Hindwings, 1, ovate-lanceolate, cilia 1 ; 2-4 parallel, 5 and 6 tolerably approximate at base.

*Peritrana distacta*, n. sp.

♂ ♀. 12-18 mm. Head grey-whitish. Palpi grey sprinkled with blackish, apex whitish. Antennæ grey. Thorax whitish, shoulders suffused with dark grey. Abdomen grey. Forewings elongate, narrow, pointed, acute whitish

sprinkled with pale grey, and strewn with small indistinct fuscous or brownish striguläe; two narrow semioval blackish spots on costa near base and in middle, and a smaller blackish spot on costa at ¾; usually several blackish-grey costal spots or striguläe besides these, sometimes mostly obsolete; sometimes a small black spot below middle beyond ½; a blackish mark in disc beneath median costal spot, sometimes elongated and connected anteriorly with it, a dot on dorsum before tornus, and a dot above tornus, all variable in development: cilia whitish irrorated with fuscous. Hindwings grey; cilia grey-whitish.

Ten specimens, Maskeliya, Ceylon, in May, July, and from November to February (Pole, Alston).

*Thisizima sedilis*, n. sp.

♂♀. 17-21 mm. Head and antennæ whitish-ochreous. Palpi whitish-ochreous, second joint dark fuscous except towards apex. Thorax dark fuscous, posteriorly ochreous-whitish. Abdomen whitish-ochreous. Forewings elongate, costa moderately arched, apex rounded-obtuse, termen obliquely rounded; pale whitish-ochreous with a few scattered fuscous scales; markings deep purplish-fuscous; a moderately broad basal fascia, slightly broader on costa and sometimes connected with median blotch; a large rounded-triangular blotch extending over central third of costa and reaching more than half across wing, narrowed downwards and rounded off beneath; a small round spot in disc at ⅔, sometimes confluent with this blotch; a small rounded-triangular spot on costa towards apex: cilia pale whitish-ochreous, sometimes partially tinged with fuscous. Hindwings grey; cilia pale whitish-ochreous, with grey subbasal shade.

Three specimens, Bhotan and Sikkim, in June and July (Calcutta Museum). In *T. ceratella* the median blotch extends further on costa and is triangularly indented in middle of lower margin.

*Scardia trachypsamma*, n. sp.

♀. 21-24 mm. Head, palpi, and thorax ferruginous-ochreous. Antennæ pale ochreous. Abdomen elongate, dark grey, apex pale ochreous. Forewings elongate, narrow, costa moderately arched, apex obtuse, termen very obliquely rounded; 7 and 8 stalked; ochreous irregularly mottled with reddish-ochreous or ferruginous; numerous irregularly strewn small raised tufts, three beneath fold and one beyond middle larger and more conspicuous: cilia reddish-ochreous, towards tornus suffused with dark fuscous. Hindwings and cilia rather dark purplish-fuscous, towards apex of wing more or less tinged with ochreous.

Four specimens, Bombay, from December to February (Swinhoe, Young).

ADELIDÆ.

*Adela augantha*, n. sp.

♂. 17-19 mm. Head orange, face metallic-bronze. Palpi moderate, orange. Antennæ whitish, becoming dark grey towards base. Thorax metallic bronze, striped with orange (imperfect). Abdomen dark fuscous. Posterior tibiæ yellowish, apex dark fuscous, above with thin fringe of long hairs. Forewings

elongate, rather narrow, costa gently arched, apex obtuse, termen very obliquely rounded; 8 and 9 stalked; orange; markings prismatic leaden-metallic, edged with black; a short slender streak on base of costa; a median streak from base to $\frac{3}{4}$, upper edge angularly expanded in middle; a narrow subdorsal streak from near base to middle; two transverse spots from costa before and beyond middle, reaching nearly half across wing, and one from dorsum at $\frac{2}{3}$ nearly reaching second costal, an incurved streak from $\frac{3}{4}$ of costa to tornus, nearly or quite interrupted in middle; posterior area beyond this crossed by about seven black lines on veins: cilia dark brassy-grey, base more or less violet-metallic. Hindwings and cilia dark fuscous, slightly purplish-tinged.

Five specimens, Khasi Hills.

*Adela chalcomis*, n. sp.

♂ 15-16 mm., ♀ 12 mm. Head and thorax bright metallic brass. Palpi very small, ochreous-whitish. Antennæ dark fuscous, basal joint large, coppery-purple, brassy-scaled towards base. Abdomen dark fuscous. Posterior tibiæ in ♂ above with a very long expansible fringe of ochreous-whitish hairs. Forewings elongate, moderate, costa moderately arched, apex rounded, termen very obliquely rounded; 8 and 9 separate; shining coppery or purple; a metallic brassy basal patch occupying about $\frac{1}{3}$ of wing, containing a longitudinal black mark above middle, and edged with black posteriorly and on dorsum; an undefined central fascia of black and pale yellowish irroration, narrowest on dorsum; an irregular similar patch towards apex: cilia fuscous suffused with coppery-purple. Hindwings and cilia dark grey.

Six specimens, Maskeliya and Puttalam, Ceylon, in May, September, and October (Pole).

*Nemotois chiorites*, n. sp.

♂. 15-17 mm. Face white, crown with mixed black and whitish hairs. Palpi moderately long, white, beneath black, with very long spreading white and black hairs. Antennæ whitish, towards base thickened with metallic blue-blackish scales, above this a short space ringed with blackish. Thorax blackish, laterally with some whitish hairs. Abdomen blackish, anal tuft mixed with white. Anterior and middle tibiæ and basal joint of anterior tarsi with spreading tufts of white hairs; posterior tibiæ white with narrow black subapical band, above with very long fringe of white hairs continued on first joint of tarsi. Forewings elongate, posteriorly dilated, costa posteriorly moderately arched, apex obtuse, termen very obliquely rounded; 8 and 9 stalked; bluish-white, irrorated with black; small snow-white spots on costa, at $\frac{1}{3}$ and $\frac{2}{3}$; a slender snow-white median fascia, triangularly dilated on costa, anteriorly edged with black and then by a silvery-metallic fascia: cilia white, basal half blackish-grey with a white subbasal line. Hindwings white, pellucid; apical fourth dark grey extended along costa to middle; cilia white, on costa to apex darkgrey.

Four specimens, Khasi Hills, in October. Resembles *N. cassiterites*, but recognisable by tufts of anterior legs, white costal spots and white cilia of forewings and smaller dark area of hindwings.

*Nemotois cassiterites*, n. sp.

♂ 14-17 mm., ♀ 13 mm. Face silvery-metallic, crown whitish, with a few black hairs. Palpi moderately long, white, black beneath, with long spreading black and white hairs. Antennæ whitish, in ♂ purple-blackish above and towards base, rough-scaled above near base, in ♀ thickened with dark purple-grey scales from base to a supramedian patch of spreading black scales. Thorax dark silvery-grey. Abdomen blackish. Posterior tibiæ white with broad posterior blackish band, above with long fringe of whitish hairs. Forewings elongate, costa moderately arched, apex obtuse, termen rounded, rather strongly oblique; 8 and 9 stalked; purple closely irrorated with silvery-white and black, sometimes towards apex with pale yellowish; a short black subcostal dash near base; a slender white median fascia, edged anteriorly first by a slender black fascia and then a bluish-silvery-metallic fascia, and posteriorly similarly but towards costa only: cilia grey, basal half bluish-silvery. Hindwings in ♂ white, pellucid, posterior half purplish-grey, extending as a pale suffusion along costa towards base, in ♀ wholly dark grey; cilia grey, in ♂ white on dorsum and lower half of termen.

Twenty-eight specimens, Khasi Hills, from July to September.

*Nemotois solstitiellus*, Wals.

Of two specimens from Simla, communicated by Major Nurse, one has 7 and 8 out of 9 in both forewings, the other has 7 separate, 8 and 9 stalked in one forewing and coincident in the other. Lord Walsingham does not mention the neuration.

*Nemotois seraphias*, n. sp.

♂. 17-18 mm. Face brassy-metallic, hairs of crown yellow mixed with blackish. Palpi rather long, whitish, beneath with long spreading blackish and a few whitish hairs. Antennæ whitish, above blackish, towards base purple-tinged. Thorax bright metallic bronze. Abdomen blackish-bronze. Posterior tibiæ white, with broad posterior blackish band, above with long fringe of white hairs. Forewings elongate, rather narrow, costa gently arched, apex obtuse, termen very obliquely rounded; 8 and 9 stalked; deep yellow; markings metallic purplish-silver, strongly edged with black; a subcostal streak from base, curved upwards to costa at ¼; two approximated fasciæ towards or somewhat before middle, first straight, extended along dorsum to base, second straight or rather curved; an incurved fascia from ⅔ of costa to tornus, continued as a golden-metallic streak along termen to apex: cilia blackish-grey, base coppery-golden, tips pale. Hindwings white, pellucid, apical third, and costa dark grey; cilia white, round apex grey.

Three specimens, Khasi Hills, in October.

*Nemotois fluorites*, n. sp.

♂♀. 20-21 mm. Head wholly clothed with whitish-ochreous hairs. Palp moderate, above whitish, beneath with long spreading blackish-grey hairs. Antennæ whitish, towards base dark purplish-grey, in ♀ clothed with purple-black scales on basal ¾. Thorax purple-blackish striped with yellowish

(imperfect). Abdomen blackish. Posterior tibiæ yellowish, apex dark fuscous, above with long fringe of grey-whitish hairs. Forewings elongate, rather narrow, costa gently arched, apex obtuse, termen hardly rounded, very oblique; 8 and 9 stalked; deep ochreous-yellow; markings violet-leaden-metallic, irregularly edged with blackish; a fine streak along anterior half of costa, in ♂ mostly reduced to a black line; in ♂ subcostal, median, and subdorsal streaks from base to about middle or beyond, and a black line along dorsum; two narrow transverse fasciæ beyond middle, curved towards each other and in ♂ usually connected in disc; an irregular black line round apical portion of costa and termen to extremities of second fascia: cilia tawny-ochreous, base violet-metallic, outer half dark fuscous. Hindwings dark purplish-fuscous; cilia fuscous, with blackish basal line.

Six specimens, Khasi Hills.

*Nemotois melichlorias*, n. sp.

♀. 16 mm. Head and palpi yellowish. Antennæ slender, dark purple-fuscous, with a median tuft of blackish scales above, beyond this wholly ochreous-whitish. Forewings elongate, moderate, costa more strongly arched posteriorly, apex obtuse, termen very oblique, rounded; 8 and 9 separate; deep purple, posteriorly sprinkled with black and pale yellowish scales; a light brassy-yellow triangular median blotch extending from base to near ⅓ of disc, upper posterior angle connected with costa at ⅓; a moderate straight light brassy-yellow fascia from middle of costa to ⅔ of dorsum, somewhat narrowed on costa: cilia dark coppery-bronze. Hindwings and cilia dark fuscous.

One specimen, Koni, Burma (Manders).

*Nemotois chrysoprasiae*, n. sp.

♂. 20-22 mm., ♀ 18-19 mm. Face metallic green, hairs of crown whitish, in ♂ mixed with blackish. Palpi moderate, slender, with long fine blackish and whitish hairs. Antennæ in ♂ grey, towards base dark purplish-fuscous, below middle with a whitish band, in ♀ dark purplish-fuscous, below middle with a patch of spreading black scales, above this with a white band. Thorax light metallic brassy-green. Abdomen dark grey, often clothed with white scales. Posterior tibiæ and basal joint of tarsi in ♂ with expansible fringe of long white hairs, less developed in ♀. Forewings elongate, costa moderately arched, apex obtuse, termen obliquely rounded; 8 and 9 separate; light metallic brassy-green on posterior half sprinkled with black; a narrow almost straight orange black-edged fascia before middle, sometimes dilated towards extremities, margined by two narrow greenish-blue-metallic fasciæ, more or less edged externally with black, especially towards costa: cilia grey, basal half scaled with brassy-green. Hindwings white; a dark purplish-grey apical patch extending furthest along costa; cilia grey, on dorsum and lower half of termen white.

Thirty specimens, Khasi Hills, in September and October.

*Nemotois pyrites*, n. sp.

♂ ♀. 17-20 mm. Head and palpi orange. Antennæ whitish, in ♂ dark purple-grey towards base, in ♀ with basal half thickened with deep purple

scales, terminated by a median dilation of black scales. Thorax shining bronze. Abdomen dark bronzy-fuscous. Posterior tibiæ shining bronze, apex coppery, above with long fringe of light greyish hairs. Forewings elongate, costa moderately arched, apex obtuse, termen nearly straight, rather strongly oblique ; 8 and 9 separate ; deep purple, overlaid with bright shining coppery-golden scales, towards base lighter golden ; a short black subcostal dash near base ; a rather narrow orange black-edged fascia somewhat before middle, rather dilated towards costa, margined by two narrow silvery-metallic fasciæ ; beyond the outer is an undefined band of black irroration : cilia purplish-fuscous, basal half coppery-golden. Hindwings dark grey, purplish-tinged towards apex ; cilia grey, with blackish-grey basal line.

Thirty specimens, Khasi Hills, in September and October.

*Nemotois engraptes*, n. sp.

♂. 17 mm. Head orange-yellow, face brassy-metallic. Palpi short, slender, thinly haired, light yellowish. Antennæ ochreous-whitish becoming deep purple towards base. Thorax bright brassy-metallic, purplish-coppery on sides. Abdomen dark purplish-bronze, beneath with segmental margins broadly pale yellowish. Forewings elongate, moderate, costa more strongly arched posteriorly, apex obtuse, termen very obliquely rounded ; 8 and 9 separate ; bright coppery-purple, with brassy-golden reflections ; an irregular deep yellow blotch extending along costa from base to $\frac{2}{5}$, and reaching about half across wing, marked with a purple-blackish subcostal streak from near base to near $\frac{1}{2}$, and three variable irregular transverse bars posteriorly ; a roundish deep yellow blotch resting on upper portion of termen, marked with seven variable irregular purple-blackish spots : cilia coppery-purple. Hindwings and cilia dark purple-fuscous.

Two specimens, Kandy, Ceylon, in August (Green, Pole).

*Nemotois pollinaris*, n. sp.

♂. 17-19 mm. Face shining metallic brass, hairs of crown pale orange. Palpi short, pale orange-ochreous. Antennæ whitish, above fuscous, becoming dark purple towards base. Thorax bright metallic coppery, sides deep purple. Abdomen dark bronzy-fuscous. Posterior tibiæ metallic coppery, tips purple, above with long fringe of pale greyish hairs. Forewings elongate, costa moderately arched, apex obtuse, termen very obliquely rounded ; 8 and 9 separate ; very deep shining purple ; broad golden-metallic costal and median streaks from base to about $\frac{1}{2}$, merged posteriorly in an orange-ochreous suffusion irrorated with black which occupies nearly all median area and extends on dorsum to near base ; a round patch of similar suffusion resting on termen beneath apex : cilia dark golden-bronze. Hindwings blackish-grey, slightly purple-tinged ; cilia dark grey, with blackish basal line.

Two specimens, Maskeliya, Ceylon, in April (Pole).

*Nemotois phœnicites*, n. sp.

♂. 13-15 mm. Face coppery-bronze, crown orange. Palpi extremely short, dark grey. Antennæ whitish, becoming dark purple-fuscous near base.

Thorax metallic-bronze, patagia metallic green or coppery. Abdomen blackish. Posterior tibiæ coppery-bronze, with long fringe of grey and whitish hairs above. Forewings elongate, rather dilated posteriorly, costa gently arched, apex obtuse, termen nearly straight, rather strongly oblique; 8 and 9 separate; bright metallic golden-bronze, suffused with purple-coppery except on dorsal half from base to fascia; a slender black transverse fascia slightly beyond middle, on upper half somewhat broader and divided into two by a slender tawny streak; cilia coppery-golden-bronze. Hindwings and cilia blackish-grey, faintly purplish-tinged.

Two specimens, Coorg (3,500 feet), in August (Newcome).

## SUPPRESSION OF *MELANELAPS MCPHERSONI.*

By

Major F. Wall, I.M.S., C.M.Z.S.

Whilst in the British Museum recently I saw a specimen of the snake described by me in this Journal (Vol. XVII., p. 27) as *Melanelaps mcphersoni.* I learnt from Mr. Boulenger that he had already described it under the name of *Atractaspis andersonii.*

He received his specimen from Aden Hinterland about the same time as I did mine, but his description appeared first, and the snake must, therefore, rest under his title, my own being suppressed.

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## THE POISONOUS SNAKES OF INDIA AND HOW TO RECOGNISE THEM.

By

Major F. Wall, I.M.S., C.M.Z.S.

### Correction.

In my paper on Poisonous Snakes of India in this Volume (No. 1, page 69) an error occurs—*Callophis trimaculatus* being misplaced.

*Melanelaps mcphersoni*, being an Arabian Snake, is best considered outside our sphere, and I accordingly reconstruct the key as follows:—

*Key to the identification of the Species.*

ANAL ENTIRE.

*TEMPORAL TOUCHES 5th AND 6th SUPRALABIALS ONLY.* (*See T, fig. 15B.*)

Internasal not touching præocular. (See Int. and Pra., fig. 15B.)

*Belly uniform red* ..... *Doliophis bivirgatus.*

*Belly barred with black* ..... *Doliophis intestinalis.*

Internasal touching præocular. (See Int. and Pra., fig. 16B.) ..... *Naia tripudians.*

*TEMPORAL TOUCHES 5th, 6th, AND 7th SUPRALABIALS. (See T, fig. 18A.)*

Subcaudals at base of tail entire. (See Sc., fig. 9C.)... ..... *Naia bungarus.*

Subcaudals divided throughout. (See Sc., fig. 9D.)..... *Callophis bibronii.*

ANAL DIVIDED.

*TEMPORAL TOUCHES 5th AND 6th SUPRALABIALS. (See T, fig. 20B.)**

Supralabials 6. (See fig. 21B.)..... *Callophis trimaculatus.*

Supralabials 7 (See fig. 20B.)* ..... *Callophis macclellandii.*

*TEMPORAL TOUCHES 5th, 6th AND 7th SUPRALABIALS. (See T, fig. 18A.)*

Tail with 2 black bands ..... *Callophis maculiceps.*

Tail with no band ..... *Hemibungarus nigrescens.*

* Readers should be reminded of the correction slip which was inserted in the front of Vol. XVII, No. 3, and especially here with reference to the transpositions of B and C in figures 20 and 23 which occurred in the original.

# NOTES ON SOME RATS OF THE *MUS METTADA* GROUP.

By

R. C. Wroughton.

Mr. Comber has kindly sent to me for examination two series of specimens: the one, collected by himself at Nasik, containing eight individuals, the other, by Major Liston, I.M.S., in the Konkan, containing five individuals.

All these specimens have only 5 plantar pads, and a mammary formula 2—2=8, characters that hitherto have been accepted as distinguishing *Mus mettada* from its congeners.

An examination of the dentition shows that four of the Nasik specimens, Nos. 133, 135, 136, 138, have distinctly stouter teeth than any of the rest. The remaining four Nasik specimens, Nos. 134, 137, 139, 140, while having smaller teeth, like the Konkan individuals, are distinguished from these latter by their smaller size and especially by their shorter hind feet.

The species *mettada* (the name *meltada* as originally published was, undoubtedly, a misprint) was established by Gray (l. c. inf.) on specimens collected by Elliot in the Southern Mahratta Country. The description is meagre and not very helpful, but fortunately the specimens are still in the British Museum Collection, and from these it appears that the form with the stouter teeth mentioned above is nearest to typical *mettada*, and the other two forms require names.

*Key.*

A.—Teeth stouter (length of upper molar row = 6—6·2 mm.), hind foot 24—25 mm.....(1) *Mus mettada.*

B.—Teeth weaker (length of upper molar row = 5·5—5·7 mm.).—

(*a*) Hind foot 24—25 mm. .....(2) *Mus listoni.*

(*b*) Hind foot 21·5—23 mm. .....(3) *Mus comberi.*

1. *Mus mettada*, Gray.

1837. *Golunda mettada*, Gray. Mag. Nat. Hist., I, p. 586.

1839. *Mus lanuginosus*, Elliot. Madr. Journ., X, p. 212.

Basing on some dimensions given by Elliot in his paper and on the

specimens sent home by him the following are measurements of the Nasik specimens compared with those of typical *mettada*:—

| | 133 | 135 | 136 | 138 | Typical *mettada*. | |
|---|---|---|---|---|---|---|
| Age and Sex ... ..... | A ♀ | A ♀ | A ♂ | A ♀ | — | A = adult. |
| Head and body..... | 127 | 122 | 141 | 122 | 142 | The body dimensions of typical *mettada* quoted from Elliot are those of "a large adult male." |
| Tail ..... | 103 | ? | ? | 104 | 109 | |
| Hind foot ..... | 24 | 24 | 25 | 24 | 24 | |
| Ear ..... | 21 | 20 | 21 | 21 | 20 | |
| Skull: greatest length. | 33·5 | 33 | 35 | 32·5 | 32 | |
| „ basilar length.. | 27·5 | 26·5 | 28·5 | 26 | 27 | |
| „ zygomatic breadth ..... | 16·2 | 16·1 | 16·3 | 15·8 | 16 | |
| „ diastema ..... | 9·5 | 9 | 9·5 | 8·7 | 9 | |
| „ upper molar row..... | 6 | 6·1 | 6 | 6·2 | 6 | |

Until sexed and measured specimens are available for examination from the type locality (Dharwar), we must accept these four specimens as typical *mettada*, of which species they are at least a local race.

2. *Mus listoni*, sp. n.

Closely resembling *mettada*, but distinguishable by its smaller teeth.

The following are dimensions of Major Liston's five Konkan specimens:—

| | 119 | 120 | 121 Type | 122 | 123 | |
|---|---|---|---|---|---|---|
| Age and Sex ..... | VO ♂ | A ♂ | O ♀ | A ♂ | A ♀ | |
| Head and body..... | 151 | 141 | 132 | 144 | 134 | A=Adult, *i.e.*, posterior molar worn. |
| Tail ..... ..... | 122 | 116 | 103 | 110 | 108 | |
| Hind foot ..... | 25 | 25 | 24 | 25 | 24 | O=Old, *i.e.*, all molars worn. |
| Ear ..... ..... | 20 | 18 | 18 | 19 | 18 | |
| Skull: greatest length. | 35·5 | 34·5 | 33 | 33·5 | 34·5 | VO=Very Old, *i.e.*, all dental cusps worn flat. |
| „ basilar length... | 29·5 | 28 | 27 | 27·5 | 28·5 | |
| „ zygomatic breadth..... | 16·7 | 16·5 | 16·1 | 16 | 16·5 | |
| „ diastema ..... | 10 | 9·5 | 9 | 9 | 9·5 | |
| „ upper molar row ..... | 5·7 | 5·5 | 5·6 | 5·6 | 5·6 | |

Type.—B. M. No. 7. 1. 7. 6. An old ♀. Collector's No. W. L. 121. Obtained in the Konkan by Major W. Liston, I.M.S., and presented to the British Museum by the Bombay Natural History Society.

The indications of a difference in size between the sexes are here strongly marked.

There is little to distinguish *listoni* from *mettada*, except the difference in the size of the molars, but this difference is quite constant and easily appreciable even by the naked eye.

3. *Mus comberi* sp. n.

Outwardly resembling the two last species, but distinctly smaller.

Unfortunately, all Mr. Comber's specimens are females.

The following are dimensions of the four individuals :—

| | 134 | 137 | 140 | 139 |
|---|---|---|---|---|
| Age and Sex | O ♀ | A ♀ | A ♀ | Y A ♀ |
| Head and body | 120 | 125 | 119 | 118 |
| Tail | 105 | 102 | 105 | 98 |
| Hind foot | 21·5 | 22 | 23 | 22·5 |
| Ear | 20 | 18 | 20 | 20 |
| Skull : greatest length | 31·7 | 32 | 32 | 32 |
| „ basilar length | 27 | 26·9 | 27 | 27 |
| „ zygomatic breadth | 14·5 | 15 | 15·3 | 15 |
| „ diastema | 8·6 | 8·8 | 8·8 | 9 |
| „ upper molar row | 5·0 | 5·7 | 5·7 | 5·7 |

Type.—B. M. No. 7. 1. 7. 3. An old ♀. Collector's No. E. C. 134. Obtained by Mr. E. Comber at Nasik, and presented to the British Museum by the Bombay Natural History Society.

Its markedly inferior size, as compared with females of the two preceding species, both of body and skull, make *comberi* easily distinguishable from either.

I have pointed out that in the mammary formula and the plantar pads these three forms are alike, and this applies also to their colouration. The fact that the specimens I identify as *Mus mettada* and those I name *comberi* were taken in the same locality and differ in the size of the teeth justifies their specific separation. The specific separation of *comberi* and *listoni*, however, must depend on the non-existence of intermediates; from my knowledge of the country I argue that the discovery of such is most unlikely, and I have not hesitated, therefore, to rank them both as species.

An interesting point indicated, if not proved, by these two series is the difference in the sexes. In *listoni* the males are markedly and

constantly larger than the females. The solitary male in the series of *mettada* seems to show that the rule holds in that species also, and I confidently expect that when a male of *comberi* is available for examination the same differences will be found to exist between the sexes in that species.

I would take this opportunity to ask members residing elsewhere than in the localities in which *comberi* and *listoni* have been found to send specimens of their local '*metad*' to the Society with a view to a more extended examination of the group, and, more especially, good specimens of *mettada* from the type locality (Dharwar) would be most valuable.

# DESCRIPTION OF A NEW GENUS AND SOME NEW SPECIES OF HYMENOPTERA CAPTURED BY LIEUT.-COL. C. G. NURSE AT DEESA, MATHERAN AND FEROZEPORE.

BY

P. CAMERON.

ANTHOPHILA.

*Halictus matheranensis*, sp. nov.

Black, covered with white pubescence; the apex of the antennæ rufous; the area on median segment irregularly reticulated; the apex of the segment keeled round the top and sides; the wing hyaline, stigma and nervures pale testaceous. ♀.

Length 5 mm.

*Habitat.*—Matheran.

Antennæ black, the 5 or 6 apical joints rufous beneath; the scape sparsely haired. The face, clypeus and outer orbits are covered thickly with white hair; the front and vertex much more sparsely with shorter darker pubescence; they are opaque, finely rugose; the clypeus bears round distinctly separated punctures, which are large in the centre at the apex, which is obliquely depressed, and is fringed with long pale golden hair. Mandibles black, broadly bright rufous before the middle. Mesonotum and scutellum closely and uniformly punctured and covered with whitish pubescence; that on the scutellum is much the longer. Post-scutellum thickly covered with depressed white pubescence. The area on the median segment bears irregularly twisted longitudinal striæ which almost form reticulations, the apical is slightly hollowed, and is bordered at the top and sides by a stout keel; the keel on the top is narrower, and is bent downwards slightly. The propleura at the top projects into a ridge; the pronotum above this is thickly covered with depressed white pubescence; the base of the projection is oblique. The legs are piceous black; the pubescence is white; the calcaria white with a faint rufous tinge; the apices of the tarsal joints rufous, the calcaria bear some dark rufous spines. The abdomen is shining; the punctuation is only visible with a strong lens; the base of the segments covered with depressed white pubescence; the apical ones have also longish white hairs; the rima is rufous.

*Andrena ilerda*, sp. nov.

Black; the basal 3 segments of the abdomen red; the head and thorax thickly covered with white hair; the 3rd, 4th and 5th abdominal segments lined with white pubescence at their apices; the wings clear hyaline, the stigma dark rufous; the apical half of the clypeus and the labrum rufous. ♀.

Length 13 mm.

*Habitat.*—Ferozepore.

The basal 3 joints of the antennæ black; the others dark rufous below, black above. The hair on the head is long, dense and clear white; the

clypeus is distinctly and closely punctured except at the apex; its top is more closely punctured than the centre; the face is closely punctured; the labrum is rufous; it becomes obliquely narrowed towards the apex; the middle is slightly roundly incised at the apex. The front and vertex are alutaceous, opaque; the former is obscurely longitudinally striated. Mandibles black; the apex and the lower side of the base rufous. The hair on the thorax is long, dense and clear white, the mesonotum is furrowed down the middle at the base and is punctured slightly, as is also the scutellum. The area on the median segment is obscurely obliquely striated on the sides; the middle at the base is irregularly and weakly reticulated. Legs rufous; the coxæ and the 4 anterior femora black; the hair on the femora is long and clear white; on the tibiæ it has a slight fulvous tint; on the metatarsus the fulvous tint is more distinct; the knees are black. Wings clear hyaline; the stigma is fuscous, the nervures blacker in tint. The basal 3 segments of the abdomen are rufous; the base and ventral surface are covered with soft white hair, the apices of the 2nd, 3rd and 4th segments are banded with white hair; the 5th segment above is thickly covered with long sooty black hair; its sides with long white hair; the 6th segment is almost bare in the middle; the sides are thickly covered with long black hair.

The ♂ is similarly coloured; the basal segments of the abdomen may be marked with black in the middle or laterally.

*Andrena leaena*, sp. nov.

Black; the greater part of the flagellum rufous; the head and thorax covered with white pubescence; the abdominal segments with their apices banded with white pubescence; the anal segment above covered with longish rufous pubescence; the wings hyaline, the stigma testaceous. ♀.

Length 7—8 mm.

*Habitat.*—Ferozepore, Deesa.

Antennæ black, the 6th and following joints of the antennæ rufous; the scape on the underside covered with long white hair. The face, clypeus and front are covered thickly with long white hair; the upper orbits to the hinder ocelli are bordered by a broad band of pale fulvous pubescence; the occiput and outer orbits are covered with long white pubescence. The front and vertex are alutaceous, almost punctured; the hinder part of the vertex is obscurely punctured behind; the clypeus is more distinctly punctured than the face. The labrum has the sides obliquely narrowed towards the apex, which is transverse; the part beneath it is thickly covered with longish rufous hair. The mandibles beneath are rufous, and their lower side, at the base, is fringed with long rufous hair. The hair on the mesonotum is sparser and shorter than it is on the pleuræ; the scutellum is fringed thickly with long hair round the sides and apex and also on the post-scutellum. The area on the median segment is closely punctured; its basal half irregularly longitudinally striated; there is a shallow median furrow on the apical slope. Legs black; the 4 apical joints of the tarsi rufo-testaceous; the hair on the femora and tarsi is

long and white ; on the metatarsus beneath it has a fulvous tinge ; the calcaria are pale. Abdomen shining, closely and minutely punctured ; the basal 5 segments are narrowly banded with white pubescence on the apex ; the 5th is thickly covered with rufous hair.

In Bingham's arrangement (Hymen. of India, p. 442) this species would come into Section B ; but it has no near relationship with the only species (*gracillima*, Cam.) included in it.

*Ceratina divisa*, sp. nov.

Dark green, the abdomen black, with yellow lines on the 2nd to 4th segments, the 1st 2 lines somewhat widely, the 3rd more narrowly separated, the 4th broader and may be continuous, there may be a narrower 5th line ; the clypeus except for 2 fuscous lines, mandibles except at apex, a line completely round the apex of pronotum, a transverse line at the apex of mesonotum, sides of scutellum, post-scutellum and the greater part of the tegulæ as well as the legs, pale yellow ; the coxæ, trochanters, femora, except at apex, and a line on the outer side of the tibiæ on apical half, black ; wings milky hyaline, the nervures and stigma pale, almost white, the 1st recurrent nervure interstitial with 2nd transverse cubital. ♀

Length 5 mm.

*Habitat.*—Deesa (April and May).

Underside of scape yellow, of flagellum brown. Metanotal area finely closely punctured, more or less finely transversely striated, not keeled, the apical slope steep. A minute impressed line on basal slope of mesonotum. Pubescence white. 2nd abscissa of radius nearly as long as the 3rd. The size of the yellow markings probably varies.

*Ceratina punjabensis*, sp. nov.

Head and thorax dark green, the abdomen black, the base of the segments broadly banded with pale yellow, the clypeus except for 2 black lines, mandibles except at apex, underside of antennal scape, the greater part of tegulæ, scutellums, except for a large square mark on the base of centre of scutellum, and the legs, except at the base, pale yellow ; wings clear hyaline, the nervures and stigma pale yellow, the 2nd cubital cellule much narrowed in front ; the 1st recurrent nervure interstitial with 2nd transverse cubital. Pubescence dense and white ; underside of flagellum brown ; metanotal area finely closely punctured, there is no keel on metanotum ; its apical slope somewhat steep. There is a slight impressed line on centre of mesonotum ; there is no keel on the front. Antennal joints not very clearly separated. ♀

The green colour may be somewhat bronzy, the yellow line on the basal segment of abdomen may be absent ; the apical 2 segments of the abdomen may be wholly yellow.

Length 6 mm.

*Habitat.*—Punjab.

May be known from *divisus*, described above, by being a broader and stouter species, by the apex of the scutellum being white, the black central part not

extending to the apex, by the abdominal yellow lines being broader, occupying the half of the segment, and continuous throughout. The basal abdominal line may be absent.

*Ceratina curvilineata*, sp. nov.

Viridis, abdomine flavo, nigro balteatus; clypeo, mandibulis, linea late pronoti, scutello, post-scutello pedibusque pallide flavis; alis hyalinis, costa nervisque pallide flavis. ♀

Length 3·5 mm.

*Habitat.*—Deesa.

The scape of the antennæ bright yellow; the flagellum light brownish, darker on the top. Head greenish-black; the lower part of the face in the centre, the mark transverse below, rounded above, a mark on either side, longer than broad, transverse above, gradually narrowed below, the clypeus and the mandibles pale lemon-yellow; the apex of the mandibles rufous with the teeth black; the head is sparsely punctured and covered with white down; the oral region is fringed with long white hair. Thorax dark metallic blue-green and thickly covered with white hair; the upper edge of the prothorax broadly, the lower more narrowly; the scutellum, post-scutellum, a curved transverse line between the two and extending to the wings and the sides and base of the tegulæ broadly, lemon-yellow. The mesonotum is closely and uniformly punctured and has brassy tints; the scutellums are impunctate; the post-scutellum is covered with long white hair. The median segment is furrowed in the middle; it is more strongly punctured than the mesonotum; on the basal region it bears curved striæ. Wings clear hyaline; the stigma and nervures are pale; both the recurrent nervures are almost interstitial. The coxæ and femora are lemon-yellow like the body; the tibiæ and tarsi are paler and are thickly covered with long white hair; the hinder tibiæ are broadly black on the outer side, and there is a shorter black mark on the outer side of the metatarsus. Abdomen pale lemon-yellow; the basal two segments are banded with black on their apices; the black lines being narrowed at the sides; the 3rd and 4th segments have narrower interrupted black lines; the abdominal segments are broadly brownish-black.

*Nomia fulvinerva*, sp. nov.

Black: the tarsi and the 4 posterior tibiæ fuscous and thickly covered with pale fulvous hair; the wings hyaline, only very slightly infuscated at the apex; the stigma and nervures testaceous, the stigma darker in tint than the nervures; the vertex smooth and shining on the outer side of the ocelli; the vertex is raised above the level of the inner side of ocelli; the abdominal segments broadly banded on the apex with pale fulvous pubescence. ♀

Length 9 mm.

*Habitat.*—Deesa.

Antennæ black; the apical two joints rufous beneath; the scape sparsely covered with pale hair; the flagellum more thickly with a microscopic pile. The vertex is distinctly and strongly, but not very closely punctured on either

side of the ocelli ; the space between the ocelli is more closely punctured and is depressed and distinctly furrowed in the middle. Face and clypeus closely rugosely punctured and covered thickly with silvery pubescence ; the apex of clypeus fringed with golden hair. Mandibles black, rufous at the apex. Thorax thickly covered with long white hair ; the hair on the mesonotum, scutellum and post-scutellum is fulvous ; on the mesonotum it is much sparser and paler ; it does not hide the punctuation which is close and strong ; the apex of the pronotum is raised into a thin plate, which is widely and deeply incised in the middle ; the incision is narrowest in the centre. The median segment is rugosely punctured, more finely and closely in the middle than on the sides ; the basal area is irregularly and not very closely longitudinally striated. The hinder tibiæ become gradually thicker towards the apex ; the 2nd joint becomes gradually wider from the top to the bottom ; its upper part projects ; the calcaria are closely covered with stiff hairs, almost pectinated. The basal segments of the abdomen are piceous in the middle, dorsally and ventrally, and have their apices broadly banded with pale bright fulvous pubescence. The pygidial area is densely covered with bright golden pubescence, except on the centre and towards the apex.

*Megachile phaola*, sp. nov.

Nigra, dense albo-pilosa ; abdominis basi femoribusque posterioribus supra rufis ; alis hyalinis, stigmate fusco. ♂

Length : 6 mm.

*Habitat.*—Deesa.

Antennæ long, nearly 3 times the length of the head ; the basal two joints black ; the flagellum brownish beneath ; the apical joints are slightly dilated below. The clypeus, face and lower part of the front are densely covered with white hair ; the vertex and upper part of the front sparsely covered with longish fuscous hair ; the lower orbits and the lower part of the head are covered with long white hair. Front and vertex closely, uniformly and strongly punctured. The base of the mandibles is strongly and deeply punctured ; the apex is bidentate : the upper tooth is smooth, depressed and shining ; the lower part is deeply and widely furrowed. Thorax closely punctured and thickly covered with white hair ; the basal area of the median segment is coarsely shagreened, more coarsely at the base than at the apex ; across the base is a wide, not very deep, furrow. Wings clear hyaline ; the stigma is lighter in colour than the nervures, the 2nd recurrent nervure is received nearer the transverse cubital than is the first, but is not interstitial. Tegulæ piceous ; their base is thickly covered with white pubescence. Legs black, thickly covered with white hair ; the 4 hinder femora are for the greater part beneath brownish, as are also the greater part of the basal joint of the tarsi and the apices of the other joints. Abdomen black ; the basal segment, except in the middle at the apex, rufous ; all the segments are fringed at the apex with white pubescence ; they are distinctly, but not very strongly, punctured ; the last segment is widely furrowed in the middle ; the ventral segments are rufous.

*Megachile saphira*, sp. nov.

Nigra, dense albo-pilosa, apice femorum, tibiis tarsisque rufo-testaceis ; alis hyalinis, stigmate nervisque fuscis. ♂.

Length 6—7 mm.

*Habitat.*—Matheran.

Antennæ longer than the head and thorax united, black ; the flagellum brownish beneath, bare. Front and vertex closely punctured ; sparsely covered with long white hair ; the lower part of the front, the inner orbits, the face and clypeus densely covered with long white pubescence which hides the sculpture entirely. Mandibles becoming gradually narrowed towards the apex ; their base punctured and covered with short, white pubescence. Mesonotum and scutellum closely and uniformly punctured and moderately thickly covered with white pubescence, which is longest on the scutellum. The latter is broadly rounded behind. The base of the basal area of the median segment is obscurely punctured and finely, irregularly striated ; the apex is shagreened ; the rest of the segment is closely covered with round shallow punctures and is thickly covered with white, longish pubescence. Pleuræ closely punctured and thickly covered with long white pubescence. The apex of the femora, tibiæ and tarsi are reddish-testaceous, the legs are thickly covered with longish white hair ; the tarsi are much more thickly haired than the tibiæ, especially at the base ; the basal 4 joints of the anterior tarsi are broadly dilated. Wings clear hyaline : the stigma is fuscous, the nervures are darker coloured ; the first recurrent nervure is received shortly beyond the transverse cubital ; the 2nd is almost interstitial. Abdomen black ; closely punctured ; the basal segments are narrowly banded with white pubescence ; the apical segment on the lower side is widely and deeply furrowed ; the 2nd and 3rd segments have their bases deeply depressed.

*Megachilee lefroma*, sp. nov.

Nigra, dense albo-pilosa : tarsis anticis rufo testaceis ; alis hyalinis, stigmate testaceo, nervis nigris. ♂.

Length 7 mm.

*Habitat.*—Matheran.

Antennæ nearly as long as the body ; black, the scape punctured and covered with long white hair ; the flagellum almost bare. Front and vertex strongly and closely punctured ; the apex smooth, furrowed in the middle and narrowed gradually towards the apex ; the lower outer part of the head is thickly covered with long white hair. Head and thorax closely and distinctly punctured and sparsely covered with long white hair ; the apex of the scutellum is smooth on the apical slope in the middle ; it has there a broadly rounded slope and does not overhang the post-scutellum which is aciculated, and at the base, obscurely punctured. The basal area of the median segment is aciculated ; the apical slope is steep. Legs black ; the anterior tibiæ and tarsi rufo-testaceous in front ; the pubescence on the under side of the base of the tarsi is rufous. Abdomen closely punctured ; the base of the 2nd segment is

widely depressed ; the apex of the depression has an oblique slope ; the segments are fringed with white pubescence, which is interrupted in the middle on the basal segments. The basal ventral segment is broadly, somewhat triangularly, raised in the middle ; the middle segments are thickly covered with white pubescence.

DIPLOPTERA.

*Odynerus deesanus*, sp. nov.

Pale yellow with the following black markings : a broad mark covering the ocelli, broadly rounded behind and with 2 short curved lines on the inner side of the hinder ocelli running obliquely beyond the apical, the mark continue, laterally as a broad line to each antenna, a mark in centre of occiput obliquely narrowed in the middle behind, a short oblique line behind the top of the eyes, a narrow line round the base and sides of the mesonotum, the line dilated on the base, a broad line, about 4 times longer than wide, narrowed at the apex, nearer the base than the apex, a curved broad line on the sides, triangularly dilated at the base, extending to the scutellum where it unites with a transverse apical line, which is narrowed at the sides, dilated in the centre, a line, roundly narrowed, at the base of scutellum, a line of equal width at the base of post-scutellum, 2 large oblique oval marks on the top of basal slope of 1st abdominal segment, narrowed on the inner side, a broad line on the base of the 2nd, broadly, roundly dilated laterally and with a longer narrower line issuing from the centre, and small obscure spots in the centre of the other segments, as well as a transverse line at the base of the 5rd ventral. Antennal scape yellow, with a black line above, the flagellum rufous. Four hinder femora and tibiæ broadly lined with black above. Wings clear hyaline the nervures and stigma black. ♀

Total length 12 mm.

*Habitat.*—Deesa (May).

Closely punctured, the abdomen distinctly, but less strongly than the thorax ; on basal half of the centre of the 2nd ventral segment is a distinct clearly defined furrow of equal width. Clypeus clearly wider than long, not quite so strongly or so closely punctured as the vertex ; the apex broad, transverse. Base of thorax not quite transverse. Apex of post-scutellum broadly narrowed. Sides of metanotum broadly rounded, the centre not much depressed, transversely striated. First abdominal segment cup-shaped, short, clearly shorter than it is wide at the apex ; the 2nd is longer than wide, its apex slightly, narrowly depressed.

*Odynerus xanthus*, sp. nov.

Yellow, an irregular mark, wider than long, covering the ocelli, the sides behind projecting, the centre with a ∧- shaped mark between the ocelli, a narrow curved line on the top of the occiput, a triangular mark on the base of mesonotum, an irregular transverse one on the sides, before the tegulæ, its inside wider than the outer, a line at the base of scutellum, dilated laterally, the base of 1st abdominal segment narrowly, a mark, rounded and dilated at

the apex, gradually narrowed towards the base, in the centre of the 1st abdominal segment, a narrower, less distinct one on the centre of the 3rd, and irregular, small spots on the sides of the segments, black; antennæ blackish above. Wings hyaline, the apical and outer margin narrowly violaceous, the costa and stigma narrowly yellowish testaceous, the nervures black. ♀

Total length 13 mm.

*Habitat.*—Deesa (July).

Head and thorax closely, regularly and somewhat strongly punctured all over; the clypeus strongly closely punctured like the vertex; it is longer than wide, transverse in the middle above, the sides broadly rounded, the apex broad and transverse. Base of thorax almost transverse; the sides of the apex broadly rounded, reticulated, the edge serrate, ending below in a distinct tooth, the centre broadly, but not deeply, hollowed. Scutellum large, quadrate, transverse at base and apex; the top of post-scutellum is almost on a level with it, its apex at the top almost serrate, the apical slope steep, its apex bluntly, broadly rounded, clearly separated by a furrow. Abdomen smooth, almost impunctate, the 1st segment cup-shaped, not quite so long as it is wide at the apex.

The above is the description of the lighter coloured form; the black markings may be much more distinct, longer and broader, on the head, abdomen and thorax, the lateral lines on the mesonotum may be united by a narrower line to the scutellar one; there may be a row of 4 black marks on the base of the 1st abdominal segment, its black central mark is in the shape of an elongate triangle and, in addition to the lateral spots on the other segments, there is an outer one in the centre of the 2nd; there may also be spots on the ventral segments. The palpi are sparsely covered with long, stiff hairs.

*Eumenes fulvipennis*, Cam.*

This appears to be a variable species, as shown by some specimens taken by Col. Nurse at Deesa from July to October. The black line across the ocelli may be broad or very narrow, the mesonotum may be rufous, or pale yellow, with 3 black or rufous lines, of which the central extends from the base to the apex, the lateral commencing near the middle, and there may be also a stripe across the apex; the size of both the reddish and black lines varies. The size of the abdominal lines varies, and they may be either black or red. There may be a black line on the base and near the apex of the 1st abdominal segment; in all the specimens there is a black or transverse line before the middle of the 2nd segment, which varies in width, and it may be united to the base of the segment by a longitudinal one down the middle. The occiput may be for the greater black. The clypeus in the ♀ is broader, though the eyes not converging so much; it is not much longer than its greatest width; the lower narrowed part is almost as long as the upper, while in the ♂ it is distinctly shorter; the antennæ, too, are more widely separated

* Manchr. Mem., XLII, IV, p. 39; pl. 4, f. 3a, 3b.

from the eyes than they are in the ♂; and the ocelli in the latter are closer to the eyes than they are in the ♀. On the apex of the 1st abdominal segment there may be a continuous line (yellow or black) or 2 spots; on the 2nd ventral segment the red may be continuous, transverse at the apex, or the latter may be trilobate; and there may be central or lateral yellow spots. The apex of the clypeus in the ♀ is more transverse than it is in the ♂; in the latter the abdominal petiole is longer than it is in the ♀, being almost as long as the head and thorax united. The affinities of the species appear to be with the African *E. caffra*, *E. lepelleterii* and *E. asina*, and doubtless affords another example of an African element in the Fauna of Western India, of which we have others in *Meria* and *Apterogyna*.

SPHEGIDÆ.

*Trypoxylon testaceicorne*, sp. nov.

Black, the antennæ testaceous beneath, the 4 front knees, the greater part of the 4 front tibiæ and tarsi and the basal third of the hinder tibiæ pallid-testaceous, almost white; the wings clear hyaline, the nervures and stigma black. Metanotum to the spiracular keel closely, irregularly striated, the base irregularly reticulated; the central furrow commences at the apex of this reticulated part, is moderately broad and shallow; the two lateral keels are distinct; the top half of the apical slope is depressed, with the sides oblique and deeply furrowed in the centre. The petiole stout, dilated at the apex, about one-third longer than the 2nd—distinctly shorter than the 2nd and 3rd segments united; the base of the 3rd is pale testaceous. ♀

Length 6 mm.

*Habitat*.—Deesa (Nurse)

The 3rd joint of the antennæ is not much longer than the 4th. Face and clypeus thickly covered with silvery pubescence. Mandibles rufo-testaceous. Front alutaceous, furrowed in the centre above, finely keeled below. Hinder ocelli separated from each other by double the distance they are from the eyes. Tubercles and tegulæ testaceous. Propleuræ obliquely depressed at the apex; the upper part of the meta- finely striated. The outer furrow on the metanotum is narrow, distinct and obscurely striated.

*Cerceris lanata*, sp. nov.

Black, the abdomen orange-red; the inner eye orbits from shortly below the ocelli, the ocelli except on the sides above, a line extending from the ocelli to the clypeus, its lower part dilated, a mark on the base of the mandibles, a line on the outer orbits shortly below the top of the eyes, its inner side thicker than the outer and 2 large irregular marks on the apex of the petiole, pale yellow. Legs black; the outer side of the 4 front tibiæ, the base of their tarsi and the greater part of the hinder tibiæ, on the outer side to near the apex and behind to the middle, pale yellow; the hinder femora, tibiæ and tarsi have a brownish tint. Wings smoky, with hyaline patches, the nervures and stigma blackish. ♂

Length 12 mm.

*Habitat.*—Abu.

Antennæ black; the flagellum brownish beneath; the last joint double the length of the preceding, curved, hollowed on the underside. Face and clypeus sparsely, but distinctly, punctured; the apex of the clypeus broadly roundly projecting, and armed with 3 short, broad teeth; the sides are rounded and fringed with stiff cream-coloured hair. Front and vertex closely and distinctly punctured; the lower half of the front depressed and smooth on either side of the yellow line; between the antennæ is a sharp keel. Thorax closely and distinctly punctured; the pleuræ, sternum and metanotum covered with long white hair; the area on the metanotum is closely and distinctly punctured, smooth at the base. The basal half of the petiole is black; between the two yellow marks on the apex is a triangular brown mark; the 3rd to 6th segments have a narrow yellow line on the apices; there is a black mark, narrowed gradually behind, on the apex of the 5th segment; the last 2 are entirely black. The pygidium is coarsely and closely punctured, and is of equal width; the hypopygium is not incised.

There are two lines on the pronotum; the tegulæ are brownish; the tibial spines white. The hair is longer and denser than usual. Has a superficial resemblance to *C. vigilans* Sm.

*Miscophus nigricans*, sp. nov.

Black, densely pruinose, wings hyaline to the outer side of the transverse radial nervure, fuscous beyond, the stigma large, fuscous, the nervures and costa black, the 2nd cubital cellule triangular, the basal nervure rounded, the apical longer, straight, oblique, longer than and bulging out from the pedicle. ♀

Length 5 mm.

*Habitat.*—Matheran (March).

Opaque, granular, covered with a white pile, which is longer and thicker on the clypeus, apex of clypeus broadly rounded. Anterior ocellus separated from posterior by a distinctly greater distance than these are from each other; the latter are separated from each other by a greater distance than they are from the eyes. Metanotum long, very finely transversely striated, a longitudinal keel down the middle; the apical slope has a wide furrow down the middle and is distinctly, but not closely, striated; the metapleuræ above are finely, obliquely striated.

Related to *M. difficilis*, Nurse, from Baluchistan; that has the antennal scape, tibiæ and tarsi red.

*Astatus interstitialis*, sp. nov.

Black, an irregular mark on the top of the vertex enclosing the anterior ocellus, wider than long, almost touching the eyes above, below rounded and with a squarish incision in the middle, the tegulæ, except at the apex (where they are fuscous) and the tubercles cream-white, a broad brownish band across the base of 2nd abdominal segment; the knees and base of fore femora white

or pale ; wings clear hyaline, the costa whitish, as are also the basal nervures, the others and the stigma fuscous. Head, pleuræ and breast covered with white pubescence. Base of mandibles brown. Basal half of mesonotum punctured and striated ; the metanotum opaque, closely, finely, irregularly, transversely striated ; the top of the apical slope raised in the centre, bordered below by a semi-circular depression. The 1st recurrent nervure is interstitial with the 1st transverse cubital, the 2nd is received shortly beyond the middle ; the front half of the 1st transverse cubital is straight and obliquely bent towards the 2nd, which is straight and only slightly oblique, the 3rd is roundly curved outwardly to shortly below the middle, where there is a longish stump of a nervure, below which it is straight and bends towards the base of the wing. Tibiæ and tarsi spinose, the latter almost fuscous in colour. Mesopleural furrow narrow, but distinct. The anterior ocellus is not much larger than the posterior ; there is a furrow on the lower half of the front, its top projecting into the white frontal mark. Antennæ stout, the basal 3 joints of flagellum thinner than the others, the 3rd shortly, but distinctly longer than the 4th. Allied to *A. nigricans*, Cam.

Length 7 mm. ♀

*Habitat.*—Deesa.

## ICHNEUMONIDÆ.

### Paniscini.

*Parophelte*s, gen. nov.

Mandibles with a long, gradually narrowed upper tooth and an indistinct subapical one. Clypeus broad, its apex transverse. Eyes large, slightly incised on the inner side ; parallel, below reaching to the base of the mandibles. Temples moderately wide, rounded behind. Occiput transverse. Ocelli large, placed in a triangle, the outer placed close to the eyes. Third joint of antennæ distinctly longer than the fourth. Scutellum not margined. Areolet triangular, the recurrent nervure interstitial with the 2nd transverse cubital nervure ; disco-cubital nervure slightly broken ; the transverse median nervure received beyond the transverse basal ; the transverse median nervure in hindwings broken clearly above the middle. Fore claws (the others are broken) simple.

This genus can only be confounded with *Opheltes* from which it may be known by the undernoted characters :—

Mandibles broad, with 2 equal teeth, cheeks and temples broad, sides of middle breast divided by a deep transverse line in 2 parts.....*Opheltes*, Holm.

Mandibles not broad, with a long upper and an indistinct lower tooth ; cheeks and temples not broad ; mesosternum not divided by a transverse line.....*Parophelte*s.

*Parophelte*s *flavolineatus*, sp. nov.

Luteous, the 3rd and following segments of the abdomen and the sheaths of the ovipositor blackish ; the head, except the occiput and the outer edge of the outer orbits, apex of prothorax, 2 broad lines on the mesonotum, sides of scutellum broadly, the tubercles, a broad curved mark on the base of the

mesopleuræ, narrow above, gradually widened below, a mark on the apex below and the lower side of the metapleuræ, whitish-yellow ; wings clear hyaline, iridescent ; the stigma pale yellow, the costa darker coloured, the nervures triangular ; the areolet oblique, triangular ; the recurrent nervure interstitial. Tarsi closely spinose ; the tibiæ with a few weak spines. Smooth, shining, impunctate, almost bare. The eyes have a greenish tint. ♀

Length 8 mm.

From the large size of the eyes and more particularly of the ocelli and from the pale colouration I have no doubt that the species is nocturnal like *Paniscus*.

*Habitat*.—Ferozepore (March) (Nurse).

# MISCELLANEOUS NOTES.

## No. I.—NOTE IN REGARD TO THE HABITS OF THE PRAYING MANTIS.

The Praying Mantis is such a common feature of the Indian dinner-table that a fact in connection with its life history, if even of no great scientific importance, cannot, I think, be without interest to many readers of the Journal unless it happens to be well-known, which I think can hardly be the case.

A Praying Mantis has been on one spot on my tent wall for the last four days. This evening at dinner time it completely shed its skin like a snake and then proceeded to eat it, commencing at the tail. In the process of shedding the Mantis grew from about 1½ inches in length to 2 inches. I should be obliged if you would let me know if this process has been previously remarked with regard to the Mantis?

A. A. DUNBAR BRANDER.

HOSHANGABAD, 28*th November* 1906.

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## No. II.—NESTING OF THE COOT (*FULICA ATRA*) IN INDIA.

On referring to a back number of the Journal (Vol. XIV, p. 392) I find a note by Mr. C. M. Inglis on the nesting of the coot (*Fulica atra*) in the Darbhanga district, Tirhoot. This is however not the only instance. On August 16th, 1900, whilst staying with Mr. Inglis at Baghownie, a native brought in some nestlings which we both at the time thought were the young of the Purple Moorhen (*Porphyris poliocephalus*) but I now know that they were young coots. Since that time several nestlings of the coot have passed through my hands and they were all identical with the Baghownie specimens. I append a description of one of the nestlings. Top of head bare with the exception of some black hairs; a number of minute red papillæ at base of forehead and in front of the eyes to the bill; throat and round the neck orange, rest of plumage blackish blue, mixed on the back with orange hairs and underparts with grey. Iris dull black; bill red at base, pink in the middle and tipped purplish black. Some time in June 1900 (I have no exact date) I saw two coots on a small and very reedy pond near Somastipur and have no doubt they intended nesting.

GORDON DALGLIESH.

GODALMING, SURREY,
15*th November* 1906.

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## No. III.—*MELANITIS BETHAMI* IN PACHMARHI.

It was soon after I had arrived there that I heard of the existence of a butterfly which was only to be found in Pachmarhi and its vicinity and as far as is known nowhere else throughout the length and breadth of India. I gathered that its haunts were dark and secluded and that it was to be

known by a conspicuous yellow patch on the forewing. It was in the collection of a Sergeant of the School of Musketry, however, that I first saw *Melanitis bethami*. Its captor had been diligently sugaring the trees round his quarters for three years, and among large numbers of moths had taken a few specimens from time to time at just or after dusk on the sugar; he however took them for a variety of *Melanitis leda*. Having brought my entomological paraphernalia with me, I determined thenceforward to devote my spare time to the quest of *Melanitis bethami* and searched hill and nullah but in vain. I tried sugaring but with a like result, till I began to regard the insect as a myth and its capture as chimerical. The day on which the spell was broken was October 6th. I had taken a light trout-rod and a tin of worms to the bottom of a neighbouring nullah, where ran a small stream, in the hopes of catching a few fingerling mahseer, while a *chokra* carried my butterfly net and a tiffin basket. On the way down I had caught a fine specimen of *Kallima inachis* and had only been fishing a few moments when my boy called out that he had seen and had marked down another *Kallima*, "patti-wallah titli" he called it. Dropping my rod, I had scarcely reached the boy, when a tawny looking butterfly rose from the ground just in front of me and after a curious jerky flapping flight, pitched on the dry sal leaves some fifteen yards ahead. I recognised it at once as *Melanitis bethami* and took it without difficulty as it sat. My prize was a true *Melanitis* but easily distinguishable from the other species of that genus by the large tawny golden patch covering the apical half of the forewing. Fishing was at once abandoned and by evening I had eight perfect and one battered specimen. This last being smaller, altogether less brilliant and its forewing much less falcate, I rightly assumed it to be one of the last survivors of the wet-season brood, while the others were evidently the harbingers of the dry season. The next day I visited the same nullah and took six more perfect specimens, from which it was evident that the dry season batch had just commenced. Before the end of the month I had taken I am ashamed to say how many specimens of *Melanitis bethami* and can now claim to be fairly familiar with its ways. The habitat is always the same, *viz.*, on the very edge or in the partially dry bed of a tiny tributary streamlet at the bottom of some deep gloomy nullah where the sal leaves form an almost impenetrable screen overhead. I took two specimens only on the plateau, evidently wanderers, but success can only be achieved in the localities above described. The sexes are distinguishable by the slightly smaller size of the male and the smaller area of the golden patch on the forewing, the outer margin of which is cinereous, or rather a silvery grey. The undersides of both sexes, which are dark-ashy grey in the male and lightish sepia in the female, are striated and resemble exactly the dead leaves on which the insect invariably settles with closed wings when disturbed. The colouration and markings of the undersides of each sex are subject to very little, if any, variation, an unusual feature in *Melanitis*. In the centre of the golden patch is a large

pupilled spot which, however, is very variable in size and sometimes obsolete in the males. I never found either pupa or larva.

The quest of *Melanitis bethami* is now only a pleasant memory ; but I hope some day to renew the encounter among the deep sandstone nullahs, which guard the approaches to Pachmarhi.

H. W. KETTLEWELL, CAPTAIN,
85th King's Light Infantry.

FYZABAD, 28*th November* 1906.

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## No. IV.—THE BRONZE-CAPPED TEAL (*EUNETTA FALCATA*) IN TIRHUT.

After an interval of six years this beautiful teal has again been found here. Yesterday I got a female on a jheel close to here. There were only about half a dozen birds and they were at too great a distance for me to be able to say whether there were more of this species or not. I fancy had there been any drakes they would have been noticeable.

CHAS. M. INGLIS.

BAGHOWNIE FCTY., DARBHANGA, 4*th December* 1906.

## No. V.—SOME NOTES ON TIGERS AND PANTHERS.

There are several matters of great interest dealt with in the issue of the Journal of 20th September 1906 (No 2. Vol. XVII) regarding the habits of tigers and panthers.

One correspondent notes the placing by a panther of the carcase of a spotted deer in the fork of a tree. This habit of depositing prey in trees is not uncommon, and I have found remains of barking-deer and four-horned antelope, goats and dogs so disposed of by panthers on several occasions. I think an instance of the body of a Banjara boy, killed by a panther, being deposited in the fork of a tree was recorded in the Journal some twelve or fourteen years ago. The instances of the boldness of panthers, described by another correspondent, are not unusual. It is a common occurrence for dogs to be pounced on and carried off in the presence of their masters at many of our hill-stations, and I have known one enter a tent for the same purpose. Panthers will frequently return to a kill after being fired at and I recollect one coming back to the carcase of a nilgai three times under such circumstances. Indeed the boldness of these animals appears to be unlimited. In a village near which I was encamped some years ago one entered a hut in which a woman, a child and a dog were sleeping alongside each other. The beast stepped over the dog and the woman, and carried off the child, which it devoured a few hundred yards off.

As regards the killing of their prey by tigers and panthers, these animals have certainly no fixed and invariable method of accomplishing their object. Very probably one tiger will generally kill in the same way, but different

tigers appear to have idiosyncracies and characters of their own, and I have seen the great cats kill both by seizure of the throat and of the back of the neck. I have never come across a kill on which the marks of the canine teeth were absent, so have known of no instance of the prey being destroyed by a blow of the paw. I recollect, however, seeing a large brass dish, carried by a beater on his back, perforated in three or four places by the blow of a tiger's paw; in this case the tiger did not use his teeth, and the man was not injured beyond bruises incidental to the blow and fall. I much regret not to have examined the hundreds of "kills" I have seen, to ascertain whether the neck was broken or not. On one occasion I shot a blue bull in a very emaciated condition with the marks of a tiger's claws on his back, causing suppurating wounds. I agree with Mr. Dunbar Brander that the tiger (and also the panther) has no very acute sense of smell, but I doubt his having very keen sight. He appears to be quick to catch sight of a moving object at a short distance, but I have known tigers look at me for some time with unseeing eyes, so long as I remained motionless, and this within a distance of twenty or thirty yards. Their quick sense of hearing is undoubted.

There are many recorded cases of cannibalism in tigers. One instance came under my own observation in 1895, when out on a shooting expedition in the Nizam's Dominions. I was after a tiger for some days, whose tracks were easily distinguishable owing to his having suffered an injury in one of the hind legs, causing the "pug" to assume a plantigrade shape. One day I broke open the dry dropping of this tiger, and found it to be composed of tiger's hair, whilst embedded in it was a perfect claw. The late Mr. James Douglas of Bombay told me he had found an exactly similar object at Mahableshwar some forty years ago. I never shot the tiger with the injured foot or leg, which had presumably been caused in an encounter with another of his species whom he had devoured.

Captain Watson mentions a pack of 11 wolves seen in Persia in August. The European wolf, which is the same species, forms into large packs, generally in winter, and I have seen a pack of 25 or 30 in Russia in a hard winter.

There was a pack of Indian wolves which took to man-eating some 18 years ago in the Hoshangabad district, but I forget of how many it was composed. Generally in India these animals seem to be in pairs, and I have seen no more than five together, but a friend of mine saw a large pack of fifteen or more at Jalna, and relates that they did not exhibit any fear of him, although he passed quite close to them.

I have just seen the skin of a wolf shot here in Baluchistan, which does not appear to differ in any way from *Canis pallipes*, the Indian species, although I understand only *Canis lupus* is found in this country.

R. G. BURTON, MAJOR,
94th Russell's Infantry.

FORT SANDEMAN, *December 12th*, 1906.

## No. VI.—AN INJURED MONKEY.

In August 1903, I was marching through heavy jungle one morning during the pouring rain, when I came upon a monkey (*P. entellus*) lying just beside the path. When I went up to it, I found that it was impaled upon a broken bit of stump some 12 in. long and about 1 in. in diameter. It was hopelessly injured, and the liver was protruding when I lifted it up. It had evidently missed its hold on the slippery branch and fallen. I have never heard of a similar case. The beast was about 7 months old.

H. R. G. HASTED.

BROOK HOUSE, SUFFOLK, *5th December* 1906.

## No. VII.—PANTHER KILL UP A TREE.

In No. 2 of this year's Journal (Vol. XVII, page 317) there is an account of a panther having placed its kill in a tree, and Mr. Comber, the Honorary Secretary of our Mammal and Bird Section, asks if any member has come across anything similar. I once had a somewhat similar experience.

In 1903 I was camped at a small village where panthers committed a great amount of damage among goats, and on the first night I had several goats tied up. Next morning one of them was killed, and on going to the spot I found that the hind quarters and stomach had been entirely devoured, and the remainder of the goat had been deposited on the branch of a jack-fruit tree. It was a big tree with no branches for about eight feet. The kill was resting on a fork in one of the lower branches about six feet from the trunk and some nine or ten feet from the ground. I did not disturb it, and, as there was a good moon, I sat up about twenty feet from the tree in order to watch the beast. As bad luck would have it, the night came up very cloudy, and I could see nothing. The panther returned just after dark and made no noise at all in ascending the tree, the first thing I heard being the crunching of bones. After waiting about an hour in the hopes of it getting brighter, I fired at the sound and heard the panther drop to the ground and make off.

H. R. G. HASTED.

BROOK HOUSE, SUFFOLK, *5th December* 1906.

## No. VIII.—ENCOUNTER BETWEEN A SNAKE AND LIZARD.

*Apropos* an article of mine in a recent issue of this Journal on the enemies of snakes, Mr. L. V. Baghame has favoured me with an account of a most interesting encounter he witnessed in Upper Burma (Trindat), in which a lizard attacked and vanquished a snake. The lizard was the "Tuctoo" (*Gecko verticillatus*) so familiarly met with in Burmese houses, and the snake was a rat-snake (*Zamenis mucosus*) between 4 and 5 feet in length.

The snake was a frequent caller in Mr. Baghame's house, where its visits were encouraged with a view to keeping down the rats that infested the thatched roof.

On the occasion referred to, the snake was lying along a beam in the roof when a tuctoo was seen to advance towards it and challenge it; and it seems very remarkable, when one considers the truculent disposition of the dhàman, and the disparity in size of the contesting parties (the tuctoo only grows to about one foot), that the ophidian should have retreated before the advances of the lacertian. The snake, though obviously anxious to withdraw from an awkward situation, refrained from making a bolt of it as though apprehensive of the consequences of presenting so vulnerable a portion of its anatomy as its tail to the foe, and throughout an engagement, lasting about an hour, persisted in facing its antagonist. At last, however, in desperation, it summoned sufficient courage to attempt an undignified exit through a hole in the roof; but no sooner had its head disappeared than the tuctoo rushed upon it and bit off some 9 inches of its tail, retiring with the spoils of war into its usual corner, but whether it devoured it or not Mr. Baghame could not discover.

The dhàman has not been seen since!

F. WALL, MAJOR, I.M.S.

*December* 27th, 1906.

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## No. IX.—THE VITALITY OF SNAKES.

If I remember right, some years ago an account appeared in the Journal of the head portion of a cobra—that had been shot in half—pursuing a native. This story was, I think, received with a certain amount of scepticism. I therefore thought the following might be of interest as confirming the above, and showing the wonderful vitality of snakes and the care that is necessary in dealing with them.

Several weeks ago, while at the Division Office here, a native reported that there was a large snake in the compound. Accordingly, Col. Middleton, A. A. G., Major Vincent, D. A. A. G., and I went out to see it, and can all three vouch for what is here related.

There was a small masonry tank of the usual kind for watering a garden, with a closed drain some 4' long leading out of it, the tank end being plugged and the water some few inches above the level of the plug. In the open end of the drain we saw the tail of a black snake which we thought looked like that of a cobra. As it was impossible to get at it with a stick, Major Vincent sent for his shot gun, and on its arrival fired at and cut the snake clean in two, as we afterwards ascertained, the tail end being a few inches shorter than the head portion. The tail was easily poked out with a stick, but there was no sign of the head, and inserting a stick into the drain produced no effect. Accordingly, the plug was pulled out of the tank end, thinking that the rush of water would wash out the snake; but it only brought out a quantity of blood and several frogs; which latter perhaps had proved the attraction. Rattling a stick in the tank end of the drain, however, produced a wonderful effect. Instead of a defunct snake, out came the head and some 15" or 16" of a very lively and angry cobra, head raised, hood expanded, and the mouth so

wide open that the jaws nearly formed an angle of 180°. It turned its open mouth upwards towards us, so that we could almost see down its throat whether with the intention of ejecting poison or not I do not know. No mention was made by anyone of any such ejection being noticed. I had seen snakes represented in Heraldic drawings with their mouths open to this extent, but had thought such an attitude existed in the imagination only, but now see that the Heralds were truer to nature than one thought. We were so surprised that none of us did anything the first time, and the snake quickly withdrew again into the hole. This was repeated several times, the blows aimed at the cobra not taking effect, as it withdrew almost immediately. At about the third or fourth appearance I pinned the body of the snake against the side of the tank with my stick so that it could not withdraw. It struck savagely at the stick twice and then seized it and held on, in which position it was finally killed by blows from another stick by one of the European soldier clerks. Even then we had some difficulty in pulling out the rest of it, as the portion in the drain seemed to grip on to the sides and resist all it could. We, however, finally gripped it in a split bamboo and got it out. We had no means of measuring with us, but estimated it to be about a 5′ cobra, almost black and rather thick for its length, and the head half as cut off by the shot to be some 3″ or 4″ longer than the tail half.

H. V. BIGGS, Lt.-Col., R.E.

Mhow, C. I.,
11*th January* 1907.

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## No. X.—THE BOLDNESS OF PANTHERS.

I was glad to read a letter on the above subject on page 522 of this volume of the Journal by F. Field, but consider that the following personal experience taken from a record made in my diary at the time beats anything I have heard on the subject of the boldness of panthers, and as such may be also of interest to your readers.

On the 29th of April last I was camped near a fishing stream close to a village in quite open country except that on the right front of my tent there was a little tongue of scrub-jungle detached from some heavier scrub-jungle by a path and bare ground. I usually have constructed, in front of my tent, a temporary roof supported on four bamboos driven into the ground.

It was at night after dinner that I sat reading with a strong light behind me on a table, just outside the tent but under the temporary roof, my legs thrown out horizontally and resting on one of the bamboo props of the roof, my dog asleep directly under my outstretched legs.

At the end of a story, I let the magazine rest on my chest and closed my eyes. On re-opening them, I was conscious of something near me and looked down straight into the eyes of a large panther, scarcely 3 yards away, which came crouching along the ground. To jump, shout and throw the magazine

in its face, was the work of impulse. He scurried back into the scrub and the dog, not in the least aware of his danger, was soon curled up fast asleep again. Everything else was left undisturbed and I took up my position, after carefully shading the tent-side of the lantern, behind one of the front flaps of my tent.

It appeared to me that I was scarcely kept waiting five minutes when the Panther appeared again, sitting up like a dog some 20 paces away. I could not see my sights, but saw the animal fairly clearly, so aimed for the chest and pulled. Result: Noise, blood and a certain amount of fur, but no panther.

Next day after breakfast I took up the blood trail, but never got the panther.

S. E. F. JENKINS.

LOI-LEM, S. SHAN STATES. *December* 1906.

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## No. XI.—ABNORMAL SAMBUR HORNS.

When shooting in Mundla at 'Xmas, while beating we found a sambur which had been killed by a tiger. It was a rather curious one as it had nine points. The left horn was that of a normal 3-pointed sambur 32½" long. The right however had an ordinary brow antler, but up at the top of the beam were 6 points (like "royal" points on a Scotch stag). The biggest of these was about 6" long and the smallest 3". The beam was curious too, as instead of the ordinary sweep of the horn, it grew straight up without curving at all practically either backwards or sideways. I should be interested to hear if these are common or not.

J. ARCHIBALD FIELD.

JUBBULPORE, C. P.,
*15th January* 1907.

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## No. XII.—AN ABNORMAL HOG-DEER HEAD.

I send a photograph of a Hog-deer (*Cervus porcinus*) head. I have never before seen one with an extra tine, though I have seen hundreds of these deer in Burma Big heads were common there, but I think this is an exceptional one for this part of India. The deer was shot in the Karnal District by my brother-in-law, Major R. M. Lowis.

The horns measured 19⅜ inches, the extra tine being 10¼ inches long.

R. CLIFFORD, LIEUT.,
(22nd Punjabis).

JHELUM, PUNJAB,
*7th December* 1906.

ABNORMAL SAMBHAR HORN.

ABNORMAL HOG-DEER HEAD.

## No. XIII.—THE FOOD OF PYTHONS.

I send herewith particulars given me by Mr. Ralph, the Executive Engineer, P. W. D., of this District, as they may prove of interest to some of our readers.

On the 19th December 1906, at about 6 p.m., news was brought to Mr. Ralph and Mr. Debrulais (Assistant Engineer, Bengal Duars Railway) that a huge python (*Python molurus*) was lying in the Tondoo Forest between the Murti and Saldacca Rivers (Nagrakhatha Sub-district).

As the snake was reported to be only about 150 yards from the railway line, the two went off at once duly armed, but on their arrival, they found the snake absolutely comatose, and it was killed with sticks. It was very distended and they decided to see what it had been feeding on. It was opened and found to contain a leopard measuring 4 feet 2 inches from nose to rump. The tail came off when removing the body and was too decomposed to be accurately measured. The panther had been swallowed head first, with its forearms stretched out in front of its head.

On the snake were found seven hind-claw cuts, the first about 3 feet from the head, the last about 1 foot from the tail.

The python was 18 feet in length and the span of the skin, after removal of the leopard, was 22 inches.

ARUNDEL BEGBIE, MAJOR
(13th Rajputs).

BAKSA DUAR, 14*th January* 1907.

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## No. XIV.—BATS FEEDING ON SMALL BIRDS.

For the past three years I have been puzzled to know whether my surmise that the Indian Vampire Bat (*Megaderma lyra*) was responsible for the remains of several kinds of small birds, chiefly of the Indian Bush Chat (*Pratincola maura*), small bats and insects, which are always to be picked up from the floor of my front verandah every morning in the cold weather, and which is at times quite strewn with them.

At first I suspected the culprits might be either rats or owlets (*Athene brama*), which occupied a leaf shed close to the bungalow but were killed on account of the unpleasant noise they made. I had frequently scared this bat off specimens of birds that were hung up preparatory to skinning in the morning, but not before they had damaged the breast and abdomen.

To-night, however, I have been able to confirm the fact that undoubtedly small birds do form a portion, and here a substantial one, of *M. lyra's* food, having just killed one in the act of eating a small bird, and the bat and its victim lie before me as I write. On going into my office, which opens into the verandah, to get some note paper, I heard something drop and saw three of these oats flying round the room. Picking up a stick I knocked one down and

told the boy, who was holding a light, to see if it was not a bird that the bat had dropped; it was, the remains being quite warm and bleeding.

I think this conclusive evidence and perhaps worth recording.

A. M. PRIMROSE.

TAMARHAT P.O., GAURIPUR, ASSAM.
*12th November* 1906.

(The above confirms Mr. Green's note in the last number of our Journal and was written quite independently before its publication.—EDS.)

## No. XV.—BATS FEEDING ON BIRDS.

Referring to Mr. Ernest Green's query on p. 835, Vol. XVII of this Journal, there is no doubt whatever that *Megaderma lyra* habitually feeds on birds and mice. These verminiferous vermin (the bats) used to annoy me greatly by catching mice about my house, and fetching birds out of their comfortable nests in the night and chewing them up in the corners of rooms or verandahs. We are spared the use of our inductive and deductive faculties (which would perfectly suffice) by the simple fact that I have seen them do it many times. The well known zoologist, Mr. F. Finn, was living with me at that time. We caught and caged the bats and he fed them on small birds brought for sale by natives. The hanging bat watched his time, made a grab, had the bird by the back of the neck and killed it instantly. No chase or excitement, simply a swoop or even a grab with the wings when the bird passed close enough. Having got the bird by the neck close behind the head, the hanging bat made a clean job of it in wonderful fashion. He started by chewing the neck in two and dropping the head as neatly as any one could with two hands and a knife and fork. Never by any chance did he drop the body though the wings were not used for holding it. Wings were occasionally used for turning the body round by a mere touch but never for supporting it. He chewed steadily along to the feet and tail, which dropped in their turn with the same matter-of-course facility.

F. GLEADOW.

CAMP BANDRA, SALSETTE,
*10th March* 1907.

## No. XVI.—CURIOUS BEHAVIOUR OF A PANTHER IN CONNECTION WITH A KILL.

I read with much interest an article by Mr. Comber in a recent number of our Society's Journal (page 517 of this volume) regarding the curious behaviour of a panther in relation to a kill, and have had the good fortune myself to witness a more or less similar incident which, from a sportsman's point of view, is not only interesting, but important, and shows most remarkable sagacity.

The scene of the incident I am about to relate was a forest, into which large numbers of wild cattle had been driven and enclosed for purposes of breeding and preventing them from roaming about the country damaging crops. In certain parts of this forest *kuchha* wells had been dug, and drinking troughs erected for these animals in the hot months; at these spots large numbers of

wild cattle, with their calves, would congregate before nightfall for refreshment. It was an exceedingly pretty sight to see the extraordinary variety of wild animals that came to these troughs to drink when the sun was setting, and, in order to obtain a better view of this proceeding, I had erected, in close but hidden proximity, a machan in a large "kadam" (*Anthocephalus cadamba*) tree amidst dense foliage, where my presence would never be suspected, and into this I used frequently to go and sit before sunset, in order to watch these different animals come for their evening drink. It was most interesting to note the regularity of order in which the same animals used to come, a certain sequence being invariably kept, beginning with the wild cattle themselves, followed by nilghai, antelope, jackals, wolves, hyænas, wild boar, and, lastly, panther! One evening, in close proximity to the tree in which I had erected my machan, I noticed a tree, of which the trunk near the ground had been much marked by, what looked like, scratches deeply engraved into the bark and around it were panther pug marks. I also noticed that the scratches extended up the trunk, and upon casually looking up into the branches, saw, quite 25 feet from the ground, something white hanging upon the bifurcation of one of the main branches, regarding the exact nature of which, in order to satisfy myself, I directed my orderly, who was with me at the time, to climb up and ascertain. It turned out to be the half devoured carcase of a calf, which had evidently been dragged up there by a panther, whose scratches on the trunk all the way up were marked, as well as pug marks around it on the ground, showing ample evidence as to the perpetrator! My suspicions were not long in being substantiated. On that same evening, before sunset, I took up my position in the same machan, but this time with my .303 rifle, and awaited events. As usual, the same string of animals, in absolutely identical order, came and went, till at last, after several sounders of pig had departed, a fine boar came and wallowed for a good many minutes in the mud and slush which inevitably accumulates around these drinking troughs. I was so interested watching this beast having his bath that my attention, for the time being, was rivetted upon him; but suddenly, as if a puff of wind or something had aroused him from his dream, he sprang to his feet and stood looking fixedly in a certain direction—the opposite to which I had been looking—when I also turned my head to look, and there was a panther standing about 30 yards off, slowly moving its tail. I remained still, though my friend, the boar, did not wait long, but, turning on his heels, scuttled off into the jungle in the opposite direction. I sat still watching the panther. She went up to the tree I have mentioned (at nearly the very top of which she had spitted her evening meal in a nice cool larder under the thick foliage aloft) and smelt around and looked longingly up, evidently making up her mind to ascend, when she suddenly changed it and came slowly up to the place where the boar had been wallowing, and after a fairly long pause, during which she was looking about and around, lowered her head and began to drink. I thought this should be my opportunity, so I quickly brought the head of my rifle on to the back of her

head—at the junction of head and neck—and fired, whereupon the unfortunate animal just rolled over into the water, without a struggle, stone dead. She was a fine beast, not very large but in the pink of condition, and had been the murderer, I fear, of many wild cattle calves. The spot selected by this beast for her larder was most ingeniously thought out, as it was sufficiently high to prevent any animals, such as jackals, hyænas, etc., from touching it, and was most carefully concealed below the thick foliage of the tree, so that vultures or other carrion birds should not detect or tamper with it in any way during her absence. The temperature, moreover, at that point was, I fancy, the lowest to be found in the neighbourhood, as, owing to the transpiration of moisture from the leaves and exposure at such a height to the hot wind then prevailing, a uniform and cool temperature was kept up by evaporation, which helped to preserve her meal from too early decomposition possibly, as even a panther, I fancy, has sufficiently good taste to prefer, when possible, fresh rather than decomposed matter for its meals. I fancy many such instances of sagacity in wild animals could be obtained, if sportsmen laid themselves out to observe life in jungles, as I have, when opportunity afforded. In order to do so effectually, an extremely interesting and entertaining method of seeing such sights is to erect a machan at a carefully selected and much-haunted drinking spot. I am, however, far from advocating such means as sportsmanlike in the pursuit of game, for methods of shooting animals over water are truly oriental in their origin, and, as such, should never be resorted to by us, but for the observance of interesting phenomena in connection with animal life in jungles they are unequalled.

H. E. DRAKE-BROCKMAN, F.Z.S., Major, I.M.S.

Bangalore, *January*, 1907.

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## No. XVII.—ON A NEW SPECIES OF *FULGORID* FROM DARJEELING.

Order—*Rhynchota*. Sub-order—*Homoptera*. *Purohita arundinacea*, Dist.

I have to record the occurrence in Darjeeling of a new species of Fulgorid of the genus *Purohita* (sub-family *Delphacinæ*), specimens of which were sent me by Dr. Harold H. Mann in September 1906, collected from Bamboos at an elevation of 3,100 feet, and which, through the kindness of Mr. W. L. Distant, has been named *Purohita arundinacea*. A description of the insect will appear in the Supplement to Vol. IV. on *Rhynchota* by Distant in the Fauna of British India Series.

CHAS. B. AUTRAM,
Entomologist, Indian Tea Association.

*5th February*, 1907.

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## No. XVIII.—*CANTECONA FURCELLATA*, WOLFF.

Order—*Hemiptera*. Family—*Pentatomidæ*. Sub-family—*Asopinæ*.

This Pentatomid Bug has previously been recorded as attacking the larva of *Hyblæa puera*, a Noctiud moth, and the silkworms of the Tusser moth, feeding

in the open. I have now found it attacking the larvæ of the *Limacodidæ* in Sylhet, some of which are sometimes very serious caterpillar pests of tea. It also occurs in North Cachar, a few specimens having been taken in January 1907. The insect is figured on plate XVI, fig. 5, in Ind. Mus. Notes, Vol. V., No. 3.

CHAS. B. AUTRAM,
Entomologist, Indian Tea Association.

*5th February*, 1907.

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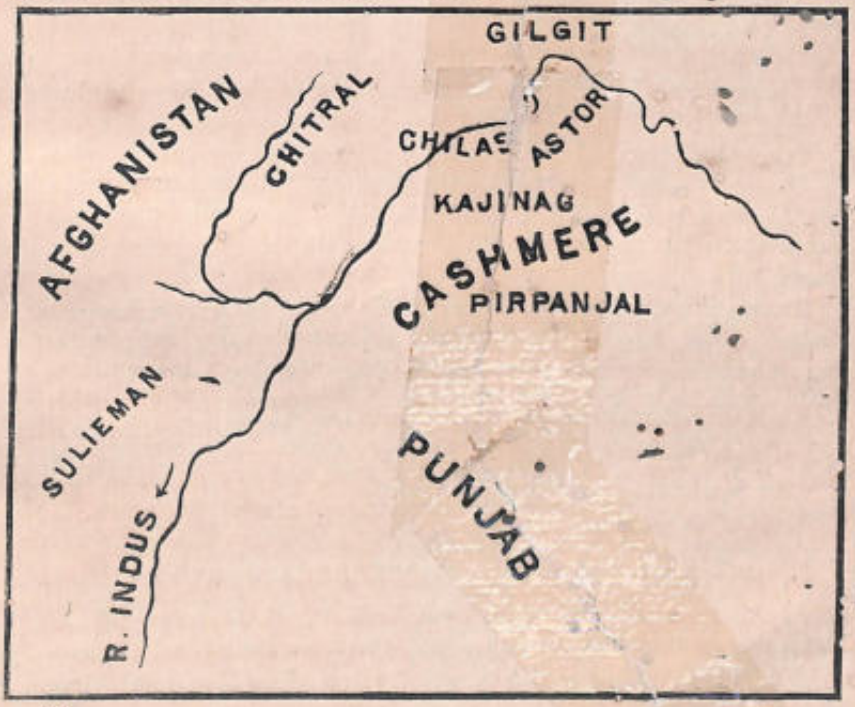
## No. XIX.—THE DISTRIBUTION OF THE DIFFERENT VARIETIES OF HIMALAYAN MARKHOR (*CAPRA FALCONERI*).

(*With a plate.*)

The accompanying photographs of markhor trophies may be of interest to your Society, as illustrating the variation of type, which occur in horns, obtained in different localities.

The habitat of the markhor roughly follows the band of the Indus, from the Sulieman ranges in Baluchistan, the North-West Frontier Province, and Afghanistan, through Chitral, to Chilas, Gilgit, Astor, thence South to the Kaj-i-Nag and Pir Panjal mountains in Cashmere.



The photographs show types from these localities. Horns from the Sulieman mountains are straight, and the tendency is for them to curl more and more, as we follow them through Chitral, Chilas and Astor to the Kaj-i-Nag. No particular reason can be assigned for this.

Seeing, however, that the Suliemans are generally devoid of forest, and Chitral nearly so, while the jungle becomes denser as we follow the range of the markhor to the Kaj-i-Nag, which is heavily wooded, I am inclined to the theory that the horns are found to assimilate to a type best suited to synchronise with the character of the country and cover in which the animal is bred. Individual heads, of course, vary, and local varieties may merge into one another, except in the case of the Kaj-i-Nag and Pir Panjal, between which and the Chilas and Astor districts there is an area devoid of markhor. It has, however, been ascertained that the locality in which the trophy was obtained can generally be determined according to whether it approximates to one or other of the types shown in the photographs. I may mention that these photographs are of specimens selected not for their size, but as typical of the five groups of unlabelled horns, into which an officer unacquainted with markhor shooting separated a large number of heads in possession of the 5th Gurkha Rifles. It was afterwards found that the groups thus selected corresponded exactly with the groups of localities in which the animals were shot.

1. Straight Horn, Sulieman Markhor, 38", picked up in Chitral.

The average length of the Chitral, Chilas, Astor and Kaj-i-Nag horns in this collection was found to be 45·5 inches round the curve. This method of measurement hardly does justice to the Chitral markhor, a larger and heavier animal than his brother of the Kaj-i-Nag.

H. P. BROWNE, Captain,
5th Gurkha Rifles.

Indian Staff College, Deolali,
10th *February* 1907.

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## No. XX.—"SHOT-BORERS" IN BAMBOOS.

I notice in the Journal No. 2, Vol. XVII., p. 526, the notes of Mr. N. F. Troup on "Shot-borers" in bamboos that have been felled on moonlight nights. The cause is this: the bamboo is powerfully affected by the moon, and

2
CHITRAL
MARKHOR,
49", shot at
DROSH NULLAH.

3
CHILAS
MARKHOR,
49", shot at
GHOR NULLAH
(opposite CHILAS).

4
KAJ-I-NAG
MARKHOR,
49", shot at ARA-
LORI NULLAH.

5
ASTOR MARKHOR,
52",
shot near ASTOR.

VARIETIES OF MARKHOR (CAPRA FALCONERI).

when that object appears, the sap rises and remains till the moon has waned. If bamboos are cut at this time they are certain to go to powder within 18 months; and if used immediately after felling for spears, &c., they usually break. Bamboos cut on dark nights will keep indefinitely, and seldom break. Also bamboos cut in the daylight at any time of the month usually go to powder in three or four years.

R. BARTON-WRIGHT,
Asst. Manager to the Lessees, Sivaganja Zemindary.

SIVAGANJA ZEMINDARY,
SIVAGANJI P. O.,
MADURA DISTRICT,
27*th January* 1907.

[Mr. E. P. Stebbing writes in reference to the above note :—"This appears to be merely a recapitulation of the opinions or theories or superstitions, I scarce know which to call them at present. I should be delighted to hear whether Mr. Barton Wright has ever carried out a series of experiments on the lines laid down in my paper* to *prove* that the opinions commonly held on the subject have really a foundation to rest upon. It is useless attempting to solve what appears a most curious problem until we have authoritative proof, based upon carefully carried out experiments, that a scientific problem exists which requires solution."—EDS.]

## No. XXI.—A REMARKABLE TREE.

I regret that in my note on page 527 of this volume under the above heading, I have given the wrong botanical name. The tree is not *Michelia champaca*, but *Michelia nilgirica*, Zenk.

Until to-day I had not seen the flowers, and was misled by statements of others and by the vernacular name given in the list of trees and shrubs of the Madras Presidency. I secured the flowers to-day, and discovered my error.

C. E. C. FISCHER.

CAMP DODDASANIPAGAI,
17*th February* 1907.

## No. XXII.—THE NESTING OF THE RUFOUS-BELLIED HAWK-EAGLE (*LOPHOTRIORCHIS KIENERI*).

I am sending for identification the skin of a bird that I take to be the Rufous-bellied Hawk-Eagle (*Lophotriorchis kieneri*). As Dr. Blanford in the "Fauna of British India, Birds, Vol. III.," mentions the nidification as being unknown, I give particulars of how I obtained the bird. I discovered the nest on the Anamallai Hills in December last (1906). It contained one young bird, which I procured and reared successfully until it was, as you will perceive, nearly full fledged, intending to train it, if possible, for hawking hares, but, unluckily, it broke its leg in some mysterious way and to my great regret

* [This paper owing to Mr. Stebbing's absence in England, cannot appear in this number but it is hoped will be published in No. 1 of Vol. XVIII.—Eds.]

I had to kill it. The nest was in the midst of the evergreen forest in the fork of a tree which the natives (Karders) there call "Karani maram," the flowers of which are eaten by them both raw and pounded into a pulp, when they are mixed with flour and made into cakes. This particular tree had not a single branch for over 100 feet—in fact none till the fork where the nest was. This was a huge platform of sticks lined with green leaves only, and the two Karders climbed up by driving wooden pegs into the trunk at intervals, and then tying long, thin poles to them, thus making a ladder in a wonderful manner. I tried to shoot a parent bird, but did not succeed. As the nest will probably be occupied again next October, I hope to obtain the egg and another young eagle to attempt to train.

A. M. KINLOCH.

"CLYFFE" ESTATE, KIL-KOTAGIRI, NILGIRIS.
*21st February* 1907.

[Mr. Kinloch's identification is quite correct and it is to be hoped that he will be able to get an egg next season.—EDS.)

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## No. XXIII.—VERNACULAR NAMES OF SOME INDIAN DUCKS.

During a visit to the Null* at Christmas, I was interested to find that the Koli fishermen had distinctive names for the different species of duck which, in several instances, corresponded closely with the names used by the Mohánas, the inland fishermen and boatmen of Sind. While in most parts of India it is difficult to get the duck distinguished by local names, the Mohánas never use any but the specific name. The following list is, I think, pretty complete for Sind, though I have omitted several varieties, *e.g.*, Dholári for the Shoveller (*Spatula clypeata*), which are really nicknames. I have put in the few Null names I learnt for the sake of comparison :—

| Name of Duck. | Sindhi Name. | Null Name. |
|---|---|---|
| Whistling Teal (both species). (*Dendrocygna javanica.*) | Chihu } Chihar } ... ... | ..... |
| Ruddy Sheldrake ... (*Casarca rutila*). | Chakwa ... ... ... | ..... |
| | Kwancha ... ... ... | ..... |
| | Kathiun (Manchar Lake)... | |
| | Mangh (for all geese) ... | |
| Sheldrake ... ... (*Tadorna cornuta.*) | Thar-jo-hiragi ... ... | ..... |
| Shoveller ... ... ... (*Spatula clypeata.*) | Gaino, ... ... ... | Gaino. |
| | Langho ... ... ... | |
| | Alipat (Thar Parkar). | |

* For the benedt of those readers who are not acquainted with the piece of water termed "The Null," it may be as well to state that it is situated on the East of Kathiawar and North of Guzerat in the Bombay Presidency.

| Name of Duck. | Sindhi Name. | Null Name. |
|---|---|---|
| Mallard ... ... ... (*Anas boscas.*) | Niragi, hiragi ... ... | ..... |
| Spot Bill ... ... ... (*Anas poecilorhyncha.*) | Hangar ... ... ... | ..... |
| Gadwall ... ... ... (*Chaulelasmus streperus.*) | Burd, Buári ... ... | Buar, fem. Buari. |
| Pintail ... ... ... (*Dafila acuta.*) | Drighush ... ... ... | Paras, Parai. |
| Wigeon ... ... ... (*Mareca penelope.*) | Phàrao ... ... ... | Pharao, fem. Phamainshi. |
| Common Teal ... ... (*Nettium crecca.*) | Kardo (کرڙو) .. ... Chikhlo (Lower Sind) | Chékhlo, Jékhlo. |
| Garganey Teal ... ... (*Querquerdula circia.*) | Charho ... ... ... Kardo ... ... ... | Kandio. |
| Marbled Teal ... ... (*Marmaronetta angustirostris.*) | Chhoi ... ... ... | ..... |
| Pochard ... ... ... (*Nyroca ferina.*) | Tarando ... ... ... | Tarandio. |
| Red-crested Pochard ... (*Netta rufina.*) | Ratoba ... ... ... | Ratobari. |
| White-eyed Pochard ... (*Nyroca africana.*) | Burnu ... ... ... | Tamni. |
| Tufted Pochard ... ... (*Fuligula fuligula.*) | Raháru ... ... ... | Kalweio. |
| Smew ... ... ... (*Mergus albellus.*) | Jhàli ... ... ... | ..... |

It will be seen that out of ten names found on the Null, seven are identical with, or closely resemble, the names of the same species in Sind, while of the remaining three, one Sindhi name, that of the Pintail, is Persian and not indigenous. Other instances of correspondence are the use of the word "ad" (आड) or "adi" on the Null for duck generally, just as "ari" (اڑي) is used in Sind, though Europeans commonly restrict the latter word to the coot. The pelican is "Pen" both in Sind and on the Null. When the extent of desert between the two countries and the present entire dissimilarity in appearance, language, and religion is considered, these resemblances are interesting as showing the wide spread of the old fishing race of Western India. Perhaps some sportsmen acquainted with the Null will supply a full list of names for that place.

P. R. CADELL, I.C.S.

BOMBAY, *6th March* 1907.

## No. XXIV.—OCCURRENCE OF THE BUTTERFLY *CHILARIA OTHONA* IN SALSETTE.

On the 28th February last I captured a fresh male of *Chilaria othona*, Hew., in Salsette. This is another addition to the butterfly fauna of the Konkan as given in Messrs. Comber and Aitken's list in Vol. XV of the Journal.

I observe, however, that De Niceville gives Bombay as a locality, so it has probably been taken in the neighbourhood before.

Probably, it has been overlooked. Not many people do much collecting at this season of the year.

L. C. H. YOUNG.

BOMBAY, *March* 1907.

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## No. XXV.—A NOTE ON AN EDIBLE FUNGUS FROM LAHORE.

(*Read before the Bombay Natural History Society on 7th March* 1907.)

At our Society's meeting held last January, when speaking of the edible "*Morel*" fungus of Kashmir (*Morchella esculenta*), I promised to exhibit some dried specimens.

*Description.*—The pileus is ovate round, or oblong; adnate to the stem at the base; ribs firm, anastomosing; intervals forming pits; stem even; asci cylindrical; sporidia 8, elliptic, 20—22 + 10 $\mu$; paraphyses filiform, slightly thickened above. The native name of the fungus is *Guchhhi* or *Luchhhi*.

In LeMaout and Decaisne's "Descriptive and Analytical Botany", translated by Mrs. Hooker, there is note at page 957 (edition 1873), which runs thus:—"The Common Morel (*Morchella esculenta*) may be looked on as the harbinger of spring, appearing (in France) with tolerable regularity in April, if this month is rainy. It is eaten fresh or dried, as are all its congeners." Mrs. Hussey in the first volume of her "Illustrations of British Mycology" (1847, London) gives an excellent plate with three coloured figures of *Morchella esculenta*, Dillenius. From her account of it I find that this fungus is common all over Europe. The name is from the German "*Morchel*".

When young, the Morel is a very delicate plant; any obstruction, therefore, to its growth, such as hard soil or stone, or even roots of grasses or weeds in the ground where the fungus is growing, affects the final form which the fungus takes after emerging and developing above ground. The fungus is noted for its varied and irregular forms on this account. "It often appears lobed, twisted in the stem, and contorted into monstrous shapes, and the size varies extremely." (Mrs. Hussey.) With regard to the culinary use of this fungus Mrs. Hussey further says thus:—"Morels should be gathered in dry weather; after rain or dew they have not much flavour. . . . . They may be stuffed with bread crumbs, meat, chicken, shell-fish, &c., finely minced and seasoned, then wrapped in slices of bacon and roasted, serving them in *Italian* Sauce (? K. R. K.) or any piquant brown gravy with a little light wine in it, and buttered toast may be placed beneath them.'

The natives of Lahore and Kashmir use the fungus in the form of pickles or sauce. So far back as 1860, the Rev. Mr. Berkeley said that the Morel was then an important article of commerce. He says that good "*Ketchup*" can be obtained from various edible mushrooms. Morels also, says he, yield, when treated in the same way as mushrooms for "*Ketchup*," an admirable condiment. (*See* page 64, Berkeley's Outlines of British Fungology.) Loudon refers to this fungus in his elaborate Encyclopædia. So do Kerner and Oliver in the History of Plants (English version, Vol. II., 1895, p. 682). The Morels are designated as *Saprophytic* fungi, that is to say, fungi which grow on dead and decaying organic matter.

The several dried specimens of the Lahore Morchel now before you were very kindly analysed for me by my former pupil and now my friend, Dr. A. K. Turner, L. M. & S., Assistant Chemical Analyser of the Government Laboratory, Byculla, Bombay. The following is the result of his analysis, roughly speaking, in his letter to me, dated the 2nd instant:—

| | |
|---|---|
| Moisture ... ... ... ... | 12·120 |
| Album. compounds ... ... | 22·925 (containing N. = 3·668) |
| Sugar ... ... ... ... | 3·120 |
| Starch ... ... ... ... | *Nil* |
| Cellulose ... ... ... ... | 12·000 |
| (Ash) Mineral matter ... ... | 10·240 |
| Fat ... ... ... ... | 4·800 |

This analysis clearly shows that there is no *starch* in *Morchel*. It is therefore a puzzle to me why Sir George Birdwood has included this fungus, as has been mentioned by him, under head "Starches" at page 262 of his highly instructive work entitled "Vegetable Products of the Bombay Presidency. (Bombay, 1865)".

K. R. KIRTIKAR, Lt.-Col., F.L.S., I.M.S. (Retired).

Andheri, Salsette, 6*th March* 1907.

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## No. XXVI.—A FURTHER NOTE ON THE DISTRIBUTION OF THE VARIETIES OF COBRA IN INDIA.

In Vol. XVI., page 638, of our Journal, will be found a paper detailing the distribution of the three varieties of Indian cobras as far as was then possible from the 1,074 specimens received. The conclusions arrived at were that *Typica* may be looked for in any part of India, more rarely in Burma, and still more rarely in China. *Cæca* is the common cobra of the West part of the Central Provinces and Central India and parts of the Frontiers. *Fasciata* is eminently the Bengal cobra, and appears also to be the variety commonly found to the east thereof in Burma and China. Since then (1st April 1905 to 31st December 1906) 68 cobras have been sent to the Laboratory, and notes of six others have been received from Major O. A. Smith, 27th Punjabis, Multan, and Mr. E. H. Young, Ajmer.

No cobras of the variety *Fasciata* have been received during this period. *Naia typica* is represented by 49 specimens and *Cæca* by 25. These are distributed as follows :—

| | | *Typica.* | *Cæca.* | Total. |
|---|---|---|---|---|
| Vizagapatam (Madras) | | 3 | .. | 3 |
| C. P. | Sambalpur | 36 | 5 | 41 |
| | Wardha | 2 | 2 | 4 |
| | Saugor | .. | 2 | 2 |
| | Hoshangabad | .. | 2 | 2 |
| | Narsinghpur | 2 | 2 | 4 |
| | Khandwa | 1 | 5 | 6 |
| | Jubbulpur | .. | 2 | 2 |
| Rajputana | | .. | 3 | 3 |
| Multan (Panjab) | | 1 | 2 | 3 |
| Bombay | | 4 | .. | 4 |
| | | 49 | 25 | 74 |

As regards *Typica*, it will be seen that all the Madras and Bombay specimens are of this kind, and that in the Central Provinces—if Sambalpur be excluded, as it has been in the redistribution of provinces recently made by the Government of India—only 25 per cent. are of this sort.

In the case of *Cæca*, we find that 75 per cent. of those from the Central Provinces, and all reported from Rajputana, are of this kind.

These figures closely approximate to those given by the larger number of cobras dealt with in the first paper, but more specimens or reports are necessary before the exact geographical distribution of each variety can be defined.

Mr. Young in an interesting letter from Ajmer, dated 26th December 1906, says that he believes *Cæca* is the commonest variety in Rajputana, and suggests a solution of the colour distribution of the black cobras which are mainly found in the Central Provinces, Central India and Rajputana. He says : "If we class *Typica* and *Fusciata* together and *Cæca* separately, it rather seems to me as if the two divisions corresponded roughly with the divisions of the monsoons. *Typica* and *Fasciata* are found all through Madras, Bengal, Assam, United Provinces and the submontane tracts, whilst *Cæca* is practically confined to the Central Provinces, Central India and Rajputana,—roughly, the area most subject to drought and in no part of which is the rainfall heavy. The greater part of this area is at a considerable elevation, and includes one of the great watersheds of India, rivers flowing out of it on all four sides. My experience of India has been mostly within these limits, and certainly I think I have always found the black cobra the prevailing type."

This is an interesting suggestion, and deserves further discussion and elucidation, but more facts are needed.

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Director, Bombay Bacteriological Laboratory.

BOMBAY BACTERIOLOGICAL LABORATORY,
PAREL, BOMBAY, 7th *March* 1907.