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ERRATA AND ADDENDA.

Volume XIX.

Page 30, line 34, for *Loranthaceæ* read *Lauraceæ*.

" 34, " 6, *for* it *read* this butterfly.

Coloured Plate F, Fig. 39. The butterfly figured is *Ypthima baldus*, Fabricius, and not *Y. philomela*, Johannsen, as stated. *Y. baldus* is said to be found in the Himalayas from Chumba to Sikhim and Bhutan; Bengal; Central, Western and Southern India; Assam; Cachar, Burma and Tenasserim. *Y. philomela* has no sub-basal transverse fascia on the underside of the forewing and the striæ are not as coarse as in *Y. baldus*.

Volume XX.

Page 74, line 8, *for* 19 *read* 17.

" 105, " 20, for *Cocheacea* read *Ochracea*.

" 131, " 13, " *leucocyana* read *leucocyana*.

" 134, No. 21, " *L. ishana* read *L. isana*.

" 135, " 31, " *coalpara* read *goalpara*.

" 137, " 70, " *arpisatis* read *parisatis*.

" 137, " 73, " *'Larhestina persimilis Zeldis'* read *'P. persimilis zella.'*

" 159, line 1, " *yerburii* read *yerburyi*.

" 140, " 13, *for* October *read* September.

" 142, " 11, " Abissara *read* Abisara.

" 194, " 41, for *phœnicureides* read *phœnicuroides*.

" 249, " 6, *for* medicine *read* medium.

" 249, " 11, " " " "

" 252, " 38, for *Gunnomys* read *Gunomys*.

" 253, " 11, " *Palearnis* read *Palæornis*.

" 256, " 19, " *sucicica* read *succica*.

" 256, " 35, " *coramandus* read *coromandus*.

" 286, " 32, " *sparrerædes* read *sparreroides*.

" 292, " 35, *for* belonging.....in India *read* it is the "Common Purslane" of England and is often cultivated as a vegetable in Europe and Asia.

Page 321, line 4, from the bottom *add* 74 before *Telchinia*.
„ 321, „ 4, from the bottom for *Telchinis* read *Telchinia*.
„ 324, „ 30, *add* 75 before *Libythea*.
„ 327, „ 25, „ 76 „ *Abisara*.
„ 329, last line, *add* "The food plants of the larva are *Embelia robusta*, Roxb., a large climber in the moist forests of the Western ghats in Bombay, and *Ardisia solanacea*, Roxb., a shrub growing in similar situations throughout India, in China and Malay. The two plants both belong to the botanical family *Myrsineæ*."
Plate XIV, *after* Psammophis condanarus *for* poisonous *read* harmless.
Page 487, line 5, for *Meyeri* read *Meyeri*.
„ 519, „ 22, „ *Ibidorynchus* read *Ibidorhynchus*.
„ 519, „ 24, „ „ „ „
„ 519, „ 28, „ „ „ „
„ 520, „ 2, „ „ „ „
Cover of part II, line 3, for *Ibidorynchus* read *Ibidorhynchus*.
Page 531, line 30, for *viscivarus* read *viscivorus*.
„ 536, „ 12, „ *spekie* read *spekei*.
„ 536, „ 20, „ *orix* read *oryx*.
„ 536, „ 27, „ *Cericoula* read *Kerivoula*.
„ 536, „ 28, „ *hyperthia* read *hyperythra*.
„ 536, „ 34, „ *hymalayan* read *hymalayana*.
„ 537, „ 26, „ *Coocystes* read *Coccystes*.
„ 538, „ 5, „ *glandarious* read *glandarius*.
„ 539, „ 18, „ *Cyon* read *Cuon*.
„ 623, „ 6, „ *Pterocercus* read *Pherocercus*.
Pages 625, & 633, the descriptions of the plate should be reversed, the one on page 625 being intended for *P. condanarus* and that on page 633 being that of *T. stolatus*.
Page 752, line 6, *for* name *read* mane.

Page 797, line 31, for *clakistone* read *blakistoni*.
" 845, " 28, " *vindhina* read *vindhiana*.
" 883, " 19, " *Pericrotus* read *Pericrocotus*.
" 889, title of Miscellaneous Note No. XLIV *for* "Curious Growth of the Palmyra Palm, Borassus flabellifer, Linn. *read* Palmyra Palm (Borassus flabellifer, Linn.) Curiosities of Growth."
" 890, line 6, for *Achridotheres* read *Acridotheres*.
" 890, " 7, " *erithrorhynchus* read *erythrorhynchus*.
" 892, " 10, *for* G.M. Ryan, F.Z.S., *read* G.M. Ryan, F.L.S.
" 896, " 23, for *Cortunix* read *Coturnix*.
" 896, " 24, " *coromandelisa* read *coromandelica*.
" 896, " 25, " *Cortunix* read *Coturnix*.
Cover of part IV, line 6, *for* Blandford *read* Blanford.
" " " " Miscellaneous Note No. XXII, for *juglandipes* read *juglandifer*.
Page 938, line 11, *for* in the day time *read* at night.
" 955, " 31, for *gorrula* read *garrula*.
" 957, " 1, " *smyrnaesis* read *smyrnensis*.
" 960, " 42, " *Peophron* read *Neophron*.
" 961, " 9, " *Gypætus* read *Gypaëtus*.
" 961, " 16, " *chrysaetus* read *chrysaëtus*.
" 968, " 41, " *coramandelica* read *coromandelica*.
" 970, " 14, " *Porazana* read *Porzana*.
" 1005, " 38, " *Temelia* read *Timelia*.
" 1007, " 13, " *perigrinus* read *peregrinus*.
" 1008, " 34, " *Gecinius* read *Gecinus*.
" 1009, " 30, " *Frankalina* read *Franklinia*.
" 1010, " 9, " *Palœornis* read *Palæornis*.
" 1010, " 12, " *Hieratus* read *Hierax*.
" 1010, " 25, " *Milvous* read *Milvus*.
" 1010, " 29, " *apicaudus* read *apicicaudus*.
Pages 1012 & 1018, for "*cindrella*" read "*cinderella*.
Page 1015, line 6, for *Pataurista* read *Petaurista*.
" 1019, " 4, " *Birrel* read *Birrell*.
" 1023, " 4, *for* (nonenesd) *read* (nom : nud :)

Page 1023, line 10, for *nitidalus* read *nitidulus*.
" 1023, " 10, " " " "
" 1029, " 1, " *Felis unica* read *Felis uncia*.
" 1029, " 31, " *Wooly* read *woolly*.
" 1031, " 3, " *Gazelle* read *Gazella*.
" 1031, " 21, " *Cervis* read *Cervus*.
" 1046, " last, " *stoliezcæ* read *stoliczcæ*.
" 1052, " 33, " *melanosplia* read *melanospila*.
" 1065, " 38, " *gaucostigma* read *glaucostigma*.
" 1115, " 9, " *Papillionidæ* read *Papilionidæ*.
" 1155, " 10, *for* a *read* or.
" 1160, " 27, for *rosus* read *porosus*.
" 1174, " 30, " *humiæ* read *humiæ*.
" 1174, " 34, " *whitheadi* read *whiteheadi*.
" 1175, " 3, " *unicoler* read *unicolor*.
" 1175, " 10, " *nemoncola* read *nemoncola*.
" 1175, " 13, " *Pomatorkinus* read *Pomatorhinus*.
" 1175, " 16, " *Cacconantis* read *Caconantis*.
" 1184, " 5, " *falconepi* read *falconeri*.
" 1184, " 9, " *fimbriatus* read *fimbriatus*.
" 1184, " 21, " *scutulatus* read *scutulata*.
" 1184, " 24, " *Galinago* read *Gallinago*.
" 1184, " 25, " *solitaria* read *solitarius*.

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Capper, Brigadier-Genl. W. ... ... *Europe.*
Cardozo, C. H. ... ... Cuddalore.
Carey, Lieut. W. R. ... ... Tiddim, Burma.
Carleton, M. B. (M.D.) ... ... Subathu.
Carmichael, G. (I.C.S.) ... ... Poona.
Carr, R. C. C. (I.C.S.) ... ... *Europe.*
Carr, T. (I.F.S.) ... ... Naini Tal.
Carruthers, Col. H. St. C. (I.M.S.) ... ... Rangoon.
Carruthers, N. L. M. ... ... *Europe.*
Carter, B. S. ... ... *Europe.*
Carter, C. E. (R.N.) ... ... Atlantic Fleet.
Carter, Major J. R.... ... ... Kathiawar.
Carson, A. de C. ... ... Jaffna, Ceylon.

Cassamali Jairajbhoy Peerbhoy (Life Member)	Bombay.
Cater, A. W. L. (I.C.S.)	Sibi, Baluchistan.
Cave, W. A.	Colombo.
Central Research Institute, The Director	Kasauli, Punjab.
Chamen, C. H. K.	Hyderabad, Deccan
Channer, Capt. Kendall	Almora.
Channer, G. O. de R.	Quetta.
Chanter, E.	Rangoon.
Chapman, W. H.	Karachi.
Chatfield, H. S. (B.A., Bar.-at-Law)	Bombay.
Chaudhuri, B. L.	Calcutta.
Chesney, H. G.	Fort Sandeman.
Chico, J. R. (C.E.)	Baroda.
Childers, H. F. E.	Burma.
Chippindall, H. G. (R.E.)	Ferozepore.
Chitty, The Hon'ble Mr. Justice C. W.	Calcutta.
Cholmondeley, E. C.	*Europe.*
Christopher, S.	Rangoon.
Clark, J. (I.C.S.)	Puri, Orissa.
Clarke, H. E. Sir George Sydenham (F.R.S., C.C.I.E., G.C.M.G.).	Poona.
Clarke, L. O. (I.C.S.) (Life Member)	*Europe.*
Clarke, Robt. L. H. (I.C.S.)	Orai, Jalaun Dist.
Clayton, Major E. F.	*Europe.*
Clayton, F.	Nagpur.
Clear, T.	Vellore, N. Arcot.
Clifford, Capt. R.	Jubbulpore.
Clive, Herbert	Myitkyina, Burma.
Clouston, D.	Nagpur.
Clutterbuck, P. H. (I.F.S., F.Z.S.)	*Europe.*
Coates, C. F.	*Europe.*
Coates, Capt. V.	Jhelum.
Cochin, Private Secretary to H. H. the Raja Tripunittura	Ernakulam.
Coen, W. W.	Hubli, S. M. Ry.
Coghill, Major N. S. (I.A.)	Wadhwan.
Cogill, Dr. H. (M.R.C.S., L.R.C.P.)	*Europe.*
Colam, H. N.	Jodhpur.
Coldstream, J. (I.C.S.)	*Kulu*, Kangra Dist.
Collier, J. V. (I.F.S.)	Ramnagar.
Collings, F. W. (I.F.S.)	Pakokku, Burma.
Colomb, Lt.-Col. R. P.	Nagpur, C. P.
Colombo Museum, The Librarian	Colombo.
Colston, Capt. H. K.	Quetta.
Coltart, Dr. H. N. (Life Member)	Darbhanga, T.S.Ry.
Comber, Edward (F.Z.S.)	Bombay.
Comber, E. P.	Bombay.
Conduitt, W. A. (C.E.)	Rangoon.

Coningham, M. E. ... ... Bombay.
Conley, Andrew ... ... America.
Connor, Capt. F. P. (F.R.C.S., I.M.S.) ... ... Gaya.
Conservator of Forests, Berar Circle ... ... Amraoti.
Conservator of Forests, N. C. Division... ... Jubbulpore, C. P.
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) ... ... Kamptee, C. P.
Cook, Geo. ... ... Ceylon.
Cook, J. Pemberton ... ... Burma.
Cooke, E. B. ... ... Bina.
Cooper, Major P. T. (R.A.) ... ... Allahabad.
Cooper, R. W. ... ... Karachi.
Cooper, T. ... ... Bandikui.
Coote, M. C. ... ... *Europe.*
Copeland, T. B. (I.C.S.) ... ... Dera Ismail Khan
Corbett, Capt. W. F. ... ... *Europe.*
Cordue, Lt.-Col. W. G. R. (R.E.) ... ... *Europe.*
Cosens, F. R. ... ... Colombo, Ceylon.
Cosens, Lt. G. P. ... ... Muttra Cant.
Cosserat, L. (C.E.) ... ... Broach.
Cotton, C. W. E. (I.C.S.) ... ... Madras.
Cotton, W. B. (I.C.S.) ... ... *Europe.*
Courthope, E. A. ... ... Dehra Dun, U. P.
Coutts, W. S. ... ... Chittagong.
Coventry, B. O. (I.F.S.) ... ... *Europe.*
Coverton, Professor A. L. ... ... Bombay.
Cowie, Rev. A. G. G. (Life member) ... ... Rawal Pindi.
Cowie, W. P. (I.C.S.) ... ... Jalgaum.
Cox, C. E. C. (F.Z.S.) ... ... Hoshangabad, C.P.
Cox, Col. F. Z. (F.Z.S., F.R.G.S., C.I.E.) ... ... Bushire.
Cox, S. (I.F.S.) ... ... Ootacamund.
Craddock, W. H. (I.F.S.) ... ... Rangoon.
Craig, C. W. ... ... Lahore.
Craw, H. H. ... ... Rangoon.
Crawford, F. L. ... ... Akola, Berar.
Crawford, Leslie ... ... *Europe.*
Crawford, W. L. ... ... Saklaspur, Hassan.
Crawford, W. M (I.C.S.) ... ... Sambalpore.
Crerar, J. (I.C.S.) ... ... *Europe.*
Croly, A. E. J. ... ... *Europe.*
Cross, H. E. ... ... Muktesar.
Cross, R. G. ... ... Daloo P.O., Cachar.
Cruikshank, W. D.... ... ... Bharatpur Agency.
Cruickshank, A. H. P. ... ... Lahore Cantt.
Crum, W. E. ... ... Calcutta.
Cubitt, G. E. S. (I.F.S.) ... ... *Europe.*

Cuffe, T. W. ... ... England.
Culbertson, T. M. S. (A.M.I.C.E.) ... ... Bombay.
Cumming, J. W. N. ... ... Quetta.
Cummings, Col. W. H. (R.G.A.) ... ... *Europe.*
Cunningham, Capt. J. ... ... *Europe.*
Currie, A. J. ... ... Lahore.
Curtie, M. M. L. (I.C.S.) ... ... Ferozepore.
Currimbhoy Ebrahim, Sir, Bart. ... ... Bombay.
Currey, E. S. ... ... *Europe.*
Currey, Capt. V. F. ... ... Malta.
Cursetji, Khan Bahadur C. M. (Life Member) ... Bombay.
Cutch, H. H. Sir Shri Kengurji Sawai Bahadoor, the Rao Saheb of (G.C.I.E.) (Life Member) ... Bhuj, Cutch.

D'Abreu, E. A. ... ... Nagpur.
D'Albedyhll, C. C.... ... ... *Europe.*
Dalgliesh, G. ... ... *Europe.*
Dallaporta, J. N. ... ... Bombay.
Dalrymple-Hay, Mrs. L. ... ... *Europe.*
Daly, The Hon'ble Col. Hugh (C.S.I.) ... ... Mysore.
Daly College, The Librarian ... ... Indore, C. I.
Dames, Felix L. ... ... Germany.
Daniell, Col. A. C. (R.A.) ... ... *Europe.*
Danson, J. W. W. ... ... *Europe.*
Darjeeling, The Vice-President, Natural History Museum ... ... Darjeeling.
Dastur, J. F. ... ... Pusa, Bengal.
Datia, H. H. the Maharaja Lokendra Govind Singh, Bahadur ... ... Datia, C. I.
Davidson, J. ... ... *Europe.*
Davidson, Norman ... ... Thazi, Burma.
Davidson, H. M. M. ... ... Behali P. O. Assam.
Davies, H. J. (F.G.S.) ... ... Burma.
Davis, J. W. G. ... ... Mandla, C. P.
Davis, W. S. ... ... *Europe.*
Dawkins, C. G. E. (I.F.S.) ... ... Pyinmana, Burma.
Dawson, W. G. ... ... *Europe.*
Dawson, W. H. (I.C.S.) (Life Member) ... ... *Europe.*
Deakin, Mrs. M. E. ... ... Bombay.
Deane, Dr. A. H. ... ... *Europe.*
Deane, H. H. (C.E.) ... ... Bombay.
Deane, N. B. ... ... Rangoon.
De Carteret, St. G. ... ... Banda, U. P.
DeCruz, A. M. ... ... Bombay.
D'Souza, C. ... ... Tounoo, Burma.
DeSouza, A. B. ... ... Ratnagiri.
Delmé-Radcliffe, Capt. A. ... ... Poona.
Delmé-Radcliffe, Major H. ... ... Quetta.

Dempster, F. E. (C.I.E.) ... ... Calcutta.
Dempster, Lieut. G. H. ... ... Jhelum.
Denne, Col. A. R. ... ... Manipur.
Dening, Capt. H. .. .. Maymyo, Burma.
Deputy Director of Agriculture, Burma ... Mandalay.
Devas, A. E. ... ... *Europe.*
Dewar, D. (I.C.S.) ... ... Allahabad.
Dewar, F. (I.C.S.) ... ... Balaghat, C. P.
Dewes, Lt.-Col. F. J. (I.M.S.) ... ... Shwebo.
Dhar, H. H. The Raja of ... ... Dhar, C. I.
Dharamdas Tribhuvandas Varjivandas ... Bombay.
Dharampur, Kumar Shree Vijayadevji of ... Bombay.
Dhunjibhoy Bomanji (Life Member) ... ... Bombay.
Dickie, R. D. ... ... Rangoon.
Dimmock, Lt.-Col. H. P. (M.D., I.M.S.) ... ... *Europe.*
Director of Agriculture, Bombay ... ... Poona.
Director of Agriculture, E. B. & Assam ... Shillong.
Dixey, Revd. Mr. Duncan (C.M.S.) ... ... Sibi, Baluchistan.
Dixit, D. L. (B.A.) ... ... Poona.
Dixon, A. O. St. J.... ... ... Bombay.
Dobbs, H. R. C. (I.C.S., C.I.E.) ... ... Sibi, Baluchistan.
Dodgson, J. (I.F.S.) ... ... Dhulia.
Dodgson, R. C. ... ... Sialkote.
Dodsworth, P. T. L. (F.Z.S.) ... ... Simla.
Donaghey, J. O. B.... ... ... Monywa, Burma.
Donald, C. D. ... ... Rangoon.
Donald, C. H. ... ... Simla.
Donald, J. (I.F.S.) ... ... Chanda, C P.
Donaldson, Lionel ... ... Phillaur, Punjab.
Donovan, Major C. (I.M.S.) ... ... Madras.
Dowlay, F. M. ... ... Bezwada.
Downing, A. K. Weld ... ... Coonoor, Nilgiris.
Doyle, James ... ... Balaghat, C. P.
Dracott, C. H. ... ... Quetta.
Drake-Brockman, Major D. H. ... .. Lansdowne, Garhwal, U. P.
Drake-Brockman, D. L. (I.C.S.) ... ... Jhansi, U. P.
Drake-Brockman, E. G. ... ... Gauhati, Assam.
Drake-Brockman, Lt.-Col. H. E. (I.M.S., F.Z.S.) (Life Member) ... ... Bombay.
Drake-Brockman, Maj. V. G. (I.M.S.) ... ... Abbottabad.
Dreckmann, Rev. F. (S.J.) ... ... Bombay.
Drummond, J. R. (B.A., F.L.S.) ... ... Calcutta.
DuBoulay, J. H. (I.C.S., C.I.E.)... ... ... Simla.
Dubash, K. D. ... ... Bombay.
Duff, A. C., (I.C.S.) ... ... Russellkonda.
Duggan, E. M. ... ... Karachi.
Dumayne, Sir F. G. ... ... Calcutta.

Dunbar-Brander, A. A. (I.F.S.) ... ... Nagpur.
Dunlop, H. J. ... ... Secunderabad.
Dunlop, Dr. J. (M.D.) ... ... Barkola, Cachar.
Dunn, C. W. (I.C.S.) ... ... Rangoon.
Dunsterville, Col. K. S. (R.A.) ... ... *Europe.*
Dunsterville, Lt.-Col. L. C. ... ... Jhelam.
Durie, G. A. ... ... Pegu, Burma.
Durie, T. E. (R.F.A.) ... ... Bangalore.
Dutt, H. L. ... ... Sabour, E. I. Ry.
Duxbury, Capt. C. D. ... ... *Europe.*
Dwane, E. H. ... ... Secunderabad.
Dwane, F. C. ... ... Yellandu, Deccan.
Dwane, Major J. W. ... ... *Europe.*
Dwane, H. M. ... ... Madras.
Dyer, Lt.-Col. R. E. ... ... Multan.
Dyson, Lieut.-Col. T. E. (I.M.S.) ... ... Poona.

Eccles, P.... ... ... Calcutta.
Economic Botanist to Government, U. P. ... Cawnpore.
Ede, F. J. (A.M.I.C.E.) ... ... Silchar, Cachar.
Edwards, W. N. ... ... Majuligarh, Assam.
Egerton, B. (C.I.E.) ... ... Hyderabad, Deccan.
Elgee, Major J. W. L. ... ... Dinapur.
Elliott-Lockart, Major P. C. ... ... Mardan.
Elliot, Capt. C. ... ... Hangu, N. W. F. P.
Elliott, A. (C.I.E.) ... ... *Europe.*
Elliott, R. E. A. (I.C.S.) ... ... Bombay.
Ellis, E. V. (I.F.S.) ... ... Tharrawaddy.
Ellis, R. H. (I.C.S.) ... ... Mercara, Coorg.
Ellis, S. F. ... ... Jacobabad, Sind.
Elwes, G. F. W. ... ... *Europe.*
Elwes, H. J. (F.R.S.) ... ... *Europe.*
Emanuel, A. E. L. (I.C.S.) ... ... Larkhana.
Enthoven, R. E. (I.C.S., C.I.E.) ... Bombay.
Evans, Lt. C. B. (R.N.) ... ... Bombay.
Evans, Evan ... ... Planters' Stores, Dibrugarh, Assam.
Evans, Geoffrey (R.A.) ... ... Hoshangabad, C.P.
Evans, T. M. ... ... Bombay.
Evans, Lt.-Col. G. H. (I.C.V.D., F.L.S.)... ... Simla.
Evans, Capt. W. H. (R.E.) ... ... *Europe.*
Evans, Capt. W. K. ... ... Kamptee, C. P.
Evershed, John ... ... Kodaikanal.
Everard, L. E. C. ... ... Mongnai, S. Shan States.
Fagon, Capt. B. ... ... Imphal, Manipur.
Fagan, H. R. ... ... Rangoon.
Falkiner, Dr. J. M.... ... ... Dibrugarh, Assam.

Farmer, E. J. (I.C.S.) ... ... Lashio.
Farr, E. T. C. ... ... Ceylon.
Farrel, R. C. (I.F.S.)... ... ... Aurangabad.
Farrington, Sir H. A., Bart. (I.F.S.) ... ... Port Blair, Andamans.
Fatehsingrao of Akalkote, H. H. Raja ... ... Kirkee.
Favrer, Major F. D. S. (I.M.S.) ... ... Bombay.
Fellowes, Capt. H. Le M. ... ... Lucknow.
Fendall, C. E. ... ... Bussahir State, Simla District.
Fenton, Col. L. L.... ... ... *Europe*
Fenton, Capt. L. S. ... ... Doosa.
Ferguson, H. S. (F.Z.S., F.L.S.) ... ... *Europe.*
Ferrar, Capt. M. L.... ... ... Kulu Valley.
Fipid, Frank ... ... Gulzarbagh, E.I.R.
Field, W. P. ... ... Jaipaiguri.
Filson, J. T. W. ... ... *Europe.*
Finlay, C. K. ... ... Rangoon.
Fischer, C. E. C. (I.F.S.) ... ... Coimbatore.
Fisher, W. D. (I.F.S.) ... ... Bandra.
Fitz-Gerald, H. G.... ... ... *Europe.*
Fitz-Gerald, Capt. O. A. G. ... ... Quetta.
Fitz-Gibbon, Lt. F. (R.A.) ... ... Jubbulpore.
Fitz-Gibbon, P. J. ... ... Poona.
Fleming, Major A. M. (I.M.S.) ... ... Raipur.
Fletcher, T. Brinbrigge (F.E.S.) ... ... Pusa, Bengal.
Florence, James ... ... Cawnpore.
Flower, Capt. S. S. ... ... *Egypt.*
Flyfishers' Club, The Secretary ... ... *Europe.*
Flynn, A. A. ... ... Karachi.
Forbes, Col. James ... ... Bombay.
Forbes-Semgill, The Hon'ble R. A. ... ... Rangoon.
Forel, Monsieur Auguste (Hon. Corresp. Member). *Europe.*
Forster, T. W. (B.F.S.) ... ... Thurrawaddy.
Forsyth, Dr. W. ... ... *Europe.*
Foster, R. Guy ... ... Sallebile P. O., Kadur District.
Foster, Capt. R. T. ... ... *Europe.*
Foulkes, George F. F. (I.F.S.) ... ... Manantoddy, Malabar.
Foulkes, R. ... ... Coimbatore.
Foulkes, Major T. H. (I.M.S.) (Life Member) ... Madras.
Fountaine, Miss M. E. (F.E.S.) .. ... *Europe.*
Fowle, F. C. ... ... Bombay.
Fowler, H. ... ... *New York, U.S.A.*
Fox, J. H. Manning ... ... Barrackpore.
Francis, R. F. ... ... Jullundur.

Fraser, Capt. F. C. (I.M.S., M.D., F.L.S.) ... Madras.
Fraser, Prof. J. N. ... ... Bombay.
Fraser, S. M. (I.C.S., C.I.E.) ... ... *Europe.*
Fraser, D. de M. S. ... ... Goona.
Fraser, J. S. ... ... Madras.
Fraser, W. S. ... ... Ajmer, Rajputana.
Frederick, Capt. E. B. ... ... *Europe.*
Frenchman, Lt.-Col. E. P. (I.M.S.) ... ... Poona.
Frere, Capt. A. G. ... ... Minbu, Burma.
Friedlander and Sohn, Messrs. R. ... ... *Europe.*
Fritchley, E. W. ... ... Bombay.
Frizelle, Major J. ... ... Multan.
Frost, G. ... ... Quetta.
Fry, John T. ... ... *Europe.*
Fulton, Major H. T. (D.S.O.) (Life Member) ... *Europe.*
Fyson, Prost P. F. ... ... Madras.

Gaddum, S. ... ... Bombay.
Gales, R. R. ... ... Calcutta.
Gale, B. ... ... Peshawar.
Gale, Capt. E. S. ... ... Maymyo.
Gallie, H. H. ... ... Rangoon.
Gammie, Prof. G. A. ... ... Poona.
Gardyne, Major A. D. G. ... ... Cawnpore.
Garrett, H. B. G. (I.F.S.) ... ... Bangkok.
Garrett, J. H. (I.C.S.) ... ... Nasik.
Garrett, R. S. ... ... Sirsa, Punjab.
Gaye, W. C. ... ... Secunderabad.
Gatherer, Capt. R. G. T. ... ... Bhamo, Burma.
Gebbie, F. St. G. ... ... Karachi.
George, C. P. ... ... Secunderabad.
Gerhardt, Paul ... ... Bombay.
Gervers, Capt. F. R. S. ... ... *Europe.*
Gharpurey, Capt. K. G. (I.M.S.) ... ... Bombay.
Ghosal, J. (I.C.S.) ... ... Ratnagiri.
Giberne, H. D. ... ... Mandalay.
Gibson, A. J. (I. F. S.) ... ... Kotgarh, Simla Dist.
Gibson, R. E. (I.C.S.) ... ... Hyderabad, Sind.
Gibson, W. R. (F.R.C.S., L.R.C.P.) ... ... Madras.
Gilbert, C. E. L. (I.F.S.) ... ... Bandra.
Gilbert, Reg. (F.Z.S.) ... ... *Europe.*
Gilbert-Cooper, W. J. (I.F.S.) ... ... Kado, Moulmein
Giles, A. R. ... ... Tezpur, Assam.
Giles, G. W. ... ... *Europe.*
Gill, Capt. C. A. (I.M.S.) ... ... Lahore, Punjab.
Gill, C. G. ... ... Amritsar.
Gillespie, Capt. R. S. (R.E.) ... ... Chamba, Punjab.
Gillett, Capt. E. S. (A.V.D.) ... ... Matigiri, Salem Dist.

Gillies, Capt. F. G.... ... ... Secunderabad.
Gillum, S. J. ... ... Calcutta.
Gimlette, Lt.-Col. G. H. D. (C.I.E., I.M.S.) ... *Europe.*
Gimlette, Dr. J. D. ... ... Federated Malay States.
Girard, George ... ... Calcutta.
Girvin, Major J. (R.A.M.C.) ... ... Ahmednagar.
Gladstone, H. S. (F.Z.S., F.R.S.E.) ... ... *Europe.*
Glascock, L. C. ... ... Lahore.
Glasson, J. W. (I.C.S.) ... ... Godaveri, Madras.
Glazebrook, Hon. Mr. N. S. ... ... Bombay.
Gleadow, F. (F.R.M.S.) ... ... *Europe.*
Gloster, Capt. J. H. (I.M.S.) ... ... Bombay.
Godber, Rev. John ... ... Calcutta.
Godson, Capt. C. A. (I.M.S.) ... ... Assam.
Goldsmith, Dr. B. K. ... ... *Europe.*
Goldsmith, H. A. ... ... Bolarum, Deccan.
Gombert, Rev. E. (S.J.) ... . Trichinopoly.
Gonsalves, A. F. ... ... Bandra.
Gordon, D. M. ... ... Keng Tung, S. Shan States.
Gordon, K. L. ... ... Ceylon.
Gordon, R. G. (I.C.S.) ... . Ahmedabad.
Gordon-Ralph, J. B. ... . *Europe.*
Gore, F. W. ... ... Hoogrijhan, Assam.
Gore, Col. St. G. C. (R.E., C.S.I.) ... ... *Europe.*
Goss, E. H. A. ... ... Shwebo.
Gough, Major C. ... ... Ahmednagar.
Gough, Major H. (I.A.) ... ... Quetta.
Gourju, P. E. ... ... Berhampur.
Gover, A. A. ... ... Bangalore.
Gradon, A. F. (I.F.S.) ... ... *Europe.*
Grafton-Wignall, J. D. ... ... Rampore.
Graham, A. K. ... ... Karachi.
Graham, C. T. ... ... Rangoon.
Graham, D. N. ... ... England.
Graham, Capt. G. H. I. ... ... Chakdara.
Graham, J. A. ... ... Mercara, Coorg.
Graham, L. (I.C.S.) ... ... Bombay.
Graham, R. J. D. (M.A.) ... ... Nagpur, C. P.
Graham Roe, E. W. ... ... *Europe.*
Graham, Hon'ble Mr. W. ... ... Bombay.
Grant, F. A. ... ... Meiktila, Burma.
Gray, Chas. ... ... Coonoor.
Gray, John ... ... Rawalpindi.
Gray, P. B. ... ... *Europe.*
Greaves, Hon'ble Mr. H. R. ... ... Bombay.
Greaves, S. E. ... ... *Europe.*
Green, E. Ernest (F.E.S.) ... ... Ceylon.

Green, James ... ... *Europe.*
Green, Lt.-Col. J. S. (R.A.M.C.) ... ... Nainital.
Greer, R. F. (I.C.S.) ... ... Rangoon.
Greer, W. (I.C.S.) ... ... Belgaum.
Gregory, R. V. ... ... Purna, Deccan.
Gregson, Capt. C. D. ... ... Bangalore.
Gregson, E. G. ... ... Peshawar.
Gregson, T. S. ... ... Bombay.
Greig, Capt. W. B. ... ... Belgaum.
Gribbon, M. C. ... ... *Europe.*
Grigson, T. S. ... ... Rangoon.
Grieve, F. C. L. (R.F.A.) ... ... Mhow, C. I.
Grönvold, H. ... ... *Europe.*
Gross, Carl ... ... Rangoon.
Grubbe, Major E. A. ... ... *Europe.*
Gulabrai Bhawandas ... ... Sind.
Gupta B. Sen ... ... Gairkatta P. O., Dooars.
Gupta, N. (BAR.-AT-LAW) ... ... Dacca.
Guyon, Capt. G. S. ... ... Trimulgherry.

Habibuddin, S. (N.C.S.) (Life Member) ... ... Hyderabad, Deccan.
Hackér, K. ... ... Mandalay.
Haeberle, Curt. (I.F.S.) ... ... *Europe.*
Haffenden, Ed. D. H. ... ... Rangoon.
Haig, Major N. W. ... ... Mhow.
Haigh, P. B. (I.C.S.) ... ... Karwar.
Hale, Major C. H. (R.A.M.C.) ... ... Secunderabad.
Hall, W. D. ... ... Bombay.
Hallaner, Martin ... ... Bombay.
Hamburg Natural History Museum ... ... Hamburg.
Hamilton, A. G. ... ... *Europe.*
Hamilton, J. D. (B.F.S.) ... ... *Europe.*
Hammond, A. H. ... ... *Europe.*
Hampson, Sir George F., Bart. (F.L.S., F.E.S.) ... *Europe.*
Hankin, A. C. (C.I.E.) ... ... Secunderabad.
Hannyngton, F. (I.C.S.) ... ... Calcutta.
Hannyngton, W. O. ... ... Shwebo, Burma.
Harcourt, Capt. J. S. M. ... ... *Europe.*
Hardie, Dr. Geo. W. ... ... Big Conjeeveram, S. India.
Hardy, G. S. (I.C.S.) ... ... Ratnagiri.
Harington, Major H. H. ... ... Mandalay, Burma.
Harington, Col. V. (I.M.S.) ... ... *Europe.*
Harker, O. Allen ... ... Dhulia.
Harper, E. W. (F.Z.S.) ... ... Africa.
Harris, Capt. O. M. (R.H.A.) ... ... Allahabad.
Harris, W. ... ... Dacca.

Harrison, A. J. ... ... Lakhimpur, Assam.
Harrison, Major C. B. (I.M.S.) ... ... Madura.
Harrison, Major C. F. ... ... Rangoon.
Harrison, C. H. (I.C.S.) ... ... Camp, Punjab.
Harrison, R. T. ... ... England.
Harrold, W. ... ... Ahmedabad.
Hart, E. H. ... ... Lonavla.
Hart, G. S. ... ... Nagpur, C. P.
Harter, R. W. ... ... Bombay.
Harvey, Capt. W. F. (I.M.S.) ... ... Kasauli.
Hasted, Major A. W. ... ... Kasauli.
Hasted, H. R. G. ... ... Kurnool.
Hasted, J. E. H. ... ... Kistna.
Hasted, W. A. ... ... Palamcottah.
Hassels-Yates, Capt. G. A. (R.G.A.) ... ... *Europe.*
Hatchell, D. G. ... ... Madras.
Hate, Profr. Vinayek N. ... ... Bombay.
Haughton, H. L. ... ... Srinagar.
Haughton, Samuel ... ... *Europe.*
Hauxwell, T. A. (I.F.S.) ... ... Maymyo.
Hawkins, A. B. ... ... Dighoi, Burma.
Hawley, Capt. W. G. B. ... ... Multan,
Hay, E. Alan ... ... *Europe.*
Hay, Capt. G. W. ... ... *Europe.*
Hayden, H. H. ... ... Calcutta.
Haymes, Capt. R. L. (R.A.) ... ... Singapore.
Hazlewood, Miss M. ... ... Rangoon.
Hearn, E. S. ... ... Meerut.
Headlam, Lt. E. James ... ... Rangoon.
Hearsey, C. H. ... ... Burma.
Hearsey, T. N. (I.F.S.) ... ... Coimbatore.
Heath, H. A. ... ... Horawala, Ceylon.
Heath, R. H. (C.E.) ... ... Ahmedabad.
Hector, G. P. (M.A., B.SC.) ... ... Dacca.
Heeckerenz, Baron Von (Hon. Corres. Member) ... *Europe.*
Hemans, Capt. G. W. ... ... Bolarum, Deccan.
Henderson, Capt. H. D. ... ... Imphal, Manipur.
Henderson, Capt. R. R. ... ... *Europe.*
Henderson, G. S. ... ... *Europe.*
Henderson, W. L. ... ... Rangoon.
Hepburn, W. ... ... *Europe.*
Herbert, H. P. ... ... Trevandrum.
Herbert, V. A. ... ... Allahabad.
Heron, F. A. ... ... Punjab.
Heseltine, Capt. G.... ... ... *Europe.*
Heseltine, Capt. J. E. N. ... ... Jubbulpore, C. P.
Howetson, Major A. W. (R.F.A.) ... ... *Europe.*
Heygate, Col. R. H. G. (D.S.O.) ... ... *Europe.*

Hichens, G. W. ... ... Rangoon.
Hickman, R. St. J. ... ... Cachar.
Hide, P. (Life Member) ... ... Indore.
Higgins, H. A. ... ... Hatikhira Sylhet.
Higgins, J. C. ... ... Imphal, Manipur.
Higginson, G. R. ... ... Lucknow.
Hignell, S. R. (I.C.S.) ... ... Daltonganj, E.I.Ry.
Hiley, A. C. (I.F.S.) ... ... Belgaum.
Hill, Rev. E. E. (M.A.) ... ... Satara.
Hill, Claude H. (I.C.S., C.I.E.) ... ... *Europe.*
Hill, E. W. ... ... Mandalay.
Hill, R. D. O. (Life Member) ... ... Dehra Dun.
Hitchcock, R. H. ... ... Malapuram, Malabar District.
Hoare, H. J. (I.C.S.) ... ... *Europe.*
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Hodgson, Capt. M. R. K. ... ... Jubbulpore.
Hodgson, Hon'ble Mr. H. P. ... ... *Europe.*
Hojel, Lt.-Col. J. G. (I.M.S.) ... ... Bombay.
Holberton, N. V. (I.F.S.) ... ... Rangoon.
Hole, R. S. (I.F.S.) ... ... Bombay.
Holkar, H. H. the Maharaja Tukuji Rao (Life Member) ... ... Indore, C. I.
Holland, Dr. H. T. (C.M.S.) ... ... Quetta.
Holland, L. B. ... ... Lahore, Punjab.
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Holme, H. B. (I.C.S.) ... ... Simla.
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Hood, A. F. ... ... Kindat, U. Burma.
Homfray, Jeston ... ... Assam.
Hoosein Belgrami, The Hon'ble Mr. Syed Nawab Imad-ul-Mulk Bahadoor (C.S.I.) ... ... Hyderabad, Deccan.
Hope, A. J. R. ... ... Taunggyi, Burma.
Hopwood, J. C. ... ... Monywa, U. Burma.
Hopwood, S. F. (I.F.S.) ... ... Maymyo, U. Burma.
Hosken, A. Fayrer ... ... Secunderabad.
Hoste, R. D. ... ... Purulia, Bengal.
Hotson, J. E. B. (I.C.S.) ... ... *Europe.*
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Howlett, Capt. A. W. (I.M.S.) ... ... Quetta.
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Hudson, Capt. C. ... ... Bangalore.
Hudson, C. W. M. (I.C.S.) ... ... *Europe.*
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Hudson, Capt. P. ... ... Rangoon.
Hudson, E. H. (A.M.I.C.E.) ... ... Jalna, Deccan.

Haggins, J. R. ... ... Madura.
Hughes, Capt. F. L. ... ... Jhelum.
Hughes, T. O. ... ... *Europe.*
Hughes, E. A. ... ... Munmar, S. India
Hulbert, Major J. G. (I.M.S.)... ... ... Muttra.
Hume, H. R. (D.S.P.) ... ... *Europe.*
Humphrys, Capt. F. H. ... ... *Europe.*
Hundley, G. ... ... Rangoon.
Hunt, C. B. Holman... ... ... Federated Malay States.
Hunt, A. R. (I.F.S.)... ... ... Akola, Berar.
Hunt, Capt. A. T. (R.N.) ... . *Europe.*
Hunt, Dr. E. H. ... ... Secunderabad.
Hunt, Capt. F. W. ... ... Somaliland.
Hunter, W. H. ... . Calcutta.
Husbands, H. W. S. (A.M.I.C.E.) ... ... Hingoli, Deccan.
Husbands, Capt. G. S. (I.M.S.) ... ... Hangu, N. W. F. P.
Husbands, J. E. (I.C.S.) ... ... Thana.
Hutchinson, Major F. H. G. (I.M.S.) ... ... Belgaum.
Hutchinson, Major L. T. R. (I.M.S.) ... ... Bombay.
Hyam, Judah (G.B.V.C., F.Z.S.) (Life Member) ... Pusa, Bengal.
Hyde-Cates, Lt.-Col. G. E. ... ... Idar Ahmednagar.
Hyderabad, the Librarian, State Library ... Hyderabad, Deccan.

Ichalkaranji, The Hon'ble Meherban Narayen Govind *alias* Babasaheb Ghorpade, Chief of (Life Member) ... ... Kolhapur.
Idar, Maharaj Kunwar Major Dowlatsing, A.-D.-C. Mahi Kanta.
Inglis, C. C. ... ... Hyderabad.
Inglis, Chas. M. (Life Member) ... ... Durbhanga.
Inglis, H. A. ... ... Anarh Laberia Serai.
Ingram, Capt. A. C. (I.M.S.) ... ... Madras.
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Innes, Charles (B.S.C.) ... ... Rangoon.
Innes, Capt. H. (I.M.S.) ... ... Barisal, E. Bengal.
Inverarity, J. D. (B.A., LL.B.) (Life Member) ... Bombay.
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Ivons, Capt. H. T. C. ... ... Miranshah.
Ivens, J. H. (P.W.D.) (Life Member) ... ... Agra.
Iyer, V. Subramania (M.A.) ... ... Dehra Dun, U. P.

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Jackson, Mrs. F. E.... ... ... Assam.
Jackson, H. (I.F.S.) ... ... Naini Tal, U. P.
Jacob, W. R. LeGrand (I.F.S.) ... ... Jalpaiguri.

James, C. H. ... ... Lahore.
James, Major C. H. (I.M.S.) ... ... Patiala, Punjab.
James, Capt. F. H.... ... ... SantaCruz, Salsette
Jamkhandi, Shrimant Parashram Ramchandra Patwardhan, The Chief of (Life Member)... ... Kolhapur.
Jamsetji M. Doctor ... ... Bombay.
Janjira, H. H. Sir Sidi Ahmed Khan (K.C.I.E.) Nawab of (Life Member) ... ... Janjira.
Janson, V. T. ... ... Bombay.
Jardine, A. J. A. (D.S.P.) ... ... Rangoon.
Jardine, E. R. ... ... Rangoon.
Jardine, M. R. ... ... Bombay.
Jardine, W. E. (I.C.S., C.I.E.) ... ... Neemuch.
Jayakar, Lt.-Col. A. S. G. (I.M.S., Retd.) .. Bandra.
Jayakar, M. S. (M. A.) ... ... Alibag.
Jeddere-Fisher, H. C. ... ... Meerut.
Jellett, H. H. ... ... Calcutta.
Jenkins, Lt. N. M. (R.G.A.) ... ... Aden.
Jenkins, S. E. F. (I.F.S.) ... ... Loilem, Burma.
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Jennings, Lt.-Col. W. E. (I.M.S.) ... ... *Europe.*
Jermyn, Col. T. ... ... *Europe.*
Jesse, William ... ... Meerut.
Johnson, W. E. C. ... ... Assam.
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Johnston, Capt. P. D. C. ... . Lucknow.
Johnstone, J. W. D. (C.I.E.) ... ... Gwalior.
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Jones, W. Harvey ... ... Calcutta.
Jones, Dr. W. D. ... ... Kyaukse, U.Burma.
Julius, V. A. ... ... Colombo.
Jukes, J. E. C. (I.C.S.) ... ... Calcutta.

Kagal, Meherban Piraji Rao Bapu Saheb Ghote, Chief of ... ... Kagal, S. M. C.
Karachi Victoria Museum ... ... Karachi, Sind.
Kauffman, Oscar ... ... Marburg *i/L.* Germany.
Keddie, D. L. ... ... Burma.
Keddie, J. F. ... ... Raheng, Siam.

Kelly, B. P.	... *Europe.*
Kelly, Capt. C. R. (R.G.A.)	... Srinagar.
Kelly, Major H. N.	... Jubbulpore, C. P.
Kelsall, Major H. J. (R.A.)	... *Europe.*
Kemball, Major A. G.	... Nowshera.
Kemball, H. L.	... Gurgaon, Punjab.
Kemball, H. V. (C.E.)	... Poona.
Kennedy, Capt. R. S. (I.M.S.)	... *Europe.*
Kennedy, R.	... Bombay.
Kennion, Major R. C. (F.Z.S.) ...	... *Europe.*
Kenrick, Major W. H. (I.M.S.) ...	... Khandwa.
Keogh, A. D.	... Narayanganj, E. B. and Assam.
Kerthoven, E. J. (Hon. Corresp'g. Member)	... Java.
Kerr, Dr. A. F. G.	... Chiengmai, Siam.
Kerr, H. R.	... Pyinmana, Burma.
Kerr, Nigel	... Bombay.
Kettlewell, Capt. H. W.	... *Europe.*
Keys, Capt. W. D. A. (I.M.S.) ...	... Rajkote.
Khan, Muncherji Framji (Life Member)	... Bombay.
Khareghat, M. P. (I.C.S.)	... Bombay.
Kiddle, J. A. C.	... Moulmein.
Kilkelly, Major P. P. (I.M.S.) ...	... *Europe.*
Kilner, Dr. J. N. (M.B.)	... Chinpina, Adra, Bengal.
Kilmartin, A. J.	... Jaffna, Ceylon.
King Edward Library, The Hon. Secretary	... Rawalpindi.
King, A. W.	... Dacca.
King, Capt. Geo. (I.M.S.)	... Calcutta.
King, R. C. H. Moss (I.C.S.)	... Nagpur, C. P.
Kingston, A. H.	... Bombay.
Kinloch, A. M.	... Nelliampatty.
Kinloch, Victor	... Klang, Federated Malay States.
Kirkness, L. H.	... Madras.
Kirtikar, Lt.-Col. K. R. (I.M.S., Retd.) ...	... Andheri, Salsette.
Knyvett, Capt. W. A.	... Bankipur.
Koechlin, M. C.	... Travancore.
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, Agra Dist.
Kynaston, E.	... Yatiyantota, Ceylon.
Lace, E. W.	... Waltair.
Lace, John H. (L.V.S., F.L.S.)	... Maymyo.

Lahore, Curator, Central Museum ... ... Lahore.
Lahore Punjab Veterinary College, The Principal.. Lahore.
Laird-MacGregor, E. G. L. (I.C.S.) ... ... Dharwar.
LaTouche, J. N. D. ... ... Bombay.
Lamb, The Hon'ble Mr. R. A. (I.C.S., C.I.E.) (Life Member)... ... ... Poona.
Lambton, Capt. G. C. ... ... Ootacamund.
Lane, H. S. ... ... Bangalore.
Lane, Capt. W. H. ... ... Baroda Camp.
Lantour, E. de ... ... Sitapur, U. P.
Laurence, Revd. Mr. F. (C.M.S.) ... ... Amritsar, Punjab.
Laurie, A. S. (P.W.D.) ... ... The Nagavalli Project, Vizagapatam Dist.
Lawrence, T. R. ... ... Bombay.
Leach, F. B. ... ... Rangoon.
Lee, A. J. (I.M.S.) ... ... Delhi.
Lee, Major A. W. H. ... ... Quetta.
Lee, Lt.-Col. F. ... ... *Europe.*
LeMesurier, H. P. (C.E.) ... ... Calcutta.
Lemarchand, J. R. ... ... Kookila Mook, Assam.
Lee-Wilson, Rev. H. W. ... ... Poona.
Lee, D. H. (Life Member) ... ... *Europe.*
Lees, John ... ... Itakhola Sylhet.
Leeson, G. W. ... ... Barisal, Bengal.
Leete, F. A. (F.C.H., I.F.S.) ... ... Tharrawaddy.
Lefroy, H. Maxwell (M.A., F.E.S., F.Z.S.) ... *Europe.*
Leftwich, C. G. (I.C.S.) ... ... Khandwa.
Legard, Chas. ... ... Mercara.
Leonard, Capt. W. H. ... ... Bombay.
Leslie, Major G. A. J. (R.E.) ... ... *Europe.*
Leslie, M. ... ... *Europe.*
Ley, A. H. (I.C.S.) ... ... Calcutta.
Light, Capt. W. A. ... ... Bombay.
Lightfoot, S. St. C. ... ... Taunggyi, Burma.
Lilburn, W. ... ... *Europe.*
Limaye, S. P. ... ... Dhulia.
Lindley, E. S. (C.E.) ... ... Bombay.
Lindsay-Smith, Capt. J. (I. A.) ... ... Punjab.
Linnell, Fred. ... ... Rangoon.
List, John N. ... ... Henzada, Burma.
Lister, R. S. ... ... Ghoom, D.-H. Ry.
Liston, Major W. G. (I.M.S.) ... ... Bombay.
Little, E. ... ... Kirkee.
Little, F. D. ... ... *Europe.*
Lloyd, Capt. C. R. (A.S.C.) ... ... Bombay.
Lloyd, Capt. R. E. (I.M.S.) ... ... Calcutta.

Lloyd, Capt. R. A. (I.M.S.) ... ... Bannu, N.W.F.P.
Loam, Mathew ... ... Madanapalli, Madras Presidency.
Lock, Major F. R. E. (I.S.C.) ... ... Aurungabad.
Lodge, G. E. ... ... *Europe.*
Logan, R. O. ... ... Wellington, India.
Logan Home, W. M. ... ... Kohat.
Lomas, H. A. (I.C.S.) ... ... Mussoorie.
Long, G. R. (I.F.S.) (Life Member) ... ... Rangoon.
Long, Capt. W. C. ... ... Coimbatore.
Longden, C. C. ... ... Colombo.
Lory, F. B. P. (M.A.) ... ... *Europe.*
Lovegrove, W. H. (I.F.S.) ... ... Jummoo.
Lovell, E. H. (R.A.) ... ... Ambala.
Lowis Major R. M. ... ... Dera Ghazi Khan.
Lowndes, G. R. ... ... *Europe.*
Lowrie, A. E. (I.F.S.) ... ... Raipur.
Lowsley, C. O. ... ... *Europe.*
Lowther, Major H.... ... ... Bolarum, Deccan.
Luard, Major C. E.... ... ... Indore.
Lucas, P. N. A. ... ... *Europe.*
Lucks, The Hon'ble Mr. W. H. (I.C.S.)... ... *Europe.*
Luck, W. H. ... ... Nasik.
Lucknow, The Curator, Provincial Museum ... Lucknow.
Ludlow, F. ... ... Karachi.
Luffman, M. A. ... ... Camilla, Tippera.
Luke, J. H. ... ... Narayenganj.
Luke, K. J. ... ... Chatalpara, Bengal.
Lumley, C. C. .. .. Dacca.
Lumsden, O. F. (I.C.S.) .. .. Amritsar.
Lund, E. ... . Balur P.O.
Lunham, Capt. J. L. ... ... Poona.
Lushington, P. M. (I.F.S.) ... ... Coimbatore.
Lyall, Capt. R. A. ... ... *Europe.*
Lyall, J. H. (I.F.S.) .. .. Haldwani.
Lynn, G. R. (C.E.) ... ... Manora, Karachi.

MacDonald, Dr. D. (Life Member) ... ... *Europe.*
Macdonald, K. C. (D.S.P.) ... ... Amherst, Burma.
MacGregor, J. A.... ... ... Arconam, Madras.
MacGregor, Capt. R. D. (I.M.S.) ... ... Rangoon.
Macintyre, D. ... ... Dehra Dun.
Mackay, C. J. ... ... Mymensingh.
Mackenna, J. (I.C.S.) .. .. Mandalay.
Mackenzie, Colin A. ... ... Ootacamund.
Mackenzie, Capt. K. L. W. ... ... *Europe.*
Mackenzie, Lt. L. H. L. (I.M.S.) .. ... Bombay.
Mackenzie, M. M. ... ... Saran, Bengal.

Mackie, A. W. W. (I.C.S.) ... ... *Europe.*
Mackinlay Chas. ... ... *Europe.*
Mackinnon, P. W. (F.E.S.) ... ... Mussoorie.
Mackwood, F. M. ... ... Colombo.
MacLachlan, R. B. ... ... Sukkur, Sind.
Macleod, N. A. ... ... Calcutta.
Macleod, The Hon'ble Mr. Justice N. C. ... *Europe.*
MacMichael, N. (I.C.S.) ... ... Chatrapur, Ganjam.
MacNair, R. H. (I.C.S.) ... ... Calcutta.
Macnab, A. M. ... ... Maymyo.
Macnaghten, H. P. W. (B.A.) ... ... Calcutta.
Macpherson, R. E. ... ... Sholapur.
Macpherson, Col. T. R. M. ... ... *Europe.*
Macrae, Major J. L. (I.M.S.) ... ... *Europe.*
Macwatt, Lieut.-Col. R. C. (I.M.S.) ... ... *Europe.*
Madras, The Professor of Zoology, Christian College ... ... Madras.
Madras, The Principal, Presidency College ... Madras.
Madras, The Principal Agricultural College and Research Institute ... ... Coimbatore.
Madras, The Librarian, Govt. Central Museum ... Madras.
Magrath, Major H. A. F. ... ... Peshawar.
Mahaluxmiwalla, C. D. ... ... Bombay.
Mahomedbhoy Currimbhoy Ebrahim ... ... Bombay.
Main, T. F. ... ... Poona.
Major, Major Forbes ... ... Baroda.
Maltby, C. M. ... ... Upper Topa, Murree.
Manavadar, Khan Shree Fatehdinkhan, Chief of (Life Member) ... ... Kathiawar.
Manders, Lt.-Col. N. (R.A.M.C., F.Z.S., F.E.S.) (Life Member) ... ... Colombo.
Mandlik, Narayan V. (Life Member) ... ... Bombay.
Mann, H. H. ... ... Poona.
Mann, T. H. ... ... *Europe.*
Manners-Smith, Lt.-Col. J. (V.C., C.I.E.) ... ... Nepal.
Manson, C. E. F. ... ... Mandalay.
Marjoribanks, N. E. (I.C.S.) ... ... Madras.
Marryatt, N. ... ... Abu Road.
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Marshall, D. ... ... *Europe.*
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Marshall, J. McL. (Life Member) ... ... *Europe.*
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Marten, James ... ... Mussoorie.
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Martin, Col. Gerald (Life Member) ... ... *Europe.*
Martin, Capt. J. ... ... *Europe.*
Martin, L. K. ... ... Chanda.
Martindell, H. E. W. ... ... Shwebo, Burma.
Masani, A. M. (Life Member) ... ... Baroda.
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Masson, The Hon'ble Sir D. P. (K.C.I.E.) ... Lahore.
Maung, Po Bye (K.S.M. & F.R.C.I.) ... ... Myaung-Mya, Burma.
Maunsell, Capt. E. C. C. ... ... Baroda.
Maxwell, R. M. (I.C.S.) ... ... Karwar, Kanara.
Maxwell, Capt. W. F. (R.E.) ... ... Fatehgarh, U. P.
Mayes, W. ... ... Lahore.
Mayne, Capt. H. B. (R.G.A.) ... ... Bombay.
McCarrison, D. L. (D.S.P.) ... ... Rajamundri.
McComas, H. ... ... Lucknow.
McCrie, C. M. (I.F.S.) ... ... Dehra Dun.
McCudden, Capt. J. B. ... ... Poona.
McDiarmid, K. ... ... *Europe.*
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McDonough, A. D. ... ... Campbellpore.
McGeorge, J. C. ... ... *Europe.*
McGlashan, John (C.E.) ... ... Calcutta.
McIlwriek, L. ... ... Bombay.
McIntosh, Alex. (C.E.) ... ... Trichinopoly.
McIntosh, R. (I.F.S.) ... ... Tharrawaddy.
McKerron, R. G. (E.A., I.C.S.) ... ... Rangoon.
McKendrick, Capt. A. G. (I.M.S.) ... ... Coonoor.
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McLeod, W. C. ... ... Mergui, Burma.
McMahon, Col. The Hon. Sir A. H. (K.C.I.E., C.S.I.). Calcutta.
McMullen, Capt. G. C. ... ... Amritsar.
McNeale, J. H. ... ... *Europe.*
McNeill, J. (I.C.S.) ... ... Poona.
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McPherson, Capt. J. (I.M.S.) ... ... Bombay.
Mead, P. J. (I.C.S.) ... ... Bombay.
Mears, Major A. (I.A.) ... ... Bombay.
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Meinertzhagen, Capt. R. ... ... Mauritius.
Menon, K. G. ... ... Cochin.
Mercer, A. W. ... ... Rawal Pindi.
Merewether, Lt.-Col. H. D. ... ... *Europe.*
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Mess President, 6th Jat. Light Infantry ... Secunderabad.
Mess Secretary, 18th Infantry ... ... Ferozepore.
Mess Secretary, 1/39th Garhwal Regiment ... Lansdowne, U. P.
Mess President, 41st Dogras ... ... Cawnpore.
Mess President, 44th Merwara Infantry ... Ajmer.
Mess President, 45th Rattray's Sikhs ... ... Nasirabad.
Mess President, 52nd Sikhs, F. F. ... ... Peshawar.
Mess Secretary, 58th Rifles F. F. ... ... Quetta.
Mess Secretary, 59th Scinde Rifles ... ... Kohat.
Mess President, 64th Pioneers ... ... Belgaum.
Mess Secretary, 74th Punjabis, Book Club ... Lucknow.
Mess President, 85th Regiment (K.S.L.I.) ... Secunderabad.
Mess Secretary, 87th Punjabis ... ... Jhelum.
Mess Secretary, 91st Punjabis ... ... Meiktila, Burma.
Mess President, 101st Grenadiers ... ... Mhow.
Mess President, 103rd Mahratta Lt. Infy. ... Ahmednagar.
Mess Secretary, 109th Infantry ... ... Secunderabad.
Mess President, 110th Maharatta L. Infantry ... Belgaum.
Mess President, 117th Marathas ... ... Jask.
Mess President, 122nd Infantry ... ... Fort Sandeman.
Mess Secretary, 39th C. I. Horse ... ... Goôna.
Mess President, 1/10th Gurkhas ... ... Maymyo.
Mess Secretary, R. I. M. S. "Dufferin" ... Bombay.
Messent, P. G. (C.B.) ... ... Bombay.
Metcalfe, J. G. E. ... ... Bombay.
Meyer, O. ... ... Bombay.
Meyrick, E. (F.R.S.)... ... ... *Europe.*
Middleton, L. W. ... ... Sonapore, Assam.
Millard, W. S. (F.Z.S.) (Life Member) ... *Europe.*
Miller, W. A. H. ... ... Karwar.
Millett, Hon'ble Mr. G. P. (I.F.S.) ... ... Poona.
Mills, J. D. (Life Member) ... ... *Europe.*
Milne, Mrs. Leslie ... ... *Europe.*
Milner, C. E. ... ... Tharrawaddy.
Milward, R. C. (I.F.S.) ... ... Dehra Dun.
Minns, Mrs. H. C. ... ... Rangoon
Miraj, Shrimant Gungadhar Rao Ganesh, *alias* Babasaheb Patwardhan, Chief of (Life Member) ... Miraj.
Mitchell, F. J. ... ... Srinagar.
Mitchell, R. St. J. ... ... Nanded Dn.
Mitchell, H. H. G. ... ... Madras.
Mitchell, J. C. H. ... ... Tezpur, Assam.
Mockler, Major G. F. ... ... Kashmir.
Modi, Bomanji Edulji ... ... Kaira.
Moggridge, C. B. ... ... Mandalay.
Mohun Shumshere Jung Bahadur, General ... Nepal.
Mollison, J. ... ... *Europe.*

Montagnon, D. J. ... ... Sylhet.
Monté, Dr. D. A. de (L.M. & S.) ... ... Bandora.
Monteath, G. (I.C.S.) (Life Member) ... ... *Europe.*
Monteath, J. (I.C.S.) ... ... Radhanpur.
Montmorency, G. F. de (I. C. S.) ... ... Lyallpur.
Montgomerie, A. (I.C.S.) ... ... Dhulia.
Montgomerie, C. W. E. (I. C. S.) ... ... Jubbulpore.
Montresor, Capt. L. B. (R.F.A.) ... ... Belgaum.
Moore, T. D. ... ... Bombay.
Moore, J. ... ... *Europe.*
Moore, W. (F.I.C.) ... ... Bombay.
Moore, W. G. ... ... Mandalay.
Morgan, Mrs. Chas. ... ... Mangalore.
Morris, Major A. H. (R.A.M.C.) ... ... *Europe.*
Morris, A. P. (B.Sc.) ... ... Myittha, U. Burma.
Morris, Major D. O. ... ... Akola, Berar.
Morris, Major G. M. ... ... Rawalpindi.
Mosse, Capt. A. H. E. (Life Member) ... ... Dwarka.
Mosley, N. ... ... Bombay.
Motilal Vallabhji ... ... Bombay.
Moule, Capt. H. E. ... ... Myitkyina, Burma.
Mowbray, G. B. De... ... ... Maskeliya, Ceylon.
Moylan, W. M. ... ... Betul, C. P.
Moysey, E. L. (I.C.S.) ... ... Thana.
Muir, G. B. F. (I.C.S.) ... ... Agra.
Mudhol, Shrimant Malojirao Raje Ghorpade, Chief of ... ... Mudhol, S. M. C.
Mullan, J. P. (M.A.) ... ... Bombay.
Muller, C. H. A. ... ... Lahore.
Mülle., Professor O. V. ... ... Bombay.
Mullings, C. T. ... ... Guntur.
Mullins, Bt.-Col. W. B. ... ... Chaman.
Mulraj, Lala ... ... Quetta
Mumford, J. ... ... *Europe.*
Mundy, B. H. H. (F.R.G.S.) ... ... Bombay.
Mundy, N. S. ... ... Silchar, Cachar.
Munna Lâl, Dr. (L.M. & S.) ... ... Bara Panki.
Munn, Leonard ... ... Secunderabad.
Murison, Capt. C. C. (I.M.S.) ... ... Bombay.
Murphy, Capt. A. (I.M.S.) ... ... *Europe.*
Murphy, E. J. ... ... Rangoon.
Murray, A. G. ... ... Nelliampatty.
Murray, Lt. J. Wolfe (R. N.) ... ... Persian Gulf.
Murray, Capt. J. H. (I.M.S.) ... ... *Europe.*
Murray, R. A. C. ... ... Peshawar.
Murray, R. D. ... ... Kasauli.
Murray, S. B. (P.W.D.) ... ... Madras.
Muspratt, Lt.-Col. F. C. ... ... Bombay.

Mysore, Agricultural Chemist ... ... Bangalore.
Mysore, The Superintendent, Mysore Government Museum ... ... Bangalore.
Mysore, H. H. the Maharaja Krishna Raj Woodayar Bahadoor (G.C.S.I.) (Life Member) ... ... Mysore.

Nahar Singh of Bedla, Rao ... ... Bedla near Udaipur.
Nangle, Capt. M. C. ... ... Rangoon.
Napier, A. G. Fitz.... ... ... Allahabad.
Napier, A. H. (I.M.S.) ... ... Dera Ismail Khan.
Naranji Dwarkadas (Life Member) ... ... Bombay.
Narrotumdas Morarji Goculdass (Life Member) ... Bombay.
Nasrulla Khan, H. H. Nawab Mahomed ... Bhopal, C. I.
Needham, J. E. ... ... Bombay.
Nene, Sadashiva Sitaram ... ... Sangamner, Ahmednagar Dist.
Nevill, T. N. C. ... ... *Europe.*
Newcome, Lionel ... ... Shanivarsante P.O., N. Coorg, S. India.
Newnham, Lieut.-Col. A. (F.Z.S.) ... ... Jullundur.
Nicholetts, W. A. ... ... *Europe.*
Nicholson, E. M. F. ... ... Bombay.
Nicholson, E. F. (F.Z.S.) ... ... Bombay.
Nicholson, Capt. E. H. ... ... Mauritius.
Nicholson, Major W. C. ... ... Ferozepore.
Nicoll, Mrs. C. V. ... ... Kajang, Selangor.
Nisbett, Major W. G. ... ... Mandalay.
Nizam's College, The Librarian ... ... Hyderabad, Deccan.
Noyce, F. (I.C.S.) ... ... *Europe.*
Nurse, Lt.-Col. C. G. (F.E.S.) (Life Member) ... *Europe.*
Nuttall, W. M. ... ... Dibrugarh.

Oates, E. W. (F.Z.S.) (Hon. Correspg. Member) ... *Europe.*
Oberholser, H. C. ... ... Washington, U.S.A.
O'Brien, Capt. H. C. H. ... ... Nowshera.
O'Brien, P. ... ... Thana.
O'Brien, Major Edward ... ... *Europe.*
O'Callaghan, F. M. ... ... Gauhati, Assam.
O'Donel, H. V. ... ... Alipur, Duars.
O'Donnell, O. ... ... *Europe.*
O'Donnell, Lt.-Col. T. J. (D.S.O., R.A.M.C.) ... Quetta.
O'Nash, E. ... ... Calcutta.
Ogilvie, A. W. (I.F.S.) ... ... Raheng *via* Moulmein and Kawkerick.
Ogilvy, W. ... ... U. Burma.
Okeden, W. P. ... ... Rangoon.
Oliphant, J. ... ... *Europe.*

Oliphant, J. N. ... ...Kheri, Oudh.
Oliver, Lt.-Col. L. G. ... ...Allahabad.
Olivier, Col. H. D. (R.E., F.Z.S.) (Life Member) ...*Europe.*
Ollenbach, O. C. ... ...Dehra Dun, U. P.
Orchha, H. H. the Raja Bhagvunt Singji ...Tikumgarh, Bundelkhund.
Ormiston, W. ... ...Ceylon.
Orr, Capt. H. M. C. ... ...*Europe.*
Orr, J. P. (I.C.S.) ... ...Bombay.
Osborn, Genl. W. ... ...Kangra District.
Osmaston, A. E. (I.F.S.) ... ...Gorakpur.
Osmaston, B. B. (I.F.S.) ... ...Dehra Dun.
Osmaston, L. S. (I.F.S.) ... ...*Europe.*
O'Sullivan, Col. D. (R.A.M.C.) ... ...*Europe.*
Owen, W. Tudor (I.C.S.) ... ...Palitana, Kathiawar.
Oxley, Capt. J. C. S. (I.M.S.) ... ...*Europe.*

Paddison, G. F. (I.C.S.) ... ...Madras.
Page, W. G. ... ...*Europe.*
Page, W. T. (F.Z.S.) ... ...*Europe.*
Page, W. W. K. ... ...Calcutta.
Paget, B. C. T. ... . Wellington, Nilgiris
Paget, Dr. A. J. M. (M.D., etc.) ... ...Berbera, Somaliland
Painter, H. L. (I.C.S.) ... ...Bombay.
Palanpur, Shah Zada Taley Mahomed Khan ...Palanpur.
Palmer, Capt. C. E. (I.M.S.) ... ...Bombay.
Palmer, W. L. (I.F.S.) ... ...*Europe.*
Pandey, Mrs. J. L. ... ...Bombay.
Pandit, S. Prem N... ... ...Jaipur, Rajputana.
Panna, H. H. the Maharaja Mohendra Yadvendra Singh Bahadur ... ...Ajmer.
Parames, N. V. (C.S.) ... ...Ernakulam, Cochin.
Pargeter, C. E. ... ...*Europe.*
Parish, N. B. ... ...Alwar, Rajputana.
Parker, R. N. (I.F.S.) ... ...Abbottabad.
Parnell, R. (I.F.S.) ... ...Kangra District.
Parrington, Capt. J. W. (R.A.) ... ...Bangalore.
Parsons, A. A. L. (C.S.) ... ...Patiala.
Parsons, A. E. B. ... ...Peshawar.
Parsons, S. P. ... ...Mandla, C. P.
Parshotumdas Vishram Maoji ... ...Bombay.
Partridge, E. A. ... ...Secunderabad.
Parton, F. J. ... ...Koppa P. O., Kadur District.
Pascoe, J. Harding... ... ...Kulla Kamby, Nilgiris.
Pasteur Institute of India, The Director ...Kasauli, Punjab.

Patel, Khan Bahadoor Burjorji D. ... ... Quetta.
Patiala, H. H. the Maharaja of ... ... Patiala.
Patton, Capt. W. S. (I.M.S.) ... ... Guindy, Saidapet.
Patuck, P. S. (I.C.S.) ... ... Wardha.
Powalla, Jamsetji C. ... ... Bombay.
Payne, R. (B.A.) ... ... Bankipur, E. I. Ry
Pearce, Major C. R. (I.M.S.) ... ... Maymyo.
Pears, S. G. (I.C.S.)... ... ... Parachinar.
Pearse, Lt.-Col. J. L. ... ... *Europe.*
Pearson, R. S. (I.F.S.) ... ... Dehra Dun, U. P.
Pechey, W. P. ... ... Bombay.
Peck, N. F. (I.C.S.) ... ... Chittagong.
Peile, Capt. H. D. (I.M.S.) ... ... *Europe.*
Pendlebury, W. M. F. ... ... Jalna, Deccan.
Penton, Lt.-Col. R. H. (R.A.M.C.) ... Poona.
Percival, A. P. (I.F.S.) ... ... *Europe.*
Percival, G. S. P. ... ... Mercara, Coorg.
Percy-Rao, A. E. ... ... Rangoon.
Perfect, S. R. (P.W.D.) ... ... Karachi.
Perreau, Capt. G. A. ... ... Bakloh, Punjab.
Pershouse, Lt. S. ... ... Rangoon.
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.
Petley, C. A. ... ... Toungoo.
Phillimore, Capt. R. H. (R.E.) ... ... Maymyo.
Phipson, H. M. (F.Z.S.) (Life Member) ... *Europe.*
Phythian, Adams, Lt. E. G. P. ... ... *Europe.*
Pickersgill-Cunliffe, Lt. J. C. ... ... Jhansi.
Pickthall, Capt. J. W. ... ... Rangoon.
Pilcher, Col. J. G. (I.M.S.) ... ... *Europe.*
Pile, J. ... . Secunderabad.

Pinfold, E. S. ... ... Rangoon.
Pinhey, Lt.-Col. A. F. (C.I.E.) ... ... Hyderabad, Deccan.
Pipe, T. S. ... ... Nasik.
Pitt, W. H. ... ... Rajamundri.
Plunkett, P. E. ... ... Katha, U. Burma.
Pollard, Capt. A. E. St. V. ... ... Port Blair, Andamans.
Pollard, G. F. (F.Z.S.) ... ... Dehri, Garhwal.
Polovtsoff, Mons. A. ... ... *Europe.*
Poncins, Baron Edmond de (Life Member) ... *France.*
Pope, J. A. (I.C.S.) ... ... Satara.
Porter, A. A. ... ... Lakon, U. Siam.
Pottinger, Lieut. J. A. ... ... Jhansi.

Pottinger, Major R. S. ... ... Bombay.
Powalla, Jemsetji C. ... ... Bombay.
Powell, Dr. A. ... ... Bombay.
Powell, J. E. ... ... Mussurrie.
Powell, W. ... ... *Europe.*
Powell, W. S. (I.F.S.) ... ... Rangoon.
Praed, Lt. G. A. M. ... ... Nowgong.
Prall, Lt.-Col. S. E. (I.M.S.) ... ... Aden.
Pratt, H. C. ... ... Selangor.
Preston, F. J. ... ... Bombay.
Priestley, E. ... ... Mirpurkhas.
Primrose, Alex. M. ... ... Punkabari, Duars.
Procter, The Hon'ble Sir H. E. ... ... *Europe.*
Proctor, Capt. Alfred H. (I.M.S.) ... ... Hongkong.
Professor of Forestry, Oxford University ... *England.*
Punjab Agricultural College, The Principal ... Lyallpur.
Punjab Government Horticultural Gardens, Supdt. Lahore.
Purkis, F. C. (B.F.S.) ... ... Rangoon.
Purkis, H. V. ... ... Madhopur, District Gurdaspur.

Quin, Capt. R. P. ... ... Cawnpore.
Quinlan, D. (M.R.C.V.S.) ... ... Calcutta.
Quinn, Dr. T. W. ... ... Betul, C. P.

Rae, Capt. M. E. ... ... *Europe.*
Raikes, E. B. ... ... *Europe.*
Rajkumar College, the Principal ... ... Rajkote.
Ralston, Lt. W. H. ... ... Kashmir.
Raper, J. C. D. (A.M.I.C.E.) ... ... Lucknow.
Ravenshaw, Col. C. W. (Life Member) ... ... *Europe.*
Readymoney, N. J. ... ... Bombay.
Rebello, Rev. Jofo ... ... Margoa, Goa.
Rector, St. Mary's College ... ... Mazgaon, Bombay.
Redmond, Rev. J. ... ... Chickmagalore, Mysore.

Rees, R. ... ... Chandkhira Sylhet.
Rees, W. E. ... ... Gaya, Bengal.
Reichwald, Capt. W. F. (R.H.A.) ... ... Mhow.
Reid, Cecil H. (I.C.S.) ... ... Calcutta.
Reid, M. F. (C.I.E.)... ... ... *Europe.*
Reid, R. N. H. ... ... Mercara, Coorg.
Reid, W. J. (I.C.S.) ... ... Dacca.
Reiley, R. C. ... ... Kandri P. O.
Reilly, N. E. ... ... Panjgur, Mekran Coast.

Reinhart, W. ... ... Bombay.
Reinhold, Capt. C. H. (I.M.S.) ... ... *Europe.*
Remington, G. L. ... ... Abu Road.

Rendall, H. D. (I.C.S.) ... ... Junagad.
Rennick, Lt.-Col. Alex. de C. ... ... Delhi.
Renvie, Thos. (I.C.V.D.) ... ... Rangoon.
Reynolds, Capt. D. (R.F.A.) ... ... Nowshera.
Reynolds, G. N. ... ... Saugar, C. P.
Reynolds, L. W. (I.C.S.) ... ... Calcutta.
Rhé-Philipe, G. W. V. de ... ... *Europe.*
Rhenius, C. E. ... ... *Europe.*
Rhodes, T. M. ... ... *Europe.*
Rice, H. D. ... ... *Europe.*
Richards, B. D. (B. Sc.) ... ... Lanowli.
Richmond, R. D. (I.F.S.) ... ... Coimbatore.
Ritchie, Major C. McI. (R.H.A.) ... ... Lahore Cant.
Robert, A. W. ... ... Kistna District.
Roberts, A. A. Lane (I.C.S.) ... ... Kulu, Punjab.
Roberts, Capt. A. S. B. ... ... Rangoon.
Roberts, Lt.-Col. J. R. (I.M.S.) ... ... Indore, C. I.
Roberts, Major M. B. (Life Member) ... ... Garhwal, U. P.
Robertson, Hon'ble B. (I.C.S., C.I.E.) ... ... Calcutta.
Robertson, T. B. ... ... *Europe.*
Robertson, J. H. (I.C.S.) ... ... *Europe.*
Robertson, Laurence (I.C.S.) ... ... Bombay.
Robertson, L. V. M. (I.C.S.) ... ... Hyderabad-Sind.
Robinson, Lt. H. G. ... ... Peshawar.
Robinson, H. K. (I.F.S.) ... ... Kurseong.
Robinson, Hon'ble Mr. Justice S. M. ... ... Rangoon.
Robinson, Major H. ... ... Poona.
Roddis, F. ... ... Dacca.
Rodger, A. (I.F.S.) ... ... Dehra Dun.
Rogers, A. C. ... ... *Europe.*
Rogers, A. K.... ... ... Barrakpore, Bengal.
Rogers, C. G. (I.F.S.) ... ... Bombay.
Rogers, J. B. Leslie ... ... *Europe.*
Rogers, Rev. K. St. A. ... ... Ruaai, East Africa.
Rogers, W. S. ... ... Bombay.
Rome, H. C. ... ... Peshawar.
Rooke, E. A. ... ... Balaghat, C. P.
Roper, F. ... ... *Europe.*
Rorie, J. J. ... ... Toungoo, Burma.
Rose, Col. H. ... ... Lucknow.
Rosenthal, F. M. ... ... Secunderabad.
Ross, J. P. ... ... Bombay.
Ross, Major Tyrell (Life Member) ... ... Dilkhusha, U. P.
Routh, Capt. G. F. S. ... ... Kohat.
Roughton, N. J. ... ... Khandwa.
Row, Dr. R. (M.D.) ... ... Bombay.
Rowan, Revd. T. (B. D.) ... ... Panchgani.
Rowlandson, E. J. ... ... Vellore, N. Arcot.

Royal Asiatic Society, The Honorary Secretary ... Bombay.
Roy, Sampat Liladhar S. ... ... Bombay.
Ruddle, W. H. ... ... Secunderabad.
Rudman, F. R. R. (I.C.S.) ... ... Jubbulpore.
Rushton, C. E. ... ... Mandalay.
Russell, A. J. ... ... Banmank, U. Burma.
Russell, Hon'ble Mr. Justice L. P. ... ... Bombay.
Rust, P. J. (I.C.S.) ... ... Rupar, Umballa.
Rutherford, W. F. ... ... China.
Ryan, G. M. (I.F.S.) ... ... Karachi.
Ryan, J. G. ... ... Cawnpore.
Ryan, W. J. N. ... ... *Europe.*
Rylands, H. R. ... ... *Europe.*
Ryves, A. E. ... ... Allahabad.

Sale, Edward L. (I.C.S.) ... ... Bombay.
Salkeld, Capt. R. E. ... ... *Kismayu, British East Africa.*
Salmon, Capt. W. H. B. ... ... Poona.
Salt, Capt. H. F. (R.F.A.) ... ... Rawalpindi.
Samers, W. B. (M.B.) ... ... Rangoon.
Sampson, E. D. ... ... Hubli.
Sanderson, P. M. D. ... ... Bombay.
Sangli, Shrimant Chintamanrao Appasaheb Patwardhan ... ... Sangli, S. M. C.
Saonè, G. Prier De ... ... *Europe.*
Sassoon, Mrs. S. D ... ... Bombay.
Saxby, H. B. ... ... Ajmer.
Saunders, Capt. C. ... ... *Europe.*
Saunders, H. F. ... ... Gwalior, C. I.
Saunders, Major F. W. (R.E.) ... ... Bombay.
Savile, L. H. ... ... Bombay.
Scindia, H. H. the Maharaja Sir Madhowrao (G.C.S.I., G.C.V.O.) (Life Member) ... ... Gwalior, C. I.
Schomberg, R. C. F. ... ... Taiping.
Schultz, Chas. S. ... ... *Europe.*
Scot, J. S. (I.F.S.) ... ... Guntur.
Scott, Edmund ... ... Ceylon.
Scott, Capt. G. B. ... ... Alipur.
Scott, G. B. ... ... Ahwaz.
Scott, F. B. ... ... Dehra Dun.
Scott, R. P. ... ... Bombay.
Scrafton, J. E. B. ... ... Secunderabad.
Scroggie, Capt. W. R. J. (I.M.S.) ... ... Mercara, Coorg.
Scroope, E. W. P. (I.C.S.) ... ... *Europe.*
Selby, Major W. (D.S.O., F.R.C.S., I.M.S.) ... Lucknow.
Seale, Dr. C. E. B. ... ... Darjeeling.
Sealy, Major A. E. ... ... Gurdhaspur, Punjab

Sedgwick, L. J. (I.C.S.)	Poona.
Seervai, Dr. Rustom F.	... Bombay.
Sirdar, Anandrao Scindia	.. Gwalior, C. I.
Seton-Karr, H. W. (Life Member) ...	... *Europe.*
Settlement Reading Club, The Principal	... Port Blair.
Sewell, J. H.	... Rangoon, Burma.
Seymour Sewell, R. B. (I. M. S.) ...	... Calcutta.
Shakespear, Lt.-Col. J.	... Imphal, Manipur.
Shand, J. H. B. (I.M.S.)	... Baroda Camp.
Sharp, The Hon'ble Mr. W. H. ...	... Poona.
Sharp, H.	... Shillong.
Shaw, H. J.	... Bombay.
Shaw, Capt. W. S. J. (I.M.S.) ...	... Rangoon.
Sheldon, Dr. J. H.	... Tonngoo, Burma.
Shebbeare, E. O.	... Jalpaiguri.
Shepherd, Philip	.. Quetta.
Shepherd, W. C. (I.C.S.)	.. Bijapur.
Shepperson, C. J. W.	... *Europe.*
Shipp, W. E.	... Ajmer.
Shevade, S. V. (B. SC.)	... Kirkee.
Shore, H. A.	... Waltair.
Shortland, C. V. N. (A.M.I.C.E.) ...	... Bilaspur, C. P.
Short, Lt.-Col. A. (R.H.A.)	... Mhow, C. I.
Shoubridge, H. O. (C.E.)	... Nasik.
Silvester, C. J.	... Moradabad, U. P.
Sim, E. L.	... Bombay.
Simcox, A. H. A. (I.C.S.)	... Jalgaon, Khandesh.
Simonds, Capt. M. H.	... Ferozepore.
Simpson, J. Hope (I.C.S.)	.. Gorakhpur, U. P.
Simson, Lt. R.	... Fyzabad.
Sinclair, R. L.	... Srinagar.
Sind Club, The Hony. Secretary ...	... Karachi.
Sitwell, Capt. N. S. H. (R.A.)	... Dum Dum.
Skelton, J. H.	... *Europe.*
Skilling, W.	... *Europe.*
Skinner, Capt. J. M. (I.M.S.)	... Ganjam.
Skinner, Capt. R. B. (R.E.)	... Dagshai.
Skinner, R. R.	... Fort Bilaspur.
Slade, G. E. R.	... Sabarmati.
Slade, Rear-Admiral Sir E. J. Warre...	... Ceylon.
Sladen, Dr. R. J. L.	... *Europe.*
Slater, H. Kelshall	... Bangalore.
Slater, J. Sanders	... Bombay.
Smallwood, H. St. C.	.. Thabeitkyn. U. Burma.
Smales, Chas. B. (I.F.S.)	... Tharrawadi.
Smart, Dr. A. G. M. (M. B.)	... Kelanton, *via* Singapore.

Smith, A. Kirke	... Bombay.
Smith, J. H.	... Cutch, Bhuj.
Smith, J. J. (I.C.S.)	... Koraput, Vizagapatam Dist.
Smith, Major F. A. (I.M.S.)	... Bharatpur.
Smith, Capt. H. H....	... Fyzabad.
Smith, Major O. A.	... Alipore.
Smith, S. D. (B.A.)	... *Europe.*
Smith, W. J.	... Colombo.
Smythies, E. A.	... Naini Tal.
Somers, W. B. (M.B.)	... Rangoon.
Snow, Lt.-Col. E. Graham	... Peshawar.
Souter, C. A. (I.C.S.) ...	... Madras.
Southon, Capt. C. E. (I.M.S.)	... Bombay.
Spalding Capt. W. B.	... Cawnpore.
Sparke, W.	... Rangoon.
Sparling, A. H.	... *Europe.*
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Spence, R. A.	... Bombay.
Spooner, T. J. (C.E.) (Life Member) ...	... Gadag.
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Stanbridge Capt. W. J.	... Kasauli.
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Stanton, W. C.	... Bombay.
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Stockley, Capt. J. P.	... Kotra, Rajputana.
Stokes, I. W.	... Bombay.
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Stoney, R. F.	... Madras.
Stoner, W.	... Nagasamudram, S. M. Rv.
Storey, Thos. H.	... Oodeypur.

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Stuart, J. D. ... ... Minbu.
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Sullivan, E. H. ... ... Madanapalli.
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Suter, Dr. M. F. ... ... Bombay.
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Sykes, C. M. (C.B.) ... ... Dwarka.
Sykes, M. G. (I.C.S.) ... ... *Europe.*
Sykes, Sir Tatton, Bart. ... ... *Europe.*
Symes, W. C ... ... Bombay.
Symons, H. (R.G.A.) ... ... Kirkee.
Symons, C. T. ... ... Colombo.

Talbot, W. A. (I.F.S.) ... ... Kirkee.
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Tennant, G. F. D. ... ... Bombay.
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Thom, W. S. ... ... Paletwa, Aracan Hill Tracts.
Thomas, E. F. (I.C.S.) ... ... Palghat, Malabar.
Thomas, F. B. ... ... Kanchrapara, E. B. S. Ry.
Thomas, M. P. ... ... Orissa.
Thomasset, H. P. ... ... Seychelles.
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Thornton, Capt. F. E. ... ... Transvaal.
Thorpe, Capt. L. L. G. (R.A.M.C.) ... ... *Europe.*
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Thubron, J. B. S. ... ... Nasik.
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Tilly, T. H. (Life Member) ... ... Rangoon.
Tinley, Col. G. F. N. ... ... Meerut.
Tipper, G. H. (B.A.) ... ... Calcutta.
Tipping, P. G. ... ... Sidapur, Coorg.
Tod, Alex. M. ... ... Bombay.
Tomkins, Major E. L. (R.A.) ... ... Jubbulpore.
Toppin, S. M. (B. A.) ... . Drosh, Chitral.
Tottenham, W. F. L. (I.F.S.) ... . Pokokku, Burma.
Townsend, Major E. C. ... ... Akyab, Burma.
Traill, W. H. ... . *Europe.*
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Trevor, Surg.-Genl. F. W. (R.A.M.C.) ... ... Calcutta.
Trivandrum, The Director, Government Museum and Public Gardens ... ... Trivandrum.
Trotter, E. W. ... ... Bangkok, Siam.
Troup, N. F. T. ... ... Kousanie, Almora.
Troup, R. S. (I.F.S.) ... ... Dehra Dun.
Truninger, L. ... ... Calcutta.
Turkhud, Dr. D. A. ... ... Bombay.
Turner, A. J. (B.SC.) ... ... Bombay.
Turner, Sir Montague ... ... *Europe.*
Tweedie, A. G. ... ... Calcutta.
Tweedie, Lt. J. L. ... ... *Cairo.*
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Tyrrell, Major J. R. (I.M.S.) ... ... Sirdarpore, C. I.
Tytler, Maj. H. C. ... ... Manipur.

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United Service Club, The Secretary ... ... Bangalore.
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Vernon, H. A. B. (I.C.S.) ... ... Madras.
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Victoria Technical Institute, The Curator and Librarian ... ... Nagpur.
...al, H. S. G. ... ... Bombay.
Villar, A. R. ... ... Tharrawaddy.
Vincent, W. H. H. (I.C.S.) ... ... Mozafferpore.
Vithuldas Damodhar Thakersey, The Hon'ble Sir.... Bombay.
Vlasto, P. ... ... Bombay.
Volkart, L. ... ... Bombay.

Waddington, T. H.... ... ... Phillaur, Punjab.
Wadia, D. N. (Prof. of Biology, P. W. College, Jammoo) ... ... Kashmir.
Wadia, M. M. ... ... Bombay.
Wainwright F. M. ... ... Gudivada, Kistna.
Waite, H. W. ... ... Ferozepore.
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Wallace, W. V. (I.C.S.) ... ... Burma.
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Wallis, R. W. D. ... ... Mingin, Burma.
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Watney, C. W. ... ... Rawalpindi.
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Wickham, P. F. (C.E.) ... ... Rangoon.
Wiles, G. (I.C.S.) ... ... Branch.

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Williamson, K. B. ... ... Jubulpore, C. P.
Williamson, W. J. F. ... ... Bangkok, Siam.
Willis, R. A. ... ... Bombay.
Willock, Comdr. A. R. G. (R.I.M.) .. ... Akyab.
Wilson, Major Alban ... ... Shillong, Assam.
Wilson, A. R. ... ... Almora, U. P.
Wilson, W. B. ... ... *Europe.*
Wilson, A. T. ... ... Muhammerah, Persian Gulf.
Wilson, C. C. ... ... Coimbatore.
Wilson, Lt.-Col. C. H. L. F. (R.A.) ... ... Rawal Pindi.
Wilson, H. C. ... ... Madras.
Wilson, P. N. W. ... ... Jubbulpore.
Wilson, R. A. (I.C.S.) ... ... *Europe.*
Wilson, William Burns ... ... *Europe.*
Wimbush, O. C. B. ... ... *Europe.*
Wimbush, A. ... ... Nilambar, Malabar.
Winsor, D. W. ... ... Sirur, Poona.
Withinshaw, L. ... . Ramnad.
Withers, D. S. ... ... Assam.
Witt, D. O. (I.F.S.) ... ... Saugor, C. P.
Wood, C. W. (C.E.) ... ... *Europe.*
Wood, Capt. H. (R.E.) ... ... *Europe.*
Wood, Major H. S. (I.M.S.) ... ... Calcutta.
Wood, S. C. G. ... ... Ajmere.
Woodhouse, E. J. ... ... Sabour.
Wooster, W. G. ... . *Europe.*
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Wright, Lt.-Col. E. H. (I.M.S.) ... ... Madras.
Wright, F. A. (C.E.) ... ... Calcutta.
Wright, H. C. ... ... *Europe.*
Wright, J. M. (I.C.S.) ... ... Shwebo, Burma.
Wright, Capt. W. D. (I.M.S.) ... ... *Europe.*
Wrigley, F. A. ... ... Rangoon.
Wroughton, R. C. (F.Z.S.) (Life Member) ... *Europe.*

Yeo, Edwin W. ... ... Bombay.
Yerbury, Col. J. W. (R.A.) (Life Member) ... *Europe.*
Younan, Lt.-Col. A. C. (I.M.S.) ... ... *Europe.*
Young, E. H. ... ... Bandikui.
Young, F. B. .. .. *Europe.*
Young, H. G. ... ... Ferozepore.
Young, J. V. (I.F.S.) ... ... Pyinmana, Burma.

Young, Capt. M. J. D. ... ...Secunderabad.
Yule, Capt. R. A. ... ...Hyderabad, Deccan.

BOMBAY NATURAL HISTORY SOCIETY.

STATEMENT of ACCOUNTS (from 1st January 1910 to 31st December 1910).

RECEIPTS.	Rs. a. p.	Rs. a. p.	EXPENDITURE.	Rs. a. p.	Rs. a. p.
Balance in Bank on 31st December 1909...	2,353 10 5		Rent of the Rooms from 1st January 1910 to 31st December 1910		1,890 0 0
Cash in hand on 31st December 1909 ...	179 0 0		Salaries of the Staff		7,884 15 9
Petty Cash Balance on 31st December 1909	23 14 5		Postages		1,631 4 3
Postage Balance on 31st December 1909...	0 12 0		Printing and Stationery		929 1 7
		2,457 4 10	Journal Account		9,857 14 7
Subscription for 1907 (in arrears) ...	30 0 0		Library		1,008 1 3
,, 1908 ,, ...	75 0 0		Furniture		1,134 11 0
,, 1909 ,, ...	722 10 0		General Charges		3,427 6 3
,, 1910 ,, ...	18,955 12 6		Investments		7,982 3 2
,, 1911 (in advance) ...	2,639 13 1		Sundries		791 13 4
,, 1912 ,, ...	29 12 3		Bank's Charges		90 15 0
,, for Life Membership ...	468 0 0		Duck Book		378 12 9
		22,872 13 10			
Entrance Fees		2,639 0 0			
Government of Bombay's grant-in-aid ...		5,000 0 0		Rs. a. p.	
Sundries		1,240 10 7			
Sale of Journals		1,240 7 3	Balance in Bank on 31st December 1910.	2,729 13 6	
Sale of Duck Book and Plates... ...		2,717 15 0	Postage Balance on 31st December 1910.	46 10 9	
Interest on Investments...		1,353 14 6	Petty Cash on 31st December 1910 ...	38 11 2	
Interest allowed by the Bank		92 9 10	Cash in hand on 31st December 1910...	145 5 0	
					2,960 10 11
Total Rs. ...		39,665 13 10	Total Rs. ...		39,665 13 10

Examined and found correct.

(Sd.) A. F. FERGUSON & Co.,
Chartered Accountants.

(Sd.) L. H. SAVILE,
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BOMBAY, 28*th March* 1911.

A BIBLIOGRAPHY OF THE BOTANY OF BRITISH INDIA AND CEYLON.

BY

E. BLATTER, S. J.

The idea of compiling a list of books and papers on Indian Botany first came to my mind some eight years ago when I came out to India and was quite at a loss to ascertain what had been published on the vegetation of this vast country. What was left in my memory of the study of the history of Botany was the vague idea that, once upon a time, some enterprising botanists and explorers had lived and worked and died under the tropical sun of Hindustan, that some of them had sent huge collections to various museums in England and France and Germany, and that others lived long enough, to commit their observations to writing, whilst a few of them had to be satisfied with the fame of posthumous publications. But most of the names had escaped me; of some indeed I remembered the names exactly, but I did not quite recollect, what the bearers of the names had been doing, and of a great number who, I was sure, must have existed, I knew neither the one nor the other.

In the course of time I made the discovery (which was not a little consoling to me) that a great many of my botanical colleagues had to confess a similar ignorance. Under these circumstances it was indeed gratifying to receive inquiries like these from various parts of India: 'Could you recommend me a concise book dealing with the Botany of Rajputana?' or: 'I should be much obliged for a list of botanical books which have been issued on the flora of Hyderabad', or some other time: 'If it is not causing too much trouble, I wish to ask you, which authors described best the mosses of Southern India?' or: 'I should like to buy a book which treats exhaustively of the fungi of the Deccan.'

These and similar questions set me ahunting after the botanical literature of India. But this is not an easy task in a country

where the libraries are few and where these few libraries have no special tendency towards developing a scientific taste in the minds of their subscribers. As I had no opportunity of consulting the library in Calcutta, I had to drop the idea of getting up a list of works on Indian Botany which might be called somewhat complete, and it was only after my return to Europe that I was able to work up the bibliography to the present state, in which I wish to present it to my colleagues in India and Europe. Imperfect though it may be in many respects, I feel confident that the list, even in this form, will be welcome to many workers in Indian Botany, because, as far as I know, no attempt to supply the need has been made up to the present.

I considered it convenient to include a good many papers which appeared in the publications of the Indian Departments of Agriculture and Forestry, as well as papers from pharmaceutical and horticultural journals. But I omitted all those which treat exclusively of the specific technical side of the respective branch of science. Opinions may, therefore, be divided in many cases as to the advisability of including or excluding a certain paper. I have, besides, catalogued some of the more important monographs, dictionaries, etc., which, though they do not deal exclusively with Indian Botany, contain, nevertheless, valuable information on the subject.

As to the arrangement of the bibliography I have, after long consideration and on the advice of friends interested in it, decided to divide the whole list into two parts.

The first part (I) is to contain publications which treat of the Botany of India in general or of a greater part of India. It will also contain descriptions of single species which are not confined to a very limited locality and papers on plants of extensive cultivation (whether indigenous or not), though they may be restricted to well defined areas.

The second part (II) will enumerate the books and papers describing the Botany of smaller areas which are included entirely or at least for the greater part in one of the botanical regions recognised at present in India, viz.: The Eastern Himalayas, the Western Hymalayas, the Indus Plain, the Gangetic Plain,

Malabar, the Deccan, Ceylon and Burma. To these will be added, under separate headings, the botanically little known countries of Baluchistan and Nepal. For practical reasons we shall follow the alphabetical arrangement of the regions:

1. Baluchistan.
2. Burma, comprising Upper and Lower Burma, Chittagong and Assam of the old maps [1].
3. Ceylon, including the Maldive Islands.
4. Deccan, comprising the whole table-land of the Peninsula east of Malabar and south of the Gangetic and Indus Plains. We include the Coromandel Coast.
5. Eastern Himalaya, extending from Sikkim to the Mishmi Mountains in Upper Assam.
6. Gangetic Plain, comprising the United Provinces and Bengal (except Chota Nagpore and Orissa), extending eastwards to the Burmese botanical region.
7. Indus Plain, including the plains of the Punjab, Sind, Rajputana, Cutch, and Gujarat (to the Narbada River).
8. Malabar, comprising Gujarat (south of the Narbada), the Konkan, Kanara, Malabar proper (with Nilgiris and Palni Hills), Cochin, Travancore, and the Laccadive Islands.
9. Nepal.
10. Western Himalaya, extending from Kumaon to Chitral.

Part II will enable the botanist residing in any part of India to find out without great trouble what has been published on the vegetation of his respective district.

I shall be thankful for any additions, corrections or suggestions which may help to make the bibliography more useful than it is, perhaps, in its present form. It is quite possible that the practical use of the list will reveal some deficiencies.

I wish to express my thanks to Mr. H. N. Dixon who kindly supplied me with a list of publications on Indian Mosses, and to the Rev. F. Theissen, S. J., who helped me with regard to the mycological flora. My thanks are also due to the Librarians of the Peradeniya Botanic Gardens and of the South Kensington Natural History Museum.

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[1] The plains of Assam and Sylhet do not properly belong to this botanical region; but other considerations induced us to include them here. Our regions serve in this place a practical and not a strictly scientific purpose.

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JOURNAL
OF THE
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THE GAME BIRDS OF INDIA, BURMA AND CEYLON.

PLATE I.—THE WOODCOCK (*Scolapax rusticola*) not having arrived from England will appear in a subsequent number.

EDITORS.

INTRODUCTION.

It is now nearly 8 years since the conclusion of "Indian Ducks and their Allies" and the favourable reception accorded to that series has induced me to compile, and the editors of the Journal to accept, a further series of articles upon the remaining Game Birds of India.

Of necessity a work of this nature must be more of a compilation than original, but at the same time every effort will be made to bring each article up-to-date and we trust that much matter which has as yet found no record will here obtain a place.

In writing "Indian Ducks" I observed in the preface that the articles were written as much for the purpose of inducing sportsmen in the future to record their experiences and observations as with the object of putting together an epitome of what was already known. The former purpose has, I think, been fully achieved and much valuable information upon Indian Ducks has been recorded since the articles were written. We have added no little to our knowledge of their distribution and habits and have actually obtained a record adding Bewick's Swan to our List of Indian Birds.

So with the following pages. We trust that while the compilations will show sportsmen and field naturalists the extent of present records it will encourage them to furnish others which will not only supplement but also correct them when necessary.

It will be seen that much yet remains for sportsmen and field naturalists to do. Doubtless there are yet to be obtained additions new not only to an Indian Avifauna but to science altogether by those who have the good fortune to be posted on our far North-Eastern Frontier. But novelties are not the only things to hope for and there is much about the most common of our game birds which has not yet been properly, and sufficiently worked out. It is only within the last few weeks that Mr. Ogilvie-Grant has submitted the entirely new theory that female Woodcocks enormously outnumber the males and in the same article he has knocked on the head our old ideas as to the alleged differences in plumage between the young and old birds.

As regards classification that of Blanford's Avifauna will be adopted almost as it is, but for the sake of convenience it may be necessary to alter the sequence of the individual birds and indeed, in some cases, of the Families or Sub-Families also.

The keys to the species are based as far as possible upon such characteristics as appeal to the non-scientific observer but in each case the fullest description of the adult male and female is given as also, where possible, of the young bird.

Finally I may add that should these series prove as popular as did the "Ducks" it is proposed to bring them out in book form on the same lines as that adopted for those articles.

Part I.

Family—CHARADRIIDÆ.

In 1886 in the "Ibis," page 122 *et seq.*, Seebohm thus discoursed on the position of the Snipes in the great family of "Plovers." "The Snipes belong to the family Charadriidæ, which also includes the Sandpipers, Curlews, Plovers and a few other allied genera. From all these birds they are very easily and very distinctly characterised. Most of the Charadriidæ are web-footed; they have a distinct web at the base of the toes, sometimes much more developed between the outer and the middle toe; but the Snipes, some of the Sandpipers, and the Turnstones are exceptions to this rule, having no rudimentary web between any of the toes, which are cleft to the base. Again, most of the Charadriidæ have comparatively long legs and short bills; the Snipes on the contrary have short legs and long

bills. The only birds in this family (except the Snipes) in which the bill is as long or longer than twice the length of the tarsus, are the females of one or two species of Curlews and one or two species of Sandpiper, none of which have all the toes cleft to the base. The genus Scolopax may therefore be diagnosed as follows :—

"Charadriidæ having the bill twice as long as the tarsus, and all the toes cleft to the base."

He, however, comes to the conclusion in this paper that one cannot divide the group into genera and that these species must all come under the one genus *Scolopax*.

He first shews that they cannot be divided by any structural diagnosis, the two main points of which may be said to be the amount of feathering on the tibiæ and the number of tail feathers.

He, however, points out that there are two characteristics which divide five members of the group from all others, *viz.*, the nature of the markings on the head and the curious silvery tips to the feathers of the tail underneath.

These characteristics appear quite sufficiently satisfactory and it is upon these that most naturalists now divide the genera Scolopax and Gallinago.

Subfamily—Scolopacinæ.

The members of this Subfamily may be distinguished from all other birds of the Charadriidæ Family by having no trace of a web between the toes and by having the bill about twice as long as the tarsus. Another striking feature of the Snipes is the curious position of the eyes which are placed very far back in the head just above the anterior edge of the ear-orifice. In this country we have three genera. *Scolopax*, which contains the Woodcock only, *Gallinago*, containing the true Snipes, and *Rostratula* containing the birds generally called Painted Snipes. The genus Scolopax includes, according to Sharpe, only two species, *viz.*, *rusticula* and *sturata*. The former, the common Woodcock, is migratory summering in the Himalayas and extending in the winter to the Plains of India ; the latter is found only in Java and New Guinea and but little is known about it. Of the genus *Gallinago* Sharpe recognizes 20 species some of which are migratory and some are not ; of these seven species and one doubtful sub-species (*raddei*) are found in India. The genus

Rostratula is non-migratory and contains three species of which one, the Common Painted Snipe, is found over most of India and Burmah as well as China, Japan and Africa.

Blanford's key to the genera is as follows :—

A.—Sexes similar in plumage, bill straight.

(*a*) Tibia feathered throughout ; no longitudinal pale stripes ; occiput and nape transversely striped ..... *Scolopax.*

(*b*) Tibia partly naked, longitudinal pale stripes on crown and scapular..... ... *Gallinago.*

B.—Sexes different, bill curved downwards at tip ..... *Rostratula.*

The sportsman can always tell the Painted Snipes (*Rostratula*) at a glance by its bright colouration, so different in every way from an ordinary Snipe's plumage.

The Woodcock he can tell, not only by its weight and size, but by a glance at the under surface of its tail feathers and if these have silvery tips then the bird is a Woodcock. Again if the occiput and nape are found to be barred, and not streaked, in the character of their markings the bird is the same.

SCOLOPAX RUSTICOLA.

The Woodcock.

Scolopax rusticola.—Linn., Sys. Nat , I, p. 243 (1766); Blyth, Cat., p. 271 ; Jerdon, B. I., III., p. 670 ; Stoliczka, J. A. S. B., XXXVII, Pt. 2, p. 70 ; Beavan, Ibis, 1868, p. 391 ; Brooks, J.A.S.B., XLIII, Pt. 2, p. 253 ; Hume, S.F., II, p. 482 ; Anderson, *ibid*, III, p. 356 ; G. Austin, J.A S.B., XLV, Pt. 2, p. 200 ; Fairbank, S.F., V., p. 409 ; Butler, *ibid*, p. 504 ; Hume and Davison, *ibid*, VI, p. 458 ; Ball, *ibid*, VII, p. 228 ; Laird, *ibid*, p. 470 ; Hume, *ibid*, p. 483 ; *id*. Cat. No. 867 ; Bingham, S.F., VIII, p 196 ; Scully, *ibid*, p. 253 ; Hume, and Marshall, Game B., III, p. 309 ; Williamson, S.F., X., p. 517 ; Barnes, B. of Bom., p. 343 ; Seebohm Charadriidæ, p. 502 ; Hume, S.F., XI, p. 318 ; Newnham, Bom. N. H. S. Journal, Vol. IV, p. 52; Osmaston, *ibid*, Vol. XI., p. 473 ; Davidson, *ibid*, Vol. XII, p. 66 ; Stuart Baker, *ibid*, p. 500 ; Evans, Ibis, 1891, p. 80 ; Meade-Waldo, *ibid*, 1893, p. 204 ; Schufeldt, *ibid*, p. 653 ; Davidson, *ibid*, 1898, p. 39 ; Finn., Indian Waders, p. 138.

Scolopax rusticula.—Wharton, Ibis, 1879, p. 453; *id*, S.F. VIII, p. 500; Legge, B. of Ceylon, p. 806; Butler, S.F. IX, p. 428; Biddulph, Ibis, 1881, p. 95; Scully, *ibid*, p. 588; Marshall, Ibis, 1884, p. 424; Davison, S.F. X., p. 413; Oates, Birds of B. B., II p. 380; St. John, Ibis, 1889, p. 176; Hume's, Nests and Eggs, 2nd Edit., III, p. 349; Sharpe, Cat. B. B. M., XXIV, p. 671; Blanford, Fauna B. I., IV, p. 283; Dresser, Pal. Birds, p. 726; Oates, Cat. B. Eggs of B. M., Vol. II, p. 66; Sharpe, Hand List of B., Vol. I, p. 166; Oates, Game B., II, p. 428; Inglis, Bom. N. H. S. Journal, Vol. XII, p. 500; Bourdillon, *ibid*, Vol. XVI, p. 10; Fulton, *ibid*, p. 63; Rattray, *ibid*, p. 663; Ogilvie-Grant, Bulletin, B. O. Club, CLVI (1st Jan. 1910).

Vernacular names.—*Simtitar*, *Tutitar*, Hin.; *Sim Kukra*, Kumaun and Nepal; *Chinjarole*, Chamba; *Daodidap gadeba*, Cachari; *Simpoo-khlaw*, Khasia; *Kangtruk*, Manipur; *Wilati Chaka*, Chittagong; *Bumpal* or *Dhábhá*, Chitral; *Gherak*, Drosh; *Chustruck*, Gilgit.

Description.—Forehead and sinciput grey; generally with a dark mark on the forehead. Occiput and nape with three broad transverse bands of velvet black, divided by yellowish or rufous lines. A deep rufous brown, almost black, line running from the base of the bill to the corner of the eye; a second similar line below eye and posterior ear coverts; ear coverts and cheeks grey, with numerous rufous-brown spots. Upper parts and wing coverts rufous grey with numerous bars of brown and rufous; the lesser wing coverts brown and rufous only and the scapulars broadly black on the inner and white, yellowish white or pale grey on the outer webs. The primary coverts are rufous, with bars of grey, finely edged with dark brown. The primaries and outer secondaries brown, the latter notched on the outer webs with rufous, the notches being palest on the outermost feathers. The quills are also margined with pale rufous at the tips. The inner secondaries are barred right across with alternate bands, broad of brown and narrow of rufous. Rump and upper tail coverts barred rufous and black or rufous and brown; as a rule in the longest coverts the terminal half is almost pure rufous.

Tail feathers dark brown or black, notched or barred with rufous and tipped grey above and broadly silver-grey below.

Chin white or nearly so, remainder of lower parts dull greyish

white, barred throughout with narrow rufescent bars which become darker and more numerous on the upper breast, often running into one another and forming dark patches. On the abdomen and flanks posteriorly, the bars are sometimes centred with a paler tint.

The adult female does not differ from the male in plumage. "The female is larger with the colours more dull" (Jerdon). "Males have . . . . . the back more of the pale brown and grey, and the rump less red than the female" (Yarrell), *i.e.*, Yarrell makes out the female to be a more rufous bird than the male.

Young birds.—"Differ from the adult in being darker and having creamy-whitish, instead of ashy, spots at the end of the dorsal and scapular feathers; the lower back, rump and upper tail coverts are plainly barred across with dusky brown, and the tail feathers are not largely notched with sandy brown on their margins, but have a narrow sub-terminal line of sandy buff between the ashy tip and the black of the rest of the feathers. The outer web of the primaries has a distinct series of fulvous notches." (Sharpe).

The question of the alleged differences in the young bird have been taken up lately by Ogilvie-Grant and in the B. O. C. Bulletin he thus sums up the result of his observations. "It will thus be seen that . . Gould . . implies that the Woodcocks with tooth-like markings on the outer web of the first long flight-feathers are the young birds of the year."

"This statement has been generally accepted as correct."

"The investigations which I have undertaken during the last few years have clearly proved the entire fallacy of this theory."

He then explains how he shot many breeding birds in the Azores—an unfortunate but necesssary proceeding—and also obtained young birds of the year from Messrs. Meade-Waldo and Sir Richard Graham.

Ogilvie-Grant then comments on Seebohm's description of the differences between the young and the old bird and says that his investigations have "clearly proved that it is impossible to distinguish between the plumage of the male and female Woodcock, or between old and young birds of the year, when once the latter have fully developed their flight feathers."

Nestlings.—"Covered with a velvety down of a rufous colour with a broad band of chestnut down the centre of the crown, and another down the centre of the back, with three broad transverse bands down the

sides of the body ; on each side of the crown and dorsal stripe a broad streak of isabelline ; a black loreal line and a central streak on the forehead also black ; under surface of body pale rufous, inclining to isabelline on the abdomen, and with some chestnut patches on the throat and foreneck." (Sharpe.)

Iris deep brown, almost black. Feet green-grey or livid grey, or grey lead colour, claws generally paler and more fleshy. Bill dusky, base brown, paler and tinged with purple at the base of the lower mandible

"The legs and feet are pale bluish, brown or drab, or fleshy plumbeous or grey, or livid grey, or bluish fleshy grey, generally more or less shaded dusky on the joints ; and the claws are fleshy brown, pale brown, blackish brown or dusky."

"The bill is dusky to blackish brown at tip, the rest pale drab brown, fleshy brown with a bluish tinge or almost plumbeous ; often nearly white, or fleshy white at the base of the lower mandible." (Hume.)

Dimensions.—"Length 13·0 to 15·0 ; wing 7·2 to 8·0 ; tail from vent 3·0 to 3·85 ; tarsus 1·35 to 1·57 ; bill from gape 2·8 to 3·3 ; weight 7 oz. to 12·5 oz." (Hume.)

"Total length 15 ins., culmen 2·85 ; wing 7·5 ; tail 3·5 ; tarsus 1·55." (Sharpe.)

"*Adult female.*—Total length 14 ins., culmen 3·2, wing 7·3, tail 2·9, tarsus 1·4" (Sharpe.)

The Indian birds which I have examined from the Indian Museum and the B. N. H. Society's Museum and other skins sent me from Madras and Kashmir are as follows in their dimensions :—

Males.—Culmen 2·7″ to 3·1″ ; wing 7·30″ to 8·30″ ; tarsus 1·50″ to 1·80″.

Females.—Culmen 2·90″ to 3·25″ ; wing 7·20″ to 8·50″ ; tarsus 1·40″ to 1·80″.

The question of comparative size of the two sexes is one which has been very much discussed and the law has been laid down by various authorities in various ways. Thus Jerdon says that the female is the larger bird of the two, Sharpe makes out that it is a much smaller bird with a longer beak. Hume sums up his opinion thus "they show absolutely no constant difference in the size of the sexes." My own opinions support Hume's and I find that though the birds vary

enormously in size there is no difference in the ranges of size between the sexes. One gets adult males as small as the smallest female and big females as big as the biggest males.

I have made very careful inquiries amongst sportsmen and others concerning the comparative size of the sexes and have found most of them under the impression that one sex or the other—their ideas varied as to which it was—was much bigger than the other. This is undoubtedly due to the fact that it takes a woodcock two years to grow to its full size and the difference in dimensions between a bird of six months old and one of eighteen months is very great.

Another question which has never been settled is the reason or cause of the curious grey phase of colouration so often met with in the Woodcock. The colouration of this variety looks as if it had had all the red pigment washed out of it. I have been unable to explain this myself in any way. I have proved that it is not sexual and I have also ascertained that though it is much more common in young than in old birds it is by no means confined to the former. Major Wilson, to whom I owe thanks for much information and many useful notes, once shewed me two birds shot by him on the same day in Shillong, Khasia Hills, which might have been taken for different species so un-alike were they in tone of colouration. In this case the older, heavier and bigger bird was in the grey phase and, if I remember rightly, both grey and rufous birds were females.

It would appear, therefore, that in India young birds are more frequently grey than are adults but that this phase of colouration is by no means confined to such. In fact I have myself seen fully adult birds almost as grey in tone as the solitary or wood-snipe.

Ogilvie-Grant (in loc. cit.) observes "The Woodcock is more or less dimorphic in plumage, *i.e.*, two more or less distinct phases of plumage are found; some birds have the general colour of the upper part greyer, while in others it is richer and more rufous. The grey phase and the rufous phase occur in both sexes alike, in fully adult birds; but as far as my experience goes, the grey phase is never found among young birds, which are always more or less rufous. These represent what is often described by sportsmen as the smaller rufous "species" of Woodcock."

Ogilvie-Grant in this same paper discusses an apparent disparity in numbers between female and male Woodcocks and notes that out of

60 Woodcock shot during the breeding season in the Azores only four were females and that out of eleven young birds sent him from Cumberland only one proved on dissection to be of that sex. As, however, he himself remarks, when one goes in for shooting rôding Woodcock it can hardly be expected to get many females (fortunately). As regards the young birds this may be only an exceptional case and it is hardly safe to take this as an example of the general rule.

In India there appears to be no difference in the numbers of the two sexes. Unfortunately in both the Calcutta and Bombay collections we have but few sexed specimens and it is to be hoped sportsmen will help in settling this question one way or the other.

Yet another point about our Indian Woodcock which is unsettled is the question as to whether or not the Indian bird differs in any respect from that found in Europe and Northern Asia.

It has hitherto been considered a generally accepted fact that our Indian Woodcock is a smaller bird than the English but I cannot endorse this. My reasons are as follows. Every one who has studied migration knows that young birds are more erratic in their travels, travel greater distances and to much more unusual districts and countries than the older birds. Now certainly all those Woodcock obtained in the plains and lower hills of India and *possibly all* which are shot south of the Himalayas are birds which are on migration for the cold weather and those which travel furthest and are most often shot are the young birds of the year, hence because the birds we *shoot* are smaller than the average English bird we have come to believe, that the whole race is smaller. This idea is not, however, borne out by my researches which have shown me that fully adult Indian birds are as big as European specimens. Thus I have had two female Woodcocks sent me (*shot off the nests*) which measured in wing 8·30″ whereas my largest bird shot on migration is well under 8·0″.

Hume says that he thinks the Indian bird is smaller than the English but stultifies the value of his opinion by what he says later on, when in talking of the triangular emarginations on the primary quills of the wing, he writes, Yarrell says :—"These marks are indications of youth" and then Hume adds "It is a curious thing that out of 27 Indian-killed specimens now before me, these triangular marks are present in every specimen, only in two or three have they disappeared from the basal half of the feather. Our Museum

does not contain a single Indian-killed specimen with the whole of the outer web of the first quill entirely plain." From Hume's own words, therefore, we assume that his opinion was formed on a series of immature birds, although his deductions are somewhat upset by Ogilvie-Grant's recent discoveries.

The only way the question can be determined is by the measurement of adult birds in their breeding haunts, either during, or just prior to, the breeding season. Here again the sportsman and field naturalist must come to the fore and assist the scientific man who works in the Museum.

In regard to the weight there is no doubt that the majority of birds shot in India are lighter than those shot in England but the reasons which account for their being smaller would also account for their being lighter. Hume comments on the comparative weight of Himalayan (?) and English birds at some length but his conclusions are hardly convincing especially when one remembers, as has already been shown, that they are based on deductions made from a series of probably immature birds. He says that only 5 birds out of 53 weighed exceeded 10 oz. whilst the weight generally was between 7 and 12½ oz. and he compares this record of weights with a bag made in Ireland.

"In only 5 out of 53 birds has the weight exceeded 10 oz. and of these five the weights were :—10·5, 11·5, 12·0, 12·0, and 12·5 oz. Out of 53½ couple shot . . . . in South-West Ireland, 27 weighed between 12 and 14 oz., 6 between 14 and 15, and one between 15 and 16 . . . . —Our 53 birds weighed, between 7 and 8 oz. fourteen, between 8 and 9 oz. eighteen, between 9 and 10 oz. sixteen, above 10 oz. five. There is an undoubted instance on record of a Woodcock in England weighing 27 oz." I have found it difficult to obtain weights of Indian killed-birds but the few I have obtained of *fully adult* birds do not seem to shew that our birds are much inferior to English, when in good condition and full sized. Thus Major Wilson writes me "I have only weighed one bird as it struck me as being bigger than usual, this weighed 13 oz. and was the bird I sent on to you." Dr. Moore shot birds in Dibrugarh weighing 12, 13, and 14 oz. and Mr. Mondy sent me a bird which weighed just short of 14 oz. Any of them would have equalled good English birds and though the weights are admittedly excep-

tional for Indian birds this is only because it is also the exception to shoot any but young birds in the plains and Lower Hills of India, whilst even in the higher Hills of Southern India mature birds seem to be but seldom shot.

Dr. W. Moore writes to me anent the weight of his Woodcock as follows :—"The first two I shot, both on the same day, weighed 14¾ ounces each, and though I shot no heavier birds than these afterwards some ran them very close, and of 18 I weighed none were under 12 ounces except one and that was obviously a bird in very poor condition.

I found Woodcock in Dibrugarh on the burnt chapries (grass lands) ear damp forest, feeding on the parched and crippled insects brought to earth by the recent fires."

Distribution.—Outside our Indian limits Seebohm thus describes the habitat of the Woodcock. "Our Woodcock is a semiarctic bird ranging from the Atlantic to the Pacific. In Scandanavia it breeds up to latitude 67, in West Russia to 65, but in East Russia and Siberia not much above 60. Its Southern breeding range extends to the Azores, Canaries, Madeira, the Alps, Carpathians and Caucasus, to the Himalayas (where it breeds at an elevation of 10,000 feet) and to Mongolia and the mountains of Japan. It has not occurred in Iceland or in Greenland, and once only in the Faroes: but accidental stragglers, no doubt driven Westward by storms, principally from the Azores, have been met with on the American Continent, in Newfoundland, New Jersey and Virginia.

Within Indian limits the Woodcock is a resident throughout the Himalayas where it breeds freely above 10,000 feet, and often at even lower elevations. Thence in the cold weather it migrates in considerable number to every portion of the Indian Empire where there are suitable hills and mountains. It has been frequently shot in Ceylon and in the Burmese Hills as far south as Tennasserim, it is found in all the Hill ranges of Southern India and is common in the Sub-Himalayan Ranges during the winter months. As might be expected, where the country is adapted to sportsmen and shooting is more or less easy the Woodcock is said to be more common than elsewhere. Thus in the Nilgiris, about Ooty, it is quite common though it is reported to be far less so in the Assamboo Hills and to be comparatively rare in the Palnis, Shevaroys, &c. That is to say where the sportsman can get at the birds in comfort, he goes

out and finds them common, whereas where the cover is heavy and the ground difficult he goes out far less often and sees far fewer birds.

Exactly the same conditions are found in the North-East Frontier. The Khasia Hills appear to have been forested with an especial view to provide good shooting for Woodcock and therefore tradition has long demanded that every sportsman who wishes to be known as such must pursue this bird for all he is worth. Hence it is known to be more or less common and the hardworking gunner may work up to nearly a hundred birds in a good season, indeed Major Wilson has only just missed his 200 birds in one season. Next to the Khasia Hills are the North Cachar Hills, in fact they form part of the same Range. These, however, are either very heavily forested or are covered with bamboo. The latter are seldom in India, as far as I am aware, frequented by Woodcock and the former is too heavy to allow of shooting small game with any comfort; the consequence is no one ever attempts this form of sport and the cock is said to be rare. The fact is, I think, that anywhere between 1st November and 1st March in hills over 4,000 feet elevation one should be able to find Woodcock if sufficient time and trouble is given to the search and there are suitable places for the birds to lie up in. In the plains the matter is different and here Woodcock are only rare visitors, though chance birds are met with, generally in December and January, in many parts of the country. In Burma they seem to descend to the lower countries, often almost to sea level as Oates says, more frequently than they do in India. Still, even in the latter country, wherever there are hills near by cock are sure to be found at more or less frequent intervals during the cold weather.

In Dibrugarh, in Lakhimpur, which is surrounded by lofty hills at no great distance, anything from five or six to a dozen are shot annually. In Cachar one or two are seen or shot each cold weather and the same in practically every district of the Assam Valley. In Dibrugarh there are a few places which are almost a certain find for an odd cock or two during December and January and Mr. F. Moore, who made a point of looking up these birds, always succeeded in getting from four to a dozen birds each year he was in this district. In Sylhet Cripps reported it to be so common that he had known of as many as four brace being obtained in a single morning.

Once, however, we get any distance from Hills cock only appear as rare stragglers and in these cases it is probable that birds migrating from one range to another are, as the Irishman said of the owl, benighted by day and have to stop where they are until the succeeding sunset. In this way woodcock have been shot in Guddam (Golconda), Kurrachee, Sitapur, Agra, Nynpuri, Cawnpore, Dacca, Rangoon, Tavoy, Calcutta, Madras, Kanara (away from the hills) Taipue, Bombay and many other places.

For some reason the woodcock always forms a most fascinating object of pursuit for the sportsman. It does not matter whether it is a cold, hazy morning in the Welsh coast, a sweltering day in the foot hills of the Himalayas, or a balmy day in the lovely climate of December in the Nilgiris or Khasia Hills; the owl-like flip-flap of the brown bird's wings brings the same little thrill to the gunner and the soft thud amongst the bracken and bushes in reply to a successful shot brings a feeling of pleasure that is, for some reason, paralleled by the slaughter of no other game bird.

The haunts of the woodcock are in themselves attractive and one can wander, gun in hand through sombre pine forest, sunlit copse of oak or the dense scrub of an Indian ravine always with a certainty of being interested, whatever the sport may be. There is something in one's surroundings which makes one take an optimistic view of life and it is not until one returns to buildings and the cook has worked his will on the results of the day's bag that one once more remembers that "only man is vile."

My experience of cock shooting in India, is, unfortunately, practically nil. I have shot a casual cock in the plains of Cachar and of Kamrup and more than occasionally have bagged a brace in North Cachar but I have never had the delight of a long day's trudge through the bracken and pine forests of the Khasia Hills, in which I have now lived so many years. Perhaps the most successful of the many sportsman Shillong has harboured is Major Wilson of the 8th Gurkhas and to him my thanks are due for much information and a most interesting account of his first cock in 1908. He writes "They generally arrive after the 15th of October, (though I see in 1890, I killed one on the 8th) and I generally begin to look for them about that date, this year without result till the 23rd. On that day, I happened to have for my morning parade "Exercise in hill climbing."

so took my men up the side of the big hill overhanging Shillong, which is pretty well covered with pine forest.

"On parades like this, during the shooting season I consider it legitimate to carry a gun, and to take my two spaniels "Celar" and "Audax" with me.

"We, that is, my following of about 100 men, my batman with the cartridge bag, the two dogs and myself, start up the hill within half a mile of my house. A road runs zig-zag up the hill through forest and a hundred yards or so to the right of the road flows the stream which forms part of the station water supply. We pound steadily up the hill until we have already marched about a mile and a half, up some 1,100 feet. Here I think the men may as well halt to get their wind, whilst I go down to look at the stream.

"Celar" and "Audax" go into the wood above me, and presently one of them gives tongue. I see nothing, but from some little distance up the hill I hear the wings of a bird clicking against the branches of the trees as he flies, a sound I have noticed with both woodcock and pheasant at home. A second later, he gives me the type of shot I love best, coming towards me high overhead. I throw up the gun, fire, and as I lower it, see the cock crashing down through the branches. The orderly picks him up, and not having seen me shoot one for at least seven months, asks what he is to do with it, thereby showing ,to how great an extent, the present system of training the individual soldier to think for himself acts on some individuals. Not having sufficient command of his vernacular to tell him to put it "where the monkey put the nuts," I tell him to bring it along.

"On returning to my small command, who have by this had a good five minutes' rest, the bird is duly admired, and we fall in and plod still further up the hill. On reaching the top we turn to the left along the edge of the Government reserved forest, passing some likely looking ground, but as I should have to halt my men to try it, it is scarcely the game to do so now, so I call off the dogs, who are only too keen to work it. Along the crest of the hill for a mile or so, and then we begin to descend. Half way down, a stream runs almost parallel to, and about fifty yards from our path, and as I can keep in sight of the men, I think it quite legitimate to work it.

"Just at this moment, the dogs rout out a brace of Rufous-necked Partridges from amongst the bracken beside the path, and both are added to the bag.

"The bed of the stream looks, and usually is, a grand place for a Woodcock. Here and there are swampy bits, or patches of bracken, while both banks are covered with fern and daphne, with a fairly thick pine forest over all.

"The dogs hunt this valley for about six hundred yards down to the bottom, but there is no sign of anything till I am just coming out of the wood, when I hear a flutter to my right, and the orderly shouts he has put up a bird.

"I push my way through the grass, cobwebs and bushes, and ask if he has marked it down.

"He says he has, so we walk it up, I see a small brown shape flitting through the undergrowth, and the second cock of to-day is added to the bag; we then come out and rejoin the sepoys on the road and march home, the result of the morning's work being a march of seven miles up and down about 1,100 ft. over fairly rough country, with a brace of partridges and two woodcock to show at the end of it, all done within two and a half hours."

It will be seen from what Major Wilson writes that we do not in India get birds in the numbers they are obtained at home. In Shillong and its vicinity four or five birds in a day's tramp must be considered fair sport and six to eight birds something quite out of the common. Major Wilson has shot eight to his own gun in a day and Mr. Faichnie, of the Postal Service, once got nine but I have heard of no bigger bag to one gun in a single day's shooting. In the Nilgiris, Hume says "ten or twelve birds to two guns in a morning is quite an unusually fine bag so it must not be supposed that they lie thick as a rule, and yet in particular parts of the hills five or six are sometime shot out of one tiny shola, not perhaps above thirty yards wide and not a quarter of a mile in length." The largest bag recorded for India is that recorded by A. Grahame Young in Hume and Marshall's *Game Birds of India* 28 years ago. This bag was made in the Tos Forests in Kullu. Hume quoting him, thus records the bag. "The end of January is about the best time for them. The largest bag that I know of was 33 birds to two guns between Nuggur and Ryson; a good many others were missed. If the season be at

all favourable, one is pretty sure of flushing a dozen or so in the course of a day in the favourite haunts."

Hume writing of these favourite haunts thus describes them: "Cover and running water are what in India the woodcock most affects; you may find them alike in the middle of deep forest or thick Ringal jungle near the banks of some rushing hill streamlet, foaming and sparkling in its rushy bed, where save a few tiny velvety corners, there seems no single spot in the neighbourhood where they can possibly feed; and again in clumps of low scrub in a treeless opening where some stream debouching in a clayey basin converts this into a mossy swamp, through which its movement is to be detected only at the further end where, as if ashamed of its late sluggishness, it gushes out to resume its late brawling descent. But, swamp or stream the water must be moving to please the Woodcock; and though there are exceptions to this rule, you will generally hunt in vain mountain swamps and tarns, where there is no outlet and the water is stagnant, though all the surroundings and adjuncts be everything, apparently, the breast of woodcock can desire. In England we find them beside little stagnant ditches and pools in covers; but in India I have seldom so seen them, having almost always flushed them in the neighbourhood of running water."

In the Khasia Hills they undoubtedly generally affect places within easy reach of running water, but this is possibly because in these hills it is difficult to get away from it. They certainly sometimes lie up in small patches of swamp which are not directly connected with any running water for some distance. Thus, until this year when the whole patch was cleared, a woodcock could always be put up in a tiny patch of swamp not 50 yards by 20 which is at the bottom of my garden. I never allowed a gun to be fired here and the birds soon became curiously tame never rising until one was within a very few yards of where they squatted. Major Wilson has recorded a similar instance in his own compound. "Speaking of the little place in my garden it is a bit of rushy swamp, about twenty yards long and ten wide. On one side of it is open grass and on the other a bank on which grow some bracken, bushes, and about a dozen pine trees. Early one morning, I let the dog into it, and a woodcock jumped up almost at once, flew over the dog and pitched on the grass about five yards from me, where he squatted about five yards

off with his tail spread like a turkey-cock's, awaiting developments. The dog worked up to the end of the marshy bit and knowing there was a bird there, turned and came back towards me.

"When the cock thought he was too close to be pleasant, he again executed his manœuvre of flying over the dog, and I distinctly saw him use his beak to lever himself, as it were, into the air. This time he pitched where I could not see him, and when he rose again he evidently meant going, so I let fly and very nearly bagged an old native woman in the next compound as well."

In connection with this little piece of swamp the same writer has commented on the regularity with which woodcock return year after year to the same piece of ground. "I soon discovered that to find woodcock with any certainty a good spaniel was required, as well as an intimate knowledge of the ground, for one woodcock succeeds another in a favourite spot, just as one trout succeeds another behind a big stone in a burn at home, and in Shillong the places the cock mostly frequent are few and far between.

"This peculiarity of the bird I learnt before ever I came out to this country, and it was well expressed a few days before I left home by an old retainer of ours, who said; 'Now, Mr. A., I may be deid and gone afore ye come back, but ye'll mind the holly bush on the brae abuve the kirk-yard. When the snaw's on the ground, it aye hauds a woodcock, and a graand fine.'"

Many a woodcock I shot there as a boy, and no doubt many a one has been shot there since. So it is in Shillong. Each year the cock arrive, their instinct brings them into the haunts their ancestors frequented, though, alas, these haunts are getting fewer and fewer as the station extends.

"The unwillingness of the 'cock to leave a favourite spot, so long as any cover at all remains, is shown by the fact that both last season and the season before, I got an occasional bird within thirty yards of my house, fifteen from a much-used foot-path, and about fifty from some stables. This was a cosy little bit of covert in the old days, before the ground was so much built over.

"There is a drain and slightly marshy bit of ground in the midst of our Regimental lines where the 'cock feed at night still, although the barracks have been inhabited for close on forty years."

In England, of course, cock shooting is indulged in under very different circumstances and with very different results and I was

fortunate enough on one occasion in Wales to participate in a shoot in which three guns got 49 couple of cock in a very few hours. We had been shooting three days a week over the rough country all round the South Coast obtaining small, mixed bags of pheasant, partridge, hare, &c., anything from ten to thirty brace a day but never, as far as I remember, had a cock shown itself. On the day in question, a crisp November morning in 1894, we start our morning trudge with a beat through some bracken bordered by a tiny copse of oak and scrub on the crest and with a ditch and some swampy ground at the foot of the hill. As we enter the bracken a hare breaks and is neatly turned over in the open by H, the gun on my left hand. The report, however, puts up a small covey of partridge, out of shot, who sweep over the little copse and pitch in a field just over the covert. Finishing the bracken without further result we turn round and beat the far side of the hill for the partridge. I, as right-hand man, taking the deep bracken lying just inside the oak trees. We have only gone some hundred yards when we walk into the birds, which have scattered a little, and four are added to our bag. I have one shot and a miss at the partridge but as I fire I catch a glimpse of what I am sure is a woodcock get up and flit through the trees to my right, but on saying so I am merely laughed at for my pains, as the cock are not supposed to be in. I, however, insist on beating back through the spinney on my own account and hardly have I got well inside when two cock are up and off before I am ready for them. Within five paces, however, another gets up and falls to my shot and as he falls another rises and is missed. Before I can load the spaniels have another bird in the air and before I have walked the spinney through five birds have been dropped and at least as many more missed. After this the other guns come up and after inspecting my bag it is at once decided that a large flight must have just come in and that the original day's shoot should be abandoned for the purpose of hunting up the most likely places for the cock.

Their favourite haunts along these Coasts are the numerous small copses and spinneys which nestle in between the hills, sometimes running a little way up the sides, often surrounded with a fringe of light scrub or gorse and nearly always with a tiny stream trickling down the centre and losing itself in a swamp at the foot. We soon

come to one of these little woods and arrange to work it from the bottom upwards, one gun taking the centre and the other two the edges. As the guest I am given the best place in the centre but before we get into the wood itself two cock are put up from the bracken at the edge of the swamp and are downed with a pretty right and left by my host. No more birds are seen until we are well inside the cover when a single bird gets up from the mossy bed of the tiny stream just in front of me and is promptly bowled over. A second gets up within a few yards but I miss badly and the bird jinks away to my right and I hear the bang, bang of H., gun number three, a good shot who has doubtless accounted for him.

For some time I get no more shots only putting up one bird which flops out of my sight before I have time to take a snapshot at him. The birds seem to be lying up in the holly bushes and gorse on the edge of the copse and both my neighbours are getting repeated shots and soon one of them missing a double shot, turns a cock my way and he comes towards me in and out of the trees with his curious owl-like flight and though he escapes my first barrel the second brings him down almost on my head. I then get a pheasant and miss another cock but finish up the beat with a nice right and left at a pair of wood-pigeon.

Counting our bag we find that B, our host, has six cock, a pheasant and a rabbit, H. two pheasant and four cock and myself a pheasant, two pigeon and two cock.

Our next beat is a narrow strip composed of scrub and holly bushes intermixed with a few bigger trees fringing a ditch of running water which here and there widens out into small patches of bracken covered swamp. This is too narrow for three guns, so B. goes ahead and stands at the end, whilst we beat up to him. A start is made by H. with a right and left at pheasant and we then walk half way through before we get another shot and we begin to think the birds are not so thick after all. Here however from a dense patch of holly bushes the dogs put up four cock together and we have the pleasure of accounting for all four though, to level matters, we each miss a comparatively easy shot immediately after. Yet again we have four birds in the air at the same time but we only drop three, two are picked up at once and whilst hunting round for the third another bird gets up between H. and myself and flies straight towards me; neither can shoot until he

gets almost up to me when he rises and tries to dodge back but is bowled over with a lucky shot just in time.

So on through the strip with constant shots all through its length and, curiously enough, in this bit of cover we keep putting up the birds three and four almost together with intervals in which we put up none at all. The taller trees are scanty and the bracken very withered so the cock are all hiding under the many clumps of holly bushes and brambles at the very edge of the swampy pieces. The shooting is easy in the comparative absence of the taller trees and we find when we get through our beat that H. has nine birds to my ten and that our host has beaten us both with 12 cock and a pheasant.

We do not have such luck, however, with our next beat which is a pine wood with very little under-growth and no water. Here we put up three or four cock only and get but one, though we add a couple of rabbits and one more pheasant to the general stock. Leaving this wood we work through a scarp facing the sea and covered with bracken, gorse and brambles whilst every few yards a cheerful little cascade goes tumbling down into the sea below us. Both rabbits and cock are very numerous here, but the walking is terrible and, having but one arm both to shoot and climb with, I frighten a great many more birds and rabbits than I kill, indeed I emerge the other end of the scarp with but one cock and two rabbits, a result exactly doubled both by H. and B., the latter adding a brace of partridge out of a covey put up on the fields above him by some labourers.

Yet another scarp succeeds this one, but the walking is better and out of the 7 birds collected here I claim three having only missed one. This beat brings us up to the farm where we have lunch, a Welsh lunch of cold birds, apple tart and Devonshire cream washed down with draught beer. Half an hour more for a smoke and our host makes us turn out again to take full advantage of a day's shooting of a kind that does not come too often.

Walking down the lane a small boy says he has seen a cock pitch in some brambles by a pond in the field to our right and, sure enough, the dogs turn him out and B. adds him to the fast-swelling bag. From here we make for three small spinnies divided from one another by about a hundred yards or so and themselves covering only two or three acres each. Our host and B. each take one corner and send me on ahead to shoot the gaps and very pretty shooting I get. They have

hardly got into the first spinney before a couple of shots are heard and a few seconds after a cock comes flitting towards me out of the last few trees and as he passes I bowl him over: a little fluff of feathers rise into the air, a soft thud on the grass and before we can pick him up a second bird is dropped almost on the top of the first and no sooner are my cartridges home than a third follows. Then I have two long shots and misses and whilst reloading another passes over me before I can shoot. Both B. and H. are in sight now and I prepare to move on to the next gap but as I turn round a cock flies almost into me and, giving him a little law, he too finds his way to grass.

The second gap is a repetition of the first but here I put in six misses to three kills as the birds do not fly so kindly for me. The last spinney is best of all, the birds seem determined to favour me and I get two shots to every one by the two guns inside and when they come out I am able to shew them 13 birds, of which 6 have been the result of the last spinney, besides a wood-pigeon and a pheasant. The others between them have 15 cock, two rabbits and a brace of pheasants so we have every reason to be jubilant. We have now 88 cock, a bag never beaten here before but we are not yet finished. Another long pine wood with bracken and hazel on the outskirts only gives us a single bird but a hazel copse a few yards further on gives us three more and but for my bad shooting should have given us five. Then we pick up two odd birds, one from a holly hedge near a pool and another from a bracken patch bordering some turnips. By this time it is getting late and the birds are now in the open feeding and H. gets one as it flaps overhead, making its way from one feeding ground to another. Only a few minutes more of day-light remain and we hurry for the last beat on our way home. Here we find that there are still lots of birds but it is getting too dark for good shooting and we miss more than we hit so that only three more birds are brought to book. We have now 98 birds and our host insists on our trying to make up the hundred, but three or four more misses in the gloaming at silent things, more like bats than birds, and one bird lost in the dark are the only results, so we have to be content with making the biggest bag of cock recorded in my host's shooting experience. A tramp of two miles to the carts in the fast gathering dark and then home after a long twenty miles trudge and the best days small game shooting I ever hope to have.

Contrasting well with Major Wilson's account of shooting in the Khasi Hills and with ordinary cock shooting at home is the account given by Tickell of cock shooting in Nepal which is quoted by Hume. "Woodcock-shooting in Nepal is laborious work from the steepness of the hills and the spongy nature of the ground which the bird frequents. We found them on light rich mould, thickly matted with grasses, ferns, and other weeds, and everywhere furrowed by little rills of water trickling through the tangle, or here and there stagnating in little pools or 'bog-holes' concealed under a layer of vegetation, which formed tolerable pitfalls to the unwary intruder, receiving him sometimes up to the hip. The jungle on these hills is pretty thick, but not lofty, consisting mostly of briars and thicket : and it would have been impossible to get a fair shot within it, were it not that some of the largest rills (perhaps a yard broad) bordered with mossy turf, formed narrow vistas through the tangle, up and down which the birds when flushed would fly, giving some chance to a snap shot. We had no dogs, a luxury known to very few Indian sportsman, but employed beaters to find the game. I had never even seen cock-shooting in England, and my first day's experience of it in Nepal surprised me not a little. I was a good snipe shot in those days, and, imagining from the general resemblance of the two birds that a Woodcock must fly like a Snipe, I was much taken aback, when hailed to 'look out,' at perceiving what appeared like a large bat coming with a wavering, flagging flight along the little lane-like opening in the wood where I was posted ; but in an instant, ere I had made up my mind to fire, the apparition made a dart to one side, topped the bordering thicket, and seemed to fall like a stone into the covert beyond. These sudden jerks and zigzags, in the midst of its otherwise dilatory flight, are terribly puzzling to a novice. The bird alights also in the same fashion, dropping at once down as if it had flown against a wall. They were not numerous in Nepal, and two couple bagged to one gun during the afternoon was considered very fair sport. We found them only on the low spurs bordering the open valley of Kathmandu, on its northern side—on such slopes as were of the description above given, looking more like the copses and hazel woods of England than the forests of India."

Tickell's remarks on the birds flight are very good and to the point. At home the bird is a strong, good flier and the curious inde-

finite manner it has of flying is often far more puzzling to a beginner than the flights of swifter straighter-going birds. Its very haunts, of course, add to the difficulties of shooting as in addition to its naturally zigzag flight it is constantly twisting and dodging to escape obstructions, then too the light is often not of the best and the extreme silence of its rise and flight is in itself disconcerting. There is no warning whirr of wings or "pench" as of a snipe rising, the first thing is you see it, perhaps only as it flits behind some impossible jungle, barely giving time for a hasty snap shot.

In India the Woodcock seems to be of a far more tame and confiding nature than it is in Europe and this also affects the flight as the bird makes no effort to get away at any pace when it is flushed. Hume writes:—"When migrating they are said to fly strongly and well, but when flushed, the flight is at first slow, uncertain and Owl-like, and ceases suddenly, the bird dropping instantaneously behind some bush. I have never had any sport with Woodcock in Northern India. I have often shot them, rarely more than three in a day; but they gave no sort of sport. They fluttered up flushed by the dogs or some beater within twenty yards, and were knocked over by a snap shot as they hung wavering on first rising. One shot them because they were so good to eat; in every other respect they were not worth shooting. They don't seem to fly a bit as Woodcock do in covers at home, where even a good shot is at times baulked; but, like Snipe, and almost every living thing domiciled in this "clime of the sun," they seem to have become listless and sluggish."

The manner in which Woodcock are said to perform surgical operations on their own wounds has often been alluded and is a common belief with gamekeepers and others, indeed many sportsmen whom I have met are quite convinced that the apparent attention which has been paid to a wound is the intelligent work of the bird itself. Thus Major Wilson writes me:—"On two occasions I have noticed instances of the so-called wonderful way the Woodcock has of doctoring itself. One day I wounded a bird, saw it go off badly hit but failed to pick it up. A fortnight or so later I flushed a bird in exactly the same place and got it. It seemed in very poor condition and on examining it, I found it had what looked like a regular splint on one of its legs formed of a tiny piece of stick most carefully bound round with feathers. The other case was one of a

bird which had evidently escaped from a snare. A great patch of skin had been torn off just above the wing and this was covered with a poultice of feathers beautifully attached to the feathers growing in the bird's body."

Of course, these works of art are the result of accident, not design, and are caused by the birds lying in muddy places. The wounded part, in most places wet with blood already, naturally gets covered with mud or clay to which feathers, tiny sticks and grass adhere and make, what Major Wilson terms, a poultice and doubtless this may be in some instances as effectual as a splint or poultice made by design. I once shot an owl with a badly smashed thigh, how caused I do not know, but it had been lying in muddy grass-land and the breast, next the wounded leg and the whole thigh itself had become densely matted with feathers, chips of grass, mud and blood which formed a perfect plaster of Paris splint and in addition to this, in lying down the bird had had the wounded leg forced up against the breast where the foot had stuck to the feathers and mud so that it might have been said that not only had the bird arranged a splint for itself but had also put its foot into a sling to prevent its moving about.

The Woodcock is generally considered rather a stupid bird and an easy prey to trappers and snarers who take full advantage of his weak intellect.

They are said to be regular trapped in the Nilghiris and parts of the Himalayas and certainly in the Khasia Hills snares are to be found set in almost every place known to be haunted by Woodcock.

In Latham's Synopsis, Vol. III, p. 130, there is a very quaint description of the Woodcock. Amongst other things Latham notes that "they are stupid birds and often taken in nets placed at the openings where they come out of the woods and return to them in the evenings, which they do in particular paths; they are also caught in springes placed on the ground, or near it, sometimes by the legs, at other times by the neck; for as these birds will not walk over the least obstacle which projects in their way, it is usual to place a range of stones and in the avenues between to set springes, by which means many are often taken."

The Woodcock is a very silent bird and but little is on record about its voice. The male is said to have a hoarse, grating note

called "a bleat," "a croak," "a jarring chuckle" by various writers. Mr. Osmaston speaks of the noise made by a female Woodcock disturbed in its brooding as being "a continuous sort of grating purring noise." Hume says that as far as his own experience goes the Woodcock is mute in the cold weather, but he quotes Mr. Wilson as writing of them in their summer haunts: "At this season they are seen towards dusk, about the open glades and borders of the forests on the higher ridges, flying rather high in the air in various directions and uttering a loud wailing cry." Hume also quotes "European authors" to the effect that the Woodcock has "a very peculiar call-note, first one or two snorts, a hollow coarse, somewhat lengthened nasal sound, followed by a short fine sharp sort of whistle, which when one is accustomed to it, may be heard to a considerable distance."

The diet of the Woodcock ranges over rather a wide limit. Tickell says it will swallow a lob worm whole, I have found tiny snails and water shells in its stomach and on another occasion a bird I examined had been feeding entirely on some small white worms, of a very wiry hard consistency. It feeds on grubs, beetles, insects of almost any sort and will also swallow spawn of frogs. It is almost entirely a nocturnal bird, even more nocturnal than crepuscular, feeding after dark or only a very short time before nightfall. In the day it lies up and sleeps, and at this time is usually found in a dry spot though near water.

Breeding Habits and Nidification.—There are two points in connection with the breeding of the Woodcock which call for remark: first is the curious manner of flight during the breeding season, somewhat analogous to the drumming of snipes; and, secondly, the habit the Woodcock has of carrying its young from one place to another.

As regards the rôding of the Woodcock, as its habit of flight during the breeding season is called, this is described by Seebohm as follows:—"The Woodcock does not drum like the snipe but during the breeding season like that bird, the male forgets for a time his skulking habits and flies backwards and forwards, uttering a peculiar note, which, though unquestionably proceeding from the throat, must be regarded as analogous to the drumming of the snipe. This peculiar habit of the Woodcock is described as rôding and is

indulged in early in the morning and late in the evening, in the pairing season, sometimes before it reaches its breeding grounds, but more often after its arrival there. This rôding continues for about a quarter of an hour, during which his peculiar notes are uttered, sometimes singly and sometimes one following the other."

Dresser quoting Ekström gives in greater detail the manner in which the Woodcock rôdes. He writes :—" During the first days of spring the Woodcock commences rôding the instant the sun has sunk below the horizon, but at a more advanced period somewhat before its final disappearance and continues until nightfall. In the morning it begins rôding whilst it is still quite dark, and ceases previous to its being full daylight. When he rôdes there is always an interval between each *tour* and *retour*, which is more observable in the evening, when it goes and returns there several times. The first time it always flies high and generally with rapidity, the second its flight is but little above the tree tops, and commonly slower, the third time still nearer the ground and yet more leisurely." Oates who quotes both these authors adds " when flying about in this extraordinary manner the plumage is puffed out and the flight is rather slow."

Oates' remarks agree well with what was told me by a gamekeeper in Wales, who said that he had observed Woodcock just before they left in March rôding outside some of the spinnies I have mentioned in my account of a day's shooting in Wales. This man informed me that just at dusk the cock came out of the cover and sailed slowly backwards and forwards a few times in front of it. At first the flights were high, but gradually the birds got lower and lower until reaching the level of the scrub they again disappeared into it. Each flight was said to be in the shape of a long arc, the highest points being reached at the end and commencement of it, whilst in length they were anything from 50 yards to 200 or more. The bird was described as flying slowly with plumage puffed out, head thrown far back and bill somewhat pointed upwards. I did not inquire how many times the flights were repeated, but the impression I obtained was that they were numerous and lasted for some time.

In this country Mr. F. Wilson, whose note I have already quoted, seems to be the only writer who has recorded anything in regard to

these nuptial flights. Mr. J. Lindsay Smith has, however, written me an interesting letter on the Woodcock and its habits on Dungagali, and he says in this that he has often observed them rôding; and that whilst thus engaged this bird utters "a rather harsh croak alternately with a sharp whistle or squeak, something like that of a cat but very much stronger."

The habit the Woodcock has of carrying its young from one place to another is very well known, but there are not many descriptions on record of how the carrying is done.

Davidson saw the bird in the act of carrying its young in Kashmir, but has unfortunately left but little on record about it. He observes:—"On the 28th May I found a pair with small young ones and distinctly saw one of the old birds carrying a young one between its feet or legs. It flew only some 50 yards, but though I followed at once, I not only failed to find the young bird, but could not even put up the old one again, and on returning could not find the young one that I had previously noticed on the ground."

Littledale also records having seen the same occurrence. He writes, "to my delight up flew a Woodcock about five yards from my feet. She had a young one—the men said two young ones, but I could not see two distinctly myself—in her claws pressed close under her; and she flew slowly and heavily for about ten yards, then rested above a bramble which the young one seemed to catch hold of with its claws, or become entangled in. The old bird fluttered for quite half a minute over it, before she could pull the little one clear and fly a few yards further down, when she alighted but rose again, when I sent a man to try to catch the young one."

A friend in Scotland to whom I wrote to obtain information on this point informs me that he has only once *certainly* seen the Woodcock carry its young, though he believes that on two or three occasions when he has disturbed cock in spring they carried away a young one with them. On the occasion he refers to as having distinctly seen what happened he writes *in epistola*:—"We came on this bird very suddenly and she rose almost at my feet and made off with a young one held tightly up against her breast, and, I think, held on either side by her claws. As she left three young ones behind her when she first flew away, I at once hid myself and awaited to see what further she would do. In a few minutes back came the old

lady and dropped on *the* ground close to the nest and after scuffling about a bit she grasped one of the young ones on either side and picked it up. As she rose I could see that her extended legs held the young one low down on either side, but she at once drew up her legs close to her body and then appeared to be holding it between her breast and thighs, this of course owing to the contracted position of her legs. Once started she flew quite easily to some distance, but seemed to find it rather difficult to get a comfortable hold of the young ones at first. She removed all four a distance of nearly 50 yards within about a quarter of an hour."

It is not definitely known whether both parents share in the labour of removal, but it is probable that such is the case. Indeed, from Davidson's note given above, it would appear rather as if whilst he was following one of the parent birds, the other had carried off the remaining youngster.

It is possible that the removals are not always due to the birds being disturbed, and it may be that they are undertaken also for the purpose of getting to fresh feeding grounds. On several occasions young Woodcocks known to be in one place have been found removed to some distance, although, as far as was known, no disturbing element had approached the original nest site.

The Woodcock breeds very freely throughout the Himalayas at 10,000 feet upwards and probably also very much lower down. Whether its breeding range extends to the East as far as the more lofty ranges of the Naga Hills and Manipur is very doubtful, and there is nothing to show that it breeds in any of the Burmese Hill Ranges.

Although so many Oologists have taken its eggs in this country, there is curiously little on record about its nidifications therein. Hume when he wrote the "Game Birds" remarked on this, and noted that of the many who had taken the nests, the only account he possessed was that given him by Anderson, which he quotes as follows:—

"On the 30th June, I turned my face towards the snows in another direction, determined to consider my expedition a failure so long as the discovery of the breeding haunts of the Woodcock, which was one of its chief objects, still remained unachieved. After two days' stiff marching I pitched camp at a place called Kemo, at

an elevation of some 10,000 feet over and against Namick, which is celebrated for its salt springs."

"We were following up a huge wounded *Presbytis schistaceus* through a dense undergrowth of ringals, when a Woodcock rose close to us, dropping again almost immediately, disappearing in the cover. A diligent search revealed the long-looked-for prize, four eggs, which were deposited in a slight depression in the damp soil, and embedded amongst a lot of wet leaves, the *thin ends* pointing *inwards* and *downwards* into the grounds."

"The eggs found (I could see they were hard-set), I told Triphook I had no intention of leaving the place without bagging the bird. It was raining heavily and bitterly cold with the thermometer down to 40°; but fortunately for us, before we had time to make ourselves comfortable under an adjoining tree, the bird flew back in a sort of semicircle, alighted, and ran on to her nest. No sooner down than she was off again, frightened, as I subsequently learnt, by one of our dogs, but which at first thought alarmed me not a little as I thought she was removing her eggs. After having satisfied myself that my suspicions were unfounded, it was decided, as I had done my duty in finding the nest, shooting the bird should devolve on Triphook, and right well he did it, considering all the disadvantages which militate against having a snap-shot in dense cover and a thick mist. I never do anything but miss on such critical occasions; at any rate, I would rather some one else made a *mull* of it than myself."

"The eggs were a most beautiful set . . . they are far *darker* and *redder* than the usual run of Woodcocks' eggs, all four resembling the *second* figure in Hewetson's work, and in the character of their markings they are not *unlike richly* coloured specimens of some Terns' eggs."

Osmaston has an interesting account of the finding of a nest in the Tons Valley, especially interesting as in the case there was no attempt to carry off the young; the mother, when disturbed, attempting to divert attention by feigning being crippled. He says that after finding the mother and tiny young, only a day or two old, the former "all the time I had been inspecting her brood had been going through the strangest of antics with outspread wings and tail, and making a continual sort of grating, purring noise. She allowed me

to approach within a few feet, and then, with an apparent effort half fluttered, half ran away."

Rattray took a large number of nests of the Woodcock in Changla Gali, Danga Gali and other places near Murree. In our Journal (in *loc. sit.*) he records:—"This bird breeds freely round Changla Gali from about 8,500 feet upwards. I saw some 8 or 10 pairs, and found some 5 nests, each containing the usual four eggs. The nests were all in thick forests and generally under a shrub like Rue. The nest is a typical one. I hope next year to get a good photo of a sitting bird and settle the question I lately ventilated in "The Field" as to birds sitting with eyes closed and bill resting on the ground."

The typical nest referred to is that shown by Rattray in the beautiful photograph which accompanies his article. This shows a nest formed by a depression in a mass of leaves and rubbish lying on the ground under a thickly foliaged bush.

In India the Woodcock seems seldom to breed before May and generally not before the end of that month. Osmaston found young birds on the 17th June in the Tons Valley. Davidson says:—"On the 24th and 25th May we obtained two clutches of its eggs, consisting of four slightly incubated and three fresh eggs, and on the 28th May I found a pair with small young ones." This was in Kashmir near Ganjadgir, and I have eggs in my own collection taken by Rattray at Danga Gali as late as the 14th July. Lindsay Smith records hard set eggs as late as the end of August, and he twice came on nests and eggs, broken by cattle, at the end of July.

In Europe they seem to breed a great deal earlier than in India. Many seem to commence breeding operations in March, and I have European eggs taken in March, April and May, my latest date being that of a clutch taken in Germany on the 25th May. They are, however, sometimes much later than this. Davidson writing to me on the 6th August says that as he is writing there is a Woodcock sitting on four eggs in his own preserves, and he adds that this is the third sitting, the bird having hatched off two previously.

Hewetson says that the "Woodcock lays its eggs amongst the dry grass or dead leaves which form the surface of the woods and plantations which it frequents. It is an early breeder, frequently having young ones in the middle of April."

Yarrell describes the nest as being "all in dry warm situations

amongst dead grass and leaves without any attempt at concealment. The nest was wholly composed of dead leaves, chiefly of the common fern, loosely laid together and without any lining."

"It would, however, be more proper to say beds than nests; for, like those of the Plover, they are merely slight hollows, formed by the nestling of the birds in dry soft spots or on the fallen leaves."

Seebohm (Eggs of British Birds) merely says that the nest is placed on the ground and is little more than a hollow scratched in the earth and lined with a few leaves and a little dry grass.

The eggs appear to be *always* four in number, and I have no information as to any full clutch numbering less. Typically the eggs are far more tern like in character than like snipes' eggs as one would have expected. As a rule they are broad ovals, distinctly pointed at one end and sometimes *slightly* "peg top" in shape, but *never* the actual peg top of the true snipes' eggs. The texture of the eggs is fine and smooth and often has a considerable gloss, which is more or less permanent, as I have eggs in my collection more than 20 years old which still show a fine glossy surface.

Hume thus describes his eggs:—"The ground colour varies from pale yellowish white, through various shades of buff and buffy stone colour to a reddish café-au-lait. The markings never very densely set and at times very sparse, consist of different shades of brown, brownish-yellow and brownish-red on the one hand, and greys, from sepia to purple on the other. The former occur in moderate sized blotches, spots and specks as primary markings. Often these are more numerous in a cap or zone about the large end. Occasionally not a single blotch or spot is one-tenth of an inch in diameter, and nine out of ten are little more than specks, but in other eggs many of the blotches, especially about the large end, are a quarter of an inch and upwards in length. The greys, pinkish, lavender, sepia occur as small clouds, spots and smears, secondary not surface looking markings rarely either large or thickly set, except when amongst the blotches of a zone or cap, when the eggs exhibit such."

"A large series, chiefly Northern European, vary from 1·5 to 1·8 in length and from 1·3 to 1·5 in breadth. I have no Himalayan eggs, but I suspect that like the birds they would average smaller than European specimens."

My eggs which contain series from Scotland, England, Germany and India agree well with Hume's description except one clutch from Germany which has a red café-au-lait ground with dense blotches and smears of rich vandyke brown and a few subsidiary blotches and smears of deep-lavender.

My Indian eggs average 1·6″ × 1·32″ as against an average of 1·70″ × 1·34″ in English and Scotch eggs, and 1·69″ × 1·32″ for German eggs. My biggest egg is one from Germany, measuring 1·86″ × 1·54″, my smallest is from Scotland and measures 1·59″ × 1·26″.

It will be seen that the measurements of my eggs do not bear out Hume's opinions as to Indian birds being smaller than European, but rather endorses my view that Indian birds average small, because they are immature.

Seebohm gives the size of the Woodcock's eggs as being 1·8″ to 1·6″ in length and 1·4″ to 1·3″ in breadth.

Dresser gives the average size as being 1·75″ × 1·32″.

THE PLATE.—This is an excellent one. This bird in the background is supposed to represent the grey phase of colouration, but, though this is well shown in regard to the scapulars and back, yet many birds will be found far more grey than this specimen on the lower parts and wing quills also. As regards the bird in the foreground all that need be said is that the white round the eye is far too conspicuous and the bill is not a normal colour. It is true that in a few birds the tint of the bill may be as depicted, but, as a rule, there is always a more flesh or horn-coloured tinge about it.

It must be remembered that the range of variation in the depth of colouration of the Woodcock is very great, and though the plate is a very fine example of one shade, many birds will be found to be paler, especially on the lower parts, whilst some again may be obtained even darker than this bird.

In life the eye of the Woodcock seems even larger, darker and more lustrous than it is shown to be in the plate.

(To be continued.)

THE PALMS OF BRITISH INDIA AND CEYLON, INDIGENOUS AND INTRODUCED.

BY

E. Blatter, S. J.

(With Plate I and Map A).

INTRODUCTION.

It was a favourite idea of the late Dr. Scheffer, formerly Director of the Botanic Gardens of Buitenzorg, to illustrate by means of photography the palms of the Malay Archipelago and many others from various parts of the world which grow so luxuriously in the famous Gardens of Java. His premature death (1880), however, prevented him from giving life to his idea and from finishing the promising series of illustrations which he had started in the "Annales du Jardin Botanique de Buitenzorg." Professor Beccari was kind enough to undertake the publication of some of Dr. Scheffer's notes and plates, enriched by his own valuable observations. It is to be regretted that, after the appearance of the "Reliquiæ Schefferianæ," nobody felt inclined to continue the work, as there is scarcely a better way of conveying correct notions regarding the habit of palms than by means of photographic illustrations. Even the most elaborate description and detailed analysis will never, in that respect, come up to a tolerably good photograph. It is for this reason that we intend to publish a series of articles on Indian palms, indigenous as well as introduced, and to illustrate them by as many photographs as we are able to procure. We are sorry not to be in a position to give much fresh information with regard to the morphological characters of most palms, as the leisure required for such observations was not at our disposal. We have, however, tried to make the descriptions as complete as possible by carefully comparing and, where practicable, verifying the descriptions and illustrations as given by various authors. In many cases, where we found a good description of a species we have not hesitated to adopt it almost word for word, supposing that everybody will understand that in a condensed, technical description of a plant not much originality can be expected, especially if a uniform plan has once been adopted. In this we are only following in the footsteps of systematic botanists.

With regard to the classification of the palms we shall follow the arrangement laid down by Professor Drude in the "Natürliche Pflanzenfamilien"; in minor points only we found it convenient to introduce a few changes. We have chosen Professor Drude's system of classification in preference to the one adopted in Sir J. Hooker's "Flora of British India" for entirely practical reasons. As we include in our description a great number of exotic species, the plan given by Professor Drude seemed to simplify matters considerably. In order to give the series not only scientific interest but also practical value, we shall add to the description of the species an account of their economic uses and, besides, a few notes on their cultivation. We cannot lay claim to the practical experience of a gardener and have, therefore, to rely in this matter on the remarks scattered in various books on gardening. As many of the palms described below have been introduced into European Conservatories, we hope that some hints on palm-growing in Europe will be welcome.

In order to avoid, on the one hand, too frequent references to authorities in the text, and on the other to indicate the books where those desirous of further information may easily find it, we shall give a list of the literature on palms at the end of the introductory chapter. Later on all the references to botanical authors will be given in their usual abbreviated form. In the interest of those who are not familiar with the ways of botanists, we shall add a list of the authors with the abbreviations commonly used in botanical works.

We are fully aware of many imperfections regarding the treatment of our subject. Those who have ever made, or tried to make, a special study of palms will realise the many difficulties that lie in the way of such an undertaking. We shall always be very thankful for any suggestions or corrections.

Our sincere thanks are due to Captain Gage, the Director of the Botanical Survey of India, and Mr. H. F. MacMillan, the Curator of the Royal Botanic Gardens at Peradeniya, who have supplied us with a considerable number of photographs which otherwise we should not have been able to secure. To Mr. MacMillan we are, moreover, indebted for his valuable suggestions. We owe another set of photographs to the kindness of Mr. Phipson, the former Honorary Secretary of the Bombay Natural History Society, to the Rev. Max

Group of Palms in Peradeniya Gardens, Ceylon.

Maier, S. J., and to Mr. Roscoe Allen. Mr. Lock, the Assistant Director of the Royal Botanic Gardens at Peradeniya, obliged us by putting the library and herbarium of the Gardens at our disposal. Lastly, we would express our thanks to Mr. Millard, the Honorary Secretary of the Bombay Natural History Society. Without his practical and untiring interest in the subject we should never have been able to start this series.

A SHORT HISTORY OF THE EXPLORATION OF THE INDIAN PALM-FLORA.

Alexander von Humboldt[1] wrote in the year 1849 : " It is remarkable that of this majestic form of plants (palms) up to the time of the death of Linnæus only 15 species were described. The Peruvian travellers Ruiz and Pavon[2] added to these 8 more species. Bonpland[3] and I, in passing over a more extensive range of country from 12° S. Lat. to 21° N. Lat., described 20 new species of palms, and distinguished as many more, but without being able to obtain complete specimens of their flowers. At the present time, 44 years after my return from Mexico, there are from the Old and New World, including the East Indian species brought by Griffith, above 440 regularly described species. The " Enumeratio Plantarum " of my friend Kunth, published in 1841, had already 356 species." It is evident from this account, that the progress made in the exploration of the palm-flora in general was a very slow one, and it cannot be expected that the knowledge of the Indian palms was much advanced at that time. In Rheede's " Hortus Malabaricus," which was finished in 1703, only those palms are described which have been cultivated in India from time immemorial (Areca catechu, Phœnix sylvestris, Borassus flabellifer, Cocos nucifera, etc.) Roxburgh's " Plants of the Coast of Coromandel " (1795—1816) contains only a few species, whilst

[1] A. v. Humboldt, Aspects of Nature in Different Lands and Different Climates, Vol. II 126. London, 1850. (Translated from the German.)

[2] Hipolito Ruiz Lopez, born in 1754, was in charge of the Botanic Garden of Madrid, and died in Madrid in 1815. He and Joseph Pavon undertook (1779-1788) a scientific tour through Peru, Chili, and the neighbouring Spanish Provinces. In a shipwreck they lost the greatest part of their botanical collections. The results of their travels were published in the " Flora Peruviana et Chilensis," Madrid, 1798-1802, and the " Systema vegetabilium floræ Peruvianæ et Chilensis." Madrid, 1798.

[3] Humboldt, in company with Bonpland, travelled in Spanish America between 1799 and 1804.

his "Flora Indica", which appeared 17 years after his death (in 1832) brings the number of palms up to 41. At about the same time Wallich's "Plantæ Asiaticæ Rariores" (between 1830 and 1832) was published by the East India Company. Though valuable in other respects, the work did not add much to our knowledge of Indian palms.

It was not until Griffith with his untiring energy and enormous knowledge began his botanical investigations, that the palms of India became better known. As Assistant Surgeon he accompanied Wallich to Assam; he explored the tracks near the Mishmi Mountains between Sudiya and Ava; made a journey from Assam to Ava, and down the Irrawadi 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 fatigue and sicknesses due to exposure during his long and restless journeys (1845). The various papers, including many on palms which he communicated to the "Calcutta Journal of Natural History" and to the Linnean Society of London, and his other publications, are models of scientific research. His drawings, microscopic analyses and descriptions of plants are evidence of astonishing industry and profound knowledge. For the fruits of these labours we are indebted to J. McClelland, who published in Calcutta, between 1847 and 1854, five volumes 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." The most important amongst these is the volume entitled: "Palms of British East India" (1850). The author's preface furnishes some information regarding the scope and origin of the book. "The present attempt," says Griffith, "will be found to include all the Palms of British East India that I have met with myself, or of which I have been able to procure such knowledge, as I considered sufficient for their determination. I wish it merely to be viewed as a slight sketch to be filled up hereafter. This subject, so far as regards systematic botany, is one of considerable interest, and in order to meet the convenience of the Indian public, I have written the descriptions in English, in preference to the common language of Botanists. This seemed to me the more proper, because English is the language through which

scientific knowledge is communicated in this country, more especially in the Medical and other Colleges, from which all that is to be expected in the dissemination of this science among the natives of India must at present be derived . . . The determination of the species having been difficult, indeed nearly insuperably so to me, in reference to the means possessed in India, the numerous names new to science proposed in this work, must be taken with some qualification. I shall never regret to see any of these names cancelled in favour of others justly prior, that is to say, prior by definition, and by publication. However imperfect the definition may be; and it must be confessed, that most of those of palms are necessarily imperfect, still it bears evidence of a wish on the part of an author to do his duty by the science, for which, moreover, he thus endeavours to show a proper respect. But I would not be disposed to waive my right, in favour of mere MSS. names originating in indolence, and too often fostered by a courtesy of a very mischievous nature, inasmuch as the practice is directly opposed to proper observation and due discrimination. Such names are, in fact, only weak and temporary usurpations of authority."

The materials from which the work has been prepared were an extensive collection of palms made by Griffith himself and his friends in various parts of India, more especially at Malacca, and in Assam, and of a few found in the Botanic Gardens of Calcutta. To these we must add the species figured in Roxburgh's national collection of drawings and most of those described in his "Flora Indica." The species of Buchanan Hamilton, amounting to nine in number, Griffith has not been able to determine, in default either of manuscripts, specimens, or drawings. For the rest, Griffith has been much assisted, as he says himself, by Martius' great work on palms, so far as regards the sections, and from Mohl's contribution to it he derived most of what relates to structure. It was Griffith, on the other hand, that enabled Martius to describe in his 3rd volume a considerable number of Indian species, as only a few months before his death he had sent his whole collection of palms to Martius, who at that time was engaged in finishing his monumental "Historia Naturalis Palmarum."

During the lifetime of Griffith and especially in the second half of the 19th century, valuable work has been done in the exploration of the palm-flora by many botanists in various parts of India. We

his "Flora Indica", which appeared 17 years after his death (in 1832) brings the number of palms up to 41. At about the same time Wallich's "Plantæ Asiaticæ Rariores" (between 1830 and 1832) was published by the East India Company. Though valuable in other respects, the work did not add much to our knowledge of Indian palms.

It was not until Griffith with his untiring energy and enormous knowledge began his botanical investigations, that the palms of India became better known. As Assistant Surgeon he accompanied Wallich to Assam; he explored the tracks near the Mishmi Mountains between Sudiya and Ava; made a journey from Assam to Ava, and down the Irrawadi 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 fatigue and sicknesses due to exposure during his long and restless journeys (1845). The various papers, including many on palms which he communicated to the "Calcutta Journal of Natural History" and to the Linnean Society of London, and his other publications, are models of scientific research. His drawings, microscopic analyses and descriptions of plants are evidence of astonishing industry and profound knowledge. For the fruits of these labours we are indebted to J. McClelland, who published in Calcutta, between 1847 and 1854, five volumes 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." The most important amongst these is the volume entitled: "Palms of British East India" (1850). The author's preface furnishes some information regarding the scope and origin of the book. "The present attempt," says Griffith, "will be found to include all the Palms of British East India that I have met with myself, or of which I have been able to procure such knowledge, as I considered sufficient for their determination. I wish it merely to be viewed as a slight sketch to be filled up hereafter. This subject, so far as regards systematic botany, is one of considerable interest, and in order to meet the convenience of the Indian public, I have written the descriptions in English, in preference to the common language of Botanists. This seemed to me the more proper, because English is the language through which

scientific knowledge is communicated in this country, more especially in the Medical and other Colleges, from which all that is to be expected in the dissemination of this science among the natives of India must at present be derived . . . The determination of the species having been difficult, indeed nearly insuperably so to me, in reference to the means possessed in India, the numerous names new to science proposed in this work, must be taken with some qualification. I shall never regret to see any of these names cancelled in favour of others justly prior, that is to say, prior by definition, and by publication. However imperfect the definition may be; and it must be confessed, that most of those of palms are necessarily imperfect, still it bears evidence of a wish on the part of an author to do his duty by the science, for which, moreover, he thus endeavours to show a proper respect. But I would not be disposed to waive my right, in favour of mere MSS. names originating in indolence, and too often fostered by a courtesy of a very mischievous nature, inasmuch as the practice is directly opposed to proper observation and due discrimination. Such names are, in fact, only weak and temporary usurpations of authority."

The materials from which the work has been prepared were an extensive collection of palms made by Griffith himself and his friends in various parts of India, more especially at Malacca, and in Assam, and of a few found in the Botanic Gardens of Calcutta. To these we must add the species figured in Roxburgh's national collection of drawings and most of those described in his "Flora Indica." The species of Buchanan Hamilton, amounting to nine in number, Griffith has not been able to determine, in default either of manuscripts, specimens, or drawings. For the rest, Griffith has been much assisted, as he says himself, by Martius' great work on palms, so far as regards the sections, and from Mohl's contribution to it he derived most of what relates to structure. It was Griffith, on the other hand, that enabled Martius to describe in his 3rd volume a considerable number of Indian species, as only a few months before his death he had sent his whole collection of palms to Martius, who at that time was engaged in finishing his monumental "Historia Naturalis Palmarum."

During the lifetime of Griffith and especially in the second half of the 19th century, valuable work has been done in the exploration of the palm-flora by many botanists in various parts of India. We

mention only Anderson, Thwaites, Scheffer, Kurz, Brandis, Trimen, Beccari, and especially J. D. Hooker, who in the VIth Volume of his "Flora of British India" (1894) gives a concise account of all the palms which had previously been found in India and to which he himself and Beccari were able to add some new species. Lately, Prof. Beccari has enriched the literature on palms by his magnificent monograph on the genus Calamus, and we can only hope that he will be able to continue and finish his great undertaking to describe and illustrate the Asiatic palms.

In spite of all the labour spent by many scientific men in the study of Indian palms, there still remains much to be done. A great number of species are only partially known; the knowledge of others is extremely scanty, and there are, besides, a few, of which we know only the name, the original not having been discovered as yet.

THE PALMS IN GENERAL.

The Stem.—The adult palm has generally a tall, woody stem, bearing a crown of leaves; a considerable number, however, remain shrubby and some even have quite the appearance, but nothing save the appearance of perennial herbs. The stems in some species hardly appear above ground, in others they rise to the height of 500 feet (Calamus). It is doubtful whether there exist entirely stemless palms. Not seldom we find in descriptions palms mentioned as stemless, but on closer examination we usually find that the stem is very short and covered all over with the bases of the stalks of fallen leaves and the dense crown of new leaves. In diameter the stems vary from the reed-like Chamædorea and slender Rattan to the more usual sturdy, pillar-like structure as seen in the Date-palm, Palmyra-palm, the Oreodoxa, the Talipot and many others. While in some the stem is hardly as thick as a goosequill, it measures in others from three to five feet in diameter (Borassus flabellifer, Corypha). The long, slender stems of the Rattans or cane-palms are not self-supporting, but scramble over the surrounding vegetation; but in most palms the stem exists quite independent of all other plants.

The trunks of some are almost perfectly smooth, others rough with concentric rings, the scars of the fallen leaves. Many are clothed with a woven or hairy fibrous covering, which binds together the sheathing bases of the fallen leaves; others are densely beset with

cylindrical or flat spines, often eight or ten inches long and as sharp as a needle. As in these cases also the leaf-sheaths are covered with spines, such palms offer a serious obstacle to the traveller who attempts to penetrate the tropical forest.

Branching is a rare occurrence in the tall aërial stem. It is the rule only in a few species of the genus *Hyphæne* (*thebaica*, *coriacea*, and *indica*). In these palms the stem forks, often several times in succession, and there is no doubt that here we have cases of true dichotomy, similar to the mode of branching observed in *Pandanus furcatus* (Screw-pine). In ten other genera (out of a total of 131) exceptional cases of branching are recorded. These are often due to an injury to the terminal bud, as in the Wild Date, where the apex is continually tapped for toddy. In other cases branching takes place in consequence of the replacement of flowering buds by leaf-buds, which develop into shoots. Mr. F. Field gives a photograph of a Wild Date Palm with 14 branches (Journal, Bombay Natural History Society, Vol. XVIII, p. 699) that was growing at a village named Amas in the Gaya District, and he mentions that at one time the tree had been struck by lightning and split, and that from the base of the split those branches started.

The formation of horizontal suckers at the base of the stem is not so seldom. When they grow erect, they afford a characteristic bushy habit, as in the case of *Rhapis flabelliformis*, a species often cultivated in gardens.

The Leaf.—The foliage generally forms a magnificent crown at the end of the trunk. It is this crown that renders the palms objects of such beauty and elegance. The leaves are large and often gigantic, surpassing those of any other class of plants. In some species they are 50 feet long and 8 wide. We can easily distinguish two main types of leaves, the palmate and pinnate, which give rise to the popular terms Fan-palm and Feather-palm respectively. In the Fan-palms the blade is entire while enclosed in the bud, but folded up. When the leaf expands the folds become torn to a greater or less distance from the margin inwards. The depth of division varies much in different genera and species. In the pinnæ (leaflets, segments) of the Feather-palms we can observe similar characteristic foldings and tearings. The presence or absence of a terminal leaflet and the shape of the pinnæ in such a leaf afford useful distinctive

characters. Occasionally, in the genus Caryota, these segments are again divided (bipinnatisect), their ultimate divisions resembling in shape the fin or tail of a fish.

The petiole (leaf-stalk) is usually large and stout and has a strong, broad, sheathing base. The leaf-fall is, as generally in Monocotyledons, not a predetermined process, as observed in dicotyledonous trees. After some time, when the leaf has reached the end of its life-period, it gradually falls over, as the weight of the large blade is too great for the dying petiole. The blade remains attached until the stalk becomes so decayed that the leaf falls by its own weight or gets broken off by wind or rain-storm. The sheath is often seen to persist for sometime, its tough fibres forming a dense matting round the bases of the younger leaves. In some genera (Calamus, Desmoncus) the stem is surrounded above the petiole by a sheath-like stipule, called ochrea. In a few species the ochrea forms a hollow smooth-walled chamber, in which ants make a home (*Korthalsia echinometra*, *scaphigera*, *scortechinii*, *wallichiaefolia*).

Within the leaf-sheath we often find stem-thorns, which are at first flattened upwards against the stem and spread only after leaf-fall. The stems and leaves of the Rattans often bear numerous recurved spines which aid them in scrambling over trees and bushes. Also the leaf-rachis (midrib) may be produced into a naked, barbed, whip-like flagellum.

The leaves are generally green on both sides, but occasionally of a silvery white on the underside (*Copernicia cerifera*). In rare cases blue the middle of some leaves shows concentric bands of yellow and in the manner of a peacock's tail, as in the prickly Mauritia.

Another important character is the direction of the leaves. The segments may be arranged in a comb-like manner close to one another, with a stiff parenchyma, allowing the rays of the sun to play over their surface, and causing them to shine with a brilliant verdure in the Cocoa-nut Palm, and with a fainter ashy-coloured hue in the Date-tree, or they have a more flexible, grass-like texture, and are curled near the extremity. The more acute the angle formed by the leaves with the upper part of the stem, *i.e.*, the nearer the leaves approach the perpendicular, the bolder and nobler is the aspect of the species to which they belong. A comparison between the Real Date Palm and the Wild Date Palm will show this sufficiently.

In Feather-Palms the petioles either burst from the dry, rough, woody portion of the stem (*Cocos nucifera*, *Phœnix dactylifera*), or there rises in the rough part of the stem a grass-green, smooth, and thinner shaft, like one column above another, from which the petioles spring (*Oreodoxa regia*). A special character of melancholic solemnity and grandeur is added to the tree, when in Fan-Palms the living foliage rests on a circle of dead leaves.

There are various ways in which the leaf-blade protects itself against the influence of too intensive sun-light and the violent force of the rain. Fan-leaves as well as feathery leaves very often assume an inclined or even vertical position. This is effected either by the torsion of the petiole or by the leaf-stalk trying to get into a more upright position. It is not uncommon that the two rows of pinnæ are turned upwards till they form a small angle with each other (*Chrysalidocarpus lutescens*), and even the two halves of a fan-leaf are sometimes seen to close upon each other—just like a half-open book.

The Root.—After germination the primary root soon perishes and is replaced by adventitious roots springing from the base of the stem. In the South American genus Iriartea, development takes place above ground, the short stem being supported by prop-like adventitious roots, which increase in size with the increase in circumference of the shoot. The Sabal-Palm, Wax-Palm, and others, differ in that they form on the surface a short, horizontal rhizome, which becomes gradually thicker until the normal sized leaf-rosette is produced, when it begins to grow erect and forms the cylindrical stem. At the base the stem is often conically thickened. This gives the necessary mechanical rigidity, in consequence of which the stem does not curve in a gale but bends from the base, from a position like | to one like /. The mechanical physiology of stem and root is on the whole very little known. Why, *e.g.*, the stems of *Cocos* and other palms are curved—and not straight, we are not yet able to explain.

The Flower.—The flowers of a palm are never solitary; they always form a usually very large and much branched inflorescence. This is either a simple or compound spike, or a richly branched panicle. The branching is racemose and the flowers are often embedded in the fleshy surface of the branches; for this reason it is customary to call the inflorescence a spadix. In the Talipot and Metroxylon it is

terminal; after many years' growth and the production of a stout woody trunk, the growing point ceases to produce leaves and develops a gigantic inflorescence. This so exhausts the plant that, after fruiting, it dies. In most cases, however, the spadix is axillary and withers away after fruiting. It is formed in the sheathed axil of a leaf but often does not develop until after the subtending leaf has fallen, when the spadix is therefore below the leaf-crown. In other cases again, as in the *Sabal mauritiæforme* the large flower-shoots appear among the green leaves. These relations are constant for every species, sometimes even for a whole genus.

Before the flowers open a sugary sap in considerable quantities flows to the large spadix. The inhabitants of the tropics learned in early times how to obtain that sap, which by fermentation changes into a favourite intoxicating drink, the toddy. Each spadix is enclosed in an often enormous spathe, or each branch is separately sheathed by smaller spathes. After some time the spathe becomes torn along definite lines by the rapidly growing flower-shoot and either separates completely at the base or remains to sheathe the stalk and lower branches.

The flowers are small and inconspicuous, generally of a white, pale-yellow, or green colour, but, as if to make up for this defect, they are mostly produced in such masses as to present an eminently striking and imposing appearance. A single spathe of the Date-Palm contains about 12,000 male flowers, and *Metroxylon rumphii* has been computed to have no less than 208,000 flowers in one spathe, or about 624,000 upon a single tree.

The flowers are sessile or sometimes embedded in the surface of a fleshy spadix, as in the male inflorescence of the Brab Tree (*Borassus*). They are arranged in a close or loose spiral, or more rarely are distichous. As a rule the flowers are unisexual, the male and female often occupying different parts of the same inflorescence, *e.g.*, a few females occur at the base of the branches, whilst the upper part is thickly crowded with males, or the branches of the spike bear female flowers in the lower and male in the upper half. In other species, the two sexes may be mixed, usually one female between two males. In this case the two male flowers appear in succession and then the female, so that the spike is for the time being unisexual. The male and female flowers may vastly differ in size, as in the Brab Tree where the enormous female flowers contrast strongly with the minute male.

The flowers are regular and follow the very general formula of monocotyledonous plants. We have therefore usually 3 sepals, 3 petals, 6 stamens or a multiple of it, and 3 carpels for the exceptional hermaphrodite flower, while the stamens are rudimentary (staminodes) in the female and the carpels in the male (pistillode). The sepals and petals are tough and persistent, leathery or fleshy in their structure. The sepals are generally smaller than the otherwise similar petals, and only in rare cases is the corolla entirely covered by the calyx. Sometimes a whorl of stamens is wanting, or there is an indefinite number. The powdery pollen is produced in great quantities, escaping in clouds from the large male spikes. The pollination-methods of the palms want investigation. Wind-pollination is probably most general, as *e.g.*, in the Cocoa-nut Palm, though some palms, *e.g.*, *Sabal* and *Chamædorea*, are said to be entomophilous. The sweet smell of the inflorescence and the great mass of flowers which form a conspicuous object, seem to be in favour of insect-pollination. Where the male and female flowers are close together on the same spike, self-pollination is excluded by the well-marked protandry which we have already mentioned.

The ovary consists almost throughout of 3 carpels which are either quite free or completely united. In the latter case the ovary is generally trilocular. The style is short and the ovules, one for each carpel, are either anatropous, hemitropous, or rarely orthotropous.

Fruit and Seed.—When the fruit ripens, two of the carpels with their ovules may become abortive, as *e.g.*, in the Cocoa-nut, where we find only one seed, though the three carpels are distinctly indicated by three longitudinal sutures and by the constant presence of three round scars (germ-pores) on the hard endocarp. The fruit is either a berry or a drupe; in the latter case the endocarp is usually united to the seed. If the carpels are free, a syncarp of one-seeded fruits results; if they are united, we shall have a single fruit with one, two or three seeds according to the number of ovules that develop. The fruit in *Lepidocaryinæ* (including the Rattans, the Sago-palm, and others) is covered with hard, closely fitting, generally smooth, imbricating scales.

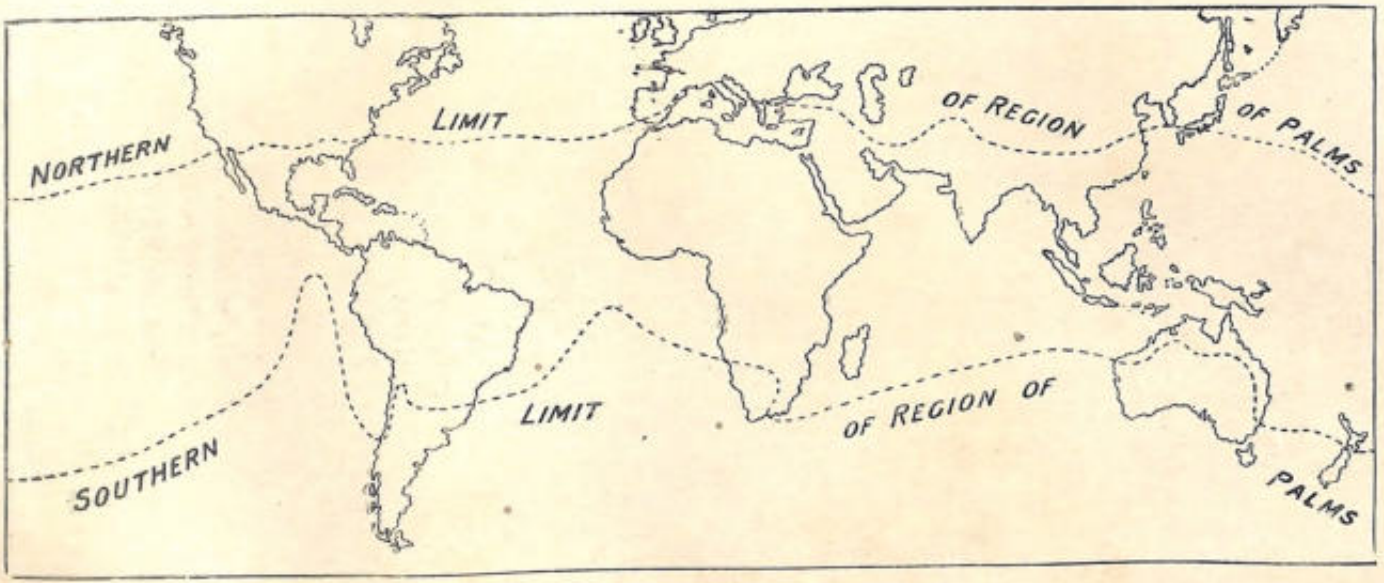
Compared with the size of the plants, the fruits are generally small; some are in this respect like peas, as in the Euterpe of tropical America. The common Cocoa-nut is one of the largest; and the

Double Cocoa-nut (*Lodoicea sechellarum*), measuring about four feet in circumference, is probably surpassed by no other fruit hitherto discovered.

In the seeds we observe a similar variety in size and shape. In fruits which contain only one seed it is generally more or less rounded, as in the Cocoa-nut ; in the Date it is long and narrow. In fruits with three seeds, it often becomes flattened on two sides and rounded on the outer in consequence of mutual compression.

The point on the testa from which well-marked vascular bundles radiate, shows the position of the raphe or chalaza. The inner integument of the ovule is, in some genera, much thickened along the course of these bundles and becoming greatly increased during ripening, grows into the endosperm and produces the characteristic appearance in section known as ruminate. This can be seen in the Betel-nut. Within the thin, fibrous seed-coat there is a copious endosperm which holds embedded in some part of its circumference the minute cylindrical or conical embryo. The endosperm may be comparatively soft, the cells containing a considerable amount of oil and proteid (Cocoa-nut), or it may be hard (Date), or occasionally mucilaginous.

Geographical Distribution.—There are about 1,100 known species of palms which are distributed among 131 genera. They form a monocotyledonous order, essentially characteristic of the tropical region *(cf. Map A.)*. *Chamærops humilis* is the only native of Europe ; it is a Mediterranean species which occurs in Southern Spain, Italy, and Greece. The monotypic genus Nannorhops which is indigenous on the Himalayas extends through Afghanistan and Baluchistan to south-east Persia. Of the Chinese-Japanese region, only the east-coast, as far as Korea and the south of Japan, shows some representatives of this order. A few small genera are peculiar to the Southern United States and California. The Chilian genus Jubæa extends to the 37th parallel, while in the eastern hemisphere the southern limit is 44° S. Lat. in New Zealand. The great centres are tropical America and tropical Asia. The order is represented in Central America by 7 genera, in the West Indies by 5, and extends southwards as far as Chili. In tropical Asia it covers the Indo-Malayan region, Borneo, New Guinea and Australia, always within the northern and southern limits indicated above. In tropical Africa



Map showing the Limits of the Region of Palms.

only 14 species are known to occur. Several genera have been found in the Pacific Islands.

Drude has shown that, with the exception of three genera, all the rest are restricted either to the Old or to the New World. Of those three the Cocoa-nut has a wide distribution on the coasts of tropical America, in India and the South Seas, but all its allies are American. The Oil-palm (*Elæis guineensis*) is indigenous in western tropical Africa, whilst another species of the same genus is a native of equatorial Africa. One species of Raphia belongs to America, whilst several others have their original home in tropical Africa and Madagascar.

The following table gives all the genera of palms with the number of species and their distribution. An asterisk indicates that the genus is represented by indigenous species in India and Ceylon: two asterisks, that representatives of the respective genus are cultivated in Indian gardens.

TRIBE 1.—CORYPHINÆ.

1. *Phœniceæ.*

1. * Phœnix, L. Sp. about 12, Sub-tropical Africa; Tropical Asia.

2. *Sabaleæ.*

2. * * Chamærops, L. Sp. 2, Mediterranean region.
3. * Trachycarpus, Wendl. Sp. 3, Northern India, Burma; Northern China; Japan.
4. Rhapidophyllum, Wendl. & Dr. Sp. 1, Florida, South Carolina.
5. * * Rhapis, L. Sp. 3, Eastern Asia, from China to the Sunda Islands.
6. Acanthorhiza, Wendl. & Dr. Sp. 4, Tropical America.
7. Colpothrinax, Griseb. & Wendl. Sp. 1, Cuba.
8. Trithrinax, Mart. Sp. 4, South America.
9. * * Thrinax, L. Sp. 9, Antilles; Florida.
10. * Corypha, L. Sp. 6, Tropical Asia, Malay-Archipelago.
11. * Nannorhops, Wendl. & Hook. Sp. 1, India; Afghanistan; S. Persia.
12. * Licuala, Wurmb. Sp. about 45, Indo-Malayan region, New Guinea; North Australia.
13. * Livistona, R. Br. Sp. about 13, Indo-Malayan region; New Guinea; East Australia.
14. Erythea, Wats. Sp. 2, South California and Guadalupe Island.
15. * * Pritchardia, Seem. & Wendl. Sp. 5, Sandwich Islands.
16. * * Washingtonia, Wendl. Sp. 2, South California and Arizona.
17. Brahea, Mart. Sp. 2, Mexico; South Texas.

18. Crysophila, Bl. Sp. 1, Mexico.
19. ° ° Sabal, Adans. Sp. 7. from Venezuela to the Antilles and the South-Eastern States of North-America.
20. Serenæa, Hook. f. Sp. 1, Florida.
21. ° ° Copernicia, Mart. Sp. 6, America.
22. Teysmannia, Zoll. Sp. 1, Sumatra.

TRIBE II.—BORASSINÆ.

3. *Borasseæ.*

23. Pholidocarpus, Bl. Sp. 5, Amboina ; Timor, Borneo.
24. Medemia, P. Guil. de Wuertt. & Braun. Sp. about 4, East Africa.
25. ° Hyphæne, Gaertn. Sp. 10, Africa, India.
26. ° ° Latania, Comm. Sp. 3, Mascarene Islands and neighbouring coast of Africa.
27. ° Borassus, L. Sp. 1, Tropical Africa ; India, from Ceylon to the Sunda Islands.
28 ° ° Lodoicea, Labill. Sp. 1. Sychelle Islands.

TRIBE III.—LEPIDOCARYINÆ.

4. *Mauritieæ.*

29. Mauritia, L. f. Sp. 9, Northern Brazil ; Guiana ; West Indies.
30. Lepidocaryum, Mart. Sp. 5, Northern Brazil ; Guiana.

5. *Metroxyleæ.*

31. ° ° Raphia, P. de B. Sp. 6. Tropical Africa ; Madagascar ; Tropical America.
32. Oncocalamus, Wendl. & Mann. Sp. 1, West Africa.
33. Ancistrophyllum, Hook. Sp. 3, West Africa.
34. Eremospatha, Wendl. & Mann. Sp. 3, West Africa.
35. Eugeissona, Griff. Sp. 2, Malay-Archipelago.
36. ° ° Metroxylon, Rottb. Sp. 7, Malay-Archipelago ; New Guinea.
37. Pigafetta, Bl. Sp. 3, Malay-Archipelago ; New Guinea.
38. ° Zalacca, Reinw. Sp. 10, Assam ; Malay-Archipelago.
39. ° Korthalsia, Bl. Sp. 20, Malay-Archipelago ; New Guinea.
40. Ceratolobus, Bl. Sp. 2, Sumatra ; Java.
41. ° Plectocomia, Mart. Sp. 6, Khasya Hills ; Himalaya ; Assam ; Malay-Archipelago.
42. ° Plectocomiopsis, Becc. Sp. 3, Malayan.
43. ° Calamus, L. Sp. about 170, Tropical and Sub-tropical Asia ; Tropical West-Africa ; Australia.
44. ° Dæmonorhops, Bl. Sp. about 80, Tropical and Sub-tropical Asia.

TRIBE IV.—CEROXYLINÆ.

6. *Arecineæ.*

45. ° Caryota, L. Sp. about 10, tropical Asia, Malay-Archipelago, Australia.

46. ° Arenga, Labill. Sp. about 10, Tropical Asia; Malay-Archipelago; New Guinea; Australia.
47. ° Didymosperma, W. & Dr. Sp. 8, East India; Malay-Archipelago.
48. ° Wallichia, Roxb. Sp. 3, East India.
49. Orania, Sp. 5, Malay-Archipelago; Papua.
50. Podococcus, Wendl. & Mann. Sp. 1, West-Africa.
51. Sclerosperma, Wendl. & Mann. Sp. 1, West-Africa.
52. ° Bentinckia, Berr. Sp. 2, Travancore; Nicobar Islands.
53. Manicaria, Gaertn. Sp. 1, Tropical America.
54. Leopoldinia, Mart. Sp. 4, Brazil.
55. Calyptronoma, Griseb. Sp. 4, Tropical America.
56. Geonoma, Willd. Sp. about 80, Tropical America.
57. Asterogyne, Wendl. Sp. about 2, Central America.
58. Calyptrogyne, Wendl. Sp. 3, Central America.
59. Welfia, Wendl. & Hook. Sp. 2, Central America.
60. Iriartea, R. & Pav. Sp. about 10, Tropical America.
61. Catoblastus, Wendl. Sp. 3, Columbia; West Brazil; Peru.
62. Wettinia, Pœpp. & Endl. Sp. 3, Andes.
63. Ceroxylon, H. B. Kth. Sp. 5, Andes.
64. Juania, Dr. Sp. 1, Juan Fernandez.
65. ° ° Chamædorea, Willd. Sp. about 60, Tropical America.
66. Morenia, R. & P. Sp. 5, Andes.
67. Kunthia, Humb. & Bonpl. Sp. 1, North-West Brazil; Columbia
68. ° ° Hyophorbe, Gaertn. Sp. 3, Mascarene Islands.
69. Gaussia, Wendl. Sp. 1, Cuba.
70. Pseudophœnix, Wendl. & Dr. Sp. 1, South Florida.
71. Synechanthus, Wendl. Sp. 3, Central America; Columbia.
72. Reinhardtia, Liebm. Sp. 8, Central America; Mexico.
73. ° ° Dypsis, Noronh. Sp. 6, Madagascar.
74. Phloga, Hook. Sp. 1, Madagascar.
75. Hyospathe, Mart. Sp. 3, Tropical America.
76. Prestœa, Hook. Sp. 1, Trinidad.
77. ° ° Oreodoxa, Willd. Sp. 6, Tropical America.
78. Gigliolia, Becc. Sp. 2, Borneo.
79. ° ° Howea, Becc. Sp. about 3, Lord Howe's Island.
80. Linospadix, Wendl. & Dr. Sp. 6, New Guinea; east coast of Australia.
81. Iguanura, Bl. Sp. 10, from Malacca to Borneo.
82. Calyptrocalyx, Bl. Sp. 2, Moluccas; Australia.
83. Sommieria, Becc. Sp. 2, Papua-Archipelago.
84. Clinostigma, Wendl. Sp. 3, Samoa; Lord Howe's Island.
85. ° ° Heterospathe, Scheffer Sp. 1, Amboina.
86. Jessenia Karst. Sp. 3, South America.
87. Roscheria, Wendl. Sp. 1, Seychelles.

88. ° ° Nephrosperma, Balf. Sp. 1, Seychelles.
89. ° ° Verschaffeltia, Wendl. Sp. 1, Seychelles.
90. ° ° Phœnicophorium, Wendl. Sp. 1, Seychelles.
91. ° ° Deckenia, Wendl. Sp. 1, Seychelles.
92. ° ° Acanthophœnix, Wendl. Sp. about 3, Mascarene Island.
93. ° Oncosperma, Bl. Sp. 4, Tropical Asia.
94. Euterpe, Mart. Sp. about 10, Tropical America ; West Indies.
95. Œnocarpus, Mart. Sp. 8, Tropical America.
96. Ptychandra, Scheff. Sp. 2, Moluccas.
97. Cyphokentia, Brongn. Sp. 10, New Caledonia.
98. ° ° Hydriastele, Wendl. and Dr. Sp. 1, tropical north-coast of Australia.
99. ° ° Kentia, Bel. Sp. 10, Moluccas ; New Guinea ; Lord Howe's Island ; Norfolk Island ; New Zealand ; Chatham Islands.
100. Kentiopsis, Brongn. Sp. 2, New-Caledonia.
101. Veitchia, Wendl. Sp. 4, New Hebrides ; Fiji Islands.
102. Drymophlœus, Zipp. Sp. 12, Malay-Archipelago ; New Guinea ; New-Caledonia ? Australia ?
103. ° ° Cyrtostachys, Bl. Sp. 2, Malay-Archipelago.
104. Ptychococcus, Becc. Sp. 3, New Guinea ; Moluccas.
105. ° ° Ptychosperma, Labill. Sp. 13, Sunda Islands ; Papua-Archipelago ; Fiji Islands ; North Australia.
106. ° Loxococcus, Wendl. & Dr., Sp. 1, Ceylon.
107. ° ° Actinorhytis, Wendl. & Dr., Sp. 1, Malay-Archipelago.
108. Rhopaloblaste, Scheff. Sp. 2, Moluccas ; New Guinea.
109. ° Ptychoraphis, Becc. Sp. 3, Malayan.
110. ° ° Dictyosperma, Wendl. & Dr., Sp. 3, Mascarene Islands.
111. ° ° Archontophœnix, Wendl. & Dr., Sp. 3, Tropical and Sub-tropical East-Australia.
112. Nenga, Wendl. & Dr., Sp. about 11, from Malacca and the Sunda Islands to New Guinea.
113. Cyphophœnix, Wendl. & Hook., Sp. 2, New Caledonia.
114. Mischophlœus Scheff., Sp. 1, Ternate.
115. ° Pinanga, Bl. Sp. about 40, India ; Malay-Archipelago.
116. ° Areca, L. Sp. 14, Tropical Asia; Malay-Archipelago; New-Guinea; Australia.

7 *Cocoineæ.*

117. Barcella, Trl. Sp. 1, Brazil.
118. ° ° Elæis, Jacq. Sp. 2, Tropical Africa and America.
119. Orbignya, Mart. Sp. 6, South America.
120. ° ° Attalea, H. B. Kth., Sp. 23, Tropical America.
121. ° ° Maximiliana, Karst. Sp. 3, Tropical Brazil ; Guyana ; Trinidad.
122. ° Cocos, L. Sp. about 30, Tropical and Sub-tropical America.

123. Diplothemium, Mart. Sp. 5, Brazil.
124. Jubæa, Gay, Sp. 1, Chile, 31-35° S. Lat.
125. ° ° Martinezia, Kth. Sp. 7, Tropical America.
126. ° ° Acrocomia, Mart. Sp. 7, Tropical America.
127. ° ° Astrocaryum, Mey. Sp. 29, Tropical America ; Brazil.
128. ° ° Bactris, Jacq. Sp. 90, Tropical America.
129. Desmoncus, Mart., Sp. about 25 Tropical America.

TRIBE V. PHYTELEPHANTINÆ.

130. ° ° Phytelephas, R. & P. Sp. 3, Tropical America, between 9° N. Lat. and 8° S. Lat.
131. ° Nipa, Thunb. Sp. 1, Tropical Asia ; New Guinea ; Australia.

DISTRIBUTION OF PALMS IN BRITISH INDIA.

Roughly speaking about a hundred species have been described as being indigenous to British India and Ceylon ; certainly a small number if compared with many regions in tropical America. Nearly all of them are comparatively unobtrusive, and if a traveller in India meets palms forming a conspicuous feature in the landscape of the plains, he may be sure that the trees are either Wild Date-Palms (*Phœnix sylvestris*) or Palmyra-Palms (*Borassus flabellifer*), or, near the sea, Cocoa-nut Palms (*Cocos nucifera*). The most majestic palm of India and easily distinguished by its stature, foliage and inflorescence, is the Talipot (*Corypha*), but it is exceedingly rare and confined to certain localities.

A short survey of the botanical regions of India, as laid down by Sir Joseph Hooker, will reveal some interesting facts regarding the distribution of Palms.

We begin with the Burmese region, which is richest in species, not only regarding its whole vegetation, but also as to its palm flora. According to Sir J. Hooker, the region is bounded on the north and north-east by the flanking mountains to the south of the Assam valley and China, on the east by China and Siam, on the west by Bengal and the Indian Ocean, and on the south by the State of Khedah in the Malay Peninsula. We include here also the Andaman and Nicobar Islands. Up to 70 species have been recorded from this region, of which, according to our present knowledge of the neighbouring countries 28 are endemic.

We may divide this botanical region into four sub-regions, Northern, Western, Eastern, and Central, to which we shall add, in the

meantime, the two separate sub-regions of the Andaman and Nicobar Islands. Northern Burma extends for 500 miles in a north-eastern direction from the great bend of the Brahmaputra in Bengal to the Chinese Province of Yunnan. The range of mountains flanking the Assam valley on the south forms its northern boundary. It belongs politically to Assam and comprises the districts known as the Garo, Khasya, Jaintia, Nowgong, Naga, Patkai, and Manipur Hills. They rise, on the average, to 4,000 to 5,000 feet, a few peaks even above 10,000. Blanford's description of the climate of Shillong gives on the whole a fair idea of the meteorological condition of this sub-region. "This station is situated on a gently undulating tableland, 4,800 feet above the sea-level, immediately north of the culminating ridge of the Khasi hills, and about midway between the valley of Assam and the plains of Sylhet. . . On the average of the 4 years, 1869-1872, the mean temperature of Shillong was 62°, which is about the same as that of Constantinople, Barcelona, and Oran; in fact of an average Mediterranean climate. In the warmest months, June to August, it is below 70°, and in April and May intermediate between the two, since in the Khasi Hills rain is so frequent in the spring months that the temperature does not rise to a maximum in May, and suffers no abatement when the monsoon rains set in in June. The lowest reading recorded was just above the freezing point; the average minimum of the 4 years 34°, and the mean temperature of December and January 51°. In December and January, the most serene months of the year, the mean difference of the early morning and afternoon temperatures is 19° or 20°. While in respect of temperature, the climate of Shillong much resembles that of places in the south of Europe, in the dampness of its atmosphere and its rainfall it is eminently tropical. In the driest month, March, the humidity is indeed only 59 per cent. of saturation, but from July to October inclusive it ranges between 86 and 89, and from June to September, on an average, eight-tenths or more of the sky is clouded. In April it rains on one day in three, in May on two days out of three, and in the four succeeding months even more frequently. On the average of 18 years there have been 150 rainy days in the year. The average rain-fall of the year hardly exceeds 85 inches."[1]

[1] Blanford, Climates and Weather of India, p. 112.

To this sub-region are exclusively confined the following species: *Areca nagensis*, *Pinanga griffithii*, *P. hookeriana*, *Didymosperma nana*, *D. gracilis* and *Pleetocomia khasyana*. Of other species we find *Pinanga gracilis*, *Wallichia densiflora*, *Didymosperma nana*, *Caryota urens*, *Caryota obtusa*, *Phœnix rupicola*, *P. acaulis*, *P. humilis*, *Licuala peltata*, *Livistona jenkinsia*, *Trachycarpus martiana*, *Calamus erectus*, *C. flagellum*, *C. leptospadix*, *C. floribundus*, *C. acanthospathus*, *C. gracilis*, *Dæmonorops jenkinsianus*, *Zalacca secunda*.

Western Burma includes the humid strip of land between the sea and the crests of the Chittagong and Arakan Hills, and separated by the deltas of the Irrawaddy, Sittang, and other rivers, the coast of Tenasserim down to Mergui. The mean temperature of Chittagong is 77°. April and May are about equally hot, *viz.*, 81° and 82° and it remains nearly uniform from April to the end of September, the night temperature rising in the same measure as the day temperature falls, until the daily range is reduced by one-half, more or less. The highest temperature of the year occurs in April, or, more frequently in May, and varies between 91° and 99°. In the cool season the lowest temperature occurs as a rule in January, sometimes in February, and varies between 45° and 52°. The diurnal range of temperature in the drier seasons of the year does not exceed 23°. The humidity of the air averages 80, and in the driest month, either February or March, is as high as 70. At the height of the rains the humidity averages 87 per cent. and upwards. The rainfall amounts on an average to 106 inches and the number of rainy days to 122. "The position and configuration of Arakan and Tenasserim on the west coast of the peninsula, with hill ranges running parallel with the coast, expose them to the influence of the south-west monsoon of the Bay of Bengal, in the same manner and as fully as are the Konkan and Malabar to that of the Arabian Sea, and with a similar result, *viz.*, an excessive rainfall from June to September. In Arakan, however, this rainfall is more prolonged than on the west coast of the Konkan in the same latitudes." (Blanford). Dense, evergreen forests cover this tract of country, Dipterocarps, Oaks, Bamboos, Orchids, Palms, and Ferns forming a conspicuous feature. In Chittagong occur *Wallichia densiflora*, *W. caryotoides*, *Calamus erectus*, *C. viminalis*, *C. tenuis*, *C. guruba*, *C. gracilis*, and *Dæmonorops jenkinsiannus*, in Tenasserim *Licuala longipes*, *L. speciosa*, *Calamus concinnus*, *C. jeanus*, *C.*

nitidus, *C. platyspathus*, *C. myrianthus*, *C. melanacanthus*, *C. palustris*, and *Plectocomia macrostachya*. Spread all over the sub-region, from Chittagong to Tenasserim, we find *Areca triandra*, *Pinanga gracilis*, *Caryota urens*, *Nipa fruticans* and *Calamus latifolia*. In Pegu the following species have been found :—*Pinanga hexasticha* (endemic in Pegu), *P. hymenospatha* (endemic), *Wallichia disticha*, *Arenga saccharifera*, *Livistona speciosa*, *Calamus arborescens* (endemic), *C. longisetus*, *Zalacca beccarii*, *Plectocomiopsis paradoxus*, and others.

The sub-regions Eastern and Central Burma are little known, and no materials are at our disposal.

Of the Andaman Islands, only a few points have been explored by botanists, of which the chief is Port Blair. Barren Island, Narcondam and the Coco have been visited by Major Prain. The climate of these islands is almost equatorial in its uniformity, and in many respects similar to that of Tenasserim. They are hilly, the hills being for the most part only a few hundred feet in height, and covered with forests, which are typically Burmese. The vegetation of the interior hills, which reach 2,400 feet in height, is not known at all. The mean temperature of Port Blair is 80°. There is but little variation during the year : March and April are the warmest months, with a mean temperature of 82°, and a mean daily maximum of 92°. The average extreme range of temperature in the course of the year is only 26°. The diurnal range of temperature is as much as 14° or 15° in the driest months, February, March, and April. The mean humidity is 83 per cent. of saturation. The monsoon sets in in May and the rainfall of that month is little less than that of June. The number of rainy days amounts to nearly half the days in the year, and during the summer monsoon there are only 5 or 6 rainless days in the month. A comparatively considerable number of palms have been recorded from the Andaman Islands. *Areca triandra*, *Pinanga manii*, *Pinanga kuhlii*, *Caryota mitis*, *Phœnix paludosa*, *Corypha umbraculifera*, *Licuala peltata*, *L. spinosa*, *Calamus longisetus*, *C. viminalis*, *C. andamanicus*, *C. palustris*, *Dæmonorops manii* (endemic), *D. kurzianus* (endemic), *Korthalsia laciniosa*.

The flora of the Nicobar Islands is even less known than that of the Andaman Islands. Climatically there is not a great difference between the two groups of Islands, and as to the vegetation of the Nicobars, we cannot decide at present whether it belongs to the

Burmese or to the Malay Peninsular flora. Four species of palms are endemic in these Islands, *viz.*, *Ptychoraphis augusta*, *Bentinckia nicobarica*, *Calamus nicobaricus* and *C. unifarius*; two species are endemic in the Nicobar and Andaman Islands: *Pinanga manii* and *Calamus andamanicus*.

Of the Eastern Himalayan region, only Sikkim is botanically well known. Its proximity to the Bay of Bengal and the direct exposure to the effects of the south-west monsoon make the district the most humid part of the whole range of the Himalayas. The total number of species of flowering plants is estimated to be about 4,000, of which only 20 are palms. Of these, only 2 inhabit the temperate zone (from 6,500-11,500 feet): a scandent Rattan (*Plectocomia himalaica*) and a Fan-Palm (*Trachycarpus martiana*). The rest belong to the tropical zone (1,000-6,500 feet). At the lowest elevations we find *Phœnix rupicola*; *Pinanga gracilis* and *Wallichia densiflora* reach as high as 3,000 feet, *Calamus erectus*, *C. flagellum* up to 4,000, *Caryota urens* up to 5,000, *Calamus acanthospadix* up to 6,000. Other palms belonging to the same zone are *Wallichia disticha*, *Licuala peltata*, *Calamus leptospadix* and *Dæmonorops jenkinsianus*.

The Western Himalayan region, which extends from Kumaon to Chitral has a much cooler and drier climate than the Eastern Himalaya. In consequence of it we find that 12 of the eastern species of palms have entirely disappeared in the western region. In the temperate zone there occurs only one species (a Trachycarpus) which is confined to and local to Kumaon and Garhwal. Five others belong to the tropical zone of Kumaon, *viz.*, *Phœnix sylvestris*, *P. acaulis*, *P. humilis*, *Wallichia densiflora* and *Calamus tenuis*, all of which have a very wide distribution.

In the Indus Plain region, including the Punjab, Sind, and Rajputana, west of the Aravalli range and Jumna river, Cutch, and Northern Gujarat, the only indigenous palms are *Phœnix sylvestris* and *Nannorhops ritchieana*. The latter finds its north-eastern limit in the Salt range, and the south-western limit in Sind and Baluchistan.

The Gangetic Plain region stretches from the Aravalli hills and Jumna river to Bengal, including the Sundarbans, the plains of Assam and Sylhet, and the low country of Orissa north of the Mahanadi river. Hooker has divided this region into three sub-regions: an upper dry, a lower humid, and the Sundarbans. In the upper

Gangetic plain, extending from Eastern Rajputana to a little above the bend of the Ganges at Rajmahal, we have a vegetation characteristic of a dry country. The trees are, for the most part, leafless during the hot season, and the herbaceous flora is burnt up. Two palms are cultivated in many parts (Phœnix and Borassus), and in thickets we find two species of Rattan (Calamus). The lower Gangetic plain or Bengal proper of the old maps is distinguished from the upper valley by its humidity and luxuriant evergreen vegetation. The Betel-nut palm, Phœnix, Palmyra, and Cocoanut are generally cultivated. Of indigenous palms, the following are found, *Corypha elata*, *C. talliera*, *Calamus viminalis*, *C. tenuis*, *C. guruba*, *Dæmonorops jenkinsianus*. The Sundarbans consist of a great number of islets which, in great part, are covered with a dense evergreen forest of trees and shrubs with a rich undergrowth of climbers and herbaceous plants. *Nipa fruticans* is gregarious in the swamps and on river banks, whilst *Phœnix paludosa* is found in drier localities. There occur, also two Rattans, a Calamus and a Dæmonorops, both common to Bengal.

The Malabar region (including Southern Gujarat, the southern half of Kathiawar, the Konkan, Kanara, Malabar Proper, Cochin, Travancore, and the Laccadive Islands) is for the greatest part a hilly or mountainous country and "is (except in the north) of excessive humidity, the mountains often rising abruptly from the flat coast of the Arabian Sea. Its abrupt western face is clothed with a luxuriant forest vegetation of Malayan type, except towards the north where, with the drier climate, the elements of the Deccan and Indus Plain Floras compete with that of Malabar. The eastern face slopes gradually into the elevated plateau of the Deccan, but it is varied by many spurs being thrown off which extend far to the eastward, often enclosing valleys with a Malabar Flora. One great break occurs in the chain in lat. 11°N., where a transverse valley separates Travancore from the mountains north of it, and carries species characteristic of the Malabar Flora almost across the Peninsula." (Hooker).

To this region, including the Nilgiri Hills, belong over 20 species of palms. *Pinanga dicksonii*, *Bentinckia coddapanna*, *Calamus rheedii*, *C. huegelianus*, *C. brandisii*, *C. gamblei* are endemic. Of other palms we mention: *Phœnix sylvestris*, *P. robusta*, *P. acaulis*

P. humilis, Caryota urens, Calamus pseudotenuis, C. thwaitesii, Corypha umbraculifera. Areca catechu, Borassus flabellifer and *Cocos nucifera* are widely cultivated.

The Deccan region comprises the whole comparatively dry elevated tableland of the Peninsula east of Malabar and south of the Gangetic and Indus Plains. The Coromandel coast, extending from Orissa to Tinnevelly may be considered as a sub-region. Deciduous forests form the most conspicuous feature of the Deccan plateau. Comparatively evergreen ones are found on the coasts and slopes with an eastern aspect. Of palms, there occur *Phœnix sylvestris, P. robusta, P. acaulis, P. humilis, Calamus viminalis, C. pseudotenuis, C. rotang, Borassus flabellifer. Phœnix pusilla* forms impenetrable thickets in sandy soils near the sea.

The Ceylon region presents, on the one hand, a close affinity to the vegetation of Malabar and the Deccan, on the other it differs from the Malabar flora in having many more Malayan types. Of endemic species 780 have been reported, and of these eleven are palms: *Areca concinna, Loxococcus rupicola, Oncosperma fasciculata, Phœnix zeylanica, Calamus rivalis, C. pachystemonus, C. digitatus, C. radiatus, C. zeylanicus, C. ovoideus.* The most conspicuous palm in Ceylon is *Corypha umbraculifera*; *Nipa fruticans* is rare. Other indigenous palms are *Phœnix pusilla, C. thwaitesii, C. pseudotenuis, C. delicatulus, C. rotang.*

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(To be continued.)

THE COMMON SNAKES OF INDIA.

BY

MAJOR F. WALL, I.M.S.

PLATE XIII. (*Ancistrodon himalayanus* and *Psammodynastes pulverulentus*) not having arrived from England, will be published in the next number of the Journal.

EDITORS.

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 XIII with Plate XIII and Diagram.

(Continued from page 792 of Volume XIX).

The vipers constitute a family (*Viperidæ*) characterised by the shape of the maxilla or upper jawbone which as shown in a previous paper (Vol. XVI., p. 535) consists of a vertical column bearing a pair of tubular fangs. In all other snakes the long axis of the maxilla is placed horizontally.

The fangs of vipers are relatively much longer than in poisonous colubrines. They are also more curved, and slender, and the seam on their anterior faces—which marks the junction of the circumflexed walls that form the poison canal—is far less obvious than in poisonous colubrines.

The family *Viperidæ* is divided into two subfamilies on the presence or absence of a cavity placed between the eye and the nostril, and known as the loreal pit. The pit bearers are called pit vipers, and are classed together under the name *Crótalinæ*, the pitless vipers under the name *Viperinæ*.

ANCISTRODON HIMALAYANUS.

This viper belongs to one of the four genera into which the subfamily Crotalinæ is divided. The genus is characterised by the possession of large shields of the colubrine type on the top of the head, and the absence of a rattle at the end of the tail. It contains eleven species, seven of which are American, three Asian, and one European.

History.—It was first described by Dr. Günther in 1864.

Nomenclature.—(*a*) *Scientific.*—The generic name from the Greek "agkistron" a hook, and "odous" a tooth was introduced by de Beauvois in 1799.

From the derivation, and the fact that the godfather of the genus spelt the name *agkistrodon*, it seems a pity that the word has been

altered to its present rendering which was introduced by Baird in 1864.

(*b*) *English.*—The brown Himalayan viper is probably the best name for it. The only other brown viper in this mountainous region is *Lachesis monticola* which occurring only in the Eastern Himalayas, and extending to the Malayan subregion may be designated the brown, or spotted Himalo-Malayan viper.

(*c*) *Vernacular.*—The only native name I know for it is "poiur" which is what the Kashmiris call it.

General characters.—The body is rather stout, and heavy for the length of the snake, and round in section. Anteriorly it attenuates so as to make the neck very apparent, behind the broadly expanded angles of the jaws. Posteriorly it suddenly reduces in girth at the anus, so that the termination of the body, and commencement of the tail are far more obvious than in colubrine, and other snakes. The head is rather elongate and remarkably flat above, and especially so on the snout, this being due to the marked ridge (*canthus rostralis*) proceeding forwards from the eye-brow. The muzzle is rather narrow in front, the head broadest midway between the eyes and the neck. The nostril is rather small, and placed near the middle of a shield which is usually quite divided below, and frequently above the nasal aperture. The eye is rather large with an iris beautifully specked with gold, and a vertical pupil. The commissure of the mouth shows an exaggerated curve opposite the fang. The tail is about one-seventh the total length of the snake and ends in an elongate terminal shield. The scales on the upper parts are lustreless, and strongly ridged, the shields beneath smooth, and highly polished.

Identification.—It is a very easy snake to recognise. To begin with the association of a loreal pit, with large shields on the head proclaims the genus, and there are only three species within Indian limits, *viz.*, *himalayanus*, *hypnale*, and *millardi*. Both the last have a more or less well marked boss on the top of the snout—which is absent in the foremost—and inhabit Hills South of Bombay, or Ceylon.

Dimensions.—The largest measurement I know of is that recorded by Stoliczka, *viz.*, 34 inches. I have never seen one more than 25½ inches and I should say that average adults vary from about eighteen inches to two feet.

Haunts.—The brown Himalayan viper favours an altitude between about 7,000 to 10,000 feet though it wanders higher. Within these limits it is a very common snake, perhaps the most common in the Western Himalayas, but East of Nepal is decidedly uncommon. Mr. G. A. Millar writing to me in 1900, told me that during a 13 years' residence in Darjeeling he had only once had this snake brought to him, though he was interested in the collection of snakes now preserved in the museum of St. Joseph's College, and did much to make it what it is. I know of no other authentic record of this viper from this part of the Himalayas (*i. e.*, East of Nepal). Above 10,000 feet the snake becomes increasingly scarcer with the altitude. I found it at about 12,000 feet in Kashmir, and a specimen in the Indian Museum was captured at the foot of the Dharmsala glacier at an elevation of 16,000 feet. This is by far the highest altitude I know of for any snake. The only other proximate elevations known to me are 14,000 feet where the snake discovered by Lieut. F. M. Bailey, inhabiting hot springs in Thibet was captured, which I described in this Journal as *Tropidonotus baileyi*, and 12,500 feet the elevation at which Dr. H. Gadow encountered a rattlesnake in Mexico (*Crotalus triseriatus*). I think it is essentially a forest lover, being rarely found away from the protection offered by vegetation. In Kashmir I had no difficulty in finding specimens whenever I instituted a search for them. It very frequently found refuge beneath fallen timbers, so that I had rarely to turn over more than half a dozen logs before flushing one, and I have found two beneath different parts of the same bole. Of course it finds abundant refuge in other situations such as clefts in rocks, or beneath boulders where it is more difficult to dislodge. In Kumaon it frequently takes up quarters in the walls of terraced fields, or gardens where it is a source of special danger to the inquisitive house dog, that will thrust its nose into any cranny where it has discerned a movement. In camp it is by no means an infrequent visitor to one's tent, a fact which places most people on their guard who know Kashmir, and indulge in the gipsy life which is so attractive in that State.

Habits.—I encountered many in Kashmir when not searching for them. On a warm summer's day it is frequently to be seen coiled up, and basking in lazy enjoyment in the sun. Usually it selects a spot within easy reach of cover, to which it withdraws in a leisurely

fashion when disturbed. In cold or inclement weather it retires to any convenient quarter. Its movements are never what I would call really active, in fact compared with other non-viperine snakes it is a sluggard and it does not appear capable of hurrying itself under any amount of stimulation.

It probably passes a long term of hibernation each year, coming forth like other snakes of temperate climes in the spring and retiring in the late autumn. In spite of this it manages to fatten itself amply, for in the autumn months, its organs are packed with fat to a degree that has made me suspect a gravid condition, but subsequent investigation has frequently proved such a specimen a male. This snake in common with many other will often when provoked flatten itself, or crouch on the ground in a remarkable manner. The flattening is most evident in the hinder part of the body, but what object the snake has in behaving so it is difficult to guess at. Mr. Gleadow has remarked on this peculiarity in this Journal (Vol. xii, p. 577).

Disposition.—The brown Himalayan viper is a lethargic individual, slow to anger, but if sufficiently provoked will bite. It would appear to avoid a disagreeable situation whenever possible rather than provoke an encounter. The specimens I removed into the open and played with, would pass by a stick, or other offending object pushed in their way again and again as if unconscious of the offence offered. If rapped on the tail they shook that appendage with vigour in acknowledgment of the insult, without turning to avenge it. If cover was within easy reach they always strived to get there, rather than show fight, but if baulked, or if severely struck they would coil themselves up, erect the head, quiver the tongue and vibrate the tail tip, and on further provocation would frequently strike out fiercely. I think it probable that they rarely inflict a bite unless trodden upon.

Food.—Stoliczka* says that it feeds principally on mice, but although my observations were made for the most part in the same part of the Himalayas as his, I never found anything in the stomachs of those captured in Kashmir except the little skink *Lygosoma himalayanus*. This beautiful little lizard with its cherry-red waistcoat, is extremely common in Kashmir, where one rarely turns over a stone, without

* Journ. As. Soc., Bengal, Vol. XXXIX., p. 226.

finding one quartered in company with an equally common black scorpion. So many of my brown Himalayan vipers had recently fed on this lizard, that it is evident, that they must contribute largely to checking their numbers. I have found as many as three *Lygosoma* in the stomach of a single *Ancistrodon*. In other parts of the Himalayas I have usually found this same lizard taken, but in Kumaon I have on four occasions known mice devoured.

Breeding.— I do not know the exact mating season, but it is probably in the spring—April or May. The period of gestation is also not known. Like most other vipers this species is viviparous in habit, and the young are launched forth probably in August and September. Several specimens I had in July were gravid and contained immature embryos. These were seen to be coiled spirally, in a bath of transparent fluid, which occupied the upper part of the yolk. The investing membrane covering this oval shaped bath was transparent, so that the contained fœtus could be seen clearly in every detail, before the egg investment was ruptured. The embryos I unravelled in July were about two or three inches in length. What the length of the embryo at birth is I cannot exactly state, but it is probably about 5 inches. The species is not very prolific, only from 5 to 7 embryos having been observed in a single brood.

Poison.—Nothing is known about the qualities of the poison and I have never been able to hear of a casualty in the human subject, except that of a cooly employed by Mr. P. W. Mackinnon near Mussoorie who was scratched in the thumb when attempting to capture one. The fact that the injury sustained was very slight and superficial and no ill effects of any sort were evoked makes it fairly certain that no venom had been injected in this case. A dog bitten on the nose this year at Binsar (Kumaon) suffered considerably. The whole muzzle swelled, and the animal was very distressed and affected constitutionally. The wound was not incised, but permanganate of potash was applied locally. One may assume that this reagent had little if any effect in neutralising any poison injected below the surface skin. After one day's serious illness, the dog improved, and in two more days was quite well again. There were no hœmorrhages reported. I did not see the dog, but the snake was referred to me and I learnt the details of the casualty later.

It would seem from this case that the poison is not very virulent,

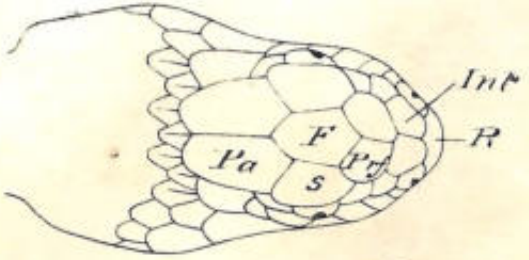
and it is probable that in the human subject a fatality is unlikely to occur, but it seems strange that we should know so little about the effects of the bite of so common a snake. There must be abundant casualties every year in the Himalayas, but so long as people before whom these cases are brought, refrain from publishing details, and omit to refer the offender to some authority for identification, our ignorance of the poison effects will remain what it is.*

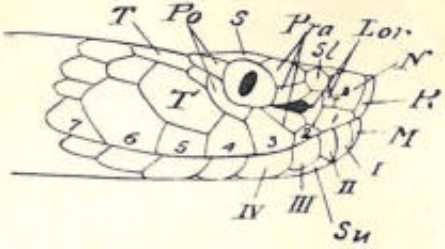
Distribution.—The Himalayas, probably as far as the Indus in the West and the Brahmaputra in the East. The Khasi Hills in Assam is also reported as a habitat, as far as I am aware on the sole authority of Jerdon. I think we should await confirmation of this before accepting it. It is a very easy matter for even the most careful collectors to mix specimens. In at least one instance, *viz.*, *Dinodon septentrionalis*, Jerdon was in doubt as to whether the locality was the Himalayas or Khasi Hills in Assam. I have also shown reason to doubt† the Himalayas as the habitat of the specimens of *Trachischium monticola* in the British Museum collected by Jerdon, this snake being otherwise only known from the Khasi and neighbouring Assam Hills, and it seems to me possible that in the case of *Ancistrodon himalayanus* Jerdon's specimens in the British Museum may have come from the Himalayas.

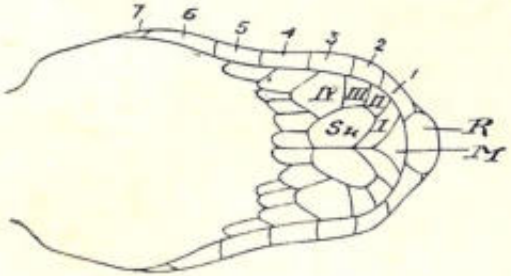
Lepidosis.—*Rostral.*—About as high as broad; in contact with six shields, the anterior nasal sutures being much the longest. *Internasals.*—A pair; the suture between them as long or nearly as long as that between the præfrontal fellows, as long or rather shorter than the internaso-præfrontal sutures. *Præfrontals.*—A pair; the suture between them subequal to the prefronto-frontal sutures; in contact with internasal, supraloreal, uppermost præocular, supraocular, and frontal. *Frontal.*—Touches six shields (exclusive of the small scales so often interpolated at the angles of the head shields); the fronto-supraocular sutures longest. *Supraoculars.*—Length and breadth subequal to that of the frontal. *Nasal.*—Usually incompletely divided by a suture from the nostril to first labial, which, however may be absent; sometimes an additional suture passes from the nostril to the internasal; in contact with the 1st only of the supralabial series. *Supraloreal.*—One, in contact with the internasal. *Loreal.*—

*This was written before Colonel Fenton's notes which appeared in our last Journ., p. 1004.

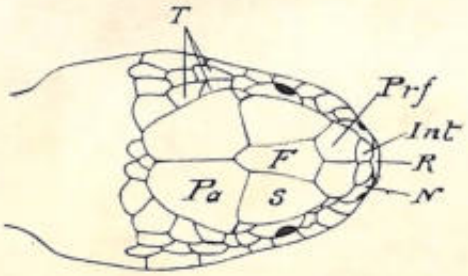
† Bomb. Nat. His. Journ., Vol. XIV., footnote, page 343.

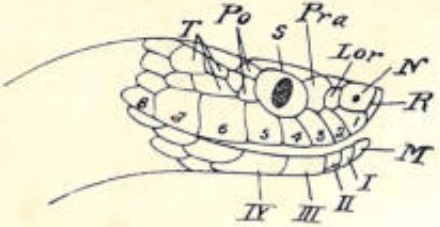


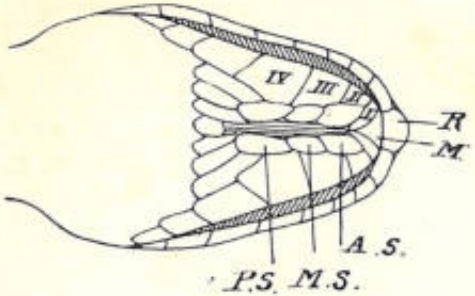




Ancistrodon himalayanus (× 2).







Psammodynastes pulverulentus (× 2).

EXPLANATION OF DIAGRAM.

ANCISTRODON HIMALAYANUS and *PSAMMODYNASTES PULVERULENTUS.*

A. S.	Anterior Sublinguals.
F.	Frontal.
Int.	Internasals.
Lor.	Loreals.
M.	Mental.
M. S.	Median Sublinguals.
N.	Nasals.
Pa.	Parietals.
Po.	Postoculars.
Pra.	Præoculars.
Prf.	Præfrontals.
P. S.	Posterior Sublinguals.
R.	Rostral.
S.	Supraocular.
Sl.	Supraloreal.
Su.	Sublingual.
T.	Temporals.
I to 8	Supralabials.
I to IV	Infralabials.

One deeply grooved, and forming the anterior boundary of the loreal pit. *Præoculars.*—Three, the two lowest diverging forwards, and forming the upper and lower boundaries of the loreal pit. *Postoculars.*—Usually two (sometimes three), the lower larger, and somewhat crescentic. *Temporals.*—Two, the lower very large and in contact with the 3rd, 4th and 5th supralabials normally (where the supralabials are 8, it touches the 4th, 5th and 6th). *Supralabials.*—Usually 7, the 2nd touching the eye (sometimes 8 with the 3rd touching the eye); the penultimate a very large and high shield. *Infralabials.*—Four, the 4th largest, and in contact with 3 or 4 scales behind. *Sublinguals.*—A single pair. *Costals.*—Two headslengths behind head, 21 usually (rarely 23), midbody 21 (rarely 23), two headslengths before the anus 17; all the rows strongly keeled except the last for a variable distance anteriorly; apical facets present in pairs. *Ventrals.*—144 to 166. *Anal.*—Entire. *Subcaudals.*—34 to 52, divided.

Abnormalities.—Small scales are often intercalated between the head shields. Rarely some of the anterior subcaudals are entire. I have never seen a specimen with the scale rows 23 in midbody, but Boulenger mentions such.

Colour.—Very variable. Specimens occur of a nearly uniform light brown, of various tints to blackish-brown. Usually the snake is more or less conspicuously marked with a coarse mottling or blotching, darker than the ground colour, and irregularly distributed. Sometimes more or less obvious short crossbars are apparent, and very frequently a light vertebral line bordered with dark zigzag or sinuous stripes laterally. The flanks are beautifully dappled with various shades of dark brown, and there are often some white mottlings at the side of the neck. The head is often darker than the back, and shows dark marks on the enlarged shields. A conspicuous oblique dark streak bordered with white, runs from the eye to the gape. The lips are enamel-white or pale pink, and so is the chin and throat, and many of the labial sutures pigmented. The underparts are very finely powdered with various tones of brown, sepia, rufous, plumbeous or dirty white. The tail is usually reddish towards the tip.

Dentition and jaws—Maxilla.—Upper half hollowed out into a cup, the external and posterior walls of which are deficient. This cup to which the præfrontal bone provides a roof, forms a spherical chamber—the loreal pit. Below the bone supports two canaliculate fangs.

Palatine.—Very short, about one quarter the pterygoid in length, highly compressed; not extending forwards as far as the maxillæ; a short edentulous space in front, and a longer space behind; supports 3 or 4 subequal well developed teeth. *Pterygoid.*—Highly compressed; from 6 to 9 subequal well developed teeth anteriorly; more than half its length edentulous behind. *Mandibular.*—Dentary bone about half the length of the articular; supports 11 teeth, gradually reducing in length behind.

The family *Colubridæ* according to the present accepted scheme of classification is divided into three large groups or "Series" based upon the absence, presence, and situation of grooved or tubular teeth (fangs). The *aglypha* (Greek "a" without and "glypho" I carve) are characterised by the absence of "carved" or grooved teeth. The *opisthoglypha* (Greek "opisthe" behind), has grooved fangs fixed in the posterior extremity of the maxilla or upper jaw, and the *proteroglypha* (Greek "proteros" before), has tubular fangs situated in the front of the maxilla. The fact that the fangs in the *opisthoglypha* are grooved, and those in the *proteroglypha* tubular has never yet been actually stated in works on ophiology, and in perusing the standard work on the subject, *viz.*, the Catalogue of the snakes in the British Museum by Mr. Boulenger one must of a necessity be misled, for the author repeatedly, if not invariably, speaks of grooved fangs in describing the dentition of the *proteroglypha*. As a matter of fact all the fangs in the snakes of this series are tubular, though there is always a very obvious seam on the anterior face of the fang where the circumflexed walls have united. The subject of this paper belongs to the opisthoglyphous series of colubrines, as will be seen on referring to the figure of the maxillary dentition. (See page 79).

This series is divided into three sub-families *Homalopsinæ*, *Dipsadomorphinæ* and *Elachistodontinæ*, the species of which are all harmless to men. *Psammodynastes* is one of the 69 genera into which the second of these sub-families is further divided.

PSAMMODYNASTES PULVERULENTUS.

The Mock Viper.

History.—This snake was first described by Boie in 1827, and for many years was classified as a *Psammophis*. In 1858 Günther

removed it from this genus on account of its corporeal habit which is much shorter, and stouter than that characteristic of *Psammophis*, and introduced the present generic name. There is no doubt that the two genera are very distinct, for though the maxillary dentition is very similar in both, I notice that there is a short edentulous gap between the 4th tooth, and the succeeding enlarged pair in *Psammophis* which does not occur in *Psammodynastes*. Of much greater significance however are the differences in shape of the præmaxillary, nasal, and frontal bones especially the last. Further the palatine bone in *Psammophis* is unusually short, not extending as far as the 4th maxillary tooth whereas in *Psammodynastes* it extends forwards to the 2nd tooth.

The genus *Psammodynastes* has but two species, one peculiar to the Malayan sub-region, *viz.*, *pictus*, the other also a Malayan snake whose range of distribution extends through a considerable area of our Indian Dominions, *viz.*, *pulverulentus*.

Nomenclature—(*a*) *Scientific.*—The generic name is from the Greek "psammos" sand, and "dunastes" a ruler. The specific title is from the Latin, meaning dusty.

(*b*) *English.*—The mock viper seems to me the most appropriate name for it, for it bears a very marked superficial resemblance to a viper, a fact remarked upon by most previous writers. Its similarity to the Himalayan pit viper *Ancistrodon himalayanus* is especially striking, as will be seen from our Plate, and I know of no more remarkable resemblance between any two snakes of different families, or even genera. The short and rather stout body, contracted tail, flattened head, swollen lips, large eye with vertical pupil, lustreless dorsal scales, and highly polished ventral plates are all very characteristic viperine traits, but the resemblances do not stop here, for its attitude of menace is very like that of vipers, added to which it is viviparous in habit.

(*c*) *Vernacular.*—I know of none.

General characters.—The head is flattened on the top, and rather almond-shaped, the snout narrowed in front, and rather short, and the neck very obviously constricted. The ridge from the eye to the snout (*canthus rostralis*) is very marked, separating the face from the crown. The upper lip is rather swollen giving a forbidding expression to the facies. The nostril is placed in a single shield, and the eye which is large has a vertically elliptic pupil, and an iris specked with gold. The body is rather stout, and short, and markedly compressed.

(Mr. Boulenger says it is cylindrical but this is a mistake.) The tail is short being about one-fifth to one-sixth the total length of the snake. The scales on the back are lustreless and smooth, those on the underparts highly polished.

Identification.—As far as I am aware it is the only Indian snake that has three pairs of sublingual shields, separated by a longitudinal furrow (the mental groove), but it will be wiser to take in conjunction with this the costal rows which are 19 in midbody. Another unusual feature in lepidosis that I should mention here is that the suture which the lower temporal makes with the penultimate supralabial is decidedly shorter than that made with the antepenultimate. In almost all other snakes where the temporal touches two supralabials the anterior suture is much shorter than the posterior.

Dimensions.—Adults usually range between about 1 foot 3, and 1 foot 9 inches. The largest specimen I have measured was a ♀ which was 2 feet and $\frac{3}{4}$ of an inch long.

Haunts.—It is eminently a forest lover. I have always met with it in jungle, or quite close to jungle, and its sombre colouration must offer it considerable protection in the gloom of such an environment. The area of its distribution is one remarkable for the abundance of its forests, and the dearth of anything approaching desert tracts, so that its scientific name "lord of the sands" is unfortunate. I have had several specimens sent to me from tea estates in the Eastern Himalayas and Assam where again there is abundance of cover and shade. Nicholson* mentions having taken one whilst swimming in the Rangoon lake. This was probably an accidental circumstance for it shows no special predilection for an aquatic environment, though like other land snakes it can evidently swim with ease when occasion demands it. It is a much commoner snake in the Hills than in the Plains, and favours especially altitudes between about 3,000 and 6,000 feet. In the Khasi Hills within these limits I found it quite a common snake, and in the Eastern Himalayas below Darjeeling I have had enough specimens sent me to show that it is to be considered one of the common snakes in this locality. Below 3,000 feet in the same vicinity it is decidedly less common, and Stoliczka† even records it as a rare snake there. It occurs in the

* Indian Snakes, p. 131. † Journal, Asiatic Society, Bengal, Vol. XL., p. 422.

Plains in Upper Assam and in Burma, but I would call it, an uncommon species at this level. In Burma Evans and I only got 4 specimens out of a total of considerably over 600 nearly all of which were collected in the Plains. In Assam I got only 5 in the Plains out of a total of 615 specimens.

Habits.—Though a vertical pupil is usually associated with a nocturnal habit, this snake appears to me to be more frequently abroad in the day time than at night, in fact most of my specimens, if not all, have been encountered during the day. It is a lively little creature exhibiting much activity when disturbed, and I have usually found it difficult to capture for two reasons, firstly owing to the agility with which it disappears into cover which is always adjacent, and secondly owing to the caution necessary in dealing with a snake that cannot be distinguished from a viper with any degree of certainty till after capture. I have liberated specimens in the open, on a road or in my verandah and it makes strenuous efforts to escape, even indulging in a series of leaps in order to evade recapture.

A hatchling of 4¾ inches that I had in captivity managed to scale, and cling to the face of the glass bottle in which it was incarcerated, the diameter of its prison being about 4 inches, a truly marvellous feat showing that its scansorial powers are little if at all inferior to that of the deftest climbing snakes, but in nature I have never noticed any inclination for it to climb into bushes or trees.

Disposition.—The mock viper is a plucky, and vicious snake. Those I have met with have usually menaced if they have not actually struck at me. One I had in captivity for some time invariably prepared to strike at me, adopting a truly viperine pose with head erect and the forebody retracted into sigmoid curves. Those I have flushed in their native haunts have usually struck viciously at me, and more than one trustworthy informant who has sent me a live specimen appears to have met with a similar experience. Blanford* mentions encountering one in Sikkim that nearly bit him. Even the little hatchling I had in captivity struck out fiercely at me. On the other hand I have had two specimens that refused to strike under severe provocation, though they posed as if intending to do so.

Food.—Its staple diet is of a reptilian order, frogs and lizards being equally favoured. On four occasions I have found frogs in the

* Journal, Asiatic Society, Bengal, 1871, p. 373.

stomach, once in a diminutive specimen only 7½ inches long. The lizards I have known taken are *Ptyctolæma gularis* once, a *Calotes* once in Shillong which was almost for certain *jerdoni* as the scales were of a vivid green colour, and skinks of the genus *Lygosoma* on three occasions, two of these being *L. indica*.

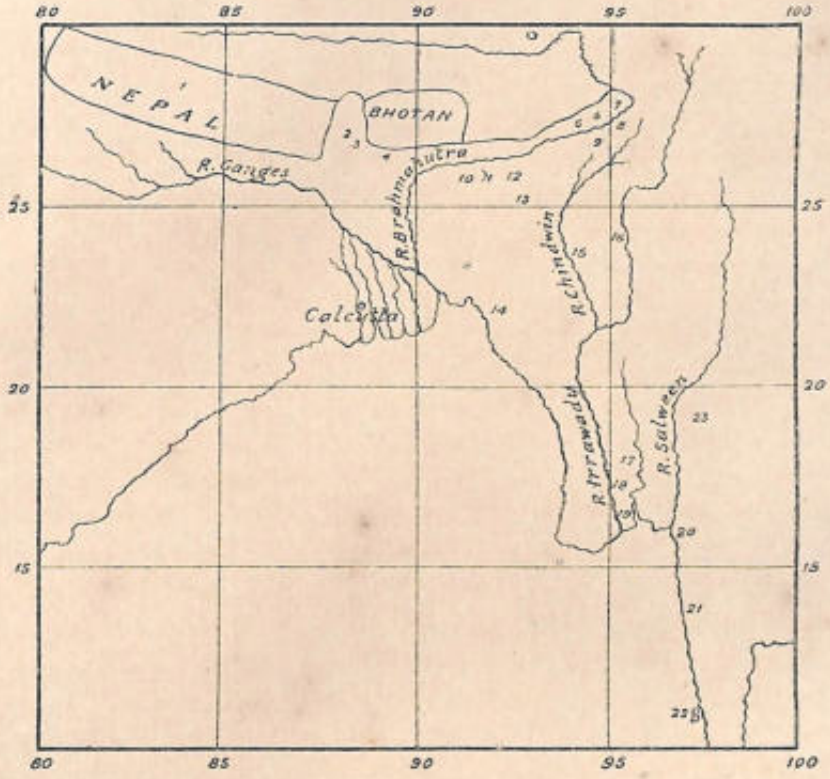
The sexes.—My notes show that the sexes are evenly balanced, and with the exception of one unusually large ♀ my measurements seem to indicate a similar degree of growth between them. Males as a rule have rather longer tails.

Breeding.—I have had opportunities of chronicling but few breeding events, so that I cannot speak with any great certainty of this important function. In the hills the mating season would appear to be in summer, probably about August since I have had two specimens with impregnated ovarian follicles in September in the Khasi Hills (Shillong) and one in the same month in the Eastern Himalayas (Pashok). As regards the Plains I can vaguely suggest that matrimonial intercourse probably occurs in the winter months—December to February—at least so it would appear. The period of gestation is not known, but probably exceeds four months, since the young are discharged alive. The gravid ♀ I kept in Dibrugarh appeared obviously in this state two months before I killed her and eviscerated her unborn progeny. In the Plains the young are born in June and July, for I captured a hatchling 4¾ inches long in Rangoon in June and the almost mature embryos of my captive Dibrugarh specimen just alluded to were expected in July.

The young at birth measure from about 4¾ to 5¼ inches. The species is not very prolific from an ophidian standpoint. I have on two occasions found 10 eggs in the oviducts, once 8, and in my Dibrugarh specimen there were 3 embryos, and 3 non-fertile eggs.

The rate of growth is somewhat difficult to calculate from my records, but it appears to me that the young double their length in the first year, add some 4 to 6 inches in the second, and at the beginning of their third year appear to be sexually mature since my smallest gravid ♀ measured 1 foot 3¾ inches. These deductions are in consonance with my observations on other snakes.

Distribution.—The Eastern Himalayas probably as far West as the Western limit of Nepal, the Assam Hills and Plains, the Burmese



DISTRIBUTION OF *Psammodynastes pulverulentus* WITHIN INDIAN LIMITS.

1. Butal, Nepal (I.M.). 2 Pashok (F.W.). 3 Tindharia (F.W.). 4 Buxa Dooars (F.W.). 5 Dejao, N. Lakhimpur (F.W.). 6 Dibrugarh (F.W.). 7 Sadiya (F.W.). 8 Jaipur (F.W.). 9 Sibsagar (I.M.). 10 Shillong (F.W.). 11 Cherrapunji (I.M.). 12 Samaguting (I.M.). 13 N. Cachar (I.M.). 14 Chittagong (I.M.). 15 Kindat (F.W.). 16 Katha (F.W.). 17 Wumbezat (Wall and Evans). 18 Pegu (I.M. and Theobold). 19 Rangoon (Nicholson, Wall and Evans). 20 Moulmein (I.M. and F.W.). 21 Tavoy (I.M.). 22 King's Isle, Mergui (I.M.). 23 Tounggyi, S. Shan States (B.M.).

I.M. implies Indian Museum, B.M. British Museum, and F.W. the Writer.

Hills and Plains, Indo-China, Tenasserim, the Malay Peninsula, and the whole Malayan Archipelago to Formosa.

The precise localities from which it has been collected within Indian limits are shewn in the accompanying map.

In the Indian Museum there is a specimen said to be from the Central Provinces of India, but as this seems to me most unlikely it is best to await confirmation of this locality, which is so far removed from its certain area of distribution, before accepting it.

Lepidosis.—Rostral.—Touches 6 shields, the rostro-nasal sutures longest. *Internasals.*—Two, the suture between them $\frac{2}{3}$ to $\frac{3}{4}$ that between the præfrontal fellows, about $\frac{3}{4}$ the internaso-præfrontal suture. *Præfrontals.*—Two, the suture between them equal to or rather greater than the præfronto-frontal suture; in contact with internasal, nasal, loreal, upper præocular, supraocular, and frontal. *Frontal.*—Touches 6 shields, the supraocular suture about three times the length of the parietals, and more than twice that of the præfrontals. *Supraoculars.*—Length subequal to frontal, breadth about twice that of the frontal along an imaginary line connecting the centres of the eyes. *Nasals.*—Single; in contact with the 1st only of the supralabial series. *Loreal.*—One, rather longer than high. *Præoculars.*—One or two (rarely three). *Postocular.*—Two (rarely three). *Temporals.*—Two anterior, in contact with the 6th and 7th supralabials, making a longer suture with the 6th than with the 7th. *Supralabials.*—Eight, the 3rd, 4th and 5th touching the eye; the 6th and 7th subequal, and largest. *Infralabials.*—Four, the 4th largest and in contact with two scales behind; the first three touch the anterior and the 4th only the posterior sublinguals. *Sublinguals.*—Three pairs. *Costals.*—Two headslengths behind the head 17, midbody 17, two headslengths before the anus 15; the row absorbed is the 4th above the ventrals; no keels; no apical pits. Ventrals 146 to 175. *Anal.*—entire. *Subcaudals.*—45 to 68 divided.

Colour.—Theobald speaking of this snake says: "This species is somewhat variable in colour and markings." I would go further, and say it is very variable, as much so as any snake I know. Some specimens are extremely dark, almost black, others very light, the prevailing hue being a pale ochraceous, but these extremes cannot be considered colour varieties for they are completely connected by transitional forms. Moreover one of the embryos I extracted from

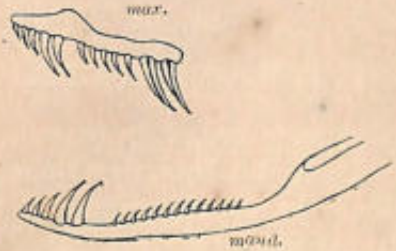
my gravid ♀ was of the light type and the two others of the dark. It must not be understood that in either case the snake is uniformly coloured for this is not so. It is always more or less obviously finely speckled or streaked with hues darker than the ground colour. There is very usually a series of large, oval, rufous or brown spots on each side of the spine, most noticeable anteriorly, and specially in the dark specimens. Sometimes these spots are confluent to form crossbars over the back. In many specimens there is a more or less distinct dark longitudinal band on the back involving the median five rows and half the sixth row above the ventrals, and a similar dark band in the flanks involving the lower half of the fourth, the third and the second, and upper half of the ultimate row. The flanks are often ornamented with white streaks anteriorly which are more or less hidden until the reptile dilates itself, and below these is usually a series of bright ochraceous, yellow streaks or spots, sometimes confluent into a band which are very conspicuous and ornamental. The head is usually streaked longitudinally on the top, and the upper lip is adorned with a white, black-edged mystaceous band. The belly is whitish or yellowish streaked, and finely specked with bright ochraceous-yellow anteriorly and with darker shades of brown further back.

Abnormalities.—I have seen the 1st supralabial divided into two superimposed parts once, and a similar condition of the loreal twice. Three præ and three postoculars less rarely occur. Boulenger says the scale rows are rarely 19.

*Dentition.**—*Maxillary.*—The first 3 (rarely 2) teeth are small but progressively increase in size, and are succeeded without any edentulous gap by two large subequal fang-like, but solid teeth fully twice as long as any of the preceding. Behind these is a short toothless gap, and then a series of 5 (rarely 6) small subequal

* Boulenger's description "Maxillary teeth 9 to 11, third or third and fourth much enlarged fang-like, followed by a short interspace, last enlarged and grooved, anterior mandibular teeth strongly enlarged" is not very accurate, and it is therefore not surprising that as recently as 1905, the snake was redescribed by Mr. Rosen (Ann. and Mag. Nat. Hist. Vol. 15, p. 176), as the type of a new genus under the name *Anisodon lilljeborgi*. It will be seen however that the characters of the dentition as shown by him, prefectly agree with that given by me from my three skulls, and Mr. Boulenger's remarks on Mr. Rosen's paper above alluded to showing that *A. lilljeborgi* is in reality *P. paleraleatus* are undoubtedly correct.

teeth followed by two large, subequal grooved fangs fully twice as long as the immediately preceding teeth.



Maxilla and mandible of *Psam: pulverulentus* (×3.)

Palatine.—8 to 11 small and subequal.

Pterygoid.—21 to 23 small and subequal.

Mandibular.—The first 2 or 3 teeth are small, progressively increasing in size, and succeeded without any gap by two large, subequal teeth fully twice as large as any of the preceding. Behind these is a short edentulous gap, followed by a series of from 13 to 15 small, subequal teeth.

(*To be continued.*)

ON THE NOMENCLATURE OF THE INDIAN HEDGEHOGS.

BY

R. C. WROUGHTON, F.Z.S.

Recently in naming some hedgehogs presented to the National Collection, by Major Dunn, R.A.M.C., from Multan, I had occasion to go through the whole of the material available for examination in the Collection of the Natural History Museum, South Kensington. This material is far too incomplete to admit of any revision of the Genus. My study of the literature, however, has shown many points on which the nomenclature adopted by Blanford in his Fauna requires correction, and these I think it well to place on record.

First, however, I would call the attention of members to a few points on which information is specially required.

Two species (*spatangus* and *grayi*) were described by Bennett from the "Himalayas" in 1832, and in 1843 Gray founded *mentalis* on a specimen from the same locality. In the latter case there is reason to believe that the label-locality was wrong; was it so also in the former case? Is any species of hedgehog found in the Himalayas?

Two species of hedgehog, with the middle upper existing premolar (the 5th tooth from the back, the 6th from the front) showing a tendency to disappear, are found one in the north (Kach, Rajputana and Lower Sind), the other in the south (Madras). Is it a fact that in the southern species the zygomatic arch is *always* imperfect?

Is no species of hedgehog found in the Dekhan, *i. e.*, between Rajputana and the Madras Presidency? *

What exactly is *E. collaris*? Specimens of varying ages from the type locality, *i. e.*, Doab (this apparently means the area between the rivers Jumna and Ganges) can alone satisfactorily settle this question.

The following are the corrections in the nomenclature of Blanford's "Mammalia" which seem to be required.

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* It is hoped that members will respond to Mr. Wroughton's appeal and send specimens of Hedgehogs to our Museum. Hedgehogs may be easily captured alive and probably a small reward offered to cultivators for live specimens would result in many being obtained. They can then be forwarded alive and this Society would convert them into specimens thus saving members the trouble of skinning them.—Eds.

"104. ERINACEUS COLLARIS"—

Type—A coloured plate without description.

Date—1830.

Locality—Doab.

Synonymy.—Royle, (Ill. Ind. Zool.) in 1839, gave the name of *indicus* to the Delhi Hedgehog but without description. Bennett in 1832 described *spatangus* and *grayi* from the "Himalayas" (Types B. M. Nos. 55, 12, 24, 34 and 55, 12, 24, 82). It must be left till further material is available for examination to decide whether these names should remain, as Blanford has placed them as synonyms of *collaris*. The name *blanfordi* must be removed from the synonymy of *collaris* for reasons given below under *jerdoni*.

"105. ERINACEUS MEGALOTIS"—

Types—B. M. Nos. 79, 11, 21, 515 and 516 (skulls only).

Date—1845.

Locality—Kandahar.

A well marked species, easily recognizable by its pale head and throat and dark underparts.

"106. ERINACEUS JERDONI"—

Co-Type—B. M. Nos. 87, 4, 2, 1.

Date—1878.

Locality—Rohri, Sind.

This name must give place to *blanfordi*, which was described at the same time, but on an earlier page. Anderson stated that the type of *blanfordi* (B.M. Nos. 87, 4, 2, 2) also from Rohri, Sind, had no bald area on the crown, this was an error. Comparison of the types shows that they are one species and *blanfordi* as the older name must be used, with *jerdoni* as a synonym.

"ERINACEUS MACRACANTHUS"—

Co-Type—B.M. Nos. 74, 11, 21, 25.

Date—1876 (East Persia by Blanford, p. 27).

Locality—S. E. Persia.

A large species, with a bald area running backwards over the crown of the head, as in *blanfordi*; spines long, with four alternate, dusky and white rings, 5mm. broad, and a long (10mm.) black point. Colouring somewhat in *megalotis* but the pale area extending backwards at least on to the chest. Hindfoot about 40mm. Blanford

records it from Beluchistan and the Natural History Museum has a specimen collected at Kandahar by Colonel Swinhoe in 1881.

"107. ERINACEUS PICTUS"—

Type—?

Date—1872.

Locality—Kach.

This name must give place to *micropus*, which was described by Blyth in 1846 on a specimen (B.M. Nos. 79, 11, 21, 517, skull only) collected by Capt. Hutton at Bhawalpur. The zygomatic arch is complete. The name *micropus*, therefore, must stand for this species, with *pictus* as a synonym.

Synonymy.—In 1843 Gray in his Catalogue named a specimen, labelled "Himalaya" (B. M. Nos. 42, 4, 12, 16) purchased from a dealer, *mentalis*, but gave no description. There seems great probability, however, that the specimen was from Nasirabad.

"108. ERINACEUS MICROPUS"—

As *micropus* applies to a northern form, it cannot be used for the Madras Hedgehog, which was described by Horsfield in 1851 on a specimen (B.M. Nos. 79, 11, 21, 467) collected by Sir Walter Elliot under the name of *nudiventris*. This latter name must therefore stand for this "South-Indian Hedgehog."

Thus corrected, the list of the Indian Hedgehogs is as follows :—

1. *Erinaceus collaris*, Gray and Hardwicke
   = *indicus*, Royle (nomen nudum)
   = *spatangus* et *grayi*, Bennett.
2. *Erinaceus megalotis*, Blyth.
3. *Erinaceus blanfordi*, Anderson
   = *jerdoni*, Anderson.
4. *Erinaceus macracanthus*, Blanford.
5. *Erinaceus micropus*, Blyth
   = *pictus*, Stoliczka
   = *mentalis*, Gray (nomen nudum).
6. *Erinaceus nudiventris*, Horsfield.

THE MOTHS OF INDIA.

SUPPLEMENTARY PAPER TO THE VOLUMES IN "THE FAUNA OF BRITISH INDIA." SERIES IV, PART I.

By

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(*With Plates F. and G.*)

Bombycidæ.

The genera *Bombyx* and *Mustilia* have the frenulum aborted and

THE MOTHS OF INDIA.

Plates F. and G., referred to in this paper, will appear in a subsequent number.

Eds.

shoulders, its body wide and flattened at the shoulders, narrowing and cylindrical at extremity, the anterior segments protrusible; a horn on anal segment; 16 feet, naked, leathery brown, darker on dorsum with a dark olive spade-shaped patch towards extremity; lateral patches of yellow, the whole body dotted with green; five small grey patches dotted with black on back, two yellow lines on the neck and two yellow spots on the spade-shaped patch: the ventral surface with a yellow patch on each segment, legs pink; prolegs with bright yellow dot on outer side. Food plant: *Camellia caudata*.

Cocoon.—Strong, silky, dull brown, pointed at one end and truncate at the other (Badgley).

47*a*. Andraca albilunata, n. sp. (Plate F., f. 2).

Forewing with the termen strongly excised below apex, angled outwards at vein 4, then strongly crenulate; hindwing with the termen slightly excised below apex and strongly crenulate from vein 4 to tornus, the inner margin not excised.

Head, thorax and abdomen dark red-brown mixed with grey, the tarsi with the

terminal joint blackish. Forewing dark red-brown mixed with grey ; a deeper red-brown antemedial band defined by greyish on inner side and with slightly waved edges, oblique from costa to submedian fold ; an indistinct brown discoidal bar with grey line in centre ; a waved brownish medial line and waved grey postmedial line with somewhat deeper brown band between them ; small obliquely placed subapical white lunules below veins 7 and 6 with a reddish tinge beyond them. Hindwing red-brown with a greyish tinge , a small brown discoidal spot and chocolate brown spots on inner margin before and beyond middle with greyish marks beyond them ; cilia with whitish tips in the indentations, underside of forewing chocolate brown, the costa grey to postmedial line with brown spot beyond middle ; hindwing grey with brown discoidal spot, two waved brown postmedial lines with the area between them tinged with red-brown and a diffused red-brown patch at tornus.

Habitat.—Assam, Khásis (Badgley). *Exp.* ♂40, ♀46 mill. Type in B. M.

Larva.—Turns its head down and humps its shoulders in repose ; gregarious, long, cylindrical ; pairs of horns on 3rd and 5th somites and a single horn on anal somite ; 16 feet ; pubescent ; dull black dusted with grey ; dorsal line pale yellow ; subdorsal and lateral lines orange; two ventral yellow lines; broad yellow patches between the prolegs ; head black ; horns dusky with orange bases and whitish at tips. Food plant : *Cudranus javanicus.*

Cocoon.—Strong, silky, blunt in front, pointed behind with long ligaments at each end and a hollowed out boat-shaped projection on dorsum (Badgley).

EUPTEROTIDÆ.

65*a*. Apona khasiana, Swinh., A. M. N. H. (7), xx, p. 75 (1907).

Head, thorax and abdomen rufous ; antennæ with the shaft white, the branches brown. Forewing pale rufous, the basal area, the area beyond the medial line and the terminal area rather deeper rufous ; an obliquely curved antemedial line with a faint line beyond it, somewhat angled outwards below costa and bent outwards below submedian fold a black discoidal point ; a nearly straight and somewhat oblique medial line followed by a waved line; two waved postmedial lines ; an incurved subterminal line followed by an indistinct line with greyish patches beyond it at apex and middle, excurved to vein 6, incurved at middle, then waved. Hindwing pale rufous, the basal inner area and terminal area rather deeper rufous ; a diffused oblique rufous antemedial band, two oblique waved medial lines and a minutely waved postmedial line ; the underside with the lines more distinct, the antemedial line double, three waved lines on medial area, the postmedial line excurved to vein 5 and with maculate band beyond it except at middle.

Habitat.—Assam, Khásis. *Exp.* ♂ 98, ♀ 110 mill.

70. Eupterote mollifera., insert (syn.) *Eupterote pulchra*, Swinh., A. M. N. H. (7), XVIII, p. 404 (1906).

86*a*. Sangatissa arctiades, n. sp. (Plate F., f. 30).

Antennæ of both sexes bipectinate with moderate branches.

Head and thorax fulvous ; antennæ with the shaft whitish, the branches brown ; pectus, legs, and abdomen greyish tinged with fulvous. Forewing pale cinnamon brown, the veins, discal and submedian folds streaked with white. Hindwing white tinged with brown, thinly scaled.

Habitat.—ASSAM, Khásis (Badgley). *Exp.* 36-46 mill. Type in B. M.

Larva.—Feeds at night and rests during day in a company on underside of leaf, the head and tail curved under in repose ; cylindrical ; hair soft, thick with scattered long hairs; dull brown with the long hairs grey ; ventral surface dull red ; head black. Food plant : *Vitisadnata.*

Cocoon.—Silken mixed with hairs, slight, oval, in a cluster, grey-brown.

Pupa.—Short, blunt at both ends, a tuft of fine hooks at tail by which it is fastened to cocoon ; shining bright brown. (Badgley).

SPHINGIDÆ.

ACHERONTIANÆ.

Genus PENTATEUCHA.

Type.

Pentateucha, Swinh., A. M. N. H. (8), 1, p. 61 (1908)..... *curiosa.*

Proboscis fully developed ; palpi upturned, slender, reaching about to middle of frons, the 2nd joint fringed with long hair in front, the 3rd short ; frons with tuft of hair ; antennæ of female ciliated ; thorax clothed with long rough spatulate hair ; tibiæ fringed with long hair, the hind tibiæ with two pairs of spurs, the fore tarsi with three large curved claws on 1st joint ; abdomen clothed with long rough hair ; frenulum present. Forewing with the apex rounded, the termen evenly curved, crenulate, vein 3 from well before angle of cell ; 5 from middle of discocellulars ; 6 from upper angle ; 7, 8, 9 stalked ; 10, 11 from cell. Hindwing with vein 3 from well before angle of cell ; 5 from well above angle ; 6, 7 from upper angle ; 8 approximated to 7 beyond the cell.

171*a*. PENTATEUCHA CURIOSA, Swinh., A. M. N. H. (8), 1, p. 62 (1908) (Plate F., f. 18).

♀. Head and thorax clothed with deep red-brown hair tipped with white ; pectus and legs rufous, the tarsi blackish ; abdomen blackish mixed with grey-white forming obscure segmental bands, the anal tuft and ventral surface rufous. Forewing clothed with dark red-brown hairy scales mixed with white, some rufous at base of inner area ; faint traces of a dark antemedial line ; an oblique elliptical white discoidal spot ; postmedial line with oblique dark bar from costa, then very indistinct, excurved to vein 3, then incurved ; subterminal line indistinct, double, oblique, waved, bent inwards to costa, where there is a white mark on it, a dentate line beyond it arising from apex, white and prominent from apex to vein 6, then indistinct and forming white points on the veins ; cilia rufous with whitish points at the veins. Hindwing bright rufous, the inner area whitish to near tornus, where there is a dark patch with whitish bar beyond it ; an indistinct diffused pale postmedial line ; cilia with some white scales at tips. Underside of both wings, rufous ; forewing with indistinct pale discoidal spot, obliquely curved postmedial band and

prominent dentate white band from apex to above vein 6 ; hindwing suffused with white to beyond middle and tornus, an oblique slightly waved medial rufous line and indistinct postmedial line bent outwards to just above tornus, the terminal area irrorated with whitish.

Habitat.—Assam, Khasis. *Exp.* 104 mill.

Ambulicinæ.

91*d*. Marumba microta, Hmpsn., Nov. Zool. xiv., p. 327 (1907). (Plate F., f. 11).

Fore tibia with long curved claw at extremity.

♂. Head and thorax red-brown, the head rather paler, except the palpi ; antennæ whitish ; abdomen red-brown. Forewing grey-brown suffused with purplish rufous and with slight dark irroration ; a black and rufous subbasal spot on vein 1 ; an oblique brown medial line diffused on outer side ; postmedial area somewhat greyer ; an indistinct slightly curved subterminal line with two conjoined red-brown spots on it at inner margin ; a small dark brown spot on termen below apex defined by a grey lunule on inner side and with a very indistinct triangular brown shade below it from termen to the subterminal line ; cilia dark brown. Hindwing purplish red-brown with indistinct darker shade on termen near tornus ; cilia dark brown with slight whitish tips towards tornus ; the underside rather redder with indistinct medial line and curved postmedial line.

Habitat.—Madras, Godavery District ; Ceylon, Kandy. *Exp.* 44 mill.

91*e*. Marumba poliotis, Hmpsn., Nov. Zool., xiv., p. 327 (1907). (Plate F., f. 23).

Fore tibia with large curved claw at extremity.

♂. Head and thorax grey white, the head and tegulæ tinged with rufous ; metathorax with two slight tufts of blackish scales ; tarsi ringed with black ; abdomen grey-white dorsally suffused with rufous except at base and with fine black dorsal line expanding into a small spot on penultimate segment. Forewing grey suffused with reddish brown and irrorated with black, the basal and terminal areas browner and the postmedial area whiter ; some blackish suffusion before the whitish antemedial line which is defined by blackish on outer side, oblique from costa to median nervure, angled inwards in submedian fold, then excurved and angled inwards to inner margin ; a dark medial line excurved from costa to median nervure, then incurved to near antemedial line ; a small pale rufous discoidal spot, slightly defined by blackish ; postmedial line dark, excurved from costa to vein 5, then incurved and sinuous ; subterminal line indistinctly double, excurved below costa, then oblique, dentate and with small somewhat dentate black marks on its outer edge, the mark below costa extending as a streak to termen and the mark at vein 4 larger ; slight black marks on termen at the extremities of the veins. Hindwing grey suffused with brown ; postmedial line excurved and indistinct from costa to vein 4, then incurved and with whitish patch beyond it in submedian interspace, ending at tornus ; the underside whitish irrorated with fuscous, the

postmedial line fine, a curved dentate subterminal line with slight brownish band beyond it becoming terminal below vein 4.

Habitat.—GANJAM. *Exp.* 54 mill.

MACROGLOSSINÆ.

113*b*. AMPELOPHAGA OBLIQUIFASCIA, n. sp. (Plate F., f. 13).

♀. Head and thorax grey slightly mixed with red-brown, the vertex of head and dorsum of thorax red-brown; palpi with white line on 1st joint at side, the 2nd joint red-brown at side; pectus ventrally orange-red; tibiæ and tarsi grey-white; abdomen grey with broad diffused dorsal deep red-brown bands, the ventral surface fiery red with segmental brown lines. Forewing purplish grey tinged in parts with red-brown; subbasal diffused red-brown marks in cell and on vein 1; three rather indistinct and diffused curved waved antemedial brown lines; a slight discoidal point; a rather broad black-brown band from middle of costa to termen at vein 4, expanding somewhat at costa and into a large triangular patch on termen extending almost to tornus; postmedial line slight and dentate from costa to the oblique band, then oblique more strongly dentate with some fulvous yellow on its outer side, with a waved line before it from vein 2 to inner margin and two waved lines beyond it from the band to inner margin; subterminal line double, brownish and slightly waved from costa to vein 5, indistinct except toward costa where it is filled in with yellowish; a wedge-shaped brown mark on termen below apex; cilia black-brown. Hindwing dark-brown tinged with red, the inner area greyish; cilia rufous, whitish at tips. Underside of forewing fiery red with the termen grey, some dark brown suffusion in and below cell, six indistinct waved lines on postmedial area, a pale yellow subapical lunule and two wedge-shaped postmedial marks below veins 3 and 2; hindwing fiery red, the inner area greyish, the terminal area brownish, three indistinct minutely waved red postmedial lines.

Habitat.—ASSAM, Khásis (Badgley). *Exp.* 80 mill. Type in B.M.

Larva.—Tapering to head, the thoracic somites very protrusible; head small; green with pale dots; subdorsal line white shading off to oblique yellow lateral stripes tinged with pink above; spiracles small, pale brown; horn brown; purple; feet maroon with a yellow mark above each. Pupates in leaves spun together.

Pupa.—Long with two horns on head and three at tail, the posterior third of tail much smaller than the anterior part which forms a prominent ring; dark brown with paler marks (Badgley).

Genus LEPCHINA.

	Type.
Lepchina, Oberth. Bull. Soc. Ent. Fr., 1904, p. 76.....	*tridens.*

Differs from *Acosmeryx* in the eyes being small, overhung by lashes; the terminal segment of antennæ not filiform; the tibial spines shorter; the 1st segment of mid-tarsi without elongate spines. Forewing with the termen

produced to points at and below apex and excurved at middle. Hindwing with the termen sinuous.

116*a*. LEPCHINA TRIDENS, Obuth. Bull. Soc. Ent. Fr. 1904, p. 76.

♂. Head and thorax violaceous grey ; abdomen brown ; ventral surface reddish. Forewing violaceous grey with velvety brown lines and patches; the basal area with three lines followed by a postmedial triangular patch touching a discoidal point with its inner edge and extending from costa to termen and inner margin ; the apical area with some streaks and marks. Hindwing brown with darker medial and terminal shades. Underside ferruginous red ; forewing with the basal half blackish, two greyish costal patches, a sinuous terminal violet grey patch on both wings with medial whitish mark on forewing ; two double brown lines on hindwing with greyish costal patch beyond them.

Habitat.—SIKKIM. *Exp.* about 64 mill. This species is unknown to me.

181. MACROGLOSSA GYRANS.

Larva.—Velvety black with green and pink lateral stripes faintly striated with black ; spiracular stripe interrupted, similar in colour ; the spiracles pink with white centres ; head glabrous, green or pale red ; thoracic plate horny ; horn black.

Pupa.—Ochreous with black spots at sides. 5. (W. H. Campbell.)

198. MACROGLOSSA RECTIFASCIA.

Larva.—Pale yellow with faint blue transverse lines ; dorsal line very dark blue edged with pale blue from 3rd to anal somite ; lateral line similar, arising from two large black spots on 2nd somite and terminating just before two large black spots on anal somite ; below this is a series of black specks; a broad sublateral black band spotted with pale blue ; head prominent, dull green ; legs black ; claspers spotted with black ; horn pale blue with a black ring at base. Food plant : *Photinia Lindleyana*. 5. (W. H. Campbell.)

PERGESINÆ.

137*e*. RHAGASTIS LEUCOCRASPIS, n. sp. (Plate F., f. 25).

♀. Head grey ; palpi whitish at sides ; tegulæ and patagia chocolate brown with grey-white stripe on outer edge ; vertex of thorax grey-brown ; pectus and legs pale grey tinged with rufous ; abdomen with the 1st three segments chocolate brown, the rest of dorsum greyish tinged with fulvous, the sides whitish, the ventral surface tinged with rufous. Forewing purplish grey suffused in parts with rufous ; a subbasal rufous shade on costal area, the base of inner margin chocolate brown ; two obliquely curved antemedial brown lines, widely separated at costa, approximated at vein 1 where they terminate ; an oblique rufous shade from costa at antemedial line to medial line at vein 3 ; medial line double, waved, obliquely curved from costa to vein 2, then slightly excurved ; postmedial line obliquely curved, dentate, at veins 4·3 produced to points and with slight fulvous marks on it ; a triangular chocolate brown patch on costa just before apex, the faint waved subterminal line arising from it ; the apex slightly tinged with white ; cilia dark brown. Hindwing black-brown, the inner margin, terminal area in submedian interspace and termen

towards tornus whitish; cilia grey with a brown line through them. Underside of forewing reddish fulvous, the disk fuscous, a fuscous striga from costa towards apex, subterminal line oblique from costa near apex to below vein 7, then dentate, the area beyond it grey; hindwing reddish fulvous, the inner area and termen greyish, an indistinct curved minutely waved postmedial line.

Habitat.—U.P. Assam, Dibrugarh (E. C. Ward). *Exp.* 96 mill. Type in B. M.

NOTODONTIDÆ.

211 *b*. Dudusa synopla, Swinh., A. M. N. H. (7), XIX, p. 205 (1907).

♀. Antennæ bipectinate with long branches, the apical part serrate.

Head and thorax rufous mixed with some ochreous scales; antennæ black; upper part of frons and vertex of head tinged with fuscous; thoracic crest with some long spatulate black scales; pectus and legs with fuscous mixed, the mid and hind tibiæ with small tufts of ochreous hair at extremity; tarsi blackish, fulvous at extemities; abdomen rufous and ochreous, with broad diffused lateral fuscous bands, the anal tuft with some spatulate black hairs. Forewing ochreous suffused with rufous and slightly irrorated with brown, the veins blackish; a black point below base of cell; an oblique blackish subbasal diffused line from costa to submedian fold, with ochreous bar beyond it from costa to costal nervure; antemedial line indistinct, dark, defined by ochreous on inner side, waved, angled outwards on median nervure, crossed by a faint diffused oblique dark fascia from submedian fold to above inner margin near base, a broad diffused oblique blackish fascia from costa beyond it to termen between vein 3 and submedian fold; postmedial line double filled in with ochreous, waved, oblique from vein 7 to submedian fold, then excurved, a silvery white wedge-shaped mark from its inner edge to beyond it below vein 4; a rather diffused dark subterminal line arising at vein 7, oblique to vein 4, excurved to vein 3, then somewhat oblique; a series of lunules before termen defined by blackish on inner side and with slight double lines on inner side cilia with a series of blackish lunules. Hindwing ochreous almost wholly suffused with fuscous leaving some ochreous at base of inner margin and at tornus; a terminal series of dark lunules; cilia pale rufous with series of blackish lunules; the underside ochreous tinged with rufous and slightly irrorated with fuscous, a black discoidal spot, curved waved postmedial line and subterminal series of black lunules.

Habitat.—Assam, Khásis. *Exp.* 118 mill.

215 *a*. Rachia nodyna, Swinh., A. M. N. H. (7), XIX, p. 206 (1907).

♂. Head and thorax pale and dark brown; antennæ and tegulæ blackish; metathorax with blackish dorsal fascia; pectus and legs with fuscous mixed; abdomen fuscous brown, the sides pale towards base. Forewing purplish brown suffused with fuscous; antemedial line very indistinct, extremely oblique from costa to vein 2 well beyond middle, then very oblique and defined by a pale fascia above to vein 1 and angled outwards above inner margin; an oblique black streak above middle of inner margin; a slight pale streak

in lower end of cell ; a slight dark streak beyond the cell above vein 4 ; postmedial line very indistinct, angled outwards below costa, oblique to antemedial line at vein 2 where it is angled outwards, then oblique and represented by slight black striæ defined by ochreous on outer side ; a slight ochreous subterminal line, dentate and defined by black towards costa, below vein 4 very oblique and strongly defined by black on inner side ; a fine black terminal line. Hindwing white tinged with brown, the veins brown, the costal and inner areas suffused with brown ; a diffused brown subterminal line with whitish line on outer edge, the brown line faint to vein 3, then strong blackish and with small black lunule above it at vein 1 ; termen black brown ; a fine black terminal line ; cilia brown.

Habitat.—Assam, Khásis. *Exp.* 76 mill.

220 *a*. Phalera goniophora, n. sp.

Head and tegulæ reddish ochreous, the latter with whitish line near tips ; palpi, lower part of frons, antennæ and thorax rufous ; patagia silvery grey ; pectus and legs whitish mixed with brown, the tarsi banded with white ; abdomen with the basal half reddish ochreous, the terminal half brown banded with whitish, the ventral surface whitish. Forewing silvery grey suffused and irrorated with red-brown ; a waved subbasal line from costa to vein 1 ; antemedial line double, with dark points on the veins, somewhat incurved in submedian interspace ; three indistinct waved lines on medial area, with dark points on the veins ; apical patch yellowish white suffused with reddish ochreous except at margins and with three dark striæ from costa, ending at vein 5 and with its outer edge angled at veins 7 and 6, the double, nearly erect postmedial line arising from it and with a series of dark points beyond it ; subterminal line oblique from the apical patch to vein 2 and with some dark points beyond it ; a crenulate brown terminal line intersecting the cilia which are reddish ochreous. Hindwing red-brown tinged with greyish ; cilia yellowish white intersected with rufous. Underside whitish, the forewing suffused with brown except on apical area ; the hindwing with diffused brown medial band from costa to vein 2.

Habitat.—Punjab, Dehra Dun ; Assam, Khásis (Badgley). *Exp.* 66 mill. Type in B. M.

Larva.—Gregarious; cylindrical; hairy, the hair growing in rings on each segment ; black with brown rings interrupted dorsally ; eight white dorsal and lateral lines, one ventral line and short lines between the feet ; hairs pale brown, nearly white at tips ; feet brown ; head large. Food plant : *Quercus serrata*. 7. 8. 10. (Badgley).

221*c*. Phalera ochropis, n. sp. (Plate F., f. 8).

Antennæ of male bipectinate, the apex serrate ; forewing with vein 5 from middle of discocellulars, 6 from upper angle.

♂. Head and thorax deep rufous mixed with some ochreous ; pectus, legs and abdomen pale ochreous. Forewing pale ochreous, thickly irrorated with deep rufous ; a strong black fascia below the cell from base to antemedial line ;

subbasal line represented by an oblique black striga from costa; antemedial line indistinct, diffused, double filled in with whitish and oblique from costa to median nervure, then black defined on inner side by whitish, oblique, dentate, a black streak beyond it in lower part of cell; reniform with whitish annulus above and below, interrupted at middle; postmedial line black defined by whitish on outer side, bent outwards below costa, then oblique, dentate, a black streak from it to subterminal line above vein 3, a shorter streak above vein 6 and slight streak above 7; subterminal line represented by a series of oblique whitish striæ defined on outer side by black from below costa to vein 2, angled inwards in discal fold; the terminal area with whitish patches below apex and at middle, a terminal series of blackish points; cilia rufous with whitish streaks. Hindwing ochreous white suffused with brown; cilia pale; the underside ochreous white, the costal area irrorated with rufous.

Habitat.—Ceylon, Haputale (Alston). *Exp.* 52 mill. Type in B. M.

237 *b*. Pydna brunnea, Swinh., A. M. N. H. (7), XIX, p. 206 (1907).

♂. Head and thorax ochreous mixed with dull red-brown; abdomen ochreous suffused with reddish brown, the extremity and ventral surface slightly irrorated with brown. Forewing ochreous suffused with dull red-brown except on costal area and below basal half of cell and irrorated with a few black scales; claviform represented by a slight blackish streak; a slight pale streak in lower end of cell before the small ochreous-defined discoidal spot; postmedial line with small blackish spot on costa, bent outwards below costa, then represented by a double series of points, oblique below vein 4, a diffused ochreous mark beyond it on costa and a diffused patch on tornal area; cilia fuscous brown. Hindwing uniform dark brown; the underside ochreous tinged with brown except on costal area, a black discoidal spot and rather diffused oblique postmedial line dentate towards costa.

Habitat.—Assam, Khásis; Ceylon, Maskeliya. *Exp.* 60 mill.

260*a*. Stauropus inclusa, n. sp.

Antennæ of male serrate and fasciculate, of female ciliated.

Head and thorax dark red-brown mixed with white; abdomen grey suffused with rufous. Forewing whitish irrorated with dark red-brown, the inner half of basal area and the terminal area suffused with red-brown; a brown streak below base of cell; subbasal line represented by an oblique brown striga from costa; antemedial line strong, brown, inwardly oblique from costa to median nervure, then nearly erect and slightly angled inwards on vein 1; a slight brown discoidal bar; postmedial line brown arising from costa just beyond antemedial line, oblique to vein 6, then inwardly oblique, dentate and joining the antimedial line at inner margin; an indistinct pale waved subterminal line with a dark mark before it on costa and lunulate patches from vein 3 to inner margin; a series of indistinct pale lunules just before termen. Hindwing greyish suffused with red-brown; an indistinct curved medial line; cilia whitish at tips.

Habitat.—Assam, Khásis (Badgley). *Exp.* ♂ 48, ♀ 52 mill. Type in B. M.

Larva.—Gregarious ; cylindrical, with a small dorsal hump towards extremity, short scattered hairs ; yellow with black dorsal line ; two lateral lines ; stigmata ringed with black and with black striæ near them ; ventral surface black with broad yellow ventral stripe and yellow lines between the feet, which are black ; head large, red. Food plant : *Quercus griffithii*. 4. 5.

Cocoon.—On or underground ; strong pudding-dish shaped, formed of earth lined with silk.

Pupa.—Somewhat pointed at ends, short, red-brown with black spiracles (Badgley).

269 *b*. STAUROPUS DILUTA, n. sp.

Antennæ of male bipectinate with short fasciculate branches, of female ciliated.

Head, thorax and abdomen rufous mixed with grey. Forewing grey suffused and irrorated with rufous ; traces of a waved subbasal line, oblique towards costa ; traces of a waved antemedial line, double towards costa ; a slight whitish point on upper part of cell towards extremity ; postmedial line rufous, minutely dentate, bent outwards below costa, incurved at discal fold and strongly below vein 4 , subterminal line indistinct, pale, defined by brownish suffusion on postmedial area, incurved between veins 7 and 4 and below vein 3 ; a series of brown striæ before termen defined on inner side by slight pale lunules ; a terminal series of slight brown striæ. Hindwing whitish suffused with red-brown ; cilia white at tips ; the underside whitish tinged with red-brown.

Habitat.—W. CHINA, Omei Shán ; ASSAM, Khásis (Badgley). *Exp.* 42-62 mill. Type in B. M.

Larva.—Solitary ; tapering to both ends ; bright green with a fine red line and white band at sides ; head white with black and red lines and yellow cheeks ; fore feet tipped with pink.

Cocoon.—An oval hollow below the ground with slight papery lining.

Pupa.—Purplish black, roughened, the extremity paler with slight anal projection. Food plant : *Ilex exsalca*. 7. (Badgley).

282 *b*. CHADISRA SEMIFERREA, n. sp. (Plate F., f. 35).

♀. Head and thorax grey mixed with rufous ; palpi black at sides ; tarsi black ringed with grey ; abdomen grey tinged with brown, the basal crest mixed with rufous. Forewing grey irrorated with rufous and fuscous, and with deep ferruginous suffusion from near base to middle except on inner obsolete on costal half, blackish from submedian fold to inner margin to area ; antemedial line obsolete on costal half, blackish from submedian fold to inner margin to which it is bent inwards; a blackish medial line, rather oblique from costa to vein 2, then strongly bent inwards and erect to inner margin ; a deep rufous discoidal bar with some white above it and on outer edge ; postmedial line formed of black striæ slightly defined by white on outer side, oblique from costa to vein 6 and incurved below vein 2 ; a dark patch on postmedial part of costa with some whitish points on costa and two slight dark streaks above veins 7. 6. before the white subterminal line which is

incurved below costa and vein 2 and minutely dentate between those points, a series of small black spots defined by white on inner side before termen; a fine black terminal line. Hindwing grey suffused with brown, a rather darker terminal line; the underside rufous, the inner area pale.

Habitat.—CEYLON, Trincomali (Green). *Exp.* 50 mill. Type in B. M.

293*b*. NOTODONTA COLLARIS, Swinh., A. M. N. H. (7), XIV., p. 132 (1904).

♂. Palpi, frons, antennæ and thorax red-brown; vertex of head and tegulæ white, the latter with black tips; tarsi with pale rings; abdomen red-brown with dark dorsal patch at extremity. Forewing pale, almost entirely suffused with red brown, leaving the submedian interspace and the area below costa towards apex paler; the costal area to beyond middle, the cell, and area from below end of cell to near termen below vein 4 and the terminal area below apex suffused with fuscous; a white point at base of median nervure; two fine brown streaks in basal half of submedian fold; traces of an irregular brown antimedial line; some dark points in end of cell and a slight discoidal bar; traces of an oblique dentate postmedial line; the apical half of terminal area with dark streaks in the interspaces and short oblique streaks below extremities of veins 4 and 3. Hindwing red-brown.

Habitat.—ASSAM, Khásis. *Exp.* 48 mill.

ÆGERIADÆ.

Genus SPHECOSESIA, nov.

Type.—*S. pedunculata.*

Proboscis fully developed; palpi upturned, fringed with long hair in front at base, the 2nd joint reaching to about vertex of head, the 3rd moderate; antennæ of male minutely serrate and fasciculate, strongly dilated beyond middle; legs without tufts of hairs on the joints; abdomen strongly pedunculate at base and narrowing to extremity. Forewing with vein 2 present; 7·8 stalked. Hindwing with the discocellulars erect; veins 3·4 stalked.

362*a*. SPHECOSESIA PEDUNCULATA, n. sp. (Plate F., f. 14).

♂. Head and thorax dark brown mixed with rufous; palpi yellow suffused with rufous; frons with lateral white lines; basal joint of antennæ white in front; coxæ whitish; tibiæ with whitish bands at middle and extremity, the tarsi whitish at base; abdomen dark reddish brown with white segmental lines on the dilated part, the extremity rufous, the ventral surface with rufous segmental lines. Wings hyaline, the veins and margins dark brown.

Habitat.—SIKHIM (Bingham). *Exp.* 28 mill. Type in B. M.

367*a*. ÆGERIA CYANOPASTA, n. sp. (Pl. F., f. 20).

Antennæ with long cilia.

♂. Head, thorax and abdomen black irrorated with silvery blue scales; neck with orange ring. Forewing black shot with purple and irrorated with metallic blue green scales; an orange streak above inner margin before middle, a wedge-shaped patch in end of cell and an elliptical patch beyond the cell between veins 8 and 3 with slight dark streak on the veins. Hindwing hyaline, the veins and margins black-brown; an oblique discoidal bar. Underside of

forewing mostly orange to beyond middle, a patch beyond cell and maculate terminal band from apex to vein 2; hindwing with some orange scales on the veins.

Habitat.—QUETTA (Nurse). *Exp.* 26 mill.

368*a*. ÆGERIA PYRODISCA, n. sp. (Plate F., f. 26).

Antennæ of male strongly ciliated.

♂. Palpi orange, yellow in front and with a few black scales at sides; frons yellow, white at sides; antennæ black above, orange below; vertex of head and thorax blue-black mixed with some orange and with fine orange streak on dorsum and upper edge of patagia; pectus mostly yellow; legs red-brown banded with yellow; abdomen blue-black with narrow yellow segmental lines, the anal tuft red-brown and yellowish, the ventral surface with broader yellow bands. Forewing hyaline, the veins and margins narrowly brown with some yellowish scales; a slight firey red mark near base; a narrow fiery red band on outer edge of the black discoidal line and a streak above vein 9; cilia brown. Hindwing hyaline, the veins and margins narrowly black; cilia brown.

♀. Antennæ fulvous above beyond middle; abdomen with the yellow bands broad at sides, the anal tuft with much more yellow, the ventral surface yellow with reddish orange bands.

Habitat.—BURMA, Maymyo (Barrow). *Exp.* ♂ 28, ♀ 32 mill. Type in B. M.

383*b*. LEPIDOPODA ANDREPICLERA, n. sp. (Plate F., ff. 15 ♂, 27 ♀).

♂. Head and thorax black-brown; palpi in front, sides of frons and neck white; pro- and metathorax, pectus, and legs with some whitish scales; hind tibiæ bluish silvery at base and with white medial band, the base of tarsus white; abdomen black suffused with brilliant blue. Forewing hyaline, a costal fascia, discoidal bar, veins, margins and a series of streaks in interspaces of terminal area, blue-black. Hindwing hyaline, the veins and margins black.

♀. Head and thorax with golden yellow replacing the white except at sides of frons; legs golden yellow; hind tibiæ with black band, the tarsus black except 1st joint. Forewing with the interspaces suffused with golden yellow, the discoidal bar yellow.

Habitat.—CEYLON, Kandy (Green). *Exp.* ♂ 28, ♀ 32 mill. Type in B. M.

Genus SCOLIOMIMA.

Type

Scoliomima, Butl., Trans. Ent. Soc., 1885, p. 371 .... *insignis*.

Proboscis fully developed; palpi upturned, reaching vertex of head, the 1st and 2nd joints clothed with long rough hair, the 3rd moderate; antennæ of male bipectinate with short branches to apex; tibiæ clothed with long rough hair; mid tarsus with the 1st joint clothed with short hair, hind tarsus with it clothed with very long hair; abdomen clothed with rough hair towards extremity. Forewing with veins 2-3 from near angle of cell; 4-5 from above angle; 6 from below upper angle; 7-8 stalked; 9-10-11 from cell. Hindwing with vein 2 from before angle of cell; 3-5 from angle, 4 absent; 6 from

below upper angle becoming coincident with 5 before termen or separate ; 7 from angle.

395*a*. SCOLIOMIMA INSIGNIS, Butl., Trans. Ent. Soc. 1885, p. 371, pl. X., f. 10.

♂. Head, thorax and abdomen black, shot with bluish; palpi with the 2nd joint golden yellow ; frons white at sides ; tegulæ golden yellow ; metathorax with some fulvous hairs ; mid tibiæ with some bluish white hairs at base and on outer side at middle, and extremity ; tarsi with the terminal joints yellow ; abdomen with dorsal yellow band on 4th segment, narrowing at middle, some yellow hair in anal tuft ventrally. Forewing cupreous brown, the costal and inner margins black ; a hyaline streak below base of cell. Hindwing cupreous brown ; the inner margin and cilia towards tornus black with a greenish tinge ; a hyaline streak below base of cell and a triangular patch on inner area from near base to termen.

The type from Borneo has a golden-yellow patch on metathorax and subdorsal yellow patches on 1st segment of abdomen ; wings, darker.

Habitat.—MADRAS, Palni Hills (W. H. Campbell) ; BORNEO. *Exp*. 52·54 mill.

SYNTOMIDÆ.

442. SYNTOMIS PASSALIS.

Larva.—Fuscous black clothed with tufts of close downy hairs (W. H. Campbell).

ZYGÆNIDÆ.

CHALCOSIANÆ.

523*a*. SORITIA VIRIDIBASALIS, Dudgeon, J. Bomb. Soc., XVI., p. 399 (1905).

♂. Head and thorax fuscous brown ; tegulæ crimson ; 1st joint of palpi and pectus yellowish white, abdomen pale blue, the first three segments fuscous brown, the ventral surface yellowish white. Forewing dark brown, the basal two-thirds suffused with green, the veins of terminal area defined by blue-green; a narrow oblique pale yellow postmedial band from costa above end of cell to tornus. Hindwing fuscous brown. Underside of forewing fuscous brown, the band broader with a curved pale blue subapical band beyond it ; hindwing with the cell, a streak on each side of vein 1, c., and four subterminal lunules pale blue.

Habitat.—TENASSERIM, Daunat Range. *Exp*. 36 mill. This species is unknown to me.

557. *Heterusia drataraja* is the male of 571. CHALCOSIA DISTINCTA and insert (syn.) *Eterusia osseata*, Wlk., XXXI, 120 (1864).

590*a*. *Isbarta cyanescens* is the male of 591. ISBARTA BINGHAMI.

PSYCHIDÆ.

ŒCETICINÆ.

617*a*. CLANIA DESTRUCTOR, Dudgeon, J. Bomb. Soc., XVI, p. 401 (1905).

Forewing with veins 4·5 stalked to near termen, the veinlets between vein 1 and inner margin slight ; hindwing with veins 4·5 strongly stalked ; vein 8

anastomosing with the cell towards extremity, then again with vein 7, the veinlets between it and costa slight.

Head, thorax and abdomen reddish brown mixed with greyish and dark brown ; tarsi whitish. Forewing red-brown mixed with greyish, the veins streaked with blackish ; an elleptical whitish mark below veins 4·5 and a small triangular mark on termen below vein 7. Hindwing reddish brown mixed with greyish, the veins blackish.

Habitat.—SIKHIM ; BHUTÁN ; ASSAM, Chittagong; BORNEO, Kuching. *Exp.* 30 mill.

Larva.—Food plant : Tea, the larva case formed of twigs of the plant placed longitudinally.

618*a*. CLANIA MONOCHROMA, n. sp.

♂. Head, thorax and abdomen dark brown with some greyish hair ; wings uniform dark brown. Forewing with three veinlets between vein 1 and inner margin. Hindwing with veins 4·5 stalked ; 7 connected with 8 by an oblique bar near end of cell ; 8 without veinlets to costa.

Larva.—Case covered with white silk to which are attached excreta and a few pieces of bark and twigs.

Habitat.—CEYLON, Kandy (Green). *Exp.* 32 mill. Type in B. M.

618 *a*. CLANIA ANTRAMI, n. sp.

♂. Forewing with veins 4·5 from cell ; hindwing with vein 6 absent, 8 not sending branches to costa.

Head, thorax and abdomen greyish fuscous. Forewing ochreous thickly irrorated with fuscous, very thickly on terminal half. Hindwing fuscous brown, the inner area paler.

Habitat.—CACHAR, Kuttal (C. B. Antram). *Exp.* 24 mill. Type in B. M.

Larva.—Case covered with fragments of dry leaves ; Food plant : Tea.

620 *a*. AMATISSA ALBITARSIA, n. sp.

♂. Fore tarsus with the terminal joint moderate ; fore and hindwings with veins 4·5 stalked ; uniform reddish brown ; the fore tarsi whitish.

Habitat.—CEYLON, Hatiyantota (Green). *Exp.* 22 mill. Type in B. M.

CHALIANÆ.

633. MANATHA SCOTOPEPLA, n. sp.

♂. Forewing with veins 4·5 from cell, 11 connected at a point with 12. Uniform fuscous brown ; the tarsi pure white.

Habitat.—CACHAR, Kuttal (C. B. Antram). *Exp.* 14 mill. Type in B. M.

Larva.—Case covered with scales of bark ; Food plant ; Tea.

644 *a*. MAHASENA TAPROBANA, n. sp.

Forewing with veins 8·9 very shortly stalked.

♂. Uniform red-brown with some greyish hair mixed.

Habitat.—CEYLON, Peradeniya (Green). *Exp.* 22 mill. Type in B. M.

Larva.—Case covered with short pieces of stick somewhat spirally attached.

645 *b*. MAHASENA THEIVORA, Dudgeon, J. Bomb. Soc., XVI., p. 400 (1905). Fore and hindwings with veins 4·5 from a point.

♂. Uniform fuscous brown, the tarsi whitish.

Habitat.—SIKHIM. *Exp.* 30-34 mill.

Larva.—Food plant: Tea, the larva-case formed of fragments and whole leaves attached to a rather soft case.

645 *a*. MAHASENA POLIOTRICHA, n. sp.

Forewing with veins 4·5 from angle of cell.

♂. Head and thorax clothed with long silky whitish grey hair mixed with some fuscous; abdomen fuscous, the ventral surface whitish grey; wings greyish fuscous, the cilia white.

Habitat.—PUNJAB, Kangra Valley, 4,500′ (Dudgeon). *Exp.* 34 mill. Type in B.M.

Larva.—Case formed by short pieces of the stems of grasses arranged in a whorl with three or four twists. It has a Hymenopterous parasite of the genus *Chalcis*.

ARBELIDÆ.

675 *b*. ARBELA CAMPBELLI, n. sp. (Pl. F., f. 7).

♂. Head, thorax and abdomen dark brown mixed with grey; antennæ with the branches rufous. Forewing grey thickly irrorated and striated with dark brown, the veins and submedian fold streaked with white; some white at base of inner margin; antemedial line formed of white striæ, from subcostal nervure to inner margin; two white discoidal striæ and a striga below extremity of cell; postmedial striæ between veins 6 and 3, and vein 2 and inner margin; a curved subterminal series of striæ placed somewhat in echelon: terminal oblique striæ from just above vein 3 to tornus; cilia white, tinged with brown at base and with dark line at middle. Hindwing white suffused and irrorated with brown; cilia brownish at base, white at tips; the underside white striated with brown forming ill-defined lines, a terminal series of small brown spots.

Habitat.—MADRAS, Horsleyhonda (Campbell). *Exp.* 36 mill.

The larva tunnels in the stem of *Ochna squarrosa* (W. H. Campbell).

676 *b*. ARBELA THEIVORA, n. sp. (Pl. G., f. 1).

♂. Head and thorax dark brown mixed with grey; abdomen fuscous mixed with grey, the basal crest blackish; pectus, legs and ventral surface of abdomen whiter. Forewing dark brown slightly irrorated with grey; the costal area, cell and vein 1 tinged with rufous; a faint blackish discoidal spot; the terminal area with faint dark striations. Hindwing fuscous brown slightly irrorated with grey, the cilia whitish at tips.

♀. Much greyer; forewing with numerous dark reticulate striations

Habitat.—ASSAM, Sylhet, Gazipur (Antram). *Exp.* ♂ 18, ♀ 22 mill. Type in B. M.

Larva.—Bores in the bark of Tea and the smaller branches of the Mango, feeding under a web.

676 *c*. ARBELA MINIMA, n. sp. (Pl. F., f. 24);

♂. Head and thorax red-brown mixed with some white; pectus and legs mostly white; abdomen red-brown, the tuft of long hair on basal segment white with some spatulate brown scales, the ventral surface white. Forewing fulvous yellow very thickly irrorated with red-brown, the basal half and costal area with fulvous yellow spots defined by blackish; a round blackish discoidal spot with a fulvous yellow spot beyond it; cilia with a dark line through them and whitish patches above and below middle and at tornus. Hindwing golden brown; cilia white at tips, the inner margin fringed with long white hair.

Habitat.—CEYLON, Galle (Bainbrigge-Fletcher). *Exp.* 18 mill. Type in B.M.

HEPIALIDÆ.

678 *a*. PALPIPHORUS PELLICIA, Swinh., A.M.N.H. (7), X, p. 152 (1905).

Head and thorax red-brown; abdomen fuscous brown. Forewing red-brown with slight greyish irroration: a white point with some dark scales round it in middle of cell and a smaller point rather nearer base below the cell; traces of oblique medial, postmedial and subterminal series of brown spots defined at sides by slight whitish striæ. Hindwing brown with a purplish tinge; a whitish patch on termen and cilia above middle.

Habitat.—ASSAM, Khásis. *Exp.* ♂ 24, ♀ 28 mill.

DREPANIDÆ.

732. DREPANA SPECULARIS, insert (syn) *Platypteryx obtruncata*, Warr., Nov. Zool., VII, p. 118 (1900). The locality Bahia is a mistake.

735. DREPANA SADANA, insert (syn) *Tridrepana adelpha*, Swinh., A.M.N.H (7), XVI, p. 620.....Khásis.

735. *a*. DREPANA RUBROMARGINATA, Leech, Trans. Ent. Soc., 1898, p. 365.

♂. Orange yellow. Forewing with indistinct somewhat diffused dark antemedial line from subcostal nervure to inner margin, strongly excurved below the cell; a small spot in middle of cell and discoidal spot; blackish spots below end of cell above veins 2·2; a slight oblique waved postmedial line from vein 7 to inner margin; the terminal area suffused with bright rufous obliquely from apex to postmedial line at lower angle of cell and thence to inner margin; a diffused lunulate band beyond the postmedial line from vein 5 to inner margin, somewhat incurved below vein 2; a diffused subterminal series of lunulate spots, the spot above vein 5 blackish. Hindwing with dark point at upper angle of cell and slight diffused medial line from cell to inner margin; diffused spots above bases of veins 3·2; a slight diffused waved postmedial line, excurved from costa to vein 3, then bent inward and a subterminal series of small lunulate spots from vein 6 to inner margin.

Habitat.—W. CHINA, Pu-tsu-fong; SIKHIM, TIBET, Yatong. *Exp.* 40 mill.

746. *b*. PHALACRA RUFA, n. sp. (Pl. F., f. 28).

♂. Head and thorax rufous slightly irrorated with grey, the vertex of head whitish; pectus and legs fuscous brown; abdomen rufous slightly banded with fuscous. Forewing rufous, the costal area suffused with grey and irrora-

ted with fuscous; traces of an antemedial line angled on median nervure, then oblique; two obliquely placed black discoidal points; an indistinct dark, minutely waved postmedial line, slightly excurved below costa, then very oblique; an indistinct subterminal line with yellowish marks on it, excurved from costa to vein 4, then oblique and slightly sinuous; a series of slight black points before termen. Hindwing rufous; the base yellowish; an oblique subbasal greyish band defined by fine dark lines; three oblique minutely waved medial lines; a straight subterminal line from below apex to inner margin; cilia grey at tips.

Habitat.—CEYLON, Maskeliya (Alston). *Exp.* 50 mill. Type in B.M.

146. *c.* PHALACRA TENERA, Swinh., Trans. Ent. Soc., 1902, p. 592 (Pl. F., f 33).

♀. Head, thorax and abdomen brownish white mixed with brown. Forewing brownish white irrorated with brown, the medial area suffused with brown and bounded by minutely waved lines, on inner side obliquely curved, on outer incurved at discal fold and oblique below vein 4; a black point at lower angle of cell; a minutely waved postmedial line with series of small black spots beyond it, oblique below vein 4; traces of a subterminal series of small pale lunules, incurved below vein 4 and with some fuscous before and beyond it towards tornus; a fine black terminal line; cilia chequered black and whitish. Hindwing suffused with rufous except basal area; traces of two antemedial lines; a black discoidal point; an indistinct minutely waved medial line; two waved fuscous postmedial lines; traces of a greyish lunulate subterminal line; a slight terminal line.

Habitat.—CEYLON, Kandy; BORNEO, Pulo Laut. *Exp.* 26 mill.

THYRIDIDÆ.

764. STRIGLINA GLAREOLA, insert (syns) *Striglina conjuncta*, Swinh., A. M. N. H. (7), XVII, p. 381 (1906) and *Striglina mediofascia*, Swinh., A. M. N. H. (7), XVII, p. 381 (1906).

766 *a*. RHODONEURA CANDIDALIS, Swinh., A. M. N. H. (7), XV., p. 504 (1905.)

♂. Head and thorax white, suffused with fuscous except behind; tarsi banded with fuscous; abdomen white. Forewing white, the costa and cell with numerous fuscous striæ and a few on basal, medial and postmedial areas; postmedial line formed of a double series of striæ, oblique, slightly incurved to costa and below vein 4; a subterminal series of double obliquely placed striæ; two black points just before termen below apex followed by an oblique series of striæ in the interspaces. Hindwing white; a double subbasal line not reaching inner margin; a double medial line formed of striæ meeting and terminating at vein 1; a double subterminal line starting from a single striga below costa, the outer line ending at vein 2, the inner at vein 1; some striæ on apical part of termen. Underside of forewing with some golden suffusion in basal half of cell, below costa to beyond middle, and between medial parts of postmedial and subterminal lines.

Habitat.—Assam, Silchar. *Exp.* 34 mill.

767 *a*. Rhodoneura erubescens, Warr., Nov. Zool., XV., p. 347 (1908).

♂. Head and thorax brown, the latter whitish behind; pectus and legs white suffused with brown and crimson, the tarsi brown ringed with white; abdomen white tinged with crimson. Wings white suffused in parts with brownish crimson and thickly reticulated with brown lines, the veins streaked with pale crimson on terminal half; the cilia pale crimson; forewing with blackish points on costa towards apex; hindwing with the basal area paler. Underside with the markings crimson; forewing with chestnut suffusion in and below end of cell and below costa towards apex, some black striæ in lower part of middle of cell, the veins beyond upper angle of cell streaked with black; hindwing with black striæ from costa.

Habitat.—Assam, Khàsis; Burma, Shàn States, Maymyo. *Exp.* 38 mill.

777 *a*. Rhodoneura nox, Druce, A. M. N. H. (7), I, p. 149 (1898).

♀. Black-brown slightly shot with purple; pectus brown mixed with ochreous white; legs brown, the tarsi ringed with white; ventral surface of abdomen ochreous. Forewing with faint dark reticulations; an indistinct oblique greyish line from costa near apex to middle of inner margin; cilia brownish at apex and above tornus. Hindwing with indistinct oblique greyish medial line; cilia whitish with a brown line through them. Underside of both wings mottled with ochreous except terminal area, the dark striæ forming numerous ill-defined lines; forewing with two dark spots on medial part of costa and two on median nervure.

Habitat.—Burma, Tenasserim. *Exp.* 22 mill.

778. Rhodoneura *Nitens*, insert *Pyralis* acutalis, Wlk., XXXIV, 1523 (1865) which has precedence, and *Pharambara fulvipicta*, Warr., Nov. Zool., XV, p. 343 (1908).

784. Rhodoneura atripunctatis insert (syns)

" *mollicellalis*, Swinh. A. M. N. H. (7), XV, p. 504 (1905).

" *turbatalis*, Swinh., A. M. N. H. (7) XV, p. 505 (1905).

Brixia comparalis, Warr., Nov. Zool., XV, p. 329 (1908).

The second is a variety with the basal half of both wings pale; a pale patch on inner area of forewing towards tornus; the apical area of hindwing pale to submedian fold.

786. Rhodoneura reticulata, Moore, 1888 (nec. Butl., 1886) will stand as *Rhodoneura moorei*, Warr., Nov. Zool., XV, p. 343 (1908).

786 *a*. Rhodoneura dissimulans, del. *Banisia ordinaria*, Warr., which is distinct.

786 *c*. Rhodoneura plumbea, Warr., Nov. Zool., XV, p. 344 (1908).

Head, thorax and abdomen red-brown with a silvery gloss; pectus, legs and ventral surface of abdomen pale rufous. Forewing red brown with a silvery gloss and numerous brown striæ; two fine well separated antemedial lines, postmedial line double, excurved beyond the cell; subterminal line forking towards costa and tornus. Hindwing red brown with a silvery gloss and

numerous brown striæ ; a slight antemedial line, a double waved medial line and a subterminal line forking towards costa and tornus. Underside paler suffused with chestnut red ; forewing with fine black and white streaks in and beyond upper part of cell.

Habitat.—Sikhim. *Exp.* 28-38 mill.

786 *d*. Rhodoneura tæniata, Warr., Nov. Zool., XV, p. 327 (1908).

Head, thorax and abdomen rufous with a whitish tinge. Forewing whitish tinged with rufous and with numerous red-brown striæ ; a rufous subbasal band from costa to median nervure ; an antemedial rufous band ; medial band rufous, slightly angled outwards in cell and expanding at inner margin ; postmedial band rufous, broad from costa to vein 5 where it is angled outwards, then narrower, incurved and expanding at inner margin ; an oblique wedge-shaped band from costa towards apex to near termen at vein 5, enclosing a pale spot on costa ; a patch on tornal area produced above to two points extending to vein 4 ; cilia deep rufous. Hindwing whitish suffused with rufous and with numerous red-brown striæ ; an indistinct rufous medial band, forking above and ending in dark points at and beyond upper angle of cell ; an indistinct subterminal rufous band from below costa to vein 5 ; cilia deep rufous. Underside similar.

Habitat.—Sikhim ; Assam, Khàsis. *Exp.* 42 mill.

792. Rhodoneura ferrofusa, trans. ad. 805. b Hypolamprus after *H. atrostriatus.*

792 *c*. Rhodoneura ruinosa, Warr., Nov. Zool. XV., p. 344 (1908).

♂. Head, thorax and abdomen whitish tinged with rufous, the vertex of head and extremity of abdomen paler. Forewing whitish, with numerous rufous striæ, the basal half suffused with rufous ; indistinct curved antemedial, medial and postmedial narrow rufous bands, a rufous mark beyond the last below costa on the inner edge of a red-brown line which is excurved from below costa to tornus ; an oblique narrow red-brown band across apical area. Hindwing whitish with numerous rufous striæ, the basal half suffused with rufous ; fine red-brown medial and subterminal lines, the former evenly curved, the latter excurved, then bent outwards to termen above tornus. Underside of forewing with black points on costa and fine black and white streaks beyond upper angle of cell, a blackish patch at lower angle of cell with band from it to inner margin, the postmedial line and subapical band distinct ; hindwing with irregular medial band except towards costa.

Habitat.—Sikhim. *Exp.* 30 mill.

792. *d*. Rhodoneura discopis, n. sp. (Pl. F., f. 19).

♀. Head, thorax and abdomen pale rufous. Forewing pale rufous with numerous lines formed of brown striæ, the more conspicuous being an antemedial line oblique from costa to median nervure, then erect, an oblique line from lower angle of cell to inner margin, and a postmedial line oblique to vein 4, then slightly incurved; a brown discoidal annulus. Hindwing pale rufous with numerous prominent reticulate lines formed of brown striæ ; a small

brown discoidal annulus. Underside with the reticulate lines very distinct; forewing with rounded black-brown discoidal patch; hindwing with black-brown discoidal annulus.

Habitat.—CEYLON, Hapatale (Alston). *Exp.* 30 mill. Type in B. M.

793*a*. RHODONEURA FERRUGINOSA, Hmpsn., A. M. N. H. (7). XVII, p. 121 (1906).

♂. Bright feruginous red. Forewing with numerous indistinct deep rufous striæ; a rufous postmedial line, excurved from costa to vein 4, then incurved, with some deeper rufous suffusion before it; the striæ on terminal area forming an ill-defined sinuous subterminal line. Hindwing with numerous deep rufous striæ forming ill-defined lines. Underside with a slight silvery gloss, the striæ rather more prominent.

Habitat.—SIKHIM. *Exp.* 30 mill.

793 *b*. RHODONEURA FALLAX, Warr. A. M. N. H. (6), XVIII, p. 229 (1896).

Head, thorax and abdomen dark violaceous grey tinged with brown; pectus legs and ventral surface of abdomen whitish. Forewing dark violaceous grey thickly and evenly striated with fine dark lines, some of the striæ forming a slight rather oblique medial line, a slightly curved postmedial line and an oblique line across apical area; a slight brownish patch beyond discocellulars. Hindwing dark violaceous grey, thickly and evenly striated with fine dark lines, some of the striæ forming an oblique line across apical area. Underside of forewing with metallic blue and black points in end of cell with some fine white streaks above them, some fine white and black streaks beyond upper angle of cell and an orange-red fascia below apical half of costa; hindwing whitish with the striæ prominent, a forked rufous line from costa before apex to termen at vein 2.

ab. 1. Medial area of forewing and apical area of hindwing suffused with black above.

Habitat.—ASSAM, Khâsis; BALI; NEW GUINEA, *Fergusson* I. *Exp.* 22 mill.

797. RHODONEURA BRACTEATA, insert (syn.) 798. *Rhodoneura rufareta.*

797 *a*. RHODONEURA INTIMALIS, insert (syns).

Rhodoneura canidentalis, Swinh., A. M. N. H. (7), XVIII, p. 381 (1906).

Microbelia fasciata, Warr. Nov. Zool. XV., p. 341 (1908).

" *privata*, Warr. Nov. Zool. XV., p. 341 (1908).

" *uniformis* Warr. Nov. Zool. XV., p. 341 (1908).

Rhodoneura giulia, Swinh. A. M. N. H. (7) X. p. 50 (1902).

797*b*. RHODONEURA NEPHELOPERA, Hmpsn., A. M. N. H. (7), XVII p. 119 (1906).

Head, thorax and abdomen deep rufous; front of thorax and dorsum of abdomen with a purplish-silvery gloss; pectus, legs, and ventral surface of abdomen rather paler; wings rufous with a golden gloss, thickly and nearly evenly reticulate with pale and deep rufous lines. Forewing with the base, costal area, and area beyond the cell to apex and down to vein 3 deep rufous suffused with purple; cilia with two white patches at tips below apex and two

above tornus. Hindwing with the extreme base deep rufous; cilia with the tips chequered white and rufous. Underside of forewing with the subcostal nervure and base of veins beyond upper angle of cell finely streaked with black and white, the terminal area between veins 8 and 2 suffused with purple, with a curved white streak below extremity of vein 8.

Habitat.—ASSAM, Khásis. *Exp.* 24 mill.

797 *c*. RHODONEURA LACTIGUTTATA, n. sp.

♂. Head and thorax white mixed with some rufous; fore tibiæ and the tarsi brown ringed with white; abdomen white with rufous segmental lines. Forewing white thickly reticulated with rufous; a brown-defined antemedial annulus in and below cell with a forked line from its outer edge to inner margin, and a streak from its upper edge to a small quadrate brown spot at upper angle of cell, giving off two lines to inner margin, the inner excurved, the outer angled outwards at vein 4, then incurved and forked towards inner margin, also a streak to apex intersected by an oblique line across apical area; the reticulations of terminal area forming small round spots. Hindwing white thickly reticulated with red-brown forming small round spots not forming definite lines; a dark brown point at upper angle of cell; cilia of both wings rufous. Underside of forewing with the costal area red-brown and with slight streaks of metallic and black scales in cell and on the veins below costa to apex.

Habitat.—BHUTAN, 3,000′ (Dudgeon). *Exp.* 20 mill. Type in B. M.

800 *b*. RHODONEURA DORILUSALIS, Wlk., XIX, 890 (1859).

Pyralis imbutalis, Wlk., XXXIV; 1524 (1865).

Siculodes acutipennis, Pag., Naas. Jahrb. f. Naturif., XXXIX, p. 166 (1886).

Head, thorax and abdomen whitish mixed with red-brown. Forewing whitish tinged with rufous and striated with dark brown; traces of an oblique medial band; a more distinct postmedial band from costa to discal fold and lower angle of cell to inner margin; a curved subterminal series of striæ forking towards costa. Hindwing whitish tinged with rufous and striated with dark brown; an oblique postmedial band formed of dark striæ; a subterminal line formed of striæ and a spot at tornus. Underside of forewing with white subterminal band from below apex to vein 5.

Habitat.—NICOBARS, Nancowry; BORNEO; PULO LAUT; MYSOL; ARU. *Exp.* 26 mill.

800 *c*. RHODONEURA CUPRIZONA, n. sp.

♂. Head, thorax and abdomen greyish largely suffused with bright rufous. Forewing greyish white, the basal half of inner area with some rufous and silvery striæ; an oblique diffused cupreous red postmedial band bent inwards to costa confluent with a large diffused patch from apex and leaving a triangular whitish patch on costa beyond middle; a blackish discoidal lunule, a small spot beyond lower angle of cell and two points in discal fold; a subterminal series of slight blackish points; two slight subapical whitish lunules defined by blackish

on inner side. Hindwing whitish tinged with rufous, the basal area striated with rufous and silvery ; an oblique rufous medial band with silvery striæ on its inner and outer sides ; traces of a subterminal series of dark points and striæ : the underside with medial and subterminal rufous bands.

Habitat.—Assam, Khásis (Badgley). *Exp.* 36 mill. Type in B. M.

801 *a*. Hypolamprus subumbrata, Warr., Nov. Zool., XII, p. 7 (1905).

♀. Head, thorax and abdomen pale rufous irrorated with a few glistening scales. Forewing pale rufous with a silky gloss and thickly striated with brown, some of the striæ forming indistinct antemedial, medial and double postmedial and subterminal lines. Hindwing pale rufous with a silky gloss and thickly striated with brown, the terminal half rather paler and with double curved postmedial and subterminal lines filled in with rather darker rufous ; a slight waved line before termen. Underside of forewing with deeper rufous shade on costal half to beyond cell.

Habitat.—Burma, Shán States, Maymyo. *Exp.* 36 mill.

802 *a*. Hypolamprus simplex, Warr., Nov. Zool. XV, p. 337 (1908).

♀. Head, thorax and abdomen whitish tinged with rufous. Wings whitish suffused with pale pinkish rufous and faintly striated and irrorated with brown. Underside of forewing with blackish points on costa, black and opalescent streaks in, below and beyond the cell, the terminal area with blackish reticulations ; an apical white patch with black point on it; hindwing with diffused dark medial band and blackish reticulations on terminal area.

Habitat.—Burma, Shán States, Maymyo ; Borneo, Kuching. *Exp.* 20 mill.

805 *b*. Hypolamprus ocellipennis, Warr., Nov. Zool., XV, p. 327 (1908).

Both wings with the termen excised below apex and strongly excurved at middle.

♂. Head, thorax and abdomen whitish suffused with rufous. Forewing rufous to well beyond middle leaving a series of small whitish spots on inner margin and a reticulate elliptical medial patch between the cell and vein 1, the outer edge of the rufous area angled at veins 5 and 2 ; terminal area yellowish white with red brown reticulations ; an oblique rufous line from costa towards apex to termen at vein 5, then strongly incurved to a small spot just below vein 5 and bent outwards to a small spot at tornus. Hindwing yellowish white with red-brown reticulations ; a medial rufous band with irregular edges ; the reticulate lines of terminal area forming an oblique line across apical area and enclosing some elliptical spots on postmedial area. Underside similar.

Habitat.—Lower Burma. *Exp.* 38 mill.

805 *c*. Hypolamprus lepraota, n. sp. (Plate F., f. 17).

♀. Head, thorax and abdomen ochreous white mixed with rufous. Forewing yellowish white thickly reticulated with rufous ; the costal area suffused with rufous expanding into the cell before middle ; a postmedial line angled outwards at veins 5 and 2 and incurved between those points, with a broad rufous band on its inner edge ; a fine subterminal line arising from a triangular mark on costa, then oblique to a quadrate spot on termen at vein 5, then strongly

incurved and ending in a quadrate spot on termen above tornus. Hindwing yellowish white thickly reticulated with rufous; a small rufous spot at lower angle of cell conjoined to a spot on vein 2; the terminal area with stronger reticulate lines.

Habitat.—CEYLON, Madulsima (W. Vaughan). *Exp.* 24 mill. Type in B. M.

806. HYPOLAMPRUS SUBROSEALIS, insert ab. *rubicunda*, Warr., Nov. Zool. XV., p. 336 (1908).

806 *a*. HYPOLAMPRUS ALBIPUNCTULA, Warr., Nov. Zool., XV, p. 335 (1908).

♂. Head, thorax and abdomen whitish tinged with rufous; tarsi brown ringed with white. Forewing whitish suffused with rufous and with numerous rather indistinct brown striæ; two indistinct antemedial lines; an indistinct oblique brownish postmedial band with three white points beyond it above vein 6. Hindwing white with brown reticulations and slight rufous suffusion leaving numerous small round white spots; a black point in discal fold just beyond the cell and a postmedial point. Underside of both wings with blackish reticulations; forewing with minute black streaks in, below and beyond the cell with opalescent suffusion between them.

Habitat.—MANIPUR; LOWER BURMA. *Exp.* 24 mill.

Genus SYMPHLEPS.

Symphleps, Warr., Nov. Zool., IV., p. 383 (1897). Type *cochracea*.

Proboscis fully developed; palpi upturned, not reaching vertex of head; antennæ laminate; hind tibiæ with the inner medial spur very long, the outer minute. Forewing with vein 3 from before angle of cell; 5 from above angle; 6·7 from below upper angle; 8, 9, 10 stalked; 11 from cell. Hindwing with vein 3 from before angle of cell; 5 from above angle; 7 from upper angle, anastomosing with 8.

808*b*. SYMPHLEPS OCHRACEA, Pag., Nass. Jahrb. f. Naturf., XXXIX, p. 139 (1886).

Rhodoneura alomosalis, Hmpsn., P. Z. S., 1897, p. 621.

Head and thorax bright rufous; antennæ ringed with white; tarsi slightly ringed with white; abdomen paler rufous with slight whitish segmental lines; wings pale rufous thickly and evenly striated with deep rufous. Forewing with series of white points on costa; a slight white discoidal bar with some black scales at its lower extremity; cilia deep rufous with series of black points at base. Hindwing with series of black points at base of cilia. Underside of forewing with two small white discoidal spots ringed with black.

Habitat.—ASSAM, Khásis; ANDAMANS; SINGAPORE; PULO LAUT; JAVA; AMBONIA; MYSOL; ARU; QUEENSLAND. *Exp.* 26 mill.

809*a*. CAMADENA POLYSTACTA, Hmpsn., P. Z. S., 1906, p. 494, Plate. 36, f. 7.

♂. Head and thorax dark-brown suffused with greyish; abdomen red-brown suffused with dark greyish brown. Forewing red-brown thickly striated with dark-brown, on terminal area forming numerous annulate spots;

the costal and inner areas suffused with dark-brown to the medial band ; two indistinct, somewhat irregular dark antemedial lines ; a broad oblique dark medial band before the indistinct postmedial line which is bent outwards below costa, excurved to vein 5, then oblique ; an indistinct subterminal line excurved from costa to vein 5, then oblique. Hindwing red-brown thickly striated with dark-brown, on terminal half forming numerous annulate spots ; a small black discoidal spot and slight medial line excurved between veins 5 and 2 ; the termen strongly excurved at middle.

Habitat.—SIKHIM, Gantok. *Exp.* 32 mill.

LIMACODIDÆ.

817*a*. SCAPELODES TANTULA, Swinh., A. M. N. H. (7), XIV., p. 132 (1904).

,, *dimacra*, Beth-Baker, Nov. Zool., XX, p. 382 (1904).

♂. Head and thorax grey mixed with fulvous, and fuscous ; palpi black at tips ; abdomen fulvous, dorsally mixed with fuscous except at base. Forewing fuscous thickly irrorated with grey, and tinged with fulvous on disk ; a diffused fulvous streak below base of cell ; cilia tinged with fulvous. Hindwing fuscous, the basal and inner areas and veins fulvous ; cilia fulvous mixed with fuscous.

Habitat.—ASSAM, Khàsis ; BRITISH NEW GUINEA, Dinawa. *Exp.* 42 mill.

823*a*. OXYPLAX FULVATA, n. sp. (Plate F., f. 16).

♂. Antennæ much thickened and flattened, simple ; metathorax with spreading crest of scales ; forewing with the inner margin lobed before middle and with tuft of scales.

Head and thorax fulvous mixed with some blackish ; abdomen fuscous. Forewing fulvous with a cupreous tinge and brown suffusion ; the basal area suffused with dark brown to the obliquely curved diffused medial line ; the terminal area suffused with black, broadly at costa and narrowing towards tornus ; cilia chequered fulvous and black and with black tips. Hindwing fuscous, cilia grey, fuscous at base and with fuscous line through them.

Habitat—CEYLON, Maskeliya (Pole). *Exp.* 18 mill. Type in B. M.

835*b*. THOSEA FLAVICEPS, n. sp.

Male with the palpi extending about length of head, female about three times length of head.

Head and thorax yellow with slight rufous dorsal streak, the terminal half of thorax suffused with rufous ; pectus, legs and abdomen rufous slightly mixed with yellowish. Forewing deep rufous, the area beyond the postmedial line browner to submedian fold ; some silvery suffusion on median nervure and vein 1, on terminal half of costal area, and on terminal area ; an indistinct very oblique brown postmedial line from costa just before apex to middle of submedian fold ; an indistinct somewhat oblique brown subterminal line. Hindwing red-brown with a slight pinkish tinge.

Habitat.—ASSAM, Khàsis (Badgley). *Exp.* ♂ 34, ♀ 40 mill. Type in B. M.

Larva.—With long pointed prominences bearing stinging hair ; solitary ; rolls itself up and drops when alarmed ; very dark maroon with fine red and

yellow lines ; sides green with yellow lines and a series of brown dots ; ventral surface semi-transparent yellow. In the young larva the red and yellow markings on back are absent. Food plants : *Andromeda ovalifolia*, *Photinia eugenifolia* and *Camellia caudata*.

Cocoon.—Oval, slight, dark red-brown.

Pupa.—Short, rounded, light brown with paler rings on dorsum of abdomen, the shoulders shining (Badgley).

836*a*. NATADA FULVIDORSIA, n. sp. (Plate F., f. 9).

♂. Head and thorax fulvous, vertex of head, patagia on outer edge and at extremity with some black scales ; abdomen fuscous brown ; pectus, legs and ventral surface of abdomen pale fulvous. Forewing fuscous brown slightly tinged in parts with grey ; a few fulvous scales below costa and on medial area below the cell. Hindwing fuscous brown ; both wings with fine pale line at base.

Habitat.—CEYLON, Maskeliya (de Mowbray). *Exp.* 26 mill.

836*b*. NATADA FULVIMIXTA, n. sp. (Plate F., f. 21).

♂. Head and thorax dark brown mixed with pale fulvous ; antennæ whitish ; abdomen fuscous brown ; pectus, legs and ventral surface of abdomen ochreous. Forewing dark brown slightly irrorated with greyish and faintly tinged with fulvous in parts ; an oblique whitish line defined by black on inner side from just below apex to inner margin beyond middle. Hindwing fuscous brown ; both wings with fine pale line at base of cilia.

Habitat.—CEYLON, Paltipolla (Alston). *Exp.* 30 mill.

847*a*. TETRAPHLEPS FERREOGRISEA, n. sp. (Plate F., f. 10).

♂. Head, thorax and abdomen iron-grey mixed with black-brown especially at tips of tegulæ and patagia. Forewing iron-grey irrorated with black-brown ; an oblique black subbasal line, arising below costa and bent outwards to inner margin, emitting a streak below the cell to the oblique sinuous black antemedial line ; a black discoidal lunule ; a brown shade from below end of cell to tornus ; an incurved black line from costa towards apex to termen at vein 2, and a black shade on terminal area from just below apex to vein 4 ; cilia chequered grey and black-brown. Hindwing grey suffused with brown.

Habitat.—CEYLON, Mankulam (Mackwood). *Exp.* 24 mill. Type in B. M.

853*a*. MIRESA THERMISTIS, n. sp.

Forewing with vein 10 from well before end of cell.

Head and thorax bright rufous, the vertex of head and tegulæ yellowish ; pectus and legs with some yellowish hair ; abdomen deep rufous with some yellowish hair at base and on ventral surface. Forewing bright rufous, the interspaces of discal area thinly scaled ; a diffused brownish patch beyond end of cell and a faint curved postmedial line. Hindwing rufous tinged with brown.

Habitat.—ASSAM, Khàsis (Badgley). *Exp.* 24 mill. Type in B.M.

Larva.—Slug-like with short stinging hairs ; head retractile, usually concealed under collar when feeding, the hairs from small prominences ; gregari-

ous ; green with a blue dorsal-stripe-edged by fine black lines ; two small black dots on the neck and four black spots at anal extremity ; ventral surface semi-transparent green. Food plant : *Bucklandia populnea*.

Cocoon.—Oval, slight, fastened to the ground and covered by a slight semi-transparent grey papery cover.

Pupa.—Rounded, pale brown (Badgley).

853 *b*. MIRESA PYRONOTA, n. sp. (Pl. F., f. 22).

♂. Head and thorax fiery red with a few red-brown scales mixed ; palpi dark at sides ; pectus and legs more rufous ; abdomen yellow slightly tinged with red and with rufous dorsal patch at base. Forewing rufous with a slight silvery gloss, some fiery red and yellow on basal half of inner margin ; some silver scales at upper angle of cell and a triangular silver spot just beyond lower angle ; a postmedial series of silver points on the veins, oblique below vein 7 ; the terminal area with slight silvery irroration. Hindwing yellow tinged with red and with a slight silvery gloss.

Habitat.—CEYLON, Trincomali (Green). *Exp*. 38 mill. Type in B. M.

855 *a*. MIRESA METATHERMISTIS, n. sp. (Pl. F., f. 6).

♂. Head and tegulæ yellow, the palpi except at tips and antennæ rufous ; thorax and abdomen yellow suffused with rufous, the metathorax with deep rufous tuft of hair. Forewing bright rufous, the basal half of inner area yellowish ; an indistinct deep rufous discoidal spot with a few silvery scales on it ; postmedial line deep rufous with silvery white scales on and before it and silvery white spots on it in submedian interspace and on inner margin, oblique from vein 6 to middle of inner margin ; a slight rufous terminal line ; cilia yellowish at base deep rufous at tips. Hindwing silky rufous, the cilia yellowish at base.

Habitat.—BOMBAY, Kanara, Karwar (T. R. Bell). *Exp*. 30 mill.

Larva.—Food plant : *Blachia*.

856 *b*. MIRESA PHOCEA, n. sp. (Pl. F., f. 5).

Antennæ of male bipectinate with short branches to apex.

♂. Head, thorax and abdomen very dark brown, the hairs slightly tipped with grey ; tarsi pale below. Forewing very dark brown with a leaden grey gloss, the scaling of medial and postmedial areas except towards costa ribbed like seal-skin ; a very oblique grey line defined on inner side by blackish from middle of costa to inner margin before middle ; an elliptical blackish discoidal spot ; an obscure diffused dark subterminal line from costa to termen at vein 2, angled outwards below costa, then incurved. Hindwing dark glossy red-brown.

Habitat.—CEYLON, Trincomali (Green). *Exp*. 32 mill. Type in B. M.

862 *a*. PARASA METATHERMES, n. sp. (Pl. F., f. 4).

♂. Head, thorax and abdomen chocolate brown ; patches on back of head, tegulæ except at middle and sides and patagia except outer edges bright grass-green. Forewing with the basal area chocolate brown, its outer edge angled outwards at median nervure and vein 1 and with slight yellowish line ;

medial area bright green; the terminal area pale chocolate brown with darker curved line on its inner edge, slightly incurved in submedian interspace Hindwing pale chocolate brown.

Habitat.—CEYLON, Ohiya (de Mowbray). *Exp.* 28 mill. Type in B. M.

Genus. EPIPYROPS.

Epipyrops, Westw., Proc. and Trans. Ent. Soc., 1876, pp. xxiv and 522 ..... *Type anamola.*

Proboscis absent; palpi extremely minute; frons smooth; eyes large antennæ bipectinate with long branches in both sexes; tibiæ without spurs. Forewing with the apex somewhat produced and acute, the termen evenly curved; vein 3 from before angle of cell; 4·5 from angle; 6·7·8·9·10·11 from cell. Hindwing with vein 3 from before angle of cell, 5 from above angle; 6 from below upper angle.

The larvæ and pupæ are covered with masses of floculent white waxy secretion.

873*a*. EPIPYROPS POLIOGRAPHA, n. sp. (Pl. F., f. 12).

♀. Head, thorax and abdomen very dark olive brown mixed with grey. Forewing very dark olive brown thickly and evenly reticulated with indistinct silvery grey markings.

Hindwing uniform very dark olive brown.

Habitat.—CEYLON, Mankulam (Mackwood), Yatiyantota (Green). *Exp.* 16-26 mill. Type in B. M.

879*a*. CERATONEMA FUSCA, Swinh., A. M. N. H. (7), XV., p. 498 (1905).

Head rufous suffused with fuscous; thorax and abdomen ochreous tinged with rufous. Forewing rufous, the costal half suffused with purplish fuscous to the postmedial line; the terminal area pale ochreous tinged with rufous and irrorated with large fuscous scales; the postmedial line diffused incurved at discal fold and more strongly at submedian; cilia pale at base, dark at tips. Hindwing pale ochreous.

Habitat.—SIKHIM; ASSAM, Khàsis. *Exp.* ♂ 22, ♀ 26 mill.

880*b*. CERATONEMA CAUSTIPLAGA, n. sp.

♀. Head and thorax deep chestnut-red glossed with silvery scales; abdomen pale red-brown. Forewing chestnut-brown suffused with purplish silvery scales; a bright chestnut-red patch between veins 5 and 2 with an oblique band from its inner edge to inner margin; a chestnut-red apical patch Hindwing red-brown, the cilia greyer with a brown line near base.

Habitat.—ASSAM, Khàsis (Badgley). *Exp.* 28-34 mill. Type in B.M.

Larva.—With long spines bearing stinging hairs; pale yellow green with diagonal yellowish marks at sides; a blue-edged white dorsal line with an orange-red band on each side of it; the anterior spines and the spines on shoulders and tail pink, with two black dots between the pair on shoulders; hairs on spines black with yellow tips or yellow with black tips. Food plants: *Andromeda ovalifolia, Eurya japonica, Viburnum punctatum* and *Smilax ovalifolia*.

Cocoon.—On a leaf under rubbish, oval, dull purplish mottled with grey-brown, fastened to leaf by some fluffy pale brown silk.

Pupa.—Short, blunt at both ends, pale brown (Badgley).

881*a*. AGAEOGYIA PHÆOPASTA, Hmpsn., P.Z.S., 1906, p. 492, Pl. 36, f. 22.

Forewing with veins 7, 8, 9, 10 stalked; fore and mid tibiæ, the 1st joint of fore tarsi and the 1st two joints of mid and hind tarsi fringed with long scales.

♂. Head and thorax grey irrorated with dark brown, the tufts of scales on the legs black; abdomen ochreous tinged with rufous. Forewing ochreous thickly irrorated with dark brown leaving an indistinct oblique ochreous line from lower angle of cell to inner margin, an elliptical spot between basis of veins 5·4, some ochreous on costa towards apex and on termen from vein 5 to tornus; cilia fuscous with an ochreous line at base. Hindwing uniform silky brown; cilia ochreous at base, brown at tips.

Habitat.—SIKHIM, Darjiling (Atkinson), Gantok. *Exp.* 22 mill.

888*a*. ALTHA PERALBA, Swinh., Trans. Ent. Soc. 1904, p. 153.

♀. White; patagia at extremity, pectus and forelegs in front, abdomen at base and extremity and on ventral surface irrorated with brown and black. Forewing with the basal area irrorated with black, a slight streak of scales on extremity of median nervure and some diffused scales on apical area.

Habitat.—BOMBAY, Poona. *Exp.* 26 mill.

894*a*. BELIPPA CYANOPASTA, n. sp.

Hindwing with veins 6·7 strongly stalked.

♀. Head and thorax rufous with some silvery blue scales on outer edge of patagia and sides of thorax; abdomen rufous with some silvery blue scales. Forewing rufous, the basal area and terminal half except towards costa irrorated with dark brown and silvery blue scales; numerous waved striæ of raised scales; traces of diffused rufous antemedial and medial bands; a diffused blackish streak from upper angle of cell to the rufous subterminal band which is oblique towards costa, incurved at discal fold, then with some blackish triangular marks before it. Hindwing dark reddish brown.

Habitat.—BURMA, Bhámo (Fea). *Exp.* 34 mill.

LASIOCAMPIDÆ.

910 *a*. METANASTRIA VITTA, Moore, Lep. E.I.C. p. 424, Pl. xii. *a*, f. 4 (1859.) Bright brick-red with slight greyish irroration; abdomen rather more ochreous.' Forewing with indistinct dark antemedial line angled in submedian fold, then oblique; a small discoidal white spot defined by fuscous; an indistinct dark minutely waved postmedial line, angled outwards at vein 7 and oblique below vein 2; a minutely dentate subterminal line angled outwards at veins 4·3; termen tinged with fuscous. Hindwing with traces of diffused maculate postmedial band angled outwards between veins 4·3.

Habitat.—BENGAL, Calcutta; BORNEO, Kuching; JAVA. *Exp.* ♂ 40, ♀ 54 mill.

Genus CHROSTOGASTRIA.

Type

Chrostogastria, Hübn. Verz., p. 189 (1827)..... ..... *pruni.*

Proboscis absent; palpi porrect to well beyond frons and thickly clothed with hair; frons with tuft of hair; eyes small, hairy; antennæ of male pectinate to apex with long decumbent branches, the basal joint with tuft of hair, of female with shorter branches; head, thorax and abdomen clothed with woolly hair, the tibiæ and tarsi fringed with long hair on outer side, the tibiæ with terminal pairs of small spurs. Forewing with the costa highly arched towards apex, the termen rather oblique and strongly crenulate; vein 3 from long before angle of cell; 4·5 from angle; 6·7 stalked; 8 from angle, 9·10 stalked; 11 approximated to 12 towards costa. Hindwing with the costa strongly lobed at base; the termen crenulate; vein 3 from close to angle of cell; 4·5 hardly stalked; 7 from long before angle of cell, bent upwards and touching 8 at a point.

922*a*. CHROSTOGASTRIA PRUNI, Linn. Syst. Nat., p. 498 (1758); Esp. Schmett, III, p. 72, Pl. 10. Hübn. Eur. Schmett. Bomb., f. 186. Godt. Lép. Fr., IV, p. 87, Pl. 8, ff. 3·4. Staud. Cat. Lép. pal., p. 124.

Odonestis prunoides, Staud. Cat. Lep. pal., p. 69 (1872).

Orange yellow suffused with red; antennæ with the branches brown. Forewing irrorated and suffused with red; an indistinct antemedial line, oblique below the cell; a rounded silvery white discoidal spot; a prominent very obliquely curved postmedial line, approximated at inner margin to the antemedial line; a rather diffused red subterminal line, slightly dentate at the veins, incurved between veins 6 and 4. Hindwing with traces of irregular postmedial line, the area beyond it usually yellower.

Habitat.—EUROPE; ASIA MINOR, Bithynia; E. SIBERIA, Ussuri; JAPAN; W. CHINA; ASSAM, Khásis, Jaintia Hills. *Exp.* 46—76 mill.

Larva.—Kirby, Butt. and Moths, Eur., p. 137.

Bluish grey spotted with whitish and with the lines yellow, the 3rd somite with red dorsal band; the 12th somite with dorsal hump defined by reddish; stigmata ringed with black. Food plants various forest and fruit trees 9·5.

929. ALAMPRA FERRUGINEA, insert (syn.) *Taragama indicus*, Conte. Rapp. Lab. Et. Soie XIII, p. 24, Pl. vi., f. 1 (1909).

The hindwing of male has the termen squarely truncate, the figure represents a female, not a male.

951*a*. GASTROPACHA KHASIANA, Swinh., A.M.N.H. (7), XV., p. 499 (1905).

♂. Head and thorax rufous mixed with whitish; abdomen ochreous white tinged with rufous. Forewing rufous suffused with whitish, especially on terminal area which is tinged with ochreous, the lines formed of small rufous lunulate marks; two antemedial lines; a black discoidal point; two postmedial lines, bent inwards and diverging towards costa, then oblique, with another line beyond them from costa to vein 6; a subterminal line bent inwards to costa

with an oblique striga beyond it from costa to vein 8; a terminal series of ill-defined lunules with the cilia beyond them white. Hindwing with the termen angled at vein 6 and 2, rufous, the terminal half tinged with greyish ochreous; a medial line incurved at discal fold; two less prominent minutely waved postmedial lines incurved at discal fold; cilia white in the excisions; the underside suffused with whitish.

Habitat.—Assam, Khásis. *Exp.* 50 mill.

LYMANTRIADÆ.

979*b*. Lælia fulvata, n. sp. (Plate F., f. 29).

♀. Orange fulvous. Forewing with subterminal series of prominent black spots, the spot above vein 6 slightly displaced outwards and those below veins 3 and 2 bent inwards parallel to inner margin. Hindwing paler.

Habitat.—Ceylon, Galboda (Mackwood). *Exp.* 52 mill. Type in B. M.

1011*a*. Dasychira dudgeoni, Swinh., A. M. N. H. (7), XIX, p. 203 (1907).

♂. Head and thorax brown mixed with grey, the metathorax with patch of black scales with a metallic gloss; tarsi whitish fringed with dark brown hair; abdomen pale, dorsally suffused with brown. Forewing dull brown, the inner margin and a patch beyond postmedial line in submedian interspace dull ochreous; sub-basal line black defined by ochreous on outerside, slightly waved, from costa to vein 1; antemedial line indistinctly double, the inner line black in submedian interspace, waved, with some black irroration before it, filled in with greenish white and with greenish irroration beyond it except on inner area; a slight whitish lunule at lower angle of cell; postmedial line blackish, oblique from costa to vein 7, then dentate, very oblique and defined by ochreous lunules on inner side below vein 3; a series of minute indistinct ochreous dentate marks from costa to vein 3, bent inwards to costa, before the subterminal series of slight dark lunules on faint ochreous spots. Hindwing uniform dull grey-brown; the underside ochreous whitish suffused with brown, an indistinct curved postmedial line from costa to vein 5 and traces of a diffused subterminal line.

Habitat.—Sikhim. *Exp.* 40 mill.

1011*b*. Dasychira cymata, Swinh., A. M. N. H. (7), XIX, p. 204 (1907).

♂. Head and thorax reddish brown mixed with grey; forelegs blackish brown, the pectus behind and mid and hind legs paler; abdomen reddish brown. Forewing reddish brown suffused with fuscous and irrorated with black and some grey; a small sub-basal whitish spot defined by black scales below the cell; antemedial line rather indistinct, blackish, highly waved, with whitish points before and beyond it in submedian fold; a pale discoidal lunule defined by black; postmedial line blackish, excurved from just below costa to vein 4, then waved; traces of a pale waved subterminal line crossed by short black streaks in the interspaces between veins 8 and 5. Hindwing uniform pale greyish brown; the underside brownish white with traces of a diffused curved brownish postmedial band.

Habitat.—Sikhim. *Exp.* 40 mill.

1036*a*. Lymantria postfusca, Swinh., A. M. N. H. (7), XVII, p. 546 (1906).

♂. Head and thorax white ; palpi and antennæ black ; tegulæ and patagia edged with black ; pectus yellow and black ; legs black with some white spots; abdomen yellow with dorsal and sublateral series of black spots, the anal tuft black. Forewing white with subbasal black band from costa to submedian fold, angle outwards in cell, a point beyond it above vein 1 and oblique striga above inner margin ; a waved antemedial line expanding into a spot on costa, excurved at median nervure, then incurved ; a small spot in middle of cell and discoidal spot ; two dentate postmedial lines, bent outwards below costa, incurved at discal fold and below vein 5 ; a dentate subterminal line ; a terminal series of black lunules. Hindwing whitish suffused with fuscous, leaving a whitish postmedial patch between veins 4 and 2 and a streak in submedian fold ; a lunulate white terminal band from below apex to vein 2 with black points on termen.

♀. Forewing with the subbasal marks above and below vein 2 absent, the antemedial and two postmedial lines conjoined by two streaks below cell and a patch on inner margin. Hindwing whitish, the basal area tinged with yellow ; a broad terminal blackish band with sinuous inner edge and some white spots on termen.

Habitat.— Ceylon, Kandy. *Exp.* ♂ 48, ♀ 64 mill.

1098*a*. Euproctis xanthoceps, n. sp. (Plate F., f. 31).

♂. Head and legs pale yellow ; antennæ whitish with rufous branches ; thorax and abdomen red-brown with a greyish tinge. Forewing uniform red-brown, the cilia pale at tips. Hindwing fuscous brown, the cilia pale at tips. Underside of forewing with the costa yellowish.

Habitat.—Ceylon, Haldamulla (Mackwood). *Exp.* 24 mill. Type in B. M.

1105*a*. Euproctis diplaga, n. sp.

♂. Head, thorax and abdomen chocolate brown mixed with yellowish ; the pectus, legs and ventral surface of abdomen yellow. Forewing yellowish, almost wholly suffused with chocolate brown ; a large quadrate antemedial deep chocolate patch defined by yellowish white from cell to vein 1 and followed by the curved brown antemedial line ; a brown postmedial line excurved from costa to vein 6, then dentate and oblique to submedian fold ; an elliptical deep chocolate patch from vein 7 to below vein 6 before the subterminal line which is whitish and excurved round its outer edge, then indistinct, brown, waved, oblique ; a slight yellowish terminal line with small brown spots before it from apex to vein 4. Hindwing dark chocolate brown with the base and costa to beyond middle orange-yellow ; cilia yellow at tips ; the underside orange-yellow with the terminal area suffused with chocolate brown.

Habitat.—Assam, Khásis (Badgley). *Exp.* 24 mill. Type in B. M.

Eggs.—Spheroidal ; smooth, shining pale dull green ; laid in lines with dark dull greenish-grey hair.

Larva.—Solitary ; cylindrical ; pubescent with a few long grey hairs ; black

with five yellow rings ; collar red ; two red tubercles near tail ; ventral surface dark olive-grey ; head black, small, retractile. Food plant : *Schima Wallichii*.

Cocoon.—Oval, silken, strong, grey, clustered together in a shallow hollow of bark of tree stem.

Pupa.—Entire, naked, dark brown, with a spike at tail (Badgley).

1116*a*. LEUCOMA THYRIDOPTERA, n. sp. (Plate F., f. 3).

♀. White. Forewing hyaline except marginal areas ; the costal and inner areas slightly tinged with fuscous ; four irregular oblique lines of raised scales on antemedial area ; a discoidal patch of white scales with some striæ beyond it ; the terminal band with its inner edge angled inwards above veins 5-2-1, with striæ of raised scales on it and ill-defined fuscous subterminal line. Hindwing hyaline except inner and terminal areas ; an antemedial patch of scales from middle of cell to inner area ; a discoidal lunule ; the terminal band with its inner edge angled inwards above veins 5 and 2 and with a diffused fuscous subterminal line on it.

Habitat.—CEYLON, Habarama (Mackwood). *Exp.* 48 mill. Type in B. M.

1125. CISPIA PUNCTIFASCIA.

In the typical form from N. India the orange band of forewing extends to the costa and inner margin.

Subsp. 1. Forewing with the orange band extending from upper angle of cell to vein 1 only.

Habitat.—CEYLON, low country, N. Central Province (Pole), Anaradpura. Kandy (Green).

Subsp. 2. Larger and darker ; abdomen with the dorsal and lateral black spots much more developed ; hindwing with the curved medial band much more developed, the terminal area tinged with rufous, leaving yellow streaks on the veins.

Habitat.—CEYLON, Hill country, Maskeliya (Pole, de Mowbray). *Exp.* ♂ 62, ♀ 76 mill

ARCTIADÆ.

NOLINÆ.

1529*a*. CELAMA LEUCOSCOPULA, Hmpsn., A. M. N. H.(7), XIX, p. 227 (1907). (Plate G., f. 2.)

Head, thorax and abdomen white, slightly tinged with pale rufous ; anal tuft pure white. Forewing white, tinged in parts with pale brown ; antemedial line black, strong, angled outwards in cell, then oblique, with brownish suffusion before it : medial and postmedial oblique elliptical patches from costa ; postmedial line very ill-defined, bent outwards below costa, then oblique ; traces of a sinuous subterminal line. Hindwing white, slightly tinged with brown and with faint discoidal spot.

Habitat.—CEYLON, Ambalangoda, Peradeniya, Matale, Pattalam, Hambantota. *Exp.* 12 mill.

1530*d*. CELAMA MESOTHERMA, Hmpsn., A. M. N. H. (8), IV, p. 349 (1909). (Plate G., f. 3).

Head, thorax and abdomen white, tinged with rufous ; palpi with the scales fringing the joints tipped with black ; tibiæ and tarsi ringed with blackish. Forewing white, irrorated with rufous and some fuscous ; a subbasal black point on costa ; antemedial line brown defined on inner side by white, angled outward below costa, then oblique ; medial area suffused with rufous, the tufts of scales at middle and upper angle of cell dark with oblique elliptical brownish stigmata above them from costa ; postmedial line blackish and somewhat punctiform, defined on outer side by white, slightly bent outwards below costa, oblique to vein 4, then incurved and again excurved above inner margin ; subterminal line white, defined on inner side by blackish scales with rufous suffusion before them, angled outwards at vein 7, excurved at middle, and ending at tornus ; a punctiform dark terminal line ; cilia white, mixed with some rufous and fuscous. Hindwing white, tinged with ochreous brown, especially towards termen ; cilia white, faintly tinged with brown ; the underside white, the costal area irrorated with brown.

Habitat.—CEYLON, Rambakkhana, Colombo ; BORNEO, Sarawak, Sandakan. *Exp.* 14 mill.

1530*e*. CELAMA RUFIMIXTA, Hmpsn., A. M. N. H. (8), IV, p. 350 (1909). (Plate G.,f.4).

Head and thorax white ; palpi rufous ; antennæ tinged with rufous ; thorax with some rufous behind tegulæ ; tarsi rufous ringed with white ; abdomen white, tinged with rufous. Forewing white, with some blackish irroration on basal area and before postmedial line ; antemedial, medial and postmedial rufous patches on costa ; the terminal area suffused with rufous except at apex ; antemedial line white, defined on inner side by rufous and on outer by black from cell to inner margin, excurved in submedian interspace ; large tufts of rufous and white scales in middle and end of cell ; an indistinct oblique waved line from lower angle of cell to inner margin ; postmedial line white, defined on inner side by brown, slightly bent outwards below costa and incurved below vein 4, subterminal line white, slightly defined on inner side by black scales, excurved below costa, at middle and above inner margin. Hindwing white, the terminal area tinged with brown ; the underside with the costal area irrrorated with brown, a dark discoidal striga.

Habitat.—CEYLON, Yatiyantota, Matale, Wattegama. *Exp.* 18 mill.

1530*f*. CELAMA DENTILINEA, Hmpsn., A. M. N. H. (8), IV, p. 350 (1909). (Plate G.,f.5).

♀. Head, thorax and abdomen white, tinged with ochreous brown ; fore tibiæ and the tarsi fuscous brown ringed with ochreous white. Forewing white, tinged with ochreous brown and slightly irrorated with fuscous ; antemedial line blackish defined on inner side by white, curved, angled outwards in submedian fold ; the tufts of scales at middle and upper angle of cell dark, with oblique elliptical brownish stigmata above them from costa ; a waved dark line from lower angle of cell to inner margin ; postmedial line

blackish, punctiform, oblique from costa to vein 6, then inwardly oblique; terminal area suffused with ochreous brown, the subterminal line white; strongly and evenly dentate; a brown terminal line; cilia white, tinged with ochreous brown. Hindwing white, the costal area tinged with ochreous brown.

Habitat.—CEYLON. *Exp.* 18 mill.

1534. RASELIA NEGRITA, insert (syn.) 1407*a*. *Galleridia fuscizonea*.

1539*b*. RASELIA PALLIDICEPS, Hmpsn., A. M. N. H. (7), XIX, p. 229 (1907). (Plate G.,f.6).

♂. Head and tegulæ ochreous white; palpi and lower part of frons black-brown; thorax grey mixed with fuscous; abdomen grey. Forewing grey thickly irrorated with fuscous brown, the terminal half slightly paler; a dark slightly curved medial line; a black discoidal bar, the postmedial line conjoined to its upper and lower extremities and excurved beyond cell, an ill-defined line from costa beyond it, joining the subterminal line at vein 4 and with a dark striga from costa between them; the subterminal line ill-defined, slightly angled outwards at vein 7 and inwards at vein 2. Hindwing grey thickly irrorated with fuscous; cilia with a fine pale line at base.

Habitat—CEYLON. *Exp.* 14 mill.

1543*b*. ZIA ECTROCTA, Hmpsn., A. M. N. H. (7), XIX, p. 229 (1907). (Plate G. f.7).

♂. Head and thorax white; legs blackish, the tarsi ringed with white; abdomen white, tinged with fuscous. Forewing pure white; a small black spot on costa near base; a medial triangular black patch from costa to origin of vein 2, its outer edge excised in cell; two small discoidal tufts of raised scales with a few dark scales round them; postmedial line black, with small tufts of raised metallic scales on it, oblique and obsolescent from costa to vein 6, slightly incurved at discal fold and strongly below vein 4, the area beyond it rufous except at apex; subterminal line represented by a dark point on costa, then on the rufous area white defined on inner side by black from below apex to vein 3, excurved below vein 7 and at middle, and below vein 2 angled inwards to near postmedial line; cilia rufous, intersected with white. Hindwing white, the terminal area slightly tinged with brown from apex to vein 3.

ab. 1. Forewing with the postmedial line more angled inwards below vein 4 and with large black patches beyond it on inner area and at middle, the latter connected with the termen below apex by an oblique black fascia.

Habitat.—CEYLON, Haputale, Maskeliya. *Exp.* 20-24 mill.

LITHOSIANÆ.

1340*a*. ILEMA ATRIFRONS, Hmpsn., A. M. N. H. (7), XIX, p. 231 (1907) (Plate G., f. 8.)

♂. Head, tegulæ, patagia, pectus and legs fulvous yellow; palpi, frons and forelegs in front fuscous; dorsum of thorax and base of abdomen grey

white, the rest of abdomen yellow. Forewing yellow with a whitish suffusion. Hindwing whitish yellow.

Habitat.—NICOBARS. *Exp.* 26 mill.

1386*c*. HALONE FLAVINIGRA, Hmpsn., A. M. N. H. (7), XIX., p. 233 (1907). (Plate G., f. 9.)

♂. Head, thorax and abdomen fuscous, the vertex of head, base of shaft of antennæ, and tegulæ yellow. Forewing orange yellow ; a black patch at base with irregular oblique outer edge ; a postmedial black band angled inwards below cell and with rather dentate edges ; some diffused fuscous before termen. Hindwing pale fuscous.

Habitat.—S. INDIA, Palni Hills, 6,000′. *Exp.* 20 mill.

1402*b*. EUGOA CRASSA, Wlk., Journ. Linn. Soc. Zool., VI, p. 114 (1862); Hmpsn., Cat. Lep. Phal. B. M., II., p. 547, Plate 34, f. 28.

Tospitis indeclaratana, Wlk., XXVIII, 427 (1863).

Tospitis inconspicua, Wlk., XXVIII, 430 (1863).

♂. Head and tegulæ pale yellow ; palpi and lower part of frons blackish ; thorax brown ; abdomen yellowish. Forewing yellowish, thickly irrorated and suffused with reddish brown ; a rather darker patch at base of costa ; a minute black point at lower angle of cell ; faint traces of an oblique band from costa near apex. Hindwing pale yellow.

♀. Hindwing pale brown, the cilia pale yellow.

ab. 1. *inconspicua*. Frons blackish ; forewing with the patch on base of costa more prominent ; the oblique postmedial band more prominent.

Habitat—ASSAM, Khásis ; BORNEO, Sarawak. *Exp.* 20-22 mill.

1424*b*. MILTOCHRISTA OCELLATA, Hmpsn., A. M. N. H. (7), XIX, p. 234 (1907). (Plate F., f. 32.)

♀. Head and thorax orange-yellow; patagia and prothorax with black spots, tibiæ banded with black, last joint of tarsi black ; abdomen greyish ochreous, the ventral surface blackish. Forewing orange yellow ; small black spots at base of costa and cell ; fuscous spots below costa and cell and above vein 1 before the antemedial line which is interrupted at submedian fold and angled inwards above inner margin ; a large annulus at end of cell ; postmedial line strongly bent outwards below costa, then highly and irregularly dentate, strongly incurved below vein 4 and conjoined to antemedial line above and below submedian fold ; a subterminal series of small spots on the veins. Hindwing yellow.

Habitat.—CEYLON, Ohiya. *Exp.* 40 mill.

1461*d*. ASURA PHANTASMA, Hmpsn., A. M. N. H. (7), XIX. p. 233 (1907). (Plate G., f. 10.)

♂. Whitish ochreous ; antennæ and forelegs in front fuscous. Forewing with the base of costa black ; a small black spot in base of cell ; an indistinct antemedial series of spots strongly excurved in cell and less so below it, sometimes almost conjoined into a line ; a medial line oblique from costa to subcostal nervure, then excurved, often almost obsolete ; a small discoidal spot;

a postmedial series of points, sometimes almost obsolete, those on veins 6 and 4 nearer termen; one or two points on termen sometimes present. Hindwing pale ochreous, the apex sometimes faintly tinged with fuscous.

Habitat.—ANDAMANS. *Exp.* 18 mill.

1462*a*. ASURA TOXODES, Hmpsn., A. M. N. H. (7), XIX., p. 233 (1907). (Plate G., f. 11.)

♂ Head and thorax pale ochreous slightly mixed with fuscous; antennæ and extremities of tibiæ fuscous; abdomen ochreous white. Forewing pale ochreous, the costal edge blackish on basal and terminal areas; a black point in base of cell; some fuscous in submedian fold; a highly curved antemedial line; a medial line angled inwards in cell; postmedial line confluent at costa and inner margin with the medial line with which it forms a bow-shaped mark, very oblique from costa to vein 6 and from vein 4 to inner margin; a very irregular subterminal line, angled outwards at veins 6 and 4; a fine black terminal line. Hindwing pale semi-hyaline ochreous.

Habitat.—ANDAMANS. *Exp.* 24 mill.

1481*a*. ASURA FULVIMARGINATA, Hmpsn., A. M. N. H. (8). IV, p. 357 (1909). (Plate G., f. 12.)

♀. Head, tegulæ and patagia orange yellow; the vertex of head with slight dark streak; antennæ brown; thorax and abdomen pale brown, the hind tibiæ and tarsi yellowish. Forewing pale red-brown, the costal and inner margins reddish yellow. Hindwing pale semi-hyaline red-brown.

Habitat.—MADRAS, Horsleykonda. *Exp.* 26 mill.

1485*a*. NEASURA TAPROBANA, Hmpsn., A. M. N. H. (7) XIX, p. 232 (1907). (Plate G., f. 13.)

♂. Ochreous yellow; antennæ at tips, forelegs in front and extremities of mid and hind tibiæ fuscous. Forewing with black point in base of cell; the costa fuscous to the curved diffused antemedial line: a blackish discoidal point on some fuscous suffusion; postmedial line very diffused and ill-defined, waved, emitting streaks inwards on the veins and outwards on veins 7·6·4. Hindwing, with slight fuscous suffusion below apex.

Habitat.—CEYLON, Maskeliya. *Exp.* 24 mill.

ARCTIANÆ.

1175*a*. DIACRISIA ALBICORNIS.

♀. Head and thorax dull brown; antennæ black; pectus, legs, except femora above, and ventral surface of abdomen brown. Forewing uniform dull brown. Hindwing brown, suffused with scarlet; a black discoidal spot; Underside brown, suffused with scarlet; forewing with slight discoidal lunule; hindwing with black discoidal spot.

Habitat.—CEYLON, Haldamulla (Mackwood). *Exp.* 50 mill.

Genus PREPARCTIA.

Preparctia, Hmpsn., Cat. Lep. Phal. B. M. III, p. 219 (1901) *Type mirifica*.

Proboscis fully developed; palpi porrect, extending about the length of

head ; antennæ of female serrate ; tibiæ with the spurs moderate. Forewing with vein 3 from before angle of cell ; 4·5 from angle ; 6 from upper angle ; 7·8·9·10 stalked ; 11 from cell. Hindwing with veins 3 and 5 from close to angle of cell ; 6·7 from upper angle ; 8 from middle of cell.

1243*a*. PREPARCTIA HANNYNGTONI, n. sp. (Plate F., f. 34.).

♀. Head black ; tegulæ yellow ; thorax black with white streaks at sides and small crimson spots behind tegulæ ; coxæ crimson, the femora and base of hind tibiæ above with crimson streaks ; abdomen crimson with dorsal series of black bars, the ventral surface black with series of slight crimson bars. Forewing black ; a subbasal creamy white striga from costa and antemedial bar both connected with a streak on median nervure from base to origin of vein 2, dilated and enclosing a slight black streak below the antemedial bar and met at origin of vein 2 by a down curved streak from base in submedian interspace ; a creamy white striga from middle of costa ; a curved band from costa beyond middle to lower angle of cell where it is produced outwards to a point, the band giving off an oblique bar from its outer edge below costa ; postmedial line creamy white, excurved from costa to vein 4, then oblique and slightly sinuous ; a narrow creamy white subterminal band, excurved from costa to vein 5, slightly incurved at vein 3, and at submedian fold, forming a wedge-shaped patch connected with the postmedial line ; the cilia and the inner margin narrowly creamy white. Hindwing crimson ; an oblique black band from costa before middle to vein 1 ; a large discoidal lunule and spot above it on costa ; postmedial band black, obliquely curved from below costa where it arises, to vein 1 where it terminates in a quadrate patch connected with the medial band, with which it is also connected by a wedge-shaped patch at vein 2 ; subterminal band black, curved, from costa to submedian fold, dilated at discal fold and vein 2 ; a triangular patch above tornus ; a fine black terminal line from apex to vein 2 ; cilia yellow ; the underside with the costal area yellow.

Habitat.—KUMAON, Niti Pass, 10,000′ (*Hannyngton*). *Exp*. 58 mill. Type in B. M.

1279*b*. UTETHEISA PULCHELLOIDES, Hmpsn., A. M. N. H. (7), XIX. p. 239 (1907). (Plate G., f. 19).

Differs from *U. pulchella* in the antennæ of male being serrate instead of ciliated and in the hindwing having a fold and tuft on inner area.

It varies much in the same way as *U. pulchella* but never seems to lose the black spots of forewing which usually has the ground colour rather white ; in specimens from the New Hebrides and Solomons the black terminal band on hindwing is largely developed. It appears to be confined to Oceanic and other Islands and to N. Australia.

Habitat.—SEYCHELLES ; CARGADOS CAREJOZ ; COETIVY ; AMIRANTES ; CHAGOS Is. ; CEYLON, Kandy, Peradenyia, Hambantota, Trincomali ; COCOS KEELING Is ; CHRISTMAS Is. ; SINGAPORE ; FORMOSA ; LOO-CHOO Is. ; NEW GUINEA ; N. AUSTRALIA ; QUEENSLAND ; SOLOMON Is. ; GILBERT Is. ; MARSHALL Is ; ELLICE Is. *Exp*. 34-44 mill.

NOCTUIDÆ.

AGROTINÆ.

For *Ala* Staud.1882 Nec. Lock. Crust. 1877 insert ANARTOMORPHA, Alph. Rom.
Mem. vi., p. 39 (1892) ... ... *Type potanini.*

1669*b*. ANARTOMORPHA FLAVESCENS, Hmpsn., P. Z. S. 1906, p. 486, Plate 36, f. 3.

♂. Head and thorax clothed with black, brown and grey scales and hair; palpi whitish banded with brown; lower part of frons whitish; fore tibiæ and tarsi with white rings; abdomen ochreous white, irrorated with fuscous. Forewing black-brown, suffused with greyish; subbasal line indistinctly double filled in with grey, angled inwards in cell and extending to vein 1; antemedial line indistinctly double filled in with grey, oblique from costa to submedian fold, then erect; claviform moderate, defined by black; orbicular and reniform with brown centres and slight whitish annuli defined by black, the former oblique elliptical, the latter angled inwards on median nervure and touching the former; an indistinct dentate whitish mark below end of cell on vein 2; postmedial line double filled in with greyish, bent outwards below costa, oblique to vein 5 where it is angled, then inwardly oblique and minutely waved; subterminal line whitish, slightly defined by black on outer side, angled outwards at vein 7 and to termen at veins 4-3, incurved at discal and submedian folds; a terminal series of slight black lunules; cilia whitish and brown with a blackish line through them. Hindwing white, strongly tinged with ochreous; the basal area suffused with fuscous; a black discoidal lunule; a terminal fuscous band, rather broad at costa, narrowing to a point at tornus; some black striæ on termen; cilia pure white, the underside ochreous white, the costal area slightly irrorated with fuscous, a slight discoidal lunule and diffused subterminal bands.

Habitat.—SIKHIM, Tungu. *Exp.* 28 mill.

1948*a*. ISOCHLORA METAPHÆA, Hmpsn., P. Z. S. 1906, p. 488, Plate 36, f. 2.

♂. Head and thorax emerald green; palpi and sides of frons purplish red; antennæ fulvous; pectus and legs greyish ochreous, the front of pectus and fore and mid legs in front purplish red; abdomen pale ochreous, the ventral surface suffused with purplish red, the anal tuft fulvous. Forewing emerald green, the costal edge white; cilia white at tips. Hindwing ochreous white, uniformly suffused with pale brown; cilia yellowish white. The underside of forewing pale purplish red, the termen greenish; hindwing brownish white, the costal area tinged with purplish red.

Habitat.—SIKHIM. *Exp.* 42 mill.

1633*b*. EUXOA CONFUSA, Alph. Hor. Ent. Soc., Ross., XVII., p. 61, Plate 2, f. 47 (1882); Staud. Cat. Lep. Pal., p. 136.

Head, thorax and abdomen grey, mixed with brown and fuscous; palpi blackish at sides; tarsi blackish with grey rings. Forewing grey, suffused in

part with brown and irrorated with fuscous; sub-basal line represented by double black striæ from costa and cell; antemedial line double, oblique, slightly waved, and angled inwards on median nervure; claviform slightly defined by black scales; orbicular and reniform with white annuli defined by black, the former round; postmedial line indistinctly double, slightly bent outwards below costa, then minutely waved, incurved below vein 4, some grey points beyond it on costa; subterminal line indistinct, whitish, defined on inner side by a blackish bar from costa and blackish dentate marks at middle, slightly angled outwards at vein 7; a terminal series of black points; cilia grey with a fuscous line at base. Hindwing grey, uniformly tinged with fuscous brown; cilia white; the underside white, slightly irrorated with brown, a small discoidal spot and indistinct curved postmedial line.

Habitat.—W. TURKISTAN; E. TURKISTAN; MONGOLIA; SIKHIM. *Exp.* 36 mill.

1627*b*. EPISILIA CLAVATA, Hmpsn., A. M. N. H. (7), XIX. p. 244 (1907). (Plate G., f. 20).

Antennæ of male bipectinate with moderate branches; the apical part serrate.

♂. Head, thorax, and abdomen dark reddish brown mixed with grey; tarsi with pale rings. Forewing grey tinged with red-brown, the medial area red-brown except towards costa and inner margin; sub-basal line represented by a black striga from costa; a strong sinuous black streak below base of cell with yellow streak above it to the claviform, which has a yellowish annulus defined by black and intersects the oblique sinuous antemedial line; orbicular and reniform grey with brownish centres and defined by black, the former oblique elliptical, open above, the latter a narrow lunule very strongly angled on median nervure to below orbicular, some blackish in cell before and between them; postmedial line strongly bent outwards below costa, then dentate, strongly incurved below vein 4; subterminal line very indistinct, greyish, slightly angled outwards at vein 7 and excurved at middle, the veins beyond it with slight dark streaks; a terminal series of slight brown lunules; cilia with fine brown line near base. Hindwing grey suffused and irrorated with brown, a dark terminal line: the underside with dark discoidal lunule and diffused curved postmedial line.

Habitat.—PUNJAB, Kulu. *Exp.* 30 mill.

1634*a*. EPISILIA ARENACEA, Hmpsn., A. M. N. H. (7), XIX., p. 245 (1907). (Plate G., f. 21).

Antennæ of male serrate and fasciculate.

♂. Head and thorax pale brownish ochreous, tarsi fuscous with pale rings; abdomen pale ochreous, dorsally irrorated with fuscous. Forewing pale brownish ochreous, slightly irrorated with fuscous; a double waved sub-basal line from costa to submedian fold; antemedial line indistinctly double, oblique, strongly waved, interrupted; orbicular and reniform with slight yellowish annuli incompletely defined by fuscous, the former round, the latter large; postmedial line double at costa, then indistinct, t outward below costa, then dentate and

produced to a series of black points on the veins, oblique below vein 4, some pale points beyond it on costa; subterminal line ochreous white, slightly defined by fuscous on inner side at costa, then by slight dentate marks, angled outwards at vein 7 and slightly excurved at middle ; a terminal series of black points. Hindwing whitish suffused with pale brown ; cilia yellowish white ; the underside white, the costal area tinged with ochreous, a small discoidal spot and punctiform postmedial line.

Habitat.—BELOOCHISTAN, Quetta. *Exp.* 46 mill.

1632*a*. LYCOPHOTIA POLIOCHROA, Hmpsn., P. Z. S., 1906, p. 489. Plate 36, ff. 16-17.

Antennæ of male strongly serrate and fasciculate.

♂. Head and thorax grey-white mixed with some brown and fuscous ; abdomen ochreous white. Forewing grey and white tinged with ochreous and slightly irrorated with brown ; sub-basal line represented by black striæ from costa and cell ; antemedial line single, black defined by whitish on inner side, interrupted at the veins, erect from costa to vein 1, and angled outwards above inner margin ; claviform moderate, defined by black ; orbicular and reniform defined by rather diffused black, with its inner edge produced inwards as a streak to antemedial line ; traces of a diffused medial line touching orbicular and claviform ; postmedial line single, black slightly defined by whitish on outer side, bent outwards below costa, then dentate and produced to short streaks on the veins, confluent with outer edge of reniform, oblique below vein 4 ; faint traces of a whitish subterminal line slightly defined by fuscous on inner side, excurved at vein 7 and middle ; a terminal series of slight black lunules ; cilia ochreous white with two slight dark lines through them. Hindwing white tinged with pale brown, the cilia pure white ; the underside white with slight discoidal spot and indistinct postmedial line from costa to vein 4.

♀. Wing aborted, small, the forewing elongate, narrow, the termen, rounded, the hindwing triangular ; forewing with the lines browner, the antemedial line excurved below cell and above inner margin ; claviform absent ; orbicular reduced to a point, the reniform a slight lunule well separated from postmedial line ; the subterminal line more distinct and dentate. Hindwing whiter.

Habitat.—TIBET, Kamba Jong ; SIKHIM, Teesta Valley, Lhanak Valley. *Exp.* ♂ 36, ♀ 12 mill.

1632*b*. LYCOPHOTIA POLIADES, Hmpsn., A. M. N. H. (7), XIX., p. 248 (1907). (Plate G., f. 22).

Antennæ of male ciliated ; pro-and meta-thorax with spreading crests.

Head and thorax white with a few fuscous hairs; tarsi banded with black; abdomen white with tufts of long ochreous hairs from lateral stigmata. Forewing grey-white slightly tinged with pale rufous in parts and irrorated with fuscous, the veins with dark streaks ; a slight black streak below base of cell ; sub-basal line represented by black striæ from costa and cell ; antemedial line represented by a black point on costa ; claviform defined by a few black scales ; orbicular

represented by a short black streak defined by white, the reniform by an undefined white lunule with fuscous spot at lower angle of cell; medial and postmedial black points on costa with some slight white points beyond them; subterminal line indistinct, whitish defined on inner side by slight dentate rufous marks, angled outward at vein 7 and inwards at discal fold; a terminal series of slight black lunules. Hindwing pure white.

Habitat.—BELOOCHISTAN, Quetta. *Exp.* 36 mill.

Genus METALEPSIS.

Type

Metalepsis, Grote, Check. List. Noct., p. 25 (1875) .....*cornuta.*

Spinipalpa, Alph. Hor. Ent. Soc., Ross., xxvi, p. 444 (1892) .....*maculata.*

Proboscis well developed; palpi oblique, fringed with long hair in front and with some spinous hair mixed; frons smooth; eyes rounded, strongly ciliated; antennæ of male typically pectinated with rather short branches; frons and vertex of head with tufts of hair; thorax clothed with hair; tegulæ forming a dorsal ridge; pro-and meta-thorax with crests; tibiæ strongly spined; abdomen fringed with long hair at sides. Forewing rather narrow, the apex produced; 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 shortly stalked; 8 anastomosing with the cell near base only.

Sect. (*Spinipalpa*) Antennæ of male ciliated.

1624*a*. METALEPSIS MACULATA.

Spinipalpa maculata, Alph. Hor. Ent. Soc., Ross., XXVI, p. 445 (1892); id. Bom. Mem., IX, p. 12, plate 1, f. 1; Staud. Cat. Lep. Pal. 154.

Metalepsis aletes, Hmpsn., P. Z. S., 1906, p. 488, plate 36, f. 6.

♂. Head and thorax pale rufous with a few black hairs; patagia with a white fascia edged on each side by black; pectus, legs and abdomen brownish grey, the anal tuft ochreous. Forewing pale rufous, the veins streaked with white and defined on each side by grey; a slight black streak below base of costa; a black streak below base of cell and another above basal half of inner margin; two black streaks in cell, the upper interrupted beyond middle, the lower not reaching lower angle; an obliquely curved postmedial series of wedge-shaped black streaks in the interspaces from above veins 7 to above 1, the streak above vein 5 displaced inwards and the streak above vein 1 longer; a terminal series of wedge-shaped black streaks in the interspaces. Hindwing pale brownish grey.

Habitat.—TIBET; SIKHIM. *Exp.* 30 mill.

Genus UFEUS.

Type

Ufeus, Grote, Bull. Buff. Soc. Nat. Sci., 1, p. 101 (1873) ..... *satyrica*

Proboscis fully developed, palpi short, porrect, clothed with long rough hair; frons smooth; eyes large, overhung by cilia; antennæ of male ciliated;

head and thorax clothed with rough hair; mid and hind tibiæ spined; abdomen dorsally flattened, the anal tuft large. Forewing rather narrow, the apex rounded; veins 3 and 5 from near angle of cell; 6 from upper angle or from areole; 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.

1654*a*. UPEUS CARNEA, Hmpsn., A. M. N. H. (7), XIX, p. 249 (1907). (Plate G., f. 23.)

♀. Head and thorax pale flesh colour mixed with brown; abdomen pale grey-brown. Forewing pale flesh pink slightly irrorated with fuscous, the medial area (except towards costa) and a patch on costa beyond postmedial line suffused with fuscous; sub-basal line represented by double striæ from costa and cell; antemedial line rather indistinct, waved, incurved to costa and angled inwards on vein 1; claviform minute, defined by blackish; orbicular and reniform pale pinkish defined by fuscous, the former rather oblique elliptical, the latter with some brownish in centre and angled inwards on median nervure; traces of a waved medial line; postmedial line indistinct, bent outwards below costa, then minutely waved, incurved below vein 4, some pale points beyond it on costa; a subterminal series of small dentate black marks, angled outwards at vein 7, then oblique; a terminal series of minute dark points; a fine pale line at base of cilia. Hindwing ochreous suffused with brown; the underside whitish tinged with flesh colour and irrorated with brown, a small discoidal spot and indistinct sinuous postmedial line.

Habitat.—KASHMIR, Narkundah, *Exp.* 44 mill.

Genus ANYTUS.

	Type
Anytus, Grote, Bull. Buff. Soc. Nat. Sci., 1, p. 144 (1873)	*privata*
Fishia, Grote, Can. Ent. IX., p. 21 (1877)	*enthea*

Proboscis fully developed; palpi upturned, reaching vertex of head, the 2nd joint fringed with hair in front; frons smooth, rounded; eyes large, overhung by long cilia; antennæ of male typically ciliated; head and thorax clothed with hair and scales, the pro-thorax with spreading crest, the meta-thorax with ridge-like crest; tibiæ fringed with hair, the mid and hind tibiæ spined; abdomen with slight dorsal crests and rough hair towards base. Forewing with the apex rectangular, the termen 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 or shortly stalked; 8 anastomosing with the cell near base only.

1654*b*. ANYTUS LEUCOCYMA. Hmpsn., A. M. N. H. (7), XIX, p. 250 (1907.) (Plate G., f. 24.)

♀. Head and thorax red-brown mixed with fuscous; frons with lateral black bars; tegulæ with slight medial black line; abdomen grey-brown. Forewing red-brown irrorated with grey and black on basal half, the veins streaked with

black ; a sinuous black streak below base of cell ; subbasal line absent ; antemedial line represented by two black striæ from costa, then very indistinct, strongly dentate, oblique ; claviform narrow, defined by black and with blackish streak from it to postmedial line ; orbicular defined by black, oblique wedge-shaped ; reniform indistinctly defined by black and with slight whitish lunule on its outer edge, its lower extremity produced ; postmedial line double at costa, bent outwards below costa, then dentate and produced to streaks on the veins, oblique to vein 5, then inwardly oblique and angled inwards in submedian fold, some white points beyond it on costa ; subterminal line white, waved, angled outwards at vein 7 and to termen at veins 4-3, with black streaks beyond it in the interspaces ; a fine waved black terminal line ; cilia greyish and fuscous intersected with white. Hindwing whitish tinged with brown, the veins and terminal area suffused with brown ; traces of a waved white subterminal line ; cilia white with a slight dark line through them ; the underside white irrorated with fuscous, a discoidal spot, slight waved postmedial line and traces of subterminal line.

Habitat.—KASHMIR, Nubra. *Exp.* 50 mill.

(To be continued.)

ORCHIDS OF THE BOMBAY PRESIDENCY.

BY

G. A. GAMMIE, F.L.S.

PART X. (WITH PLATE X.)

(Continued from page 626 of Volume XIX.)

21. SACCOLABIUM.

Epiphytes. *Leaves* two-ranked, leathery, keeled, *peduncles* from lateral axils; *flowers* small, in *spikes*, *sepals* and *petals* adnate to the base of the column, spreading, subsimilar, free; *lip* sessile at the base of the column, spurred, *lateral* and *midlobes* small, *spur* neither septate within nor with calli, *column* short, broad, truncate, rarely beaked, *foot* 0, *anther* one-celled, *pollinia* 2, bipartite.

* *Stems* long and stout, erect, *leaves* rigidly leathery, *flowers* corymbose, *sepals* and *petals* with transverse red bands ..... 1. S. wightianum.

** *Stems* very short, *leaves* few, lax and leathery, *flowers* racemose.

Sepals and *petals* greenish, *midlobe* and *spur* of *lip* white tinged with pink ..... 2. S. viridiflorum.

Sepals and *petals* yellow, each with a purple spot in the centre, *lip* white, tinged with pink ..... 3. S. maculatum.

1. SACCOLABIUM WIGHTIANUM, *Hook., f. Fl. Br. Ind., VI., p. 72* S. præmorsum, *Hook, f. Fl. Br. Ind., VI., p. 62;* S. papillosum, *Dalz. and Gibs. p. 264;* Acampe Wightiana, *Lindl., T. Cooke, Fl. of Bombay, II., p. 705;* *Ærides præmorsum, Grah. Cat., p. 204.*

Stems 12 to 18 inches long, stout, clothed with the sheaths of fallen leaves. *Leaves* strap-shaped, 4 to 8 inches long, irregularly 2-lobed at the apex. *Peduncles* stout, green, 1½ inch long, *bracts* brown, very broadly ovate. *Flowers*, each about ⅔ inch in diameter, crowded, subcorymbose, fragrant, texture thick, *sepals* subequal, ovate-oblong obtuse, slightly keeled on back towards apex, yellow mottled with brown on the outer surface, the inner surface yellow with irregular, reddish brown, transverse bands, *petals* similar in coloration but smaller and narrower, being oblanceolate, *lip* small, very fleshy, white, dotted and streaked with pink, *spur* very

I. Benjamin del. J. Green, Chromo.

SACCOLABIUM WIGHTIANUM, Hook. f.

(Life Size)

short, obtuse, *side lobes* shallow, rounded, *disk* with crisp, white hairs, *midlobe* ovate, margins crenulate.

Flowers appear from April onwards throughout the rains.

Distribution.—Western Ghats and Konkan to Ceylon. This is one of the commonest orchids of the Konkan, always easily recognized by its stiff erect growth and red banded flowers.

PLATE X.—Saccolabium Wightianum, *Hook. f.*—Part of plant (life size). *a.* pollinia × 3. *b.* a flower seen from the front × 2. *c.* a root. *d.* two fruits (natural size).

2. SACCOLABIUM VIRIDIFLORUM, *Lindl., Fl. Br. Ind. VI, p. 63*; Sarcochilus viridiflorus, *T. Cooke, Fl. of Bombay, II, p. 697*; *Dalz. and Gibs. p. 263.*

A small epiphyte, *roots* long. *Leaves* flaccid, strap-shaped, up to 3½ inches long by ½ inch broad, usually in single pairs on each plant, *base* narrowed, *apex* retuse. *Racemes* up to 2½ inches long, from lower axils, usually two on each plant, *rachis* stiffly erect, many flowered. *Flowers* ⅓ inch in diameter, *sepals* and *petals* greenish white, *lateral sepals* obovate obtuse, *dorsal* similar but more pointed, *petals* as large as and similar to the sepals, *lip* with a very broadly conical, short, blunt spur, *lateral lobes* small, triangular, *terminal* spreading fan-shaped, *margins* crenulated with a triangular projection on the centre, *column* green, *pollinia* 2, lobed, *caudicle* long, *gland* large.

Flowers during the rains.

Distribution.—Forests of the Konkan and Western Ghats and moist parts of the Western Peninsula generally.

3. SACCOLABIUM MACULATUM, *Hook., f. Fl. Br. Ind. VI, p. 64*; Sarcochilus maculatus, *Benth, T. Cooke, Fl. of Bombay, II, p. 698*; Micropera maculata, *Dalz. and Gibs. p. 263.*

Almost stemless. *Leaves* up to 6 inches long, linear or cuneately-oblong, obliquely 2-lobed at apex. *Racemes* almost twice as long as the leaves, *rachis* erect, stout, laxly many flowered, *bracts* short, broad. *Flowers* ½ inch in diameter, subsessile, *sepals* and *petals* similar, obovate, each yellow with a central purple spot, *lip* white and pink, *spur* short, obtuse, villous within, *side lobes* small, erect, triangular, *midlobe* very leathery, described by Dalzell as being like a side saddle, *margins* membraneous, 3-lobed at the apex.

Flowers appear in May.

Distribution.—Moist forests of the Western Ghats, Peninsula and Konkan.

22. SARCANTHUS.

Epiphyte, *stems* pendulous, elongate, leafy. *Leaves* fleshy. *Flowers* small, in *racemes* shorter than the leaves, *bracts* small, *sepals* subequal, *petals* rather smaller than the sepals, *lip* adnate to the foot of the column, *spur* conical, with the cavity divided by a vertical *septum* and with a dorsal 2-lobed *callus*, *lateral lobes* small, *midlobe* small, incurved, *column* short, *anther* beaked, *pollinia* 2, bipartite, *caudicle* slender, *gland* small.

1. SARCANTHUS PENINSULARIS, *Dalz. Fl. Br. Ind. VI, p. 67; Dalz. and Gibs. p. 264; T. Cooke, Fl. of Bombay, II, p. 706,* (*by error* peduncularis).

Stem as thick as a duck's quill, flexuous, green, invested by the leaf sheaths, up to a foot in length. *Leaves* 4 to 6 inches long by ½ inch broad, fleshy, curved, linear—lanceolate acuminate, narrowed at the base. *Racemes* about 1½ inch long, leaf opposed, *flowers* deflexed, scattered, ¼ inch in diameter, *bracts* minute, *rachis* slender, *pedicels* very short, *sepals* and *petals* spreading, yellow with intramarginal red bands, *lateral sepals* elliptic obtuse, *dorsal* a little longer and narrower than these, *petals* subequal to the lateral sepals, spathulate, *lip* with violet *lateral lobes* and a pink, incurved, acute midlobe, *spur* conical, septate, *dorsal callus* small.

Flowers during the rains.

Distribution.—This species only occurs in North Kanara within our area, from thence it extends southwards to Travancore and Ceylon.

23. CLEISOSTOMA.

This differs from Sarcanthus only in the *spur* not being septate and from Saccolabium in having a dorsal scale or callus within the spur beneath the column.

1. CLEISOSTOMA (sp. nov. ?).

Stem about 3 inches long, as thick as a goose quill. *Leaves* sheathing, greenish brown, coriaceous, keeled, linear-oblong emarginate, up to 14 inches in length. *Inflorescence* shortly racemose. *peduncle* slender, stiffly erect, bearing pink flowers, each ⅓ inch in diameter, in clusters of 6 towards the apex; *sepals* broadly ovate, semi-patent, broader than the petals, *lip*, base spurred, continuous with the column, *spur* obtuse, incurved, with two *calli* at its mouth, *blade* 3-lobed, *lateral lobes* shallow, pointing forwards, *midlobe* broadly triangular obtuse, *column* short, broad, *foot* 0, *anther* 1, *pollinia* 2, each bilobed.

The above is the description, written at the time of collection, of an orchid found on the Divimona Ghat in North Kanara, before 1902, when my specimens and drawings were destroyed by fire. The plants flowered at the beginning of the rains. I lost these some years ago and have never had an opportunity of collecting them again. Dr. Cooke, in his "Flora of Bombay" does not include this genus in his account of Orchidaceæ. I have never been able to identify the plant with any that are described or figured so that it is probably new.

24. DIPLOCENTRUM.

Epiphyte with a short, leafy stem. *Leaves* few, two-ranked, linear, fleshy, unequally 2-lobed at apex. *Inflorescence* a pendulous *raceme*, branched near the base. *Flowers* small, rather crowded. *bracts* minute, *pedicels* and *ovary* short, *sepals* spreading, connivent at base, *lateral* falcate, larger than the *dorsal*, all obtuse, *petals* shorter and narrower than the dorsal sepal, acute, *lip* thick entire, fixed on the base of the column, with two short blunt *spurs*. *column* short, thick and blunt, 2-auricled, *anther* 2-celled, *pollinia* 2, ovoid, furrowed or bipartite, attached by a broad strap to a broad *gland*.

1. DIPLOCENTRUM CONGESTUM, *Wight. Fl. Br. Ind., VI., p. 78; T. Cooke, Fl. of Bombay, II, p. 704.*

Leaves in 2 or 3 pairs, recurved, about 3 inches long. *Peduncles* stout, simple or with a few branches near the base. *Flowers* crowded, especially so towards the tips of the spikes, each about $\frac{1}{4}$ inch in diameter, *bracts* minute, triangular-ovate, *pedicels* very short, *sepals* greenish brown, tinged with pink, *lateral* falcately oblong obtuse, *dorsal* elliptic oblong, *petals* also greenish brown, tinged with pink, *lip* pink suffused with brown, about $\frac{1}{6}$ inch long, fleshy, oblong obtuse, *column* white, *auricles* pink.

Flowers appear during the commencement of the rainy season.

Distribution.—On trees in the forests of North Kanara and also recorded from the Iyemally Hills in Travancore by R. Wight, who figured it in his Icones, Plate 1682.

It is a mean looking plant rising so little above the moss in which it grows that it usually remains unnoticed. In Poona, where some plants were kept alive for a few years the spikes became very short indeed.

(*To be continued.*)

THE BUTTERFLIES OF KUMAUN.

BY

F. HANNYNGTON, I.C.S.

(With a Map.)

INTRODUCTION.

The Kumaun Division, comprising the Districts of Almora, Naini Tal and Garhwal, is bounded on the north by Tibet, on the south by the Pilibhit, Bareilly, Moradabad and Bijnor Districts, on the east by Nepal, and on the west by the Native State of Tehri Garhwal and the Dehra Dun and Bijnor Districts. For entomological purposes it may be roughly divided into 3 areas :—

(1) Tropical from 1,000-2,000 ft. above sea-level.

(2) Sub-Tropical and Temperate from 2,000-9,000 ft. above sea-level, comprising the greater part of Kumaun and consisting of a series of ranges and peaks intersected by deep valleys.

(3) Alpine and Sub-Alpine from 9,000 ft. up to the snow-line.

The first region with a purely artificial boundary on the south abounds with forms to be met with in the plains together with a fair number of endemic forms ; the second contains by far the larger number of species herein enumerated while the third is the home of the palæarctic forms dependent for their food-supply on the shrubs and grasses between the tree-limit and the region of perpetual snow.

While containing so far as I have been able to determine, no species of butterfly peculiar to itself, Kumaun forms a most interesting connecting link from an entomological point of view between the Sikkim forms on the one hand and the purely N. W. Himalayan forms on the other. Of the three districts, Garhwal has been far less thoroughly worked than Naini Tal or Almora and parts of it are still more or less a *terra incognita* to the naturalist. The only previous list of the butterflies of this region extant to my knowledge is the one compiled by Doherty in 1886 and published in the Journal of the Asiatic Society of Bengal, Volume LV, part 2. This list is probably inaccessible to the majority of readers of this Journal : it includes a number of species now generally recognised as local races of more

THE BUTTERFLIES OF KUMAON.

widely distributed forms and more than one species of whose occurrence in Kumaon I am still doubtful, while it omits a fair number of forms which have since been found commonly in the district. Seeing that this list, which enumerates 271 species, was the result of a stay of less than six months in Kumaun with only two trips into the interior, one of which Doherty himself confesses to have been a failure, degenerate entomologists of the present day cannot but admire the author's wonderful energy and accuracy of observation.

Treating of the question of local distribution, Doherty remarks that the Kali Valley—the Eastern boundary of Kumaun—"forms a "genuine zoological boundary.

"Among the species that seem to extend no further west are:—"*Papilio paris*, *Melanitis zitenius*, *Elymnias lencocyma* (=*malelas*). "*Symbrenthia hypselis*, *Neptis vikasi*, *Euthalia appiades* and *E.* "*lubentina* and such genera and sub-genera as *Dyctis*, *Rohana*, "*Dichorrhagia*, *Moduza*, *Haridra*, *Zemeros*, *Chersonesia*, *Chliaria*, "*Remelana* and *Cheritra*."

The danger of hasty generalisation of this nature is well borne out by the present list, nearly all the genera enumerated above being represented in West Kumaun and in some cases by more than one species, while at least two of the species—*S. hypselis* and *E. lubentina*—are to be met with in the extreme west.

The fact is that it is almost impossible to lay down hard and fast geographical boundaries when dealing with Himalayan species. Kumaun is a "debateable area" between the south-east and south-west monsoon currents and receives rain from both. When the south-east or Bay current is stronger than that from the Arabian Sea, stragglers from Sikkim like *Arhopala centaurus* or *Euthalia lepidea* may be found as far west as Naini Tal at all events, while conversely, a strong Arabian Sea current will bring in stragglers from the N. W. Himalayan area like *Nytha parisatis* and *Erebia hyagriva*.

Leaving aside the chief factor which is, of course, the presence of the food-plant which supports the larva, the distribution of Himalayan species will, I think, be found to depend chiefly upon the relative strength or weakness of these two currents and as this is a variable phenomenon, it is next to impossible to lay down specific geographical boundaries; this too probably accounts for the fact that Kumaun contains no species peculiar to itself.

In compiling the present list I have had constant access to the fine collection of Mr. Peake at Jeolikote which includes a most representative Kumaun collection made by the late Mr. Vanrenen of Binsar throughout a number of years. I have also embodied my own two years' experience, though I have been compelled through force of circumstances to depend very largely on native agency for the collection of specimens. The total number of separate forms recorded is 371.

Thanks to Mr. P. Mackinnon's generous help in identification of doubtful species, I hope that the list will be found fairly complete and, if it should prove of assistance to future workers over the same ground, its purpose will have been served.

I have marked with an asterisk any form that has not come under my personal observation. In classification and nomenclature I have, where possible, followed Bingham, whose firm stand against the ultrasectionist tendencies of some latter-day entomologists entitles him to the gratitude of posterity. That he did not live to complete his work is nothing short of a calamity.

A word as to seasons and localities. As in most parts of India, the greatest number of varieties are on the wing just after the rains in September and October, but the early summer (March and April) is only slightly less prolific in species of interest to the collector. Taking the whole year round, the wooded ravines at from 2,000-5,000 feet elevation will be found the best hunting grounds, especially in the dry months.

At high elevations above 12,000 feet, the season is late and short, beginning in July and ending in September, the rarer forms not appearing till August. The commoner varieties will, however, be found encroaching on the snow line even as early as May.

Butterflies are so easily influenced by vicissitudes of season that it is not surprising to find many species common in one year, and scarcely visible in the next. For instance, a very dry season like 1907 resulted in a "miraculous draught" of *Dophla patala* around Naini Tal in May 1908, while in 1909 this butterfly did not appear till June and was comparatively rare in all its favourite haunts. Not only so, but the early rains in July caused the few that were on the wing to disappear with disconcerting suddenness. As a rule, however, the converse holds good and heavy rains result in great abundance of in-

dividuals not only on the cessation of the monsoon, in September, but in the following March and April. This is doubtless to be explained by the abundance of food-plants for the larvæ; the exceptions will only be in the case of larvæ like *Dophla patala* which feed on oaks and hardy trees but little affected by drought. Forest fires, too, must destroy myriads of larvæ in a dry year.

FAMILY—NYMPHALIDÆ.

Sub-family—DANAINÆ.

1. **Danais limniace,** *Cramer.*—Common. April-October. 2,000 to 5,000 ft.

2. **Danais aglea melanoides,** *Cram.* (Parantica melanoides, *Moore*).—Common in April and May and from July to October at from 3,000 to 5,000 ft.

3. **Danais septentrionis,** *Butler.*—Common. May and September. 1-5,000 ft.

4. **Danais tytia,** *Gray.*—Fairly common in wooded nullahs in April and May and again in September and October at 3-5,000 ft.

5. **Danais melanea,** *Cramer.*—Rare in the Tarai in January.

6. **Danais plexippus,** *Linn.*—Common everywhere up to 5,000 ft.

7. **Danais chrysippus,** *Linn.*—Common everywhefe up to 5,000 ft.

The *Euplainæ* are only represented in Kumaun by three species, two endemic and the third a rare visitor from Nepal.

8. **Euploea core,** *Cram.*—Very common at 2-5,000 ft. especially in July and October.

9. °**Euploea splendens,** *Butler* (rogenhoferi, *Felder*).—Recorded by Bingham from Eastern Kumaun. I have not met with it from this locality into which it appears to come as a rare straggler from Nepal.

10. **Euploea mulciber,** *Bingham* (midamus, *Linn.*).—Rare at Nalena, at 3-4,000 ft. in April and May. Common in Kali and Sarju Valleys in August.

SATYRINÆ.

The *Satyrinæ* are well represented throughout Kumaun, fifty-two forms being recorded.

11. **Mycalesis sanatana,** *Moore.*—Rare at Binsar and Askot, 6-8,000 ft. in May and October. The wet-season form (*gopa*) may be looked for in August at 6,000 ft. at Ramgarh, Takula, etc.

12. **Mycalesis perseus,** *Fabr.*—Common. 1-6,000 ft. in March, April, May and October. The wet season form (*M. blasius*) occurs plentifully at Ranibagh and elsewhere from July to September.

13. **Mycalesis mineus,** *Linn.*—With its dry-season form (*otrea*) occurs in the same localities as *M. perseus*, but is not so common.

14. **Mycalesis visala,** *Moore.*—Common in the Tarai in October. I have not come across the wet-season form which is almost indistinguishable from the wet-season form of *M. mineus* (*vide* Bingham, Vol. I, p. 60).

15. **Mycalesis malsara lepcha,** *Moore.*—Common from March to October at 3-5,000 ft. in shady ravines. It has been usual hitherto to regard *M. lepcha* as the dry form of *M. malsara*. Bingham, however, classes both forms as a race of *M. malsara*.

16. **Mycalesis nicotia,** *Hewitson.*—And its dry season form (*M. langi*, de Nicèville) occur sparingly at 2-5,000 ft.

17. **Mycalesis heri,** *Moore.*—Doherty took a dry-season form at Jhulaghat 2,000 ft. and 2 wet-season specimens at Kapkot and Baghrighat 3-7,000 ft. J. S. B. 1886, p. 115. I have never come across it.

18. **Orsotriaena meda,** *Fabr.*—A single male from Kichha on the Southern border in September.

19. **Lethe europa,** *Fabr.*—Rare at Ranibagh, 2,000 ft. in December.

20. **Lethe rohria,** *Fabr.* (L. dyrta, *Felder*).—Common. April to October at 2-7,000 ft.

21. **Lethe ihsana,** (L. hyrania), *Kollar.*—Common throughout Kumaun at 7,000 ft., June to October.—The darker *dinarbas* form occurs from Binsar eastwards.

22. **Lethe confusa,** *Aurivillus* (L. rohria, *Fabricius*).—Common from June to October at 2-7,000 ft.

23. **Lethe verma,** *Kollar.*—Not uncommon at Binsar and Naini Tal, 6-8,000 ft. in August and September.

24. **Lethe sidonis,** *Hewitson.*—I am doubtful whether this is not really the dry season form of *L. vaivarta* as described by Doherty (J.A.S.B. 1886, p. 115). Both forms are to be found throughout Kumaun at about 7,000 ft., but *L. vaivarta* is only on the wing during the rains. It seems questionable whether the latter is even a local race.

25. **Lethe vaivarta,** *Doherty.*—Dhakuri, Khati 7-11,000 ft. (Doherty). Fairly common at about 7,000 ft. from July to September.

26. **Lethe nicetas,** *Hewitson.*—Common at 3-6,000 ft. from June to October.

27. **Lethe maitriya,** *de Nicèville.*—Not common at 6-10,000 ft. in May and October in higher river valleys.

28. **Lethe kansa,** *Moore.*—Common on Cheena, Naini Tal at 8,000 ft. and less so at Nalena, 4,500 ft. in April and May. Apparently not recorded before so far west. The underside is much paler than in specimens from Sikkim and Assam and the three white subapical spots on the upperside of the fore-wing are more prominent, thus approaching *L. sinorix*. The specimen from Nepal in the British Museum exhibits the transition to the Kumaun form.

29. **Lethe (Zophoessa) jalaurida,** *de Nicéville.*—Dhakuri, Khati, Pindari Valley, 7-11,000 ft. (Doherty). Evidently rare outside the Pindari Valley. I have only received specimens from that locality, and it is not in the Vanrenen collection.

30. **Lethe (Zophoessa) baladeva,** *Moore.*—Common in Pindari Valley, 7-9,000 ft. in May and August. Flies fast and is difficult to capture owing to its habit of settling in clumps of bamboo on which its larva doubtless feeds.

31. **Lethe (Zophoessa) coalpara,** *Moore.*—Habitat recorded by Bingham as the Himalayas from Simla to Sikkim. I have only received specimens in Kumaun from the Sarju Valley 4,000 ft. in September.

32. **Lethe (Zophoessa) Yama,** *Moore.*—Not uncommon at Naini Tal and Binsar at 7,000 ft. in May and June.

33. **Lethe (Neope) pulaha,** *Moore.*—Rare at Binsar and on the Eastern border in September.

34. **Orinoma damaris,** *Gray.*—Decidedly rare at Nalena and at the third mile on the Ratighat Road below Naini Tal in September at about 4,000 ft.

35. **Rhaphicera moorei,** *Butler.*—Not uncommon in the Pindari and other interior valleys at 7-11,000 ft. in August and September. De Nicéville records *Rhaphicera satricus,* Doubleday, as occurring "in the wooded hills beyond Almora in Kumaun" (*vide* Atkinson). It is not in the Vanrenen collection and *R. moorei* occurs considerably to the East of Almora. Though there is no reason why it should not stray over the Eastern border, I hesitate to include it in the absence of recent evidence.

36. **Satyrus (Amecera) schakra,** *Kollar.*—Common in May to October on stony ground at from 4,500 to 11,000 ft.

37. **Nytha (Hipparchia) parisatis,** *Kollar.*—Rare in the extreme west of Garhwal on the borders of Tehri in September.

38. **Maniola davendra,** *Moore.*—(*vide* Bingham, Vol. I. p. 119. "Recorded also by Felder from Kumaun.")

39. **Maniola pulchella,** *Felder.*—To be found at and above 12,000 ft. in inner ranges in August.

40. **Aulocera brahminus,** *Blanchard.*—Not uncommon at the same altitude and season as the foregoing.

41. **Aulocera swaha,** *Kollar.*—Very common from August to October at 6,000-10,000 ft. The commonest butterfly on the wing in Naini Tal in September.

42. **Aulocera padma,** *Kollar.*—Occurs sparingly from May to October at 5,000 to 8,000 ft. at Binsar and on the inner ranges. A rare visitor on Cheena in May, June and July.

43. **Aulocera saraswati,** *Kollar.*—Rare in August and September on the grassy slopes between 6,000 and 10,000 ft. frequented by its congener, *A. swaha.*

44. ° **Æneis pumilis,** *Felder.*—"One male, Chinese Tibet 17,000 ft.' (Doherty). Probably very rare on the Kumaun side of the Passes.

45. **Ypthima philomela indecora,** *Moore.*—Common in the valleys up to 6,000 ft. from June to October.

46. **Ypthima baldus,** *Fabr.*—This, the *Y. philomela* of de Nicéville, is fairly common from June onwards up to 5,000 ft. Its dry season form (*Y. marshalli*, Butler) is common at Haldwani from December to March.

47. **Ypthima sakra,** *Moore.*—Common at 2,000-7,000 ft. May to October.

48. **Ypthima nareda,** *Kollar.*—Common at 2,000-7,000 ft. April to October, especially in the vicinity of Naini Tal in August.

49. **Ypthima avanta,** *Moore* (= Y. singala, *Felder*).—Wet-season form common at 2-6,000 ft. from June to August and dry-season form common in Tarai in cold weather.

50. **Ypthima huebneri,** *Kirby.*—With its dry-season form (*Y. lowera*) common at same times and places as the last.

51. **Ypthima asterope,** *Klug.*—Rare in the low river valleys at about 3,000 ft. from August to October.

52.° **Erebia kalinda,** *Moore.*—Has been taken at 10,000 ft. in the interior of Garhwal. I have not come across it.

53. **Erebia nirmala,** *Moore.*—Very common from May to September at 4,000-8,000 ft., sometimes swarming at Naini Tal in damp, cloudy weather.

54. **Erebia annada,** *Moore.*—Common in May and again in August to October at Naini Tal and hills from 6-8,000 ft. The wet-season form (*E hybrida*) is almost indistinguishable from *E. nirmala.*

55. **Erebia scanda,** *Kollar.*—Fairly common between 7 and 11,000 ft. May and October.

56. **Erebia (Ypthima) hyagriva,** *Moore.*—Common during the rains at 3-7,000 ft.

57. **Melanitis ismene,** *Cramer.*—Common up to 7,000 ft. May to November.

58. **Melanitis bela,** *Moore.*—Not common in the river valleys from 2-4,000 ft. August to October.

59.° **Melanitis zitenius,** *Herbst.*—Rare in the Kali Valley in the extreme East in August.

60. **Elymnias undularis,** *Drury.*—The males are common at 2-5,000 ft. July to October in shady ravines. The females do not appear till September and are comparatively scarce.

61. **Elymnias malelas,** *Hewitson* (= E. leucocyma, *de N.*)—Fairly common, August to October, in river valleys bordering on Nepal.

62.° **Elymnias (Dyctis) patna,** *Westwood.*—"Two males at Junction of Kali and Gori Rivers" (Doherty).

Sub-family—NYMPHALINÆ.

63. **Charaxes marmax (lunawara),** *Westwood.*—Rare in Kali Valley in the extreme East in August and September.

64. **Charaxes polyxena homana,** *Butler.*—Rare at Kapkot on the Sarju and in Kali and Gori Valleys in August.

65. **Charaxes fabius,** *Fabr.*—Fairly common in river valleys debouching on the plains up to 2,000 ft. in July and August.

66. **Eulepis athamas,** *Drury.*—Common up to 3,000 ft. from July to October on outer hills.

67. **Eulepis eudamippus,** *Doubleday.*—Rare in low river valleys, September to November.

68. **Eulepis dolon,** *Westwood.*—Has been taken at Kilberry near Naini Tal in September. Very rare.

69. **Apatura ambica,** *Kollar.*—Occurs sparingly in outer ranges up to 5,000 ft. from April to October.

70. °**Apatura arpisatis,** *Westwood.*—"One male seen at Jhulaghat." (On the extreme eastern border) Doherty. It is evidently a rare visitor on the extreme east and I have not heard of its being actually taken in Kumaun up to date.

71. **Dilipa morgiana,** *Westwood.*—Very rare in Kumaun. A single male was brought to me from the Pindari Valley by a native catcher in August. It is said to occur at Bhim Tal.

72. **Hestina nama,** *Doubleday.*—Rare at Binsar in June and on eastern border in the rains.

73. **Perhestina persimilis zellas,** *Butler.*—Common at Nalena, 4,500 ft. from June to October and more sparingly up to 7,000 ft.

74. **Euripus consimilis,** *Westwood.*—Rare along outer ranges up to 3,000 ft. in April, July and August.

75. **Sephisa dichroa,** *Kollar.*—Common at Takula, Binsar, Naini Tal, etc., 6-8,000 ft. in May and October.

76. **Sephisa chandra,** *Moore.*—Rare in eastern valleys at 4,000 ft. in May.

77. **Dichorragia nesimachus,** *Boisduval.* Rare in river valleys on extreme East and at Binsar and Nalena at about 4,000 ft. in April and August.

78. **Stibochiana nicaea,** *Gray.*—Occurs sparingly in ravines at 4,000-7,000 ft. in May, June and July.

79. **Dophla patala,** *Kollar.*—Common at Naini Tal and Bhowali, 4-8,000 ft. in May and June. The larva may be found on oak trees (*Quercus incana*) in May.

80. °**Euthalia lepidea,** *Butler.*—A single male was taken by Mr. de Rhé Philippe in April 1902 at Ranibagh, 2,000 ft. (*vide* Volume XIV, No. 3, page 595, of the Society's Journal.)

81. **Euthalia appiades,** *Ménétriés.*—Not common in river valleys on the extreme East.

82. **Euthalia lubentina,** *Cramer.*—Scarce near Nalena, at 4,000 ft. in October and November and in Kali Valley in August.

83. **Euthalia garuda,** *Moore.*—Fairly common in April and again in October in valleys at 2-4,000 ft. throughout Kumaun.

84. **Euthalia (Symphaedra) nais,** *Forster.*—Has been taken at Haldwani 1,000 ft. and Bhim Tal 3,000 ft. in March, but is only a rare visitor along the outer ranges.

85. **Moduza procris,** *Cram.*—Rare at Haldwani in Tarai from October to January. Its occurrence so far north is unusual. Bingham gives its habitat as Peninsular India.

86. °**Liminitis daraxa,** *Doubleday.*—Recorded by Atkinson from Kumaun (de Nicéville, Volume II, page 158.) I have never met with it.

87. **Auzakia (Liminitis) danava,** *Moore.*—Common in shady ravines at 4,000 to 8,000 ft. April, May and again from August to October.

88. **Pantoporia cama,** *Moore.*—Common, April to October at 2,000-5,000 ft. near streams.

89. **Pantoporia selenophora,** *Kollar.*—Not common at 6,000 ft. in April and May.

90. **Pantoporia zeroca,** *Moore.*—Rare at Nalena 4,500 ft. and Binsar, 8,000 ft. in May and June.

91. **Pantoporia opalina,** *Kollar.*—Common from April to October in wooded nullahs at 3,000-7,000 ft.

92. **Athyma perius,** *Linn.*—Common in April and October in the same localities as the last-named.

93. **Athyma asura,** *Moore.* Rare at Binsar 8,000 ft. in August.

94. **Neptis eurynome,** *Westwood.*—Common all over Kumaun from 2-7,000 ft. This form includes *N. astola, emodes, varmona* and *eurymene* as recorded from Kumaun by Doherty.

95. **Neptis columella,** *Cram.*—Not common at Haldwani and Ranibagh in December and January.

96. **Neptis mahendra,** *Moore.*—Common from May to October at 6-9,000 ft.

97. **Neptis yerburii**, *Butler* (=N. nandina, *Moore*).—Common in April and May at 3-6000 ft.

98. **Neptis soma**, *Moore* (=N. susruta, *Moore*).—Common in the rains at 2-5,000 ft.

99. **Neptis sankara**, *Kollar* (=N. amba, *Moore*).—Common from April to July at 4-9,000 ft.

100. **Neptis narayana**, *Moore*.—Very rare at from 5-6,500 ft. in May.

101. **Neptis vikasi pseudovikasi**, *Moore*.—Not common in wooded ravines at 3,000 ft. in August and September. Doherty found it rare at Kapkot, 4,000 ft.

102 **Neptis zaida**, *Doubleday*. Not uncommon at Nalena, 4,500 ft., in June and July.

103. **Neptis radha**, *Moore*.—Not common at Nalena, 4,500 ft., in May and at Bageshwar 3,200 ft. in October.

104 **Neptis ananta**, Moore.—Fairly common 3,000 ft. in August and September.

105. **Neptis viraja**, *Moore*.—Not uncommon at Nalena, 4,500 ft. in June.

106. **Rahinda hordonia**, *Stoll*.—Common in April and May at 3,000-5,000 ft. near wooded streams.

107. **Cyrestis thyodamas**, *Boisduval*.—Common everywhere up to 8,000 ft. April to October. The pale yellow form appears to be peculiar to higher elevations in the dry season, in Kumaun at all events.

108. **Chersonesia risa**, *Doubleday*.—One male, Kapkot, Sarju Valley, 3,700 ft. in May. Doherty took it at 2-3,000 ft. in the Kali Valley in August.

109. **Junonia iphita**, *Cram*.—Common everywhere up to 7,000 ft.

110. **Junonia lemonias**, *Linn*.—Common everywhere up to 7,000 ft.

111. **Junonia orithya**, *Linn*.—Common on open hill-sides up to 9,000 ft.

112. **Junonia hierta**, *Fabr*.—Not quite so common and confined to open hill-sides.

113. **Junonia almana**, *Linn*.—Common in river valleys up to 4,000 ft. Its wet-season form (*asterie*) is very common at Ranibagh in the rains.

114. **Junonia atlites**, *Johannsen*.—Rare in the Tarai in January and February.

115. **Vanessa cardui**, *Linn*.—Common from June to October at 6-10,000 ft.

116. **Vanessa indica**, *Herbst*.—Very common, 3,000-11,000 ft. March to November.

117. **Vanessa kashmirensis**, *Kollar*.—Very common 2-18,000 ft. March to October. I have a curiously melanized specimen taken on Cheena in May.

118. **Vanessa rizana.**—Occurs in inner ranges above 10,000 ft. in July and August.

119. **Vanessa ladakensis,** *Moore.*—"Near Kalapani, Nepalese Tibet, 14,000 ft." (Doherty).

120. **Vanessa xanthomelaena,** *Denis.*—Common on Cheena, Binsar, and Dhakuri from March to May and again in October at 8,000 to 11,000 ft. The life-history of this butterfly as described by de Nicéville (Vol. II, p.) is very strange. It is certainly double-brooded but I do not believe that the second brood "disappears" from June till the following March as I have it from the Pindari Valley in October. It seems more probable that it passes the winter as an imago like so many of its congeners, emerging early in the following spring and producing a second brood in September. I obtained the larvæ from Binsar early in October, but they unfortunately died before pupating.

121. **Vanessa canace,** *Johannsen.*—Common in May and June and again in September and October at 5,000 to 10,000 ft.

122. **Vanessa c. album,** *Linn.*—Not uncommon in the Pindari Valley at 8,000-12,000 ft. in May and August.

123. **Symbrenthia lucina,** *Cram.* (= S. hippoclus, *de N.*) Common in April, May, August, September and October in wooded nullahs from 3,000-6,000 ft.

124. **Symbrenthia hypselis,** *Godart.*—Not uncommon throughout Kumaun in April and May and again in September, October at 2,000-6,000 ft. often along with the last-named.

125. **Symbrenthia brabira,** *Moore.*—Doherty separates the wet and dry-season forms of this species (as *hysudra* and *S. asthala*). It is fairly common in the inner valleys at 7-9,000 ft. in May and August.

126. **Hypolimnas bolina,** *Linn.*—This fine butterfly appears on the wing in July, and may be found from the plains up to 8,000 ft. till December.

127. **Hypolimnas misippus,** *Linn.*—Not so common and confined to the outer ranges up to 4,000 ft. in April and again from August to November.

128. **Kallima inachus,** *Boisduval.*—Common in nullahs from 2,000 to 6,000 ft. April to October.

129. **Cethosia cyane,** *Drury.*—Though recorded from Kumaun, I have not yet come across any specimens. It doubtless occurs on the Eastern border as it is common in Sikkim.

130. **Atella phalantha,** *Drury.*—Very common from June to December up to 7,000 ft.

131. **Issoria sinha,** *Kollar.*—Rare at Nalena 4,500 ft. in May and again in September.

132. **Cupha erymanthis,** *Drury.*—Common in May, June and October in valleys up to 4,500 ft.

133. **Argynnis jainadeva,** *Moore.*—Rare in minor ranges above 9,000 ft., July to October.

134. **Argynnis kamala,** *Moore.*—Fairly common on the inner ranges, 8,000—10,000 ft., May to September.

135. **Argynnis childreni,** *Gray.*—Common from June to October at 5,000-10,000 ft. Most of the specimens from Naini Tal are true *childreni*. The *sukuntala* type occurs further west.

136. **Argynnis hyperbius,** *Johanssen.*—Common up to 7,000 ft. in April and May and from July to October.

137. °**Argynnis gemmata,** *Butler.*—Recorded by Bingham from Kumaun. I have not come across it in any local collection.

138. **Argynnis lathonia issaea,** *Doubleday.*—Very common, April to October, 5,000-10,000 ft.

139. °**Argynnis clara,** *Blanchard.*—Very local in interior of Tehri Garhwal in August in high river valleys.

140. **Melitaea sindura,** *Moore.*—Rare at 12,000 ft., June to August.

141. **Ergolis ariadne,** *Johanssen.*—Not uncommon at 2,000-5,000 ft. in September and October.

142. **Ergolis merione,** *Cram.*—Common up to 6,000 ft. May to December. Its conspicuous larva makes little attempt at concealment on the leaves of the Castor Oil plant on the underside of which it pupates. The butterfly is mimicked by the ♀ of *Apatura parisatis* and is undoubtedly protected, though I am unable to determine precisely what form the protection takes.

143. **Faudergolis wodah,** *Kollar.*—Common up to 8,000 ft. March to October.

ACRÆINÆ.

144. **Pareba vesta,** *Fabr.*—Very common in the rains at 3-6,000 ft. in the neighbourhood of its food-plant, *Boehmeria salicifolia*.

145. **Telchinia violae,** *Fabr.*—A single male taken at Bhim Tal, 3,000 ft. in October. It probably occurs sparingly in the Tarai as it is common in Oudh in the Rains.

LIBYTHÆINÆ.

146. **Libythea celtis lepita,** *Moore.*—Very common, May to October, at 4,000 to 7,000 ft.

147. **Libythea myrrha,** *Godart.*—Very common, May to October especially at 4,000 ft. in August after heavy rain.

FAMILY—NEMEOBIDÆ.

148. **Dodona durga,** *Kollar.*—Very common, May to October especially at Ramgarh, 6,000 ft.

149. **Dodona dipoea,** *Hewitson.*—Common at 4-7,000 ft.

150. **Dodona eugenes,** *Bates.*—Fairly common, March to October at 3,000-7,000 ft.

151. **Dodona ouida,** *Moore.*—Rare and local on Binsar and Cheena at 7,000 ft. in May and October.

152. **Abisara fylla,** *Doubleday.*—Not common at 4,000 to 8,000 ft., Nalena, Binsar, Naini Tal, etc., in April and again in September.

153. **Abissara echerius,** *Stoll* (= Abisara suffusa, *Moore*).—Common from July to October at 2-4,000 ft. in river valleys.

154. **Zemeros flegyas,** *Cram.*—Common from March to October at 3,000 to 5,000 ft. in valleys near water.

(*To be continued.*)

DESCRIPTIONS OF INDIAN MICRO-LEPIDOPTERA.

BY

E. MEYRICK, B.A., F.R.S., F.Z.S.

XI.

ŒCOPHORIDÆ.

Macrobathra equestris, n. sp.

♀. 18 mm. Head and thorax dark bronzy-fuscous. Palpi dark fuscous, rather obscurely lined with ochreous-whitish. Antennæ white spotted with blackish. Abdomen dark fuscous, segmental margins mixed with ochreous-whitish. Forewings elongate-lanceolate; fuscous, towards base dark fuscous; a broad transverse yellow fascia extending from $\frac{1}{3}$ to middle, edged with a few black scales: cilia brownish. Hindwings dark grey; cilia fuscous.

Khasis, in April; one specimen. In every respect a characteristic member of this distinct genus, which is largely developed in Australia, but has not hitherto been recorded elsewhere.

Borkhausenia pseudospretella, Stt.

Newera Eliya, Ceylon; Khasis; in April, May, and September. A domestic pest.

Borkhausenia obolava, n. sp.

♀. 13h-14 mm. Head and thorax fuscous, slightly whitish-sprinkled. Palpi yellow-whitish, second joint externally suffused with dark fuscous irroration except more or less beneath and at apex. Antennæ fuscous. Abdomen grey. Forewings elongate, narrow, costa gently arched, apex pointed, termen extremely obliquely rounded; fuscous, faintly purplish-tinged, irrorated with dark fuscous; a small pale greyish-ochreous spot close above tornus: cilia grey, somewhat sprinkled with whitish. Hindwings and cilia grey.

Nilgiris, 3,500 feet (Andrewes), N. Coorg (Newcome); in May and September; three specimens.

Anchonoma, n. g.

Head with loosely appressed scales; ocelli absent; tongue developed. Antennæ $\frac{3}{4}$, in ♂ moderately fasciculate-ciliated ($1\frac{1}{2}$), basal joint moderately elongate, without pecten. Labial palpi long, recurved, second joint thickened with dense somewhat rough scales beneath, terminal joint as long as second, slender, acute. Maxillary palpi very short, filiform, appressed to tongue. Posterior tibiæ clothed with rough hairs above. Forewings with 2 and 4 long stalked, 3 absent, 5 closely approximated at base, 8 and 9 out of 7, 7 to apex, 11 from middle. Hindwings 1, elongate-ovate, cilia $\frac{1}{2}$; 3 and 4 stalked, 5-7 tolerably parallel.

Belongs to the group of *Eulechria*, but specially distinguished by the peculiar nervation of forewings.

Anchonoma xeraula, n. sp.

♂♀. 21-28 mm. Head and thorax whitish-ochreous or pale greyish-ochreous, mixed with dark fuscous. Palpi whitish-ochreous, second and terminal joints variably sprinkled or suffused with dark fuscous except towards apex. Abdomen pale ochreous, sides tinged with fuscous. Forewings elongate, rather narrow, costa gently arched, apex obtuse, termen rounded, oblique; lower margin of cell sinuate and somewhat ridged beneath towards base, especially in ♂, a space above this tending to be thinly scaled; pale greyish-ochreous, suffusedly irrorated with dark fuscous; a small spot of dark fuscous suffusion on base of costa; stigmata cloudy, dark fuscous, first discal somewhat elongate, plical hardly beyond it, second discal approximated, in middle of wing; a cloudy pale subterminal line, sharply indented beneath costa, edged posteriorly with dark fuscous suffusion: cilia pale greyish-ochreous, with broad somewhat interrupted antemedian shade of dark fuscous suffusion. Hindwings light grey, paler and somewhat ochreous-tinged anteriorly; cilia grey-whitish, with grey subbasal line.

Khasis, in September; also from W. China; four specimens. Superficially very like *Borkhausenia pseudospretella*, and might be overlooked accordingly, though structurally very distinct.

Nephogenes fugax, n. sp.

♂♀. 21-22 mm. Head, palpi, antennæ, and thorax grey. Abdomen brownish-ochreous, segmental margins pale greyish-ochreous. Forewings elongate, rather narrow, costa gently arched, apex obtuse, termen extremely obliquely rounded; light grey, slightly brownish-tinged, irregularly sprinkled or irrorated with dark fuscous, sometimes forming lines on veins towards costa posteriorly; a spot of blackish irroration on base of costa; stigmata blackish, plical rather beyond first discal; a subterminal bent series of dots of black irroration close to termen and posterior part of costa: cilia light greyish, towards base sprinkled with dark fuscous. Hindwings light grey; cilia ochreous-grey whitish.

Palni Hills, 6,000 feet (Campbell); three specimens. The genus *Nephogenes* is of some extent in Australia; this is the first species recorded elsewhere, but seems normal in every way. I have however a nearly allied species (undescribed) from Celebes.

Hypercalla pyrarcha, n. sp.

♂♀. 17-18 mm. Head yellow, a line on crown and spots on side of face and collar orange-reddish. Palpi pale yellow, second joint except towards apex ferruginous-orange sprinkled with fuscous, terminal joint with median band of orange and dark fuscous scales. Antennæ pale yellowish, suffused with grey towards apex, ciliations, in ♂ 3. Thorax yellow, irregularly streaked with orange-red. Abdomen grey. Forewings elongate-oblong, costa moderately arched, apex obtuse, termen sinuate, somewhat oblique; yellow, reticulated with orange-red; basal third of costa orange-red with three oblique dark fuscous streaks; two fasciæ of dark purplish-grey suffusion, first median, dilated towards dorsum so as to reach ½ and coalesce posteriorly with second, second

broad, terminal, united with first by bar beneath costa so as to enclose in disc an orange-red roundish patch containing a yellow spot marked with a dark fuscous dot: cilia pale yellowish, with partial interrupted grey subbasal shade, at apex and towards tornus suffused with dark purple-grey. Hindwings grey, lighter anteriorly; cilia yellow-whitish, with pale greyish subbasal shade.

Khasis, in July; two specimens.

Therapnis, n. g.

Head with appressed scales; ocelli present; tongue developed. Antennæ $\frac{4}{5}$, in ♂ serrulate, minutely ciliated ($\frac{1}{3}$), basal joint moderately elongate, without pecten. Labial palpi long, recurved, second joint thickened with appressed scales, terminal joint shorter than second, slender, acute. Maxillary palpi short, filiform, appressed to tongue. Posterior tibiæ clothed with rough hairs above. Forewings with 2 from angle, 7 to costa, 8 absent, 11 from middle. Hindwings 1, elongate-ovate, cilia $\frac{1}{3}$; 4 absent, 5-7 tolerably parallel.

Apparently allied to *Sphyrelata*.

Therapnis parorma, n. sp.

♂ 12-13 mm., ♀ 14-16 mm. Head, antennæ, and thorax dark fuscous Palpi dark fuscous, slightly whitish-sprinkled, apex of joints whitish. Abdomen fuscous. Forewings elongate, costa gently arched, apex rounded-obtuse, termen very obliquely rounded; dark fuscous, base of scales ochreous-whitish; a curved blackish transverse line at $\frac{1}{6}$, followed by more or less whitish-ochreous suffusion often marked or tinged with reddish-ochreous, in ♂ expanded into a broad fascia not quite reaching costa; stigmata large, blackish, sometimes edged with whitish-ochreous or yellowish, plical rather beyond first discal, usually an additional smaller spot between and above discal, in ♂ obliterated with reddish-ochreous and merged in the pale costal patch following; a blackish interrupted line rising from costa at $\frac{2}{3}$, sinuate downwards and running to near apex, thence very near termen to dorsum before tornus, on costa preceded by a suffused whitish-ochreous patch, larger in ♂, and preceded in discal angulation by a smaller spot of whitish-ochreous or reddish-ochreous suffusion: cilia light fuscous, basal half sprinkled with dark fuscous or blackish. Hindwings rather dark grey: cilia grey.

Kegalle, Madulsima, Haputale, Kalutara, Matale, Ceylon (Alston, Pole Vaughan); from May to August, six specimens.

Erotis, n. g.

Head small, with appressed scales, ocelli present; tongue developed. Antennæ $\frac{5}{6}$, in ♂ serrulate, simple, basal joint moderate, with pecten of short scales. Labial palpi long, recurved, widely diverging, second joint reaching base of antennæ, somewhat expanded towards apex with rather rough scales, terminal joint shorter than second, slender, acute. Maxillary palpi short, filiform, appressed to tongue. Thorax rather swollen. Anterior tibiæ dilated with rough scales; posterior tibiæ clothed with rough hairs above. Forewings with 2 from about $\frac{1}{6}$, 3 from angle, 4 absent, 5 rather approximated to 3, 7 and

8 stalked, 7 to costa, 9 from near 7, 10 remote, rising from $\frac{3}{5}$ of cell, 11 from $\frac{1}{2}$. Hindwings $\frac{4}{5}$, elongate-ovate, cilia $\frac{2}{3}$; 4 absent, 5 somewhat approximated to 3, 6 and 7 tolerably parallel.

A peculiar genus, of which the position must at present be considered quite doubtful. It can be regarded as an aberrant genus of *Oecophoridæ*, but it is possible that it should form a new family; the small head and swollen thorax, widely divergent palpi, and peculiar position of veins 10 and 11 of forewings are discordant characters which cause it to stand isolated.

Erotis phosphora, n. sp.

♂ ♀. 13-20 mm. Head, palpi, and antennæ ochreous-whitish. Thorax rose-pink spotted with dark grey irroration. Abdomen dark grey, sides and apex ochreous-whitish, basal segment suffused with pink. Forewings elongate, rather narrow, costa gently arched, apex obtuse, termen strongly rounded, oblique; rose-pink, irregularly strewn throughout with small spots of dark grey irroration; a streak of dark grey suffusion along costa from before middle to $\frac{3}{4}$; somewhat larger dark grey spots in disc at $\frac{1}{3}$ and $\frac{2}{3}$, and on dorsum at $\frac{2}{3}$: cilia rose-pink, with two lines of black points, basal third barred with dark grey irroration. Hindwings grey, thinly scaled and subhyaline in disc and towards base; cilia light grey.

Matale, Kegalle, Maskeliya, Kalutara, Ceylon (Alston, Pole); in July, November, and December; four specimens.

Macrosaces, Meyr.

The generic definition may be extended in the following points: labial palpi with second joint sometimes expanded towards apex, terminal sometimes longer than second; forewings with 3 sometimes present, stalked with 2 or separate; hindwings seldom with 5 absent.

Macrosaces negatella, Walk.

(*Gelechia negatella*, Walk, Cat. XXIX, 631.)

♂ ♀. 11-16 mm. Variable in depth of colouring, but always recognisable by the transverse blackish blotch on costa at $\frac{1}{3}$, reaching $\frac{2}{3}$ across wing. Hindwings varying from pale to dark grey.

Maskeliya, Pattipola, Ceylon (Pole, de Mowbray, Fletcher); from September to May.

Macrosaces amphiterma, n. sp.

♂ ♀. 10-14 mm. Head and thorax whitish-ochreous, irrorated with grey. Palpi ochreous-whitish, second joint considerably expanded with scales toward apex, sprinkled with dark fuscous, with a dark fuscous subapical band, terminal joint longer than second, with two dark fuscous bands. Antennæ whitish-ochreous ringed with fuscous. Abdomen grey, anal tuft whitish-ochreous. Forewings elongate, narrow, costa gently arched, apex obtuse, termen very obliquely rounded; 3 absent; whitish-ochreous, variably irrorated with fuscous, with some scattered black scales; a small blackish spot at base beneath costa, with a raised blackish tuft of scales beyond this; a somewhat oblique-transverse line of raised blackish scales at $\frac{2}{3}$, edged posteriorly

with whitish-ochreous, on costa expanded into a triangular spot, in middle with a slight angular projection posteriorly; second discal stigma raised, blackish, more or less distinctly edged with whitish-ochreous or yellowish, and a similar dot beneath and rather beyond it; an indistinct cloudy waved whitish-ochreous line from $\frac{3}{4}$ of costa to dorsum before tornus, more or less edged anteriorly with dark fuscous irroration, its central third strongly curved outwards; a waved line of dark fuscous irroration running round posterior part of costa and termen: cilia whitish-ochreous mixed with fuscous and sprinkled with dark fuscous. Hindwings and cilia grey.

Maskeliya, Ceylon (Pole); in January and February, five specimens.

Macrosaces pendula, n. sp.

♂♀. 10-13 mm. Head and thorax whitish-ochreous irrorated with fuscous. Palpi ochreous-whitish, second joint moderately thickened, dark fuscous except apex, terminal joint as long as second, with dark fuscous band below middle. Antennæ whitish-ochreous ringed with fuscous. Abdomen fuscous. Forewings elongate, narrow, costa slightly arched, apex obtuse, termen very obliquely rounded; 3 absent; whitish-ochreous more or less irrorated with fuscous and dark fuscous; a blackish subcostal tuft towards base; a rather oblique transverse gently curved blackish line at $\frac{2}{3}$, tufted beneath costa and above dorsum, edged posteriorly with whitish-ochreous, expanded into a triangular blackish spot on costa and slightly sinuate near dorsum; second discal stigma raised, blackish, and a similar dot beneath and somewhat beyond it; an indistinct line of dark fuscous irroration or suffusion from $\frac{3}{4}$ of costa to dorsum before tornus, acutely angulated in middle; some indistinct dots of dark fuscous suffusion on posterior part of costa and termen; cilia pale fuscous, sprinkled with ochreous-whitish points and a few dark fuscous scales. Hindwings and cilia grey or pale grey.

Khasis; in October, five specimens. Very similar to *amphiterma*, but with the lines differently formed, and readily distinguished by the different marking and structure of palpi.

Macrosaces icteropa, n. sp.

♂♀. 11-14 mm. Head ochreous-yellow. Palpi light yellowish, second joint moderately thickened, somewhat sprinkled with dark fuscous except towards apex, terminal joint as long as second, with a dark fuscous ring near base. Antennæ pale yellowish ringed with dark fuscous. Thorax ochreous-yellowish sprinkled with fuscous. Abdomen rather dark fuscous, anal tuft pale ochreous mixed with fuscous. Forewings elongate, narrow, costa slightly arched, apex obtuse; termen very obliquely rounded; 3 absent; light ochreous-yellowish densely irrorated with dark fuscous; a blackish subcostal tuft towards base; stigmata raised, black, plical obliquely before first discal, these two with a spot on costa and a mark on dorsum appearing to form a rather curved oblique line interrupted in disc, an additional dot beneath and rather beyond second discal; a very indistinct transverse line of darker irroration from a black dot on costa at $\frac{2}{3}$, acutely angulated in middle: cilia fuscous

suffused with whitish-ochreous at base, with three indistinct darker lines. Hindwings and cilia dark grey.

Khasis; in August and September, six specimens. Nearly allied to the two preceding, but the markings of the palpi are different from either; also characterised by the yellow head, dark general colouring, and discal interruption of first transverse line.

Macrosaces lucubrata, n. sp.

♂♀. 9-10 mm. Head and thorax whitish-ochreous irrorated with grey and fuscous. Palpi whitish-ochreous, second joint moderately thickened, irrorated with dark fuscous except at apex, with a blackish subapical ring, terminal joint as long as second, with a black band below middle. Antennæ whitish-ochreous ringed with dark fuscous. Abdomen grey, anal tuft whitish-ochreous. Forewings elongate, narrow, costa slightly arched, apex obtuse, termen very obliquely rounded; 3 absent; dark fuscous, base of scales whitish-ochreous; a small blackish spot at base beneath costa, and a black scaletuft beyond it edged posteriorly with whitish-ochreous; a nearly straight direct transverse raised black line at $\frac{2}{5}$, somewhat enlarged on costa, slightly sinuate above and below middle, strongly edged posteriorly with whitish-ochreous or yellowish; second discal stigma raised, black, strongly edged with whitish-ochreous or yellowish, and a similar spot beneath it, their pale margins usually confluent; a whitish-ochreous spot on costa at $\frac{3}{4}$, whence proceeds a very indistinct whitish-ochreous angulated transverse line, preceded by some blackish irroration; a cloudy waved line of blackish irroration along posterior part of costa and termen: cilia fuscous, sometimes mixed with dark fuscous, sprinkled with whitish-ochreous points, sometimes faintly barred with whitish-ochreous suffusion. Hindwings in ♂ grey or rather dark grey, in ♀ blackish grey; cilia grey.

Maskeliya, Peradeniya, Matale, Ceylon (Pole, Green); in July, August, December, and January; five specimens.

Macrosaces glebaria, n. sp.

♂♀. 11-14 mm. Head ochreous-yellowish, crown irrorated with dark fuscous. Palpi whitish-ochreous, second joint moderately thickened, dark fuscous except apex, terminal joint as long as second, with blackish subbasal ring. Antennæ whitish-ochreous, ringed or suffused with dark fuscous. Thorax dark fuscous. Abdomen ochreous-yellowish suffusedly banded with fuscous. Forewings elongate, rather narrow, costa gently arched, apex obtuse, termen very obliquely rounded; 2 and 3 short-stalked; dark fuscous, more or less sprinkled with whitish-ochreous; a small black spot at base beneath costa, and one on dorsum near base; a black subcostal tuft towards base; stigmata moderately large, raised, black, plical slightly before first discal, these two together with costal and dorsal black spots tending to form an interrupted rather bent transverse line, second discal sometimes pale-edged, with an additional spot beneath it; a pale ochreous-yellowish subtriangular blotch on costa about $\frac{3}{4}$, whence proceeds a very indistinct whitish-ochreous angulated

line to dorsum before tornus : cilia fuscous somewhat mixed with dark fuscous, base suffused with whitish-ochreous. Hindwings in ♂ light fuscous, in ♀ rather dark fuscous ; cilia light fuscous.

N. Coorg, 3,500 feet (Newcome) ; in June, October, and November, four specimens.

Macrosaces hemilyca, n. sp.

♂ ♀. 11-13 mm. Head and thorax rather dark fuscous, somewhat sprinkled with whitish-ochreous. Palpi whitish-ochreous sprinkled with blackish, second joint moderately thickened, terminal joint as long as second, with two broad blackish bands occupying nearly all of it. Antennæ whitish-ochreous more or less suffused with fuscous, and ringed with dark fuscous. Abdomen fuscous. Forewings elongate, narrow, costa slightly arched, apex obtuse, termen very obliquely rounded ; 3 separate or short stalked with 2 ; dark fuscous base of scales whitish-ochreous ; a blackish subcostal tuft near base ; a cloudy blackish raised rather curved direct transverse shade at $\frac{2}{5}$ edged posteriorly more or less widely with whitish-ochreous suffusion ; second discal stigma raised, cloudy, blackish, with an additional less marked dot below it ; a rather large spot of whitish-ochreous suffusion on costa about $\frac{3}{4}$, whence an indistinct angulated cloudy whitish-ochreous line runs to dorsum before tornus, edged anteriorly with blackish irroration : cilia fuscous mixed with darker, sometimes sprinkled with whitish-ochreous points, base whitish-ochreous. Hindwings rather dark fuscous, anterior half sometimes pale whitish-ochreous ; cilia fuscous.

Palnis, 6,000 feet (Campbell) ; four specimens. The variation in the colour of hindwings is singular ; it is not sexual, as the specimens include male and female of each form ; and as the two forms agree in other respects, especially in the characteristic markings of the palpi, and are from the same locality, it is improbable that they are specifically distinct. I regard the form with the basal half of hindwings pale as being the type, and think the other form with hindwings wholly dark deserves a varietal name ; I therefore name it var. *ecliptica*.

Macrosaces orphania, n. sp.

♂ 15-16 mm. Head pale ochreous, crown irrorated with dark fuscous. Palpi whitish-ochreous, second joint moderately thickened, irrorated with dark fuscous except at apex, terminal joint as long as second, with dark fuscous subbasal and subapical rings. Antennæ whitish-ochreous ringed with dark fuscous. Thorax dark fuscous, base of scales whitish-ochreous. Abdomen pale ochreous mixed with fuscous. Forewing elongate, narrow, posteriorly dilated, costa gently arched, apex obtuse, termen very obliquely rounded ; 2 and 3 short-stalked ; whitish-ochreous more or less densely irrorated with fuscous and dark fuscous, sometimes suffused with fuscous ; a dark fuscous subcostal tuft towards base ; a rather curved cloudy dark fuscous transverse raised line at $\frac{2}{3}$, indistinctly edged with whitish-ochreous posteriorly nearly straight from below costa to below middle ; second discal stigma

blackish, raised, obscurely pale-edged, and a similar spot beneath and hardly beyond it ; a faint cloudy line of darker irroration from $\frac{2}{3}$ of costa to dorsum before tornus, posteriorly faintly pale-edged, angulated in middle and indented above this : cilia fuscous, with pale base and darker subbasal shade. Hindwings and cilia grey.

♀. 15 mm. Palpi with second joint dark fuscous except apex, dark rings of terminal joint broader. Forewings with ground colour dark fuscous, markings blackish, first line posteriorly edged with whitish-ochreous. Hindwings becoming dark grey posteriorly.

Palnis, 6,000 feet (Campbell) ; five specimens. Immediately distinguished from *hemilyca* by the absence of the pale blotch on costa posteriorly ; the distinct dilation of the forewings is also a special characteristic.

Macrosaces crocozona, n. sp.

♂ ♀. 9-10 mm. Head, thorax and abdomen dark grey. Palpi dark grey anterior edge and apex of joints yellowish. Antennæ dark grey, obscurely dotted with pale yellowish. Forewings elongate, rather narrow, costa gently arched, apex obtuse, termen very obliquely rounded ; 3 present, separate ; ashy-grey irrorated with blackish ; a short yellow subcostal dash towards base ; three ochreous-yellow direct transverse fasciæ, first at $\frac{1}{3}$, moderately broad, usually narrowed on costa, posterior edge rather prominent in middle, second narrow, enclosing raised black second discal stigma and a similar dot beneath it, and reaching dorsum, but not costa, third narrow, running from about $\frac{3}{4}$ of costa to tornus, sometimes somewhat dilated in disc : cilia grey, sprinkled with black on basal half. Hindwings with 5 absent ; grey ; cilia grey.

Khasis, from July to October ; five specimens. This species differs from all the rest in the absence of vein 5 of hindwings, but, though very distinct, it is at the same time so obviously allied that generic separation is not called for.

Eutorna, Meyr.

A distinct genus, hitherto represented by ten Australian and two New Zealand species, with which the following species has close affinity.

Eutorna insidiosa, n. sp.

♂ ♀. 10-13 mm. Head and thorax ochreous, face whitish-ochreous. Palpi pale ochreous, scales of second joint loosely expanded above towards apex. Antennæ whitish-ochreous, dotted with dark grey. Abdomen grey, segmental margins suffused with ochreous-whitish. Forewings elongate, rather narrow, costa anteriorly moderately, posteriorly slightly arched, apex rounded-obtuse, termen extremely obliquely rounded ; deep ochreous ; costal edge blackish towards base ; a broad ferruginous-brown streak beneath fold from base to tornus, suffused beneath and posteriorly, edged above with some black scales and then with whitish suffusion ; a triangular patch of ferruginous-brown suffusion extending on costa from $\frac{2}{3}$ to near apex and reaching half across wing, edged anteriorly by a very oblique ochreous-whitish streak preceded towards costa by some blackish irroration, and enclosing a shorter similar streak from costa at $\frac{3}{4}$, second discal stigma round, black, edged with ochreous-

whitish ; some blackish scales along termen : cilia ochreous-whitish, with two suffused brown shades. Hindwings rather dark grey ; cilia grey.

Khasis, from August to October ; ten specimens.

Pseudodoxia melanema, n. sp.

♂♀. 12-13 mm. Head, palpi, antennæ, thorax, and abdomen dark purplish-fuscous. Forewings elongate, narrow, costa gently arched, apex obtuse, termen very obliquely rounded ; dark purplish-fuscous : cilia rather dark fuscous. Hindwings dark fuscous ; cilia rather dark fuscous.

Khasis, in July and August ; six specimens.

Pseudodoxia placida, n. sp.

♂♀. 13-16 mm. Head and thorax light fuscous, forehead sometimes tinged with whitish-ochreous. Palpi fuscous, apex of joints more or less tinged with whitish-ochreous. Antennæ fuscous. Abdomen grey, anal tuft, ochreous-whitish. Forewings elongate, rather narrow, costa moderately arched, apex tolerably pointed, termen extremely obliquely rounded ; light fuscous sprinkled with darker, sometimes suffused with darker along costa ; stigmata blackish, plical beneath first discal ; sometimes some indistinct dark fuscous marginal dots round apex : cilia fuscous, sprinkled with whitish points, base paler. Hindwings grey ; cilia rather light grey, base pale ochreous.

Madulsima, Ceylon (Vaughan) ; from April to June, ten specimens.

Pseudodoxia triastis, n. sp.

♂. 17-21 mm. Head whitish-ochreous. Palpi whitish-ochreous, second joint suffused with dark fuscous except apex, terminal joint sometimes with some dark fuscous scales towards base. Antennæ whitish-ochreous tinged with fuscous. Thorax whitish-ochreous suffused anteriorly with fuscous. Abdomen grey, anal tuft whitish-ochreous. Forewings elongate, rather narrow, costa moderately arched, apex obtuse, termen very obliquely rounded ; whitish-ochreous, sometimes tinged with fuscous, more or less irregularly and suffusedly irrorated with fuscous and dark fuscous ; stigmata rather large, blackish-fuscous, plical beneath first discal ; some more or less marked large cloudy blackish-fuscous dots round posterior part of costa and upper part of termen : cilia whitish-ochreous more or less suffused with light fuscous. Hindwings grey ; cilia whitish-ochreous more or less suffused with grey.

♀. Head and thorax usually suffused with fuscous. Palpi with terminal joint more or less irrorated with dark fuscous except towards apex. Forewings usually almost wholly suffused with light fuscous and irrorated with dark fuscous ; markings as in ♂. Hindwings and cilia grey.

Madulsima, Maskeliya, Patipola, Ceylon (Vaughan, Pole, Alston) ; from December to June ; twenty-five specimens. There is considerable variability in the development of the dark suffusion, and the sexes are normally dissimilar, the ♀ being so much darker, but the darkest ♂ is hardly distinguishable from the lightest ♀. Nearly all my examples are from Madulsima, where Mr. Vaughan takes the species in plenty. *P. placida*, which occurs with it, is smaller, and can always be distinguished by the pointed forewings.

Pseudodoxia pinarodes, n. sp.

♂. 14-16 mm. Head and thorax whitish-ochreous or pale greyish-ochreous. Palpi dark fuscous, terminal joint ochreous-whitish towards apex. Antennæ whitish-ochreous, more or less suffused with fuscous. Abdomen whitish-ochreous sprinkled with fuscous. Forewings elongate, costa moderately arched, apex obtuse, termen very obliquely rounded; pale greyish-ochreous, sprinkled with fuscous and dark fuscous, especially towards costa and posteriorly; stigmata large, blackish, plical beneath first discal; sometimes some cloudy dark fuscous dots round posterior part of costa and upper part of termen: cilia pale greyish-ochreous, sometimes mixed with fuscous. Hindwings varying from pale fuscous to grey; cilia pale greyish-ochreous, sometimes with suffused fuscous subbasal shade.

Maskeliya, Ceylon (Pole); in January, ten specimens. Smaller than *P. triastis*, with the forewings shorter and broader, and costa somewhat more arched.

Pseudodoxia cryptias, n. sp.

♂ ♀. 14-16 mm. Head and thorax grey. Palpi whitish-ochreous suffusedly irrorated with dark grey except at apex of joints. Antennæ dark grey. Abdomen dark grey, sides of anal segment suffused with ochreous-whitish. Forewings elongate, rather narrow, costa gently arched, apex round-pointed, termen extremely obliquely rounded; grey, irrorated with dark grey; second discal stigma sometimes perceptible, dark grey: cilia grey, sometimes mixed with darker, sprinkled with pale points. Hindwings and cilia in ♂ grey, in ♀ dark grey.

Madulsima, Ceylon (Vaughan, Green); in May and June, five specimens.

Pseudodoxia agorœa, n. sp.

♂. 14 mm. Head whitish-ochreous. Palpi ochreous-whitish, second joint blackish-grey except apex. Antennæ pale greyish-ochreous becoming grey towards base. Thorax grey suffused with blackish anteriorly. Abdomen whitish-ochreous. Forewings elongate, very narrow, costa slightly arched, apex round-pointed, termen extremely obliquely rounded; grey, sometimes slightly whitish-sprinkled, or posteriorly sprinkled with fuscous; base of costa suffused with blackish; stigmata rather large, black, plical rather before first discal; sometimes some cloudy blackish marginal dots round apex: cilia pale grey, sprinkled with darker and whitish points. Hindwings grey, rather thinly scaled in disc and towards base; cilia pale grey.

Maskeliya, Ceylon (Pole); in February, two specimens. Allied to *seposi tella*, but distinguished by the small size and very narrow forewings.

Pseudodoxia picrophœa, n. sp.

♂ ♀. 17-21 mm. Head and thorax dark fuscous, irrorated with whitish. Palpi whitish, suffusedly irrorated with dark fuscous except towards apex of joints. Antennæ fuscous. Abdomen whitish-ochreous irrorated with grey. Forewings elongate, narrow, costa gently arched, apex round-pointed, termen extremely obliquely rounded; fuscous, more or less irregularly sprinkled with

darker, sometimes finely irrorated with whitish ; stigmata large, dark fuscous, plical rather before first discal ; some cloudy dark fuscous marginal dots round apex : cilia pale fuscous, more or less mixed with darker, and irrorated with pale points. Hindwings grey ; cilia pale greyish-ochreous, with faint fuscous subbasal shade.

Hakgala, Ceylon (Green) ; in March and April, three specimens. Larva feeding in a portable case on lichens growing on trunks and rocks (Green) ; case 27-31 mm. long, formed of silk covered with fragments of lichen, acutely tapering posteriorly, anterior half covered by an ovate hood, 10-12 mm. broad, extending as a ragged edge to below middle. The hood in this species is larger and more extensive than in *sepositella*, in which it does not reach middle of case, and much more so than in *limulus* and *cretata*, in which the hood bears only a small proportion to the length of the long slender acute posterior portion.

Pseudodoxia sepositella, Walk.

I was in error in referring *limulus* Durr. to this species as a synonym ; the two names indicate two very closely allied but distinct species ; my previous note referred to the true *limulus*. *P. sepositella* is larger (18-21 mm.), grey or dark grey, without dark irroration but often somewhat whitish-sprinkled, with a black spot beneath costa near base, stigmata large, black, plical rather before first discal, with faint pale nearly straight subterminal line indented in middle, and black marginal dots ; head pale ochreous-yellowish, thorax grey suffused with blackish anteriorly.

Maskeliya, Ceylon (Pole) ; in January, February, and July, seven specimens. Larva feeding like *limulus* ; case intermediate in character between those of *limulus* and *picrophæa*.

Pseudodoxia ichnæa, n. sp.

♀. 16-17 mm. Head and thorax pale greyish-ochreous with some scattered dark fuscous scales. Palpi whitish-ochreous, second joint irrorated with dark fuscous except base and apex. Antennæ pale greyish-ochreous. Abdomen grey, anal segment ochreous-whitish. Forewings elongate, narrow, costa gently arched, apex round-pointed, termen extremely obliquely rounded ; light fuscous sprinkled with dark fuscous ; stigmata moderate, blackish-fuscous, plical obliquely before first discal ; a series of large cloudy blackish-fuscous dots round termen and posterior part of costa : cilia fuscous irrorated with pale greyish-ochreous. Hindwings dark grey ; cilia light greyish-ochreous.

Peradeniya, Ceylon (Green) ; in February, two specimens. Larva feeding in the same way as the two preceding species (Green) ; case generally similar to that of *picrophæa* but smaller (length 20-23 mm., breadth of hood 8-9 mm.), hood extended as a diminishing wing to well below middle of case.

Psaltica, Meyr.

The generic characters, originally drawn from a single specimen, require to be amended in the following particulars : Antennæ in ♂ 1, in ♀ shorter ; forewings with 2 from $\frac{1}{3}$, 3 from angle. The genus is structurally near

Pseudodoxia, from which it is distinguished by vein 7 of forewings running to termen.

Psaltica monochorda, Meyr.

♂ ♀. 12-16 mm. Head light yellowish, sometimes tinged with brownish. Palpi pale yellowish, second joint varying from brownish to dark fuscous. Forewings with anterior half brown or dark brown, white median line variable, nearly straight or rather curved, often followed by a fascia of pale yellowish suffusion, discal black dot usually on posterior edge of this fascia, but sometimes within it if broad, apical area beyond this more or less suffused with brown. Hindwings varying from pale to dark grey.

Maskeliya, Madulsima, Peradeniya, Ceylon (Pole); from August to May, sixteen specimens. A variable species; the above notes are supplementary to the original description.

Psaltica toxophanes, n. sp.

♂. 13 mm. Head, antennæ, and thorax fuscous, crown suffused with ochreous-yellowish. Palpi dark fuscous, terminal joint whitish-ochreous. Abdomen grey, anal tuft ochreous-yellowish. Forewings elongate, rather narrow, costa gently arched, apex rounded-obtuse, termen very obliquely rounded; glossy ochreous-fuscous, with a faint purplish tinge; an incurved pale ochreous-yellowish fascia at $\frac{2}{3}$, anterior edge sharply defined, posterior suffused: cilia fuscous. Hindwings grey; cilia pale fuscous tinged with yellowish.

Khasis; in July, one specimen. Much blunter-winged than the preceding, without white line or black dot.

Psaltica xanthochra, n. sp.

♂. 10 mm. Head, palpi, and thorax yellow-ochreous. Antennæ greyish. Abdomen grey, anal tuft ochreous-yellowish. Forewings elongate, costa gently arched, apex obtuse, termen very obliquely rounded; glossy ochreous-brown, with a faint lilac tinge; a straight whitish line crossing wing at $\frac{2}{3}$, carrying the small black second discal stigma on its posterior edge, followed by a fascia of deep yellow suffusion, becoming much broader towards costa, apical area beyond this tinged with deep yellow: cilia ochreous-yellow Hindwings rather dark grey; cilia light grey tinged with yellowish.

Puttalam, Ceylon (Pole); two specimens. Distinguished from *P. monochorda* by the smaller size, deep yellow suffusion, more obtuse forewings, and black discal dot resting on white line instead of beyond it.

Eupselia, Meyr.

A genus of about fourteen Australian species, hitherto not found elsewhere. It is allied to *Psaltica*, but differs by the shorter antennæ, which are not lengthened or thickened in ♂, and coincidence of veins 7 and 8 of forewings (7 to costa, 8 absent). The following species agrees well in character with the typical Australian forms.

Eupselia isacta, n. sp.

♂ ♀. 13-14 mm. Head, palpi, and thorax ochreous-yellow, sides of face and shoulders ferruginous. Antennæ whitish-ochreous. Abdomen ochreous-

yellowish tinged with grey. Forewings elongate, costa moderately arched, apex obtuse, termen very obliquely rounded ; ochreous-yellow ; base of costa ferruginous, edge sometimes dark fuscous ; a dark brown transverse median fascia, anterior edge suffused into ground colour, posterior sharply limited by a white line ; more or less brownish suffusion towards termen : cilia ochreous-yellow, towards tornus tinged with brownish. Hindwings fuscous or dark fuscous ; cilia light greyish-ochreous, more or less tinged with fuscous.

Cuddapah, 4,000 feet (Campbell) ; N. Coorg, 3,500 feet (Newcome) ; in June, five specimens.

Leptosaces, Meyr.

This genus, founded on a New Zealand species, differs from *Cryptolechia* by the costal termination of vein 7 of forewings. Whilst maintaining it for present convenience, I think that it may, however, be ultimately merged in *Cryptolechia*.

Leptosaces phœbas, Meyr.

(*Eulechria phœbas*, Meyr. Journal, Bombay Natural History Society, XVII., 742.)

Described from females only, but having obtained both sexes commonly, I find that the species is referable here, the antennæ in ♂ being only minutely ciliated.

Khasis ; from May to October.

Leptosaces anticentra, n. sp.

♂ ♀. 13-14 mm. Head and thorax deep ochreous-yellow, shoulders suffused with dark fuscous. Palpi ochreous-yellow, somewhat sprinkled with dark fuscous. Antennæ pale yellowish, suffusedly ringed with dark fuscous. Abdomen grey, anal tuft whitish-ochreous. Forewings elongate, costa gently arched, apex round-pointed, termen slightly rounded, very oblique ; deep ochreous-yellow, sprinkled with dark fuscous ; base of costa suffused with dark fuscous ; stigmata dark fuscous, plical rather beyond first discal, second discal merged in a narrow dark fuscous fascia running from a triangular costal spot at $\frac{2}{3}$ to tornus, where it unites with a dark fuscous terminal fascia, which is rather broad on costa and irregularly attenuated downwards : cilia ochreous-yellow, with dark grey patches above apex and on tornus. Hindwings grey, darker in ♀ : cilia pale grey, with darker subbasal shade.

Khasis ; in May, four specimens. Very like *facunda*, but larger and more strongly marked, and easily recognised by the position of the plical stigma which is obliquely beyond first discal instead of before it.

Leptosaces facunda, n. sp.

♂ ♀. 11-12 mm. Head, palpi, and thorax deep ochreous-yellow, shoulders dark fuscous. Antennæ light yellowish, ringed in ♂ with grey, in ♀ with dark fuscous except towards base. Abdomen grey, anal tuft ochreous-yellowish. Forewings elongate, rather narrow, costa gently arched, apex obtuse, termen very obliquely rounded ; deep ochreous-yellow ; a streak of

rather dark fuscous suffusion along basal third of costa ; stigmata blackish, plical rather before first discal, an additional dot beneath second discal ; a spot of rather dark fuscous suffusion on middle of costa, reaching second discal stigma ; a moderately broad rather dark fuscous terminal fascia, rather prominent in disc so as to touch second discal stigma and dot beneath it : cilia ochreous-yellow, on tornus fuscous. Hindwings grey ; cilia whitish-yellowish, tinged with grey towards base.

Khasis ; in June, four specimens.

Leptosaces matœa, n. sp.

♂ ♀. 15-17 mm. Head and thorax whitish-ochreous. Palpi ochreous-whitish, second joint brownish or fuscous except apex. Antennæ whitish-ochreous, dotted with fuscous except towards base. Abdomen whitish-ochreous tinged with grey. Forewings elongate, rather narrow, costa gently arched, apex obtuse, termen very obliquely rounded ; whitish-ochreous : cilia concolorous. Hindwings grey ; cilia ochreous-whitish tinged with grey towards base.

Cuddapah, 4,000 feet (Campbell) ; three specimens.

Periacma, Meyr.

The original diagnosis should be corrected or extended in the following particulars. Antennæ ½ to nearly 1, in ♂ simple, rather thick. Labial palpi in ♂ with basal joint somewhat lengthened, second joint greatly elongate, moderately stout, smooth-scaled, pointed, terminal joint absent, in ♀ with second joint normal, long, terminal as long as second or shorter, slender, acute. Forewings with 2 and 3 sometimes stalked, 7 to apex or sometimes termen.

Having now plenty of material for dissection, I find that the ♂ palpi are really two-jointed, the greatly elongate joint, which I supposed to be the terminal, being really the second, whilst the terminal is wholly absent ; when the palpus is denuded, there appears to be not even a rudiment of it. The long second joint, though somewhat pointed, is not slender, and acute like the true terminal. As further evidence that it is really the terminal joint which is absent, it may be noticed that in such species as *scrupulosa* and *metrica*, where the second joint in the ♀ bears a black subapical ring, this same ring will be found in the ♂ beneath the apex of the elongate joint, clearly indicating its homology. This curious palpus, which is unique and cannot be mistaken for that of any other *Lepidoptera*, is alike in all the nineteen described species, and forms the distinguishing mark of the genus. Besides the three species previously described, *Phæosaces torrida*, Meyr. is properly referable here.

Periacma contraria, n. sp.

♂ 15 mm. Head, palpi, antennæ, and thorax whitish-ochreous. Abdomen pale grey, anal tuft whitish-ochreous. Forewings elongate, costa gently arched, apex round-pointed, termen extremely obliquely rounded ; 7 to termen ; whitish-ochreous, anteriorly tinged with yellow-ochreous, with a few scattered

blackish specks ; a small spot of fuscous suffusion on base of costa ; discal stigmata moderate, black, plical absent, but an additional dot beneath second discal ; several minute blackish dots on posterior part of costa and termen : cilia whitish-ochreous. Hindwings whitish-grey ; cilia ochreous-whitish.

Nilgiris, 6,000 feet (Andrewes) ; in May, two specimens.

Periacma scrupulosa, n. sp.

♀♂ 16-18 mm. Head whitish-ochreous. Palpi ochreous-whitish, sprinkled with black except apex of second and base and apex of terminal joint, second joint with blackish subapical ring. Antennæ ochreous-whitish, ringed with dark fuscous. Thorax whitish-ochreous sprinkled with blackish. Abdomen whitish-ochreous, dorsally suffused with grey. Forewings elongate, rather narrow, costa gently arched, apex obtuse, termen very obliquely rounded ; 7 to apex ; pale greyish-ochreous, sprinkled with fuscous and blackish ; a blackish dot on base of costa, one in middle of base, and one beyond and between these ; stigmata cloudy blackish, plical rather beyond first discal ; cloudy blackish costal dots on veins 8-12 : cilia pale fuscous irrorated with whitish-ochreous, along costa and on basal third along termen whitish-ochreous barred with blackish. Hindwings light grey ; cilia whitish-ochreous with faint greyish subbasal shade.

Maskeliya, Ceylon (Pole) ; in January, three specimens.

Periacma metrica, n. sp.

♂♀ 16-19 mm. Head and thorax whitish-ochreous, shoulders blackish. Palpi ochreous-whitish, somewhat sprinkled with blackish, second joint with black subapical ring. Antennæ whitish-ochreous, sometimes tinged with fuscous. Abdomen whitish-ochreous, sprinkled with grey. Forewings elongate, somewhat dilated posteriorly, costa gently arched, apex obtuse, termen very obliquely rounded ; 7 to apex ; pale greyish-ochreous, sprinkled with blackish ; a black dot on base of costa, one in middle of base, and one beyond and between these ; stigmata black, plical slightly beyond first discal ; a more or less developed longitudinal streak of blackish irroration above middle, hardly traceable anteriorly, usually distinct from above second discal stigma to beneath costa before apex, where it forms a cloudy blackish spot ; a series of blackish dots round posterior half of costa and termen : cilia pale fuscous irrorated with whitish-ochreous, basal third more or less spotted with blackish on costa with two entire blackish bars before apex. Hindwings pale grey ; cilia whitish-ochreous.

Maskeliya, Ceylon (Pole) ; in January, April, May, August and October ; ten specimens. Closely allied and very similar to the preceding species, but differs by the distinctly broader fore and hind wings, the forewings somewhat dilated posteriorly, the presence of the dark streak or at least spot beneath costa posteriorly, and the antennæ not ringed with dark fuscous.

Periacma limosa, n. sp.

♂♀ 14-20 mm. Head, palpi, antennæ, and thorax light brownish-ochreous. Abdomen grey, anal tuft pale ochreous. Forewings elongate, costa gently arch-

ed, apex obtuse, termen obliquely rounded ; 7 to apex ; light ochreous, suffusedly irrorated with brownish or fuscous ; stigmata large, cloudy, indistinct, fuscous, plical hardly beyond first discal ; sometimes an indistinct cloudy spot of fuscous suffusion towards apex : cilia light brownish-ochreous, sometimes with indications of fuscous spots. Hindwings grey ; cilia light grey, with two faint darker shades.

Maskeliya, Kegalle, Polgahawela, Puttalam, Trincomali, Ceylon (Pole, Alston, Green) ; in May, and from October to December, twelve specimens.

Periacma byrsodes, n. sp.

♂ 20 mm. Head pale greyish-ochreous. Palpi pale greyish-ochreous, irrorated with blackish. Antennæ and thorax pale greyish-ochreous irrorated with fuscous. Abdomen pale greyish-ochreous, irrorated with grey. Forewings elongate, costa moderately arched, apex obtuse, termen somewhat sinuate, rather oblique ; 7 to apex ; fuscous sprinkled with pale ochreous and blackish ; stigmata large, cloudy, very indistinct, formed of dark fuscous irroration, plical hardly beyond first discal, from second discal a streak of rather dark fuscous suffusion runs to submedian fold before tornus ; a dark fuscous terminal line : cilia whitish-ochreous, with traces of an interrupted fuscous median shade. Hindwings grey ; cilia as in forewings.

Hakgala, Ceylon (Green) ; in May, one specimen.

Periacma pentachora, n. sp.

♂ 16-20 mm. Head, thorax, and abdomen whitish-ochreous, shoulders dark fuscous. Palpi ochreous-whitish, basal joint and base of second irrorated with dark fuscous, second joint with a dark fuscous subapical dot. Antennæ whitish-ochreous more or less suffused with fuscous, becoming dark fuscous towards base. Forewings elongate, slightly dilated posteriorly, costa gently arched, apex obtuse, termen straight, oblique ; 7 to apex ; whitish-ochreous, suffused with pale yellow-ochreous towards margins ; a moderate blackish spot on base of costa ; stigmata blackish, plical slightly beyond first discal, another dot between and above discal, and a fifth near beneath second discal ; suffused dark fuscous spots on costa at $\frac{1}{3}$, $\frac{2}{3}$, towards apex, and on tornus, variable in development and sometimes in part almost obsolete : cilia whitish-ochreous. Hindwings whitish-ochreous tinged with grey ; cilia whitish-ochreous.

Palni Hills (Campbell) ; two specimens.

Periacma turbulenta, n. sp.

♂ ♀ 18-21 mm. Head and thorax light ochreous-yellowish, thorax anteriorly more or less widely suffused with dark fuscous. Palpi pale ochreous-yellowish, second joint sprinkled with fuscous. Antennæ whitish-ochreous, more or less suffused with fuscous. Abdomen light grey, anal tuft light ochreous-yellowish. Forewings elongate, posteriorly slightly dilated, costa gently arched, apex obtuse, termen faintly sinuate, oblique ; 7 to apex ; light ochreous-yellowish, irregularly sprinkled with brownish ; a broad streak of darker brown irroration or suffusion along costa from base to $\frac{2}{3}$, including a dark, fuscous

patch on base of costa; stigmata dark, fuscous, plical rather beyond first discal, discal connected by a pale yellowish streak, second large; a more or less developed triangular patch of dark fuscous suffusion on tornus, extending along termen to apex, its angle touching second discal stigma: cilia light ochreous-yellowish, on costa and at apex barred with dark brown suffusion, on termen sometimes with interrupted brownish antemedian shade. Hindwings light grey, in ♂ more or less suffused with whitish-ochreous; cilia whitish-ochreous, with two more or less indistinct grey shades.

Khásis; in September and October, seven specimens.

Periacma ceroplasta, n. sp.

♂♀ 18-24 mm. Head and thorax light ochreous-yellowish, shoulders suffused with dark fuscous. Palpi in ♂ whitish-ochreous with a few fuscous scales; in ♀ with rough expanded hairs towards apex of second joint above, light ochreous-yellowish sprinkled with dark fuscous. Antennæ whitish-ochreous obscurely ringed with dark fuscous. Abdomen whitish-ochreous tinged with grey. Forewings elongate, somewhat dilated posteriorly, costa gently arched, apex round-pointed, termen sinuate, oblique; 7 to termen; light ochreous-yellowish, usually with some scattered fuscous or dark fuscous scales; a broad undefined costal streak of fuscous irroration from base to middle; sometimes some fuscous suffusion towards middle of dorsum; stigmata black, plical obliquely beyond first discal, an additional dot close beneath second discal and sometimes connected with it; a patch of dark fuscous suffusion on costa at $\frac{2}{3}$; a more or less developed terminal fascia of fuscous or dark fuscous suffusion, triangularly dilated beneath so as to touch dot beneath second discal stigma: cilia light ochreous-yellowish, with more or less developed subbasal series of fuscous spots, above apex and at tornus with patches of dark fuscous suffusion. Hindwings light fuscous, more or less suffused with whitish-ochreous; cilia whitish-ochreous, with faint greyish subbasal shade.

Palni Hills, 6,000 feet (Campbell); four specimens.

Periacma chelonias, n. sp.

♂♀. 14-19 mm. Head and thorax deep ochreous-yellow, sides of crown and shoulders variably suffused with dark purplish-fuscous. Palpi ochreous-yellow, second joint with dark fuscous almost apical band, in ♀ with scales somewhat expanded above towards apex, terminal joint in ♀ $\frac{1}{3}$. Antennæ whitish-ochreous more or less suffused with fuscous. Abdomen grey. Forewings elongate, costa gently arched, apex round-pointed, termen faintly sinuate, oblique, more so in ♀; deep ochreous-yellow, sometimes tinged with brownish or sprinkled with dark fuscous; markings dark purplish-fuscous; a thick streak along costa from base to beyond middle; stigmata well-marked, plical hardly beyond first discal, these two often included in a rather broad transverse fascia of dark suffusion; a variable spot on costa at $\frac{2}{3}$ often connected with second discal stigma; a moderate terminal fascia, triangularly dilated beneath so as to touch second discal stigma; cilia ochreous-

yellow with dark fuscous patches above apex and on tornus. Hindwings grey; cilia light grey, becoming pale yellowish on upper part of termen.

Maskeliya, Peradeniya, Ceylon (Pole, Green, de Mowbray); from February to October, eleven specimens. The short terminal joint of palpi in ♀ is a special character. I have a large ♀ specimen, in which the whole forewing is suffused with rather dark fuscous, except a yellow streak on costa posteriorly, the cilia yellow as usual; it is probably a variety of this species; in colouring it recalls *melicrossa*, but is not so dark, and differs in palpi and form of wing.

Periacma melicrossa, n. sp.

♂♀. 14-16 mm. Head ochreous-yellow. Palpi ochreous-yellow, second joint with dark fuscous subapical ring, in ♀ with scales somewhat expanded above towards apex. Antennæ pale yellowish, suffusedly dotted with fuscous. Thorax and abdomen dark fuscous, anal tuft in ♂ mixed with pale yellowish. Forewings elongate, costa gently arched, apex obtuse, termen straight, oblique; 7 to just below apex; dark fuscous, in ♂ somewhat suffused with ochreous except towards costa and posteriorly, with a spot of yellow suffusion on costa beyond middle, stigmata perceptible, darker fuscous, in ♀ all these absent except a few yellowish scales on costa beyond middle; a deep yellow mark long costa towards apex: cilia ochreous-yellow, with a bar above apex and tornal patch blackish-grey. Hindwings dark grey; cilia grey, with darker subbasal shade.

Coorg, 3,500 feet (Newcome); from May to August, five specimens.

Periacma laganopa, n. sp.

♂♀. 16-19 mm. Head and palpi ochreous-yellow. Antennæ fuscous, beneath pale yellowish. Thorax ochreous-fuscous. Abdomen grey, anal tuft yellow-ochreous. Forewings elongate, costa gently arched, apex obtuse, termen slightly sinuate, oblique; 7 to termen; light yellow-brownish; stigmata dark fuscous, plical slightly beyond first discal; a suffused fuscous wedgeshaped mark from tornus touching second discal: cilia brownish-yellowish, on tornus sometimes with a brown patch. Hindwings rather thinly scaled, grey; cilia greyish-yellowish.

Khásis; in June and July, three specimens.

Periacmia haliphœa, n. sp.

♂♀. 14-16 mm. Head deep ochreous-yellow. Palpi ochreous-yellow, in ♂ more or less tinged with whitish. Antennæ dark grey. Thorax lilac-fuscous. Abdomen dark grey, anal tuft ochreous-yellowish. Forewing elongate, costa gently arched, apex obtuse, termen straight, oblique; 7 to termen; lilac-fuscous, second discal stigma sometimes obscurely darker: cilia ochreous-yellowish, towards apex and tornus suffused with brownish. Hindwings rather dark grey; cilia ochreous-yellowish.

Khásis; from July to September, eleven specimens.

Periacmia isomora, n. sp.

♂. 22 mm. Head deep ochreous-yellow. Palpi ochreous-yellow, second joint with black subapical ring. Antennæ dark grey. Thorax and abdomen

dark fuscous. Forewings elongate, costa gently arched, apex obtuse, termen faintly sinuate, oblique; 7 to just below apex; dark fuscous; second discal stigma and a suffused streak connecting it with tornus very obscurely darker: cilia dark fuscous. Hindwings dark fuscous; cilia fuscous, with darker subbasal shade.

Khasis; in May, one specimen.

Periacma conophanta, n. sp.

♂ ♀. 14-16 mm. Head, palpi, antennæ, thorax, and abdomen dark fuscous; lower part of face and base of palpi in ♂ suffused with whitish-ochreous, tip of palpi in ♀ whitish; anal tuft mixed with whitish-ochreous. Forewings elongate, rather narrow, costa gently arched, apex obtuse, termen straight, oblique; 7 to apex; dark purplish-fuscous; stigmata obscurely darker, plical rather beyond first discal; a small triangular ochreous-whitish spot on costa about $\frac{3}{4}$: cilia dark fuscous. Hindwings dark fuscous; cilia fuscous.

Madulsima, Peradeniya, Maturatta, Ceylon (Green, Pole); Khasis: from March to September, ten specimens.

Periacma todesma, n. sp.

♂ ♀. 17-19 mm. Head and thorax orange. Palpi orange, second joint in ♂ with dark fuscous streak anteriorly except towards base. Antennæ grey, beneath whitish-ochreous. Abdomen grey, anal tuft pale ochreous-yellowish. Forewings elongate, costa gently arched, apex obtuse, termen obliquely rounded; 7 to apex; orange; markings dark purplish-fuscous; a dot on base of costa; an irregular spot on base of dorsum; a streak along fold from near base to middle of wing, sometimes connected with preceding; a rather elongate mark above this, representing first discal stigma; a rather narrow fascia from costa beyond middle to dorsum before tornus, where it unites with a similar more irregular-edged fascia running round apex and termen cilia orange, becoming paler towards tips, beneath tornus grey. Hindwings grey; cilia pale yellowish, with indistinct grey subbasal shade.

Khasis; in May and June, twenty specimens. Closely allied to *orthiodes*, but the latter species is smaller and paler, and entirely without the dark fuscous streak on palpi of ♂. Before recognising its distinctness I sent specimens of the present species under the name of *orthiodes* to some of my correspondents, who are hereby requested to correct the error; the type of *orthiodes* is from Burma, and still unique.

Mesothyrsa, n. g.

Head with appressed scales, side-tufts loosely spreading; ocelli present; tongue developed. Antennæ $\frac{2}{3}$, in ♂ rather stout, simple, basal joint moderate, without pecten. Labial palpi very long, recurved, second joint very long, densely scaled, with rough expanded hairs above towards apex, terminal joint in ♂ short, obtuse, flattened and somewhat concave internally, in ♀ $\frac{1}{3}$, slender, acute. Maxillary palpi short, filiform, appressed to tongue. Posterior tibiæ clothed with long hairs above. Forewings with 2 from towards

angle, 8 and 9 out of 7, 7 to termen, 11 from middle. Hindwings 1, elongate-ovate, cilia $\frac{4}{3}$; 3 and 4 connate, 5—7 tolerably parallel.

In palpi and general characters intermediate between *Periacma* and *Cryptolechia*, but differing from both in 9 of forewings rising out of 7.

Mesothyrsa eolopis, n. sp.

♂♀. 15-18 mm. Head and thorax pale ochreous-yellowish, sides of crown somewhat mixed with fuscous, shoulders suffused with dark fuscous. Palpi whitish-ochreous, in ♂ with apex of second joint and most of terminal except apex suffused with dark fuscous, in ♀ with a few dark fuscous scales. Antennæ pale yellowish. Abdomen whitish-yellowish, more or less sprinkled with grey. Forewings elongate, costa gently arched, apex round-pointed, termen sinuate, oblique; light ochreous-yellowish; markings purplish-grey mixed with blackish-grey, variable in development; a spot extending along basal fifth of costa; stigmata irregular, large or small, plical beneath first discal, sometimes cloudy grey fasciæ extending from both discal stigmata to dorsum, second also connected with a blackish spot on costa at $\frac{2}{3}$; a cloudy fascia along termen, sometimes connected with both extremities of the preceding fascia: cilia light ochreous-yellow, with grey spots above apex and on tornus. Hindwings whitish-ochreous, more or less suffused with light grey on margins; cilia whitish-ochreous.

Palni Hills, 6,000 feet (Campbell); four specimens. The single ♀ example shows less grey colouring than any of the ♂♂.

Cryptolechia, Zell.

The genera *Homosaces*, *Phæosaces*, and *Prosarotra* are structurally, but apparently not naturally, separable from *Cryptolechia*, and I have therefore included all together; the same differences of neuration and palpi occur also in *Periacma*.

Cryptolechia micracma, n. sp.

♂♀. 12-13 mm. Head and thorax ochreous-yellow. Palpi ochreous-yellowish, second joint rough-scaled above towards apex, apex dark fuscous, terminal joint in ♂ very short, in ♀ $\frac{1}{2}$. Antennæ pale yellowish ringed with fuscous. Abdomen whitish-yellowish, in ♀ dorsally suffused with grey. Forewings elongate, costa gently arched, apex tolerably pointed, more so in ♀, termen nearly straight, in ♂ rather strongly, in ♀ very oblique; 7 to apex; deep ochreous-yellow, irregularly sprinkled with dark fuscous; stigmata dark fuscous, plical nearly beneath first discal; a suffused dark fuscous spot on costa at $\frac{2}{3}$; an irregular terminal fascia of dark fuscous suffusion or irroration, projecting beneath so as to touch second discal stigma: cilia ochreous-yellow. Hindwings in ♂ pale yellowish, in ♀ light grey; cilia pale yellowish.

Ceylon (probably low country); Khasis; in July, three specimens.

Cryptolechia vespertina, n. sp.

♂♀. 17-20 mm. Head, palpi, antennæ $\frac{2}{3}$, and thorax dark fuscous, sides of crown pale ochreous. Abdomen pale ochreous, dorsally tinged with grey. Forewings elongate, costa gently arched, apex obtuse, termen almost straight,

oblique ; 7 to apex ; dark purplish-fuscous, sprinkled with blackish ; stigmata large, cloudy, blackish, plical rather obliquely beyond first discal, second discal transverse ; sometimes a suffused whitish-ochreous spot on costa at $\frac{3}{4}$: cilia dark purplish-fuscous, with an interrupted whitish-ochreous basal line. Hindwings in ♂ whitish-ochreous more or less suffused with grey towards termen, in ♀ grey, paler towards base and suffused with whitish-ochreous along costa anteriorly ; cilia whitish-ochreous with grey subbasal shade.

Khasis ; in September, eight specimens.

Cryptolechia arana, n. sp.

♂♀. 9-11 mm. Head dark fuscous, face pale ochreous, sides of crown mixed with yellow-ochreous. Palpi pale ochreous, externally dark fuscous except towards apex of second joint. Antennæ dark fuscous, beneath pale ochreous. Thorax and abdomen dark fuscous. Forewings elongate, rather dilated posteriorly, costa anteriorly slightly arched, posteriorly rather bent, apex obtuse, termen nearly straight, rather oblique ; 7 to termen ; dark purplish-fuscous, sprinkled with blackish ; some ochreous-yellow scales towards costa anteriorly ; a more or less developed rather broad undefined median fascia of ochreous-yellow irroration, broader towards costa ; some irregular scattered ochreous-yellow scales posteriorly : cilia dark fuscous, with more or less developed basal series of small ochreous-yellow spots. Hindwings and cilia dark fuscous.

Khasis ; from July to October, five specimens.

Cryptolechia arvalis, n. sp.

♂♀. 15-17 mm. Head and thorax pale ochreous-yellowish, longitudinally streaked with ferruginous suffusion. Palpi whitish-ochreous, sprinkled with ferruginous and dark fuscous, second joint with scales roughly expanded towards apex above, terminal joint with a blackish submedian ring. Antennæ pale yellowish, indistinctly dotted with fuscous. Abdomen grey, anal tuft pale yellowish. Forewings elongate, slightly dilated posteriorly, costa gently arched, apex tolerably pointed, termen slightly sinuate, oblique ; 7 to termen ; ferruginous more or less sprinkled with black, costa and all veins marked with suffused pale ochreous-yellowish streaks : cilia light ochreous-yellowish, on basal half and on tornus throughout barred with ferruginous suffusion sprinkled with black. Hindwings dark grey ; cilia light grey, becoming whitish-ochreous round apex.

Karwar (Maxwell) ; Coorg, 3,500 feet (Newcome) ; in July and December, seven specimens.

Cryptolechia iridias, n. sp.

♂♀. 17-21 mm. Head golden ochreous, face and sides of crown more or less suffused with dark purple-bronzy. Palpi ochreous-yellow, second joint more or less bronzy towards base. Antennæ light ochreous, towards base suffused with dark purplish-fuscous. Thorax yellow-ochreous, suffused anteriorly with dark purplish-fuscous. Abdomen light ochreous. Forewings elongate, slightly dilated posteriorly, costa gently arched, apex obtuse, termen

nearly straight, rather oblique : 7 to apex ; pale yellow-ochreous, more or less sprinkled with dark brownish, especially on apical third ; base of costa suffused with dark fuscous ; stigmata dark fuscous, plical rather obliquely beyond first discal : cilia pale yellow-ochreous. Hindwings pale shining ochreous, tinged with fuscous posteriorly ; cilia pale yellow-ochreous.

Khasis, in July and August ; four specimens.

Cryptolechia tyrochyta, n. sp.

♂. 19-20 mm. Head, antennæ and thorax light yellow-ochreous. Palpi ochreous-yellowish, second joint with scales roughly expanded above towards apex, irrorated or suffused with rather dark fuscous except towards apex. Abdomen grey, anal tuft ochreous-yellowish. Forewings elongate, moderate, costa gently arched, apex rounded-obtuse, termen rounded, somewhat oblique; 7 to apex ; light yellow-ochreous ; first discal stigma absent or represented by two or three blackish scales, second more or less well-marked, blackish ; in one specimen a few dark fuscous scales on tornus : cilia light yellow-ochreous. Hindwings grey ; cilia ochreous-yellowish.

Cuddapah, 4,000 feet (Campbell) ; three specimens.

Cryptolechia aganopis, Meyr.

♂. 15-19 mm., ♀ 19-26 mm. Forewing with 7 to apex (not termen as stated) ; varying from pale brownish-ochreous to light brown ; plical stigma in ♂ hardly beyond first discal, in ♀ obliquely beyond first discal, sometimes obsolete. Hindwings fuscous or pale fuscous.

Maskeliya, Madulsima, Kandy, Puttalam, Trincomali, Ceylon ; from May to February.

Cryptolechia orthotoma, Meyr.

♂. 14-17 mm., ♀ 15-21 mm. Forewings varying from pale-ochreous to light fuscous ; stigmata smaller in ♂.

Maskeliya, Peradeniya, Matale, Galle, Ceylon ; from February to August, and in November

Cryptolechia dochoa, n. sp.

♂ ♀. 14-20 mm. Head, antennæ and thorax whitish-ochreous, variably tinged with grey. Palpi ochreous-whitish, second joint with scales roughly expanded above towards apex, sprinkled with dark fuscous. Abdomen grey, anal tuft whitish-ochreous. Forewings elongate, costa gently arched, apex obtuse, termen obliquely rounded ; 7 to apex ; pale greyish-ochreous, sometimes tinged with brownish, more or less sprinkled with dark fuscous ; stigmata blackish, discal well-marked, plical obliquely beyond first discal, sometimes little marked ; a terminal series of small dark fuscous dots : cilia pale greyish-ochreous, with two more or less indicated fuscous lines. Hindwings light grey ; cilia pale greyish-ochreous, with one or two grey shades.

Maskeliya, Madulsima, Maturatta, Hakgala, Rambukkhana, Polgahawela, Patipola, Ceylon (Green, Alston, Vaughan) ; in May, June, and from September to February, seventeen specimens. Smaller than *aganopis*, and recognis-

able by the different colouring and terminal dots. This is the species erroneously identified by me as *tetraspilella*, Walk., which latter is, I believe, really a *Xyloryctid*, and probably supersedes *Odites isocentra*, Meyr., though from the difficulty of properly examining the type I cannot positively identify it at present.

Cryptolechia temperata, n. sp.

♀. 20-24 mm. Head ochreous-yellow. Palpi pale ochreous-yellowish, smooth-scaled. Antennæ pale yellowish. Thorax ochreous-yellowish, more or less suffused with light brownish. Abdomen light ochreous-yellowish. Forewings elongate, slightly dilated posteriorly, costa gently arched, apex obtuse, termen nearly straight, rather oblique; 7 to apex, ochreous-yellow, towards dorsum, more or less tinged with brownish; stigmata brownish, first discal and plical minute, indistinct, plical obliquely beyond first discal, second discal larger and darker: cilia ochreous-yellow. Hindwings light grey, more or less tinged with pale ochreous; cilia pale ochreous-yellowish.

Simla; in July and August, four specimens.

Cryptolechia costæmaculella, Christ. (*Depressaria costæmaculella*, Christ. Bull. Mosc. 1882, 18, Snell. Tijd. v., Ent. xxvii, 158, pl. 8, 5.)

Sikkim; Darjeeling; in July. Described from Eastern Siberia; it is a species of distinct appearance, allied to the following, with which it entirely agrees in structure, having the palpi smooth-scaled, and vein 7 of forewings to apex; it is therefore no *Depressaria*.

Cryptolechia eoa, n. sp.

♀. 24 mm. Head and thorax ochreous-whitish, collar tinged with grey. Palpi ochreous-whitish, smooth-scaled, basal third and a subapical ring of second joint, and apical $\frac{2}{3}$ of terminal joint blackish. Antennæ greyish, mixed with blackish towards base. Abdomen pale ochreous, sprinkled with dark fuscous. Forewings sub-oblong, slightly dilated posteriorly, costa gently arched, apex obtuse, termen nearly straight, little oblique; 2 and 3 closely approximated at base; light greyish-ochreous, almost wholly suffused with light rose-pink except in middle of disc and a narrow more whitish-ochreous terminal fascia; some irregular scattered minute dots and strigulæ of blackish scales; a narrow blackish basal fascia; two or three blackish dots or marks on costa anteriorly; a small black costal spot at $\frac{2}{3}$; first discal stigma small, blackish; a moderate black fascia-form bar from costa beyond middle, extended so as to enclose in its apex second discal stigma, which is white, and with a triangular projection of grey suffusion mixed with black from middle of its posterior margin; two blackish spots on costa beyond this, united beneath costa; a series of blackish marks round apex and termen: cilia whitish-ochreous. Hindwings light greyish-ochreous, more greyish posteriorly; three or four grey marks on upper part of termen; cilia whitish-ochreous.

Khasis; in October, one specimen. This distinct species, though structurally in all respects a true *Cryptolechia*, not improbably indicates the origin of *Depressaria* from that genus.

Depressaria, Haw.

The only species yet known to me from India are the two following, both from the Himalayan region ; the other species attributed to the genus by Stainton and others are not correctly referred.

Depressaria cyclas, n. sp.

♀. 19-20 mm. Head and thorax pale brownish-ochreous, patagia dark fuscous. Palpi whitish-ochreous, second joint irrorated with dark fuscous, terminal joint with dark fuscous median band. Antennæ pale ochreous infuscated above, especially towards base. Abdomen whitish-ochreous, irrorated with grey. Forewings elongate, costa gently arched, apex rounded, termen obliquely rounded ; 2 and 3 stalked ; pale brownish-ochreous, with irregularly scattered small dots and strigulæ of black scales ; an oblique black subdorsal dash at base ; costa irregularly spotted with blackish throughout, spots rather larger posteriorly ; discal stigmata round, black, an additional black dot obliquely before and above first discal ; an irregular dark fuscous blotch lying between and above discal stigmata, touching second but not first ; a spot of dark fuscous suffusion beneath costa at $\frac{2}{3}$; a terminal series of black dots : cilia whitish-ochreous, on basal half obscurely barred with greyish. Hindwings light grey, paler towards base ; three or four blackish-grey marks on upper part of termen ; cilia pale grey.

Dalhousie, Kashmir ; in May, two specimens. Most like the European *petasitis*.

Depressaria taciturna, n. sp.

♂♀. 24-25 mm. Head and thorax light brownish. Palpi brownish sprinkled with whitish, basal $\frac{2}{3}$ of second joint, and basal and supramedian bands of terminal joint dark fuscous, sometimes almost wholly suffused with dark fuscous except apex of terminal joint. Antennæ fuscous. Abdomen light greyish-ochreous more or less suffusedly irrorated with fuscous and dark fuscous. Forewings elongate, slightly dilated posteriorly, costa gently arched, apex rounded, termen obliquely rounded ; 2 rather widely remote ; brownish, sprinkled with darker, costal and terminal areas sprinkled with fuscous-whitish ; two indistinctly indicated oblique darker streaks from costa towards base, apex of second more or less marked with dark fuscous ; first discal stigma indicated by an oblique dark fuscous mark, sometimes followed by some fuscous-whitish scales, second by a fuscous-whitish dot, edged with some darker scales ; these are connected by an indistinct streak of darker suffusion, extending more or less beyond second ; a more or less developed sometimes interrupted similar streak along posterior half of submedian fold ; a somewhat darker curved subterminal line, on which the veins are indicated by scattered dark fuscous scales ; a series of cloudy dots of dark fuscous irroration round apex and termen : cilia light brownish sprinkled with darker, towards tips sprinkled with whitish. Hindwings pale fuscous, darker posteriorly ; cilia pale fuscous, with darker subbasal line.

Simla ; in August, three specimens. Perhaps nearest *venefícella*.

Tonica, Walk.

This generic name supersedes *Binsitta*, Walk.

Tonica niviferana, Walk.

Peradeniya, Ceylon ; Karwar, Bombay, Calcutta, Sikkim. The pupa of this and the next species stands erect on its tail, and imitates the head of a small snake (Maxwell).

Tonica teratella, Walk.

(*Tonica terasella* (prav. form.), Walk., Cat. XXIX., 788.)

Karwar (Maxwell) ; Sikkim ; in July. Also from Borneo.

Tonica zizyphi, Staint.

(*Depressaria zizyphi*, Staint, Trans. Ent. Soc., Lond, (n.s.), V., 115 ; *D. angusta* Wals., Moore, Lep. Ceyl. III., 508, pl. 209, 5.)

Maskeliya, Kegalle, Puttalam, Ceylon ; Palni Hills ; in October. Stainton's type was from Calcutta ; it was bred from *Zizyphus jujuba*.

Protonostoma, n. g.

Head with appressed hairs ; ocelli present ; tongue developed. Antennæ $\frac{3}{4}$, in ♂ serrate, minutely ciliated, basal joint moderate, without pecten. Labial palpi very long, recurved, second joint with dense appressed scales, terminal joint shorter than second, moderate, acute. Maxillary palpi short, distinct, porrected. Posterior tibiæ shortly rough-scaled above. Forewings with 2 from angle, 7 and 8 stalked, 7 to termen, 11 from middle. Hindwings 1, ovate, cilia $\frac{1}{2}$; 3 and 4 connate, 5-7 parallel.

I consider this genus must approach very near the primitive form of the *Œcophoridæ*, from which the whole of the remainder could theoretically be derived. It has also marked affinity with the *Plutellidæ*, and indicates their probable origin from that family. The labial palpi, neuration, and superficial characters are of clear Œcophorid type. On the other hand the maxillary palpi are distinctly of Plutellid type, and I have not observed any similar in the *Oecophoridæ* ; the shortness of the cilia of hindwings, and apparent absence of long hairs on posterior tibiæ (these last are more or less damaged, and the structure is not quite clear) are also Plutellid characters. Superficially the species is very similar to *Hypercallia pyrarcha* described above. If the genus is regarded as primitive, then it might have given rise through *Cryptolechia* to the Depressariad subfamily, and through *Hypercallia* to the Oecophorid subfamily. This solution would apparently satisfy all conditions of the problem known to me at present.

Protonostoma æthopa, n. sp.

♂. 13-14 mm. Head ochreous-yellowish, crown dark fuscous except on sides. Labial palpi yellow, second joint mixed with orange and more or less irrorated with dark fuscous, terminal joint dark fuscous except apex. Maxillary palpi pale yellowish, apex black. Antennæ dark fuscous. Thorax dark fuscous with a yellow spot on each side posteriorly, patagia sometimes mixed with orange. Abdomen dark fuscous, beneath whitish-yellow. Forewings suboblong, moderately broad, costa moderately arched, apex obtuse, termen slightly round-

ed, little oblique ; dark fuscous ; an irregular patch of yellow reticulated with ferruginous-orange in disc anteriorly ; oblique yellow marks edged with ferruginous-orange on costa at $\frac{1}{3}$ and $\frac{2}{3}$; a patch of suffused ferruginous-orange reticulation in disc beyond middle, touching second costal mark ; a submarginal series of more or less marked spots of ferruginous-orange suffusion running from second costal mark round apex and upper part of termen : cilia dark fuscous, with yellow patches above and below apex. Hindwings dark fuscous ; cilia dark fuscous, with more or less pale yellowish suffusion towards middle of termen.

Khasis ; in April and September, three specimens.

[*To be continued.*]

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ON THE BIRDS OF KOHAT AND THE KURRAM VALLEY, NORTHERN INDIA.

BY

LIEUT. C. H. T. WHITEHEAD, Indian Army.

With an Introduction by MAJOR H. A. F. MAGRATH, Indian Army.

I.—INTRODUCTION.

By Major H. A. F. MAGRATH.

Contrasted with a district of the Punjab, which I had just left, the variety of the surrounding bird-life was one of the first impressions received on my arrival at Kohat in December 1904, and it struck me that, as I was likely to be quartered there for some time, a list of the birds of the district might be usefully attempted. I had already made notes on a few of the commoner species, when I had the good fortune to discover in Mr. C. H. T. Whitehead, 56th Rifles, who had just rejoined his regiment at Kohat, a keen naturalist, anxious to start work at once on the ornithology of the district. We at once agreed to work together, and in spite of military duties which permitted of little leisure for the pursuit of hobbies, we had, by the end of February 1906, acquired at first hand a fair working knowledge of the local avifauna. In March 1906 my regiment moved to the Samana, a ridge 6,500 feet above sea-level and 30 miles due west of Kohat Station. This ridge forms the northern boundary of the Miranzai Valley, and overlooks on the north the Khanki Valley and Tirah, the land of the Afridis. Here a few interesting additions were made to our list—such as *Pica rustica*, *Accentor rufilatus*, *Accentor himalayanus*, *Fringillauda sordida*, and *Suya crinigera*. Meanwhile, Whitehead was doing good work below, and during the manœuvres secured, amongst other birds, an example of *Fringilla cælebs*, a species new to India. In the end of April 1906 I proceeded home on furlough and, as the sequel will shew, the production of the List was then left entirely in Whitehead's hands. An interesting discovery made by him shortly after my departure was a nesting colony of *Ædon familiaris* in the vicinity of the station. Taking two months' leave in June 1906, he paid a visit to the Kurram Valley lying to the N.-W. of Kohat, and followed to their breeding-grounds at the head of the valley many of the birds that winter in the plains around Kohat. During these two months he explored the Safed Koh Range very thoroughly, considering the short time at his disposal, ascending the two peaks of Sikaram (15,600 ft.) and Bodin (14,000 ft.), and by dint of real hard work, aided by much enthusiasm, added a great deal to our knowledge of the distribution and nesting-habits of many Oriental and Palæarctic species, discovering for the first time the nests and getting the eggs of *Saxicola capistrata* and *Phylloscopus subviridis*, besides obtaining some interesting mammals. His most important discovery, however, was a new

race of *Anorthura* procured at 10,000 feet on the Safed Koh. To this bird he has very generously done me the honour of giving my name, an honour quite undeserved, which has made me insist on the trivial name of "Whitehead's Wren" for that species.

With the kind assistance of Dr. Bowdler Sharpe and Mr. Charles Chubb I was enabled to work out, at the British Museum, the skins procured by Whitehead on this trip, in addition to those previously collected in Kohat.

During my absence on leave my regiment had marched in course of relief to Bannu, the district which borders the Kohat District to the south. My official connexion with Kohat was, therefore, much to my regret (especially as I could no longer pursue my ornithological studies there) severed. Passing through Kohat Station on my return from leave, Whitehead met me with the interesting news that he had a few days previously shot a Waxwing (*Ampelis garrulus*), another new bird for India.

In April 1907, availing myself of three months' privilege leave and Whitehead at the same time obtaining a year's furlough, we decided to take a trip together to the Kurram Valley before he went home, in order to add, if possible, to the knowledge gained in the previous year. We met at Thall on the 15th of April and there awaited the sanction of the Political Agent of the Kurram Valley to our proposed expedition in the territory under his administration. The number of the smaller Passerine birds migrating up the valley at the time was very great, and we had plenty to interest us in this unusual leave-resort. The officer commanding the Post, Lieut. Wolley, with his wonted hospitality, invited us to consider ourselves honorary members of his little mess, which privilege we were only too glad to avail ourselves of. In due course the Political Officer's permit arrived, but it was so hampered by restrictions that we had to abandon our original intention of working slowly up the valley and proceed direct to Parachinar, the headquarters of the Agency, which is situated about 13 miles from the head of the valley. Here the officers of the Kurram Militia very kindly allowed us to make use of their exceedingly comfortable mess, and most hospitably entertained us during our stay. After obtaining permission to move up to Peiwar, 10 miles further up the valley, we left Parachinar on the 21st of April. The Political Agent was so solicitous for our safety that he insisted on our taking an armed tribal escort of six men with us. We did not require their military assistance, but found them useful to look for nests, climb trees, and carry our guns and lunch-basket. Making the little rest-house at Peiwar our headquarters, we daily explored the surrounding Ilex jungle and visited several times the pine-clad hills on the Afghan border. In an Ilex, Whitehead was fortunate in coming across a nest, with eggs, of *Ægithaliscus leucogenys*. This bird is an early breeder, and six other nests that we found contained young. We had not been at Peiwar many days when rumours reached us from Parachinar that the Turis (the tribe inhabiting the Valley), who had been listening to wondrous tales of the spread of plague in Peshawar, poured into their ears by Kabuli

traders and others passing up the valley from India to Afghanistan, had become highly suspicious of our movements and credited us with all sorts of nefarious deeds. We were supposed to be agents of the Government sent up to poison their-water-supply and to spread the plague. We were said to stalk abroad at night catching and inoculating rats, in order to disseminate the pestilence. Colour was lent to this ingenuous theory by the fact that we had trapped a few Mole-rats, Gerbilles, and Dormice. Curiously enough we could see no signs of hostility in the villagers themselves, in fact we found them invariably friendly, and our tribal escort seemed to know nothing of these rumours. We were now anxious to shift camp and to move up the slopes of Sikaram, as the snow, under the influence of the summer sun, was gradually receding. But, in face of the rumours related above, the Political Agent did not think it advisable for us to do so, and even considered that our presence at Peiwar might lead to some act of violence towards us, and be the cause of administrative complications in the valley. We were, therefore, asked to return to Parachinar, where a meeting was called of the leading Maliks, on the result of which our fate with respect to being allowed to continue collecting would depend. Unfortunately and much to our chagrin the verdict of the "Jirga" was against us, and the Political Agent called on us and informed us that, owing to the popular excitement, it would be quite unsafe for us to go in to camp and that we could only work in the immediate vicinity of Parachinar. Our expedition thus came to an untimely end, and, as there was nothing more to be done in the bird-line at Farachinar, we returned to Thall, whence a few days later Whitehead took his departure for England, and I to places where ignorance and superstition would cease from troubling.

I may mention that soon after we arrived in Parachinar from Peiwar news was brought in by a native officer of the local militia, who had been on leave to his village, that we had left Peiwar just in time. Had we remained another night, we were, like the Babes in the Wood, to have been foully murdered. All arrangements had been made, assassins hired, and our pleasant little camp was to have been converted into a shamble! This was a most amusing yarn which tickled us immensely! Gladly would we have accepted these small risks if only we had been allowed to continue our expedition.

A glance at the accompanying map* will give a good idea of the geography of this portion of the N.-W. Frontier of India. Situated between the 32nd and 35th parallels of latitude and the 69th and the 72nd meridians of longitude it is in shape somewhat like a pipe, the District of Kohat forming the bowl and the Kurram Valley the stem and mouthpiece. Its northern boundary proceeding from east to west, consists of the bare and rocky hills lying between it and the Peshawar District, the Samana Range (barren hills, inhabited by independent Orakzai and Afridi tribes) and the Safed-Koh Range. This rugged barrier of hills is on the east as low as 3,000 feet above sea-level,

* This Map (Plate III) has not been reproduced.—Eds.

but gradually increases in height westward till it culminates in the imposing snowclad ramparts of the Safed-Koh Range, the highest peak of which, Sikaram (15,600 feet), lies at its western extremity. To the west it is bounded by Afghanistan and Waziristan, to the south by the districts of Bannu and Mianwali, and to the east by the R. Indus.

The general aspect of Kohat is a confused mass of low bare rocky hills, nullahs, and ravines, intersected by two main depressions running parallel and with a general trend from west to east. These depressions are formed, in the first case, by the Miranzai and Kohat Valleys running in prolongation of each other, and in the second by the Teri Valley. Two alluvial plains are also noticeable, namely, that around and east of Kohat Station, and the oasis of Lachi. The Kurram is a long valley, averaging some 2 miles in width at its lower end and broadening into a stoney plain 8 or 10 miles wide at its upper extremity and rising in the 70 miles from Thall 4,000 feet. Down its centre rushes, over a bed of stones and boulders, the river that gives its name to the valley, which rises in Afghanistan some 20 miles beyond the valley-head. Consisting, as the district does, for the most part of desert, the flora, compared with that of the Himalayas, is not luxurious. Coarse grass, Olives, thorn-scrub, and Dwarf Palms sparsely cover the hills, and in parts of the Miranzai Valley and around Thall the two latter form thick scrub-jungle. Ilex-Oaks, where their branches are not ruthlessly lopped and the trees are permitted to grow attain a considerable size on the Samana, and here and there on this hill some fine Ash-trees flourish. In the Safed-Koh Range, however, forests of Fir, Pine, and Cedar clothe the mountain-sides from about 8,000 to 12,000 feet, and cover the top of the spur over which the Peiwar Pass runs. Below, these forests are gradually replaced by Ilex trees which again, as one descends to the low foot-hills, are replaced by dense Ilex-scrub.

Where water is easily brought on to the land, as is the case in the plains around Kohat and Lachi and in the Kurram, Hangu, and Teri Valleys, green oases of cultivation relieve the general barrenness. A feature of the cultivation around Kohat and in the Miranzai Valley consists of the beautiful orchards of Mulberry, Peach, Plum, Fig, and Vine which abound, and are supplemented, in the stonier parts, by groves of wild Olive-trees. The crops consist mainly of wheat; but Indian corn, barley, millet, cotton, and sugarcane are also grown, and around Bangu, Thall, and in the Kurram Valley, rice. Immediately south of the station of Kohat the Government grass-farm, possesses many attractions for birds on migration, and, after irrigation, is not a bad place to observe Waders: even Duck and Snipe have been shot on it. The climate is very dry. As regards temperature: in the plains of Kohat the winter might be compared to that of the south of France, but the summer is decidedly hotter and probably most nearly approximates to that of Egypt. In the Kurram Valley temperatures are much lower, and the climate of Upper Kurram must be somewhat similar, both in summer and in winter, to that of Northern Germany.

Ornithologically speaking, this corner of the Palæarctic Region* has hitherto been little worked. With the exception of the two papers by Colonel R. H. Rattray published in the "Journal" of the Bombay Natural History Society, "Notes on Nests taken from March to June at Kohat and Mussoorie, North-Western Provinces" (vol. x. p. 628), and "Birds collected and Observed at Thall" (vol. xii. p. 337), and a few observations by Major Wardlaw-Ramsay and others mentioned in the "Fauna of British India," I know of no contribution to its ornithology†. Neither Hume nor Jerdon, Oates nor Blanford, nor others of India's many excellent ornithologists, appear to have visited it. And yet it is an important locality, lying as it does in the extreme north-west of the Peninsula on one of the great migration-highways into India, and at a point on that highway where it converges to its narrowest limits. The pre-eminently Palæarctic character of the avifauna is most striking. Especially is this noticeable in the forms breeding in the Upper Kurram, very few of the many subtropical species inhabiting the Western Himalayas being found there. From the description of the Country and from its geographical position the predominance of such groups as the Accipitrines, Motacillidæ, Fringillinæ, Emberizinæ, and of the desert-forms will not be considered surprising. Although undoubtedly well represented on migration, the Ducks, Waders, and shore-birds are difficult of observation in Kohat. With the exception of the grass-farm, the tank at Dhand-Idl-Khel, and some marshy tracts round Thall and Lachi, this district is singularly devoid of the moist places beloved of Wildfowl and Waders, no streams of any size flowing through it. Matters improve in this respect on arriving at the Kurram Valley. The river here being taken off for rice-cultivation in places along its banks, marshy spots have formed, and in the month of February, March and April, September and October, numbers of Wild-fowl and Waders, using

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* Dresser in the preface to his "Manual of Palæarctic Birds" does not clearly define the Palæarctic boundary in this locality, and by omitting all reference to the plains of India would seem to imply that Kohat belongs to the Indian Subregion. On the other hand, Blanford in his "Distribution of Vertebrate Animals in India" assigns the plains of the Punjab to the Palæarctic Region. Professor Newton, however, in his article on "Birds" in the 'Encyclopædia Britannica,' remarks that if Baluchistan is to be excluded from the Palæarctic Region, "then the line of demarcation must run inland and so continue between that land and Afghanistan *till* ascending the right bank of the Indus it turns the shoulder of the Great Snowy range." The italics are mine, and I take this to mean that the line of demarcation strikes the Indus at a point in prolongation eastward of the Boundary-line between Afghanistan and Baluchistan, *i.e.*, somewhere in the vicinity of Dera Ghazi Khan. If this is the correct interpretation of Newton's views then the ornithology of N. W. India strongly supports them.

† There is only one allusion to Kohat itself in the "Fauna of British India," and that is in connection with the occurrence there of the Red-wing (*Turdus iliacus*), recorded by Jerdon on hearsay from Blyth, on hearsay from Trotter. After more than two years' careful observation we failed to come across this bird, and I think we may safely say that it is not "a regular winter visitant," if it occurs at all.

this river-route on migration, are induced to halt on their way, affording good sport to "Sahibs" and Turi villagers. The importance of this river as a migration-route is illustrated lower down, where it debouches into the sandy plains of Bannu, outside of the area which we are now considering. Here vast quantities of Wild-fowl, Waders, and Gulls, on migration to their far-off northern homes from the lower reaches of the Indus and the Manchar Lake in Sind, are to be observed, in the months of February and March, asleep or preening their feathers on the mudbanks in mid-river. The majority of these birds undoubtedly keep to the river-route, there being no other important water-way lying near their line of migration, and must therefore, of necessity, pass up the Kurram Valley. It may be wondered at that the River Indus, bordering Kohat, has not been mentioned as suited to the observation of Water-fowl. But in this portion of its course that great river is confined between hills, and flows over a rocky bed, consequently here it affords no feeding-grounds or resting-places for such birds. Whitehead came down it in a boat at a time of year when he might have expected to find birds, but his journey proved disappointing. On the whole, then, Kohat and Kurram must be looked on as a profitable locality to the Indian ornithologist.

The straggling of Western Palæarctic forms, not as yet recorded within Indian limits, into this area is probably of commoner occurrence than might be supposed, and, were it possible for a winter to be spent in collecting in the Upper Kurram, yet new species to the Indian list would doubtless be forthcoming. The task we set ourselves in our late trip, so unfortunately interrupted, still remains to be done, and most assuredly new breeding species to India await the discoverer.

It was at first intended to publish two separate papers, one on the birds of Kohat and another on those of the Kurram Valley, but Mr. Whitehead has decided, wisely as I think, to combine them. The two localities are contiguous, and the latter is, as I mentioned before, the breeding-ground of many species that winter in the plains. Of the total number of 340 species which the list contains, 321 were found in Kohat, the remaining 19 were met with only in the Kurram Valley. Considered together, therefore, the single paper will be found to be of greater scientific value than if the two districts had been separately treated, and Mr. Whitehead deserves much credit for the excellent piece of work which he has accomplished.

II.—Preface.

By C. H. T. Whitehead.

Major Magrath does not take any credit for his own work. Before I even started he had made a fair list of the birds of Kohat, and it was his enthusiasm that infected me. All that I have done is to somewhat amplify this list and add a little to the notes. The paper should have been written by him, but he insisted on my doing so, and has now most kindly gone carefully through it, making many necessary corrections and alterations and entirely

rewriting the account of the Bulbuls of the genus *Molpastes*, the hybrid forms of which he was the first to observe in Kohat.

Much interesting information was kindly contributed by Mr. D. Donald, C.I.E., the Political Officer and Commandant of the Border Military Police and Samana Rifles, which his long residence in Kohat (some 18 years), his frequent tours in the district, the interest he takes in birds generally, and in the Accipitrines in particular, and his great reputation as a falconer, render of especial value.

Specimens of most of the Passerine and of a large number of the remaining birds included in this paper were shot and carefully compared with Oates and Blanford's excellent descriptions, measurements and points of difference if any, being always recorded, but only in the case of their not corresponding or of their being of special interest were skins made, for time did not permit of more. These skins are now in the British Museum and are those referred to in the paper. Amongst them will be found melanistic varieties of several species (*Lanius lahtora*, *Passer domesticus*, *Anthus similis*, *A. spipoletta*), which, except in the case of the Shrike, were shot out of flocks of similarly coloured birds. Taken as a whole, however, the birds of the District are characterized by their pale colouring, which is what one would expect from the desert nature of the country.

Many more birds appear to halt in Kohat in the spring migration, which continues from February till well into June, than in the autumn. This is probably due to the configuration of the locality. The main Kohat Valley at its junction with the Indus is comparatively broad but narrows considerably towards the Kurram River, with which it is connected by the Ishkalai, an insignificant stream flowing in at Thall. The latter stream is probably easily missed by the hosts of migrants passing down the Kurram River in autumn. Major Magrath writes that they migrate down this river in the Bannu District in great numbers in August, September, and the first half of October.

In square brackets are added notes on those species met with by Major Magrath in Bannu, but not found by us in Kohat or in the Kurram Valley, as most of them are likely to occur within our limits. The Bannu District, however, exhibits a great contrast to Kohat, consisting as it does for the most part of a broad, well-watered, highly cultivated plain with a good deal of marsh-land.

In the following notes, wherever the expression "we" is used it refers, of course, to Major Magrath and myself, as we worked together.

The word "plains" is used, as it usually is in India, to denote the low country—*i.e.*, in this case, below about 3,000 feet—as opposed to the main hill-ranges, and not merely the flat country, the greater part of Kohat being a maze of low hills and ravines. Similarly the word "desert" is used in its wider sense to include stony and not necessarily level wastes which cover such a large part of the District (there is very little sandy desert).

The nomenclature followed is that adopted by Oates and Blanford in the

'Fauna of British India, Birds,' and the numbers placed in brackets before the scientific names are those used in that work.

The following is a list of the papers chiefly referred to, all contributed to the 'Journal of the Bombay Natural History Society':—

RATTRAY, Colonel R. H.—Birds Collected and Observed at Thall. xii. pp. 337 to 348 (1899).

MARSHALL, Capt. T. E.—Notes on the Birds near Quetta: Part I. xiv. pp. 601 to 602 (1902); Part II. xv. pp. 44 to 64 (1903).

FULTON, Capt. H. T., D.S.O.—Notes on the Birds of Chitral. xvi. pp. 44 to 64 and p. 744 (1904).

RATTRAY, Colonel R. H.—Birds' nesting in the Murree Hills and Galis. xvi. pp. 421 to 428 and pp. 657 to 663 (1905).

CUMMING, J. W. N.—Birds of Seistan. xvi. pp. 686 to 699 (1905).

WARD, Colonel A. E.—Birds of the Provinces of Kashmir and Jammu and Adjacent Districts. xvii. pp. 108 to 113, pp. 479 to 485 (1906). pp. 726 to 729, pp. 943 to 949 (1907); xviii. pp. 461 to 464 (1908).

To obviate the inconvenience of looking up these papers I have added references, and where possible the gist of the note. Attention is also drawn to Capt. PERREAUS. "Notes on the Bird of Chitral" xix (4) pp. 901-922 February 1910. It supplements Capt: FULTON'S paper.

My best thanks are due to Dr. Bowdler Sharpe and Mr. Charles Chubb for much assistance in the identification of my skins, and to the former for very kindly going through my notes and putting them into correct form in spite of a great press of other work. Also to Dr. Hartert for going through the series of Wagtail and Pipit-skins. Lastly, to Dr. Sclater, F.R.S., for most kindly looking through the proofs and seeing the paper through the press.

III.—LIST OF BIRDS AND REMARKS.

By Lieut. C. H. T. WHITEHEAD.

[1.] CORVUS CORAX. The Raven.

Rattray, J. B. N. H. S. xii. p. 337 (common round Thall); Marshall, op. cit. xiv. p. 681 (the small race very common and resident at Quetta); Cumming, op. cit. xvi. p. 686 (rare in Seistan); Ward, op. cit. xvii. p. 108.

Ravens of all sizes are very common in the cold weather, especially round human habitations, the majority leaving in April or early in May, but I have counted over 80 roosting together as late as the 18th of May near Kohat.

A few, however, mostly smaller birds, are resident all the year round.

[3.] CORVUS CORONE. The Carrion-Crow.

Cumming, J. B. N. H. S. xvi. p. 686 (common in winter in Seistan, and often seen about houses); Ward, op. cit. xvii. p. 108 (resident in Kashmir, nesting between 8,000 and 10,000 ft.).

505. ♂ ad. Kurram Valley, 5,800 ft., 19th April.

I am not sure whether this species occurs in the plains or not. Major Magrath has found it fairly common in winter in Bannu, so it probably does.

In the Upper Kurram Valley it nests freely in April from 5,000 ft. upwards, a Chinar (Plane-tree) near a village being usually selected as a nesting site. Like the Raven, the Carrion-Crow is not a dweller in the wilds in these parts, but prefers the neighbourhood of mankind.

[4.] CORVUS MACRORHYNCHUS. The Jungle-Crow.

Rattray, J. B. N. H. S. xii. p. 337 (Thall : very common) ; Fulton, op. cit. xvi. p. 45 (Lower Chitral : very common) ; Rattray, t. c. p. 421 (very common up to 9,000 ft. : Murree Hills); Ward, op. cit. xvii. p. 108.

Abundant in the plains from November till mid-April (last seen on the 28th), partially taking the place of *C. splendens*. In summer it retires to the Ilex-and Fir-clad slopes of the higher ranges, nesting freely on the Safed Koh.

[5.] CORVUS FRUGILEGUS. The Rook.

Marshall, J. B. N. H. S. xiv. p. 601 (once seen in January near Quetta) ; Cumming, op. cit. xvi. p. 686 (common in Seistan in winter) ; Ward, op. cit. xvii. p. 108 (occurs in winter along the R. Jhelum).

641. ♂ juv. Samana, 6,500 ft., 5th March.

744, 745. ♀ ; 746 ♂ juv. Kohat, 1,760 ft., 25th March.

Visits the district in large flocks in winter, arriving in November and remaining as late as the middle of April. The birds, however, staying on through March appear to be almost all young which have not entirely shed the face-feathers and nasal bristles. Oates, in the 'Fauna of India,' writes : "About January or when the young bird is about nine months old the nasal bristles are cast, and by March the front part of the head has become entirely denuded of feathers." Here, neither are entirely lost till April. The above-mentioned examples represent the ordinary type found here in March.

[6.] CORVUS SHARPII. Sharpe's Hooded Crow.

Corvus sharpii, Oates, F. B. I., Birds, i. p. 20 ; Cumming, J. B. N. H. S xvi. p. 686 (common in Tamarisk-jungle of Seistan) ; Ward, op. cit. xvii. p. 109 (a rare visitor to Kashmir).

We have not observed the Hoodie in Kohat, but Mr. Donald, the Political Officer, tells me that he has met with one or two almost every year, generally about the grass-farm. This Crow is a common winter visitor to the Peshawar and Bannu Districts, which are better suited to its habits. From the latter Major Magrath has sent a typical specimen of the race *Corvus cornix sharpii* to the British Museum.

[7.] CORVUS SPLENDENS. The House-Crow.

Rattray, J. B. N. H. S. xii. p. 337 (not common at Thall) ; Ward, op. cit. xvii. p. 109 (common in the low country).

A resident and extremely common in summer. In mild winters numbers remain, but in severe weather it almost entirely disappears, *C. macrorhynchus* taking its place as the common cook-house scavenger.

[9.] CORVUS MONEDULA. The Jackdaw.

Rattray, J. B. N. H. S. xii. p. 387 (rare in Thall) ; Ward, op. cit. xvii. p. 109.

A rather rare winter visitor from December till March, occurring with large flocks of Rooks. Major Magrath noted immense flocks coming into the station on five consecutive evenings, just before the cold wave in January 1905. Similar flocks, but mixed with Rooks, roosted in cantonments for a few nights in February 1908.

[10.] PICA RUSTICA. The Magpie.

Marshall, J. B. N. H. S. xiv. p. 601 (common round Quetta) ; Fulton, op. cit. xvi. p. 46 (very common in Upper Chitral) ; Cumming, t. c. p. 686 (scarce in Seistan : 1,700 ft.) ; Ward, op. cit. xvii. p. 109 (common in Ladak and Baltistan).

661. Marai, 2,900 ft., 9th March.

773. ♀ ad. Raisan, 2,100 ft. 1st April.

A resident, but somewhat rare in Kohat, being more often seen in Samilzai than elsewhere ; a few pairs also occur on the Samana, where Major Magrath found a nest in April built in an Ilex, just above the tennis-court. In the Upper Kurram Valley it is very common, especially near Peiwar, and occurs up to the tree-limit. The nest is usually placed in an Ilex, and is of the normal type, though often within six or seven feet of the ground. The above examples appear to be typical *P. rustica*.

[16.] DENDROCITTA RUFA. The Indian Tree-Pie.

Rattray, J. B. N. H. S. xii. p. 337 (Thall : a few seen) ; Ward. op. cit. xvii. p. 109.

670. ♀ ad. Raisan, 2,300 ft., 12th March.

709. ♂ ad. Kohat, 1,760 ft., 19th March.

A common winter visitor to Kohat, arriving early in September and leaving about mid-April. A few pairs, however remain to nest, Mr. Donald, the Political Officer, having several times observed young birds in July in the Miranzai Valley barely able to fly.

[4.] GARRULUS LANCEOLATUS. The Black-throated Jay.

Rattray, J. B. N. H. S. xii. p. 337 (Thall : common on the hills) ; Fulton, op. cit. xvi. p. 46 (Lower Chitral : very common from 5,000 to 10,000 ft.) ; Rattray, t. c. p. 421 (very common round Murree) ; Ward, op. cit. xvii. p. 109

Rare in the plains. During the cold spell in November and December, 1905, a few individuals occurred about the grass-farms and the orchards of Kohat. A resident on the Samana Range above 5,000 ft., but not common.

Fairly plentiful in the Ilex scrub in the Kurram Valley, occurring up to 8,000 ft. Generally goes about in parties of four or five, out of the breeding-season, but sometimes collects into big flocks. Major Magrath observed one of about forty individuals near Peiwar (7,000 ft.) in April 1907. Very shy and difficult to observe.

[-8.] NUCIFRAGA MULTIPUNCTATA. The Larger-spotted Nutcracker.

Fulton, J. B. N. H. S. xvi. p. 46 (only got one specimen, no others seen) ;

Ward, op. cit. xvii. p. 109, xviii. p. 451 (common: young hatch out in April; probably two broods).

Occurs sparingly amongst the conifers of the Safed Koh, but is more often heard than seen. Its cry resembles the syllables "*kāck-kāck*" rapidly repeated, hence its Pushtu name "Khākārra."

[30.] PYRRHOCORAX ALPINUS. The Yellow-billed Chough.

Marshall, J. B. N. H. S. xiv. p. 605 (occurs at 10,000 ft., near Quetta); Fulton, op. cit. xvi. p. 46 (Chitral: very common from 5,000 ft. to 16,000 ft., according to season); Ward, op. cit. xvii. p. 109 (occurs from 5,500 ft. in winter upwards, often caught in traps set round carrion for foxes).

Not common, but fairly well distributed in summer along the upper slopes of the Safed Koh above tree-limit. By the end of June the birds had collected into small flocks.

[31.] PARUS ATRICEPS. The Indian Grey Tit.

Marshall, J. B. N. H. S. xiv. p. 601 (winter visitor to Quetta: seen at Ziarat, 8,000 ft., in May); Fulton, op. cit. xvi. p. 46 (Chitral: very common); Rattray, t. c. p. 421 (very common up to 6,500 ft.: Murree); Ward, op. cit. xvii. p. 109.

327. ♂ juv. Safed Koh, 7,500 ft., 16th July.

A very common winter visitor to the District from mid September till about the third week in April. A resident on the Samana above 5,000 ft. Nests in the Ilex-scrub of the Upper Kurram in fair numbers.

ANTHOSCOPUS CORONATUS. The Turkestan Penduline Tit.

Hartert, Pal. Vogel, i. p. 392.

Lachi, 1,500 ft., 25th March; ♂ ♀ ad., Kohat, 1,760 ft., 7th—8th April; ♂ ad., Kohat, 1,760 ft., 18th March.

Major Magrath first observed a party of these Tits on a Peach-tree in his garden in April 1905. Since then we have met with the bird regularly from mid-March till mid April in parties of from two or three to forty or more, chiefly frequenting Shisham trees, but also orchards and Camel-thorn scrub. The call-note resembles that of *Zosterops palpebrosa* and is constantly uttered.

Mr. T. R. Bell, I.F.S., was the first to discover this species in India. He met with parties of it in February 1904 in the tamarisk-acacia scrub-jungle near Sukkur, Sind, and procured several examples (*vide* J. B. N. H. S. xvii. p. 244).

[37.] ÆGITHALISCUS LEUCOGENYS. The White-cheeked Tit.

Fulton, J. B. N. H. S. xvi. p. 46 (resident and very common from 6,000 to 12,000 ft. in Lower Chitral); Ward, op. cit. xvii. p. 109.

333. ♂ ad. Safed Koh, 1,800 ft., 20th July.

391. ♀ ad. Samana, 5,000 ft., 5th November.

A resident in the Upper Kurram Valley and on the Samana, being largely reinforced on the latter in winter: and at that season some descend to the lower scrub covered hills occurring as far south as the Mianwali District, and down to 2,500 ft., where I have met with parties as late as the 9th of April.

Breeds freely in the Ilex-scrub near Peiwar from 6,000 to 8,000 ft. Nesting operations must commence towards the end of March, as a nest found on the

1st of May contained fully fledged young. The nest is usually placed near the top of an Ilex-bush from three to seven feet above the ground. It is egg-shaped and rather like that of the British Long-tailed Tit, but a good deal smaller and not quite so neat. It is made of moss and cobwebs outside, lined with a little grass, with a thick inner lining of feathers. The opening is usually near the top, but is sometimes nearer the centre. We came across seven nests altogether, the first six containing young, and the seventh a nearly fresh clutch of five eggs, these are pure white, three having a very faint zone of spots round the large end, the remainder being unmarked, and averaging ·58″ × ·39″. The clutch appears to vary from five to eight. The young closely resemble their parents, but the colours are duller, and the black of the chin and throat is replaced by a few indistinct dusky streaks.

Capt. Keen also observed a pair of these Tits with a newly fledged family on the Samana.

In habits this species closely resembles the Long-tailed Tit, going about in parties of eight or nine in scrub-jungle continually uttering its call-note, which may be rendered by the syllables "prit-t-t," and often in company with *Parus atriceps*.

[44.] LOPHOPHANES MELANOLOPHUS. The Crested Black Tit.

Fulton, J. B. N. H. S. xvi. p. 46 (abundant in Chitral from 5,000 to 12,000 ft.); Rattray, t. c. p. 422 (common in the Murree Hills); Ward, op. cit. xvii. p. 110 (common in Kashmir).

Very common on the Safed Koh from 6,500 ft. to tree-limit. An early breeder. Major Magrath found a nest containing young on the 25th of April. It has a great variety of notes.

[91.] TROCHALOPTERUM SIMILE. The Western Variegated Laughing-Thrush.

Fulton, J. B. N. H. S. xvi. p. 47 (resident and very common up to 6,000 ft. in Lower Chitral); Rattray, t. c. p. 422 (very common round Murree, up to 10,000 ft.); Ward, op. cit. xvii. p. 422.

417. Ad. Samana, 5,600 ft., 19th December.

A resident, but rare. Altogether I met with about a dozen individuals in one wooded nullah on the northern slope of the Samana, but nowhere else. It is a great skulker; its loud whistling notes, however, proclaim its presence. Usually found creeping about the densest part of the undergrowth.

[99.] TROCHALOPTERUM LINEATUM. The Himalayan Streaked Laughing-Thrush.

Rattray, J. B. N. H. S. xii. p. 337 (common in winter: Thall); Marshall, op. cit. xiv. p. 602 (common at 4,000 ft. in February: Quetta); Fulton, op. cit. xvi. p. 47 (abundant in Chitral); Rattray, t. c. p. 422 (commonest bird in Murree Hills); Ward, op. cit. xvii. p. 110.

130. ♂ ad. Marai, 3,000 ft., 25th February.

579. Sex? Kohat, 1,760 ft., 13th February.

631. ♀ ad. " " 1st March.

651. ♀ ad. Hangu, 2,700 ft., 8th March.

Abundant and resident on the Samana, many birds wintering in the Miranzai and Samilzai Valleys, and, in the winter of 1907/1908, and again in 1909 quite a number visited the orchards around Kohat, staying till April. Occurs also in the Kurram Valley up to 7,000 ft., but not so commonly.

[105.] ARGYA CAUDATA. The Common Babbler.

Rattray, J. B. N. H. S. xii. p. 337 (abundant at Thall); Cumming, op. cit. xvi. p. 686 (very common in Seistan); Ward, op. cit. xvii. p. 110 (found in the outer ranges).

A resident and very common, especially in scrub-jungle, only occasionally visiting gardens. Does not ascend the hills to any height, its place being taken by *Crateropus canorus*.

Breeds in April and May.

[104.] ARGYA EARLII. The Striated Babbler.

Major Magrath obtained an example of this species last March in a reed-bed in Bannu.

[110.] CRATEROPUS CANORUS. The Jungle Babbler.

Ward, op. cit. xvii. p. 110 (chiefly confined to Jammu).

639. ♂ ad. Hangu, 2,700 ft., 3rd March.

666. ♂ ad. Marai, 3,000 ft., 10th March.

A resident, taking the place of *Argya caudata* from the foot of the hills where the two occur together, up to 4,000 feet in winter and 6,000 feet in summer. Fairly common, too, in the Miranzai Valley in winter, wherever there is plenty of scrub-jungle. Not observed in the Kurram Valley.

[139.] PYCTORHIS SINENSIS. The Yellow-eyed Babbler.

Major Magrath has met with parties of this Babbler in the sugar-cane fields and reed-beds of Bannu. An example shot by him is now in the National Collection.

[187.] MYIOPHONEUS TEMMINCKI. The Himalayan Whistling-Thrush.

Rattray, J. B. N. H. S. xii. p. 338 (common in winter: Thall); Marshall, op. cit. xiv. p. 102 (Quetta: 7,000 ft. in May); Fulton, op. cit. xvi. p. 47 (common in Lower Chitral); Rattray, t. c. p. 422 (common in Murree Hills); Ward, op. cit. xvii. p. 110.

A fairly common winter visitor from mid-September till mid-April, rather rare round Kohat, but common in the Miranzai and Samilzai Valleys on the Samana and occurring as far south as the Mianwali District. A resident in the Kurram Valley, nesting between 6,000 and 8,000 feet. Usually found about cliffs and groves near water, but sometimes in very dry shadeless spots some distance from water.

[191.] LARVIVORA BRUNNEA. The Indian Blue-Chat.

Rattray, J. B. N. H. S. xvi. p. 423 (common at Murree); Ward, op. cit. xvii. p. 110 (nests in Kashmir up to 8,000 ft.).

Occurs in summer along the lower slopes of the Safed Koh between 6,500 and 8,000 ft., but is not common except in one or two secluded glens. Very shy, has a rich but quite short song.

[226.] ZOSTEROPS PALPEBROSA. The Indian White-eye.

774. ♂ ad. Kachai, 2,700 ft., 1st April.

A cold weather visitor to the District, the first parties arriving in August, but it does not become common till October, it leaves toward the middle of April. Possibly a resident on the Samana: a party of eight or nine stayed there during the winter of 1906-07, in spite of frequent heavy snow-storms; a large number arrived early in April, though whether only on migration or not I cannot say, as I left shortly afterwards. Not observed in the Kurram Valley.

[269.] HYPSIPETES PSAROIDES. The Himalayan Black Bulbul.

Fulton, J. B. N. H. S. xvi. p. 47 (common in summer); Rattray, t. c. p. 424 (common round Murree); Ward, op. cit. xvii. p. 111 (common in Kashmir).

583. ♀ ad. Kohat, 1,760 ft., 15th February.

630. ♂ ad. „ „ 1st March.

In 1907 several parties of this species visited the district early in February, staying till the end of March. They were always to be found about the same spot never wandering far away. Berries of the Boquain tree (*Persian lilac*) seemed to form their staple food.

[283.] MOLPASTES INTERMEDIUS.* The Punjab Red-vented Bulbul

Ward, J. B. N. H. S. xvii. p. 111 (found in Pooneh and Jammu).

634. ♀ ad. Kohat, 1,700 ft., 1st March.

733. ♂ ad. „ „ 23rd March.

786. ♂ ad. „ „ 4th April.

A resident and not uncommon in the gardens and orchards around Kohat, though seldom seen elsewhere in the District. This species, as Major Magrath has pointed out, probably interbreeds with *M. leucogenys*, as they are so often seen together, and birds intermediate in colouring are so common (*vide* next note). Mr. Donald, the Political Officer, states that on two separate occasions he has met with the present species in Kohat paired with a yellow vented Bulbul and *at the same nest*. Further, that it is well known amongst local gardeners that the red and yellow-vented Bulbuls do interbreed, their progeny being known as "Neemchi," *i.e.*, half-breeds. *M. intermedius* is the common resident Bulbul of the Peshawar district north of Kohat.

List of hybrids between *M. intermedius* and *M. leucogenys*.

				Ear-coverts.	Under tail-coverts.
590. ♂ ad.	Kohat, 1,760 ft.,	16th	Feb.	dingy white.	yellow.
564. Ad.	„	6th	„	„	orange.
631. ♀ ad.	„	1st	Mar.	dark brown.	red.
635. ♀ ad.	„	2nd	„	„	pale buff.
689. ♀ ad.	„	16th	„	dirty white.	yellow with orange tips.
700. ♂ ad.	„	17th	„	white.	orange.

* For Dr. R. Bowdler Sharpe's opinion on the series of Bulbul (*Molpastes intermedius*, *leucogenys*, *leucotis* and *magrathi*) we collected, see the "Ibis," April 1909, p. 302.

710. ♀ ad.	Kohat, 1,760 ft.,	19th Feb.	dark brown.	dull crimson.
735. ♀ ad.	,, ,,	24th ,,	,,	,,
758. ♂ ?	,, ,,	28th ,,	dusky white.	orange.
785. ♀ ad.	,, ,,	4th Apr.	dull white.	lemon-yellow.
790. ♂ ad.	,, ,,	5th ,,	,,	brownish-orange.
791 ♂ ad.	,, ,,	5th ,,	,,	orange-yellow.

(A truly wonderful series, but the birds *must* be hybrids.—*R.B.S.*)

These remarks are by Dr. Sharpe, and from them it will be seen that the series ranges from an almost pure *M. intermedius* to a nearly pure *M. leucogenys*. No two examples are alike, some being more like "*intermedius*," others more like "*leucogenys*" or "*leucotis*."

[284.] MOLPASTES LEUCOGENYS. The White-cheeked Bulbul.

Fulton, J. B. N. H. S. xvi. p. 47 (Chitral: summer visitor from March to October; very common up to 7,000 feet); Ward, op. cit. xvii. p. 111 (very common in Kashmir).

591. ♂ ad.	Kohat, 1,760 ft.,	16th Feb.	Very grey on the breast, but with pale yellow under tail coverts.	
724. ♂ ad.	,, ,,	21st Mar.	,,	,, ,,
767. ♀ ad.	,, ,,	31st ,,	More typical.	
779. ♂ ad.	,, ,,	2nd Apr.	,, ,,	
780. Ad.	,, ,,	,,	,, ,,	
789. ♀ ad.	,, ,,	5th Apr.	,, ,,	
792. ♂ ad.	,, ,,	,,	,, ,,	

[I do not call these birds true *P. leucogenys*, as they are so much darker on the head, which is nearly blackish, and have not the olive on the back. They illustrate how variable is the coloration of this species in Kohat. In spite of its abundance it is difficult to procure an example true to type. Most of the birds seen have the breast mottled, *i.e.*, instead of having the black of the upper breast clearly defined from the light colour of the lower parts, it graduates into it, frequently combined with a mottled back and sullied cheek-patches and a blackish head with or without a supercilium. R. B. S.]

Major Magrath, who has specially studied the Bulbuls in Bannu, kindly contributes the following note on the present species:—

"Dr. Bowdler Sharpe is, I believe, inclined to the view that this Bulbul differs generically from *Molpastes*. With this I can hardly agree. Seen in its natural state, the bird is a true *Molpastes*. In habits and notes it differs little from the next species, with which it mixes freely, and from which it is anything but easy to distinguish when in a tree. It seems likely that the two species interbreed, but I have had no opportunity of observing a fertile cross, although I have seen wild birds which looked very like hybrids between the two species. The diet of the present species is perhaps more insectivorous than that of the next. It is much addicted to the habit of fly-catching in the evenings and is often seen on the ground feeding on ants and grubs under trees. It is less of a garden bird than the next species. Its staple food in

these parts is the berries of the Ber (*Zizyphus vulgaris*) and Boquain (*Melia azedarach*) trees. Numbers of this species are caught in Bannu in winter and hawked about the bazaars, perched on pieces of stick, to which they are attached by a long string tied round the body. Although I have examined several of these captives and bought many in order to release them, in no case have I seen among them a bird of the next species, which is also so common at Bannu. I attribute the ease with which the present species is caught to its greater fearlessness and to its partiality for the grubs of the white ant, with which the traps are usually baited: this attraction the birds are simply unable to resist."

This Bulbul is resident in Kohat, and breeds freely in the Station and in the orchards round about.

[285.] MOLPASTES LEUCOTIS. The White eared Bulbul.

Rattray, J. B. N. H. S. xii. p. 338 (common in February and March, a few pairs staying to breed); Marshall, op. cit. xiv. p. 602 (a few occur in March and April); Cumming, op. cit. xvi. p. 686 (Seistan: saw several which appeared to be of this species, but failed to secure any).

In July 1905 Major Magrath found a pair of Bulbuls nesting in his garden which he took to be of the present species. At that time he concluded that this bird in summer replaced the last as the breeding species in Kohat and was unaware, as we subsequently discovered (*vide* note on the last species), that *M. leucogenys* bred commonly in and around Kohat Unfortunately we did not critically study the Bulbuls at that time, and not having since spent a "hot-weather" in Kohat we have not had an opportunity of collecting any examples of the present species. According to Major Magrath, the note of this bird is well represented by the following words repeated rapidly: "Quick—a drink with you?"

MOLPASTES MAGRATHI. Magrath's Bulbul.

Whitehead, Bull. B. O. C. xxi. p. 48 (1908).

In February 1907 Major Magrath sent a skin of a Bulbul obtained in the Bannu District to Dr. Bowdler Sharpe. The latter and other eminent ornithologists who examined it, finding that there was nothing exactly like it in the National Collection, were of opinion that it belonged to a new species. This opinion was further strengthened by the arrival of three more specimens collected by Major Magrath in the same locality. These all agreed more or less with the first example sent, except that the black of the breast in one was clearly defined from the whitish lower parts, instead of graduating into them as in the other specimens. At a meeting of the British Ornithologists' Club held on the 15th of January, 1908, I exhibited these specimens and described the bird as a new species, naming it as above in honour of its discoverer.

Major Magrath's specimens differ from the hybrid forms already described in being closely allied to *M. leucotis* and not to *M. leucogenys*. It is difficult to ascribe them to a hybrid form, as in the case of the Kohat birds, because

M. intermedius does not, Major Magrath assures me, occur in Bannu, and *M. leucogenys* there is always more or less true to type. Dr. Sharpe also concurs in this].

[320.] SITTA KASHMIRENSIS. Brooks's Nuthatch.

Fulton, J. B. N. H. S. xvi. p. 48 (Chitral: very common from 6,000 to 11,000 ft.; Ward, op. cit. xvii. p. 111 (obtained in April in Kashmir).

Fairly common on the Peiwar Spur of the Safed Koh and in the adjoining nullahs from 7,500 to 10,000 ft.

[323.] SITTA LEUCOPSIS. The White-cheeked Nuthatch.

Fulton, J. B. N. H. S. xvi. p. 48 (Chitral: very common from 7,000 to 12,000 ft.); Rattray, t. c. p. 424 (fairly common above 8,000 ft.: Murree Hill); Ward, op. cit. xvii. p. 111 (fairly common).

This is the common Nuthatch of the Safed Koh, from 8,000 ft. to tree-limit. Its curious call-note, resembling the word "pain" (pronounced like the French word for "bread"), may be heard all day long.

[327.] DICRURUS ATER. The Black Drongo, or King Crow.

Rattray, J. B. N. H. S. xii. p. 338 (summer visitor to Thall; Fulton, op. cit. xvi. p. 48 (Chitral: common in summer up to 5,500 ft.); Ward op. cit. xvii. p. 111 (Kashmir: occurs up to 7,000 ft.).

One of our commonest summer visitors from the plains up to 8,500 feet in the Kurram Valley, the first birds arriving in the middle of March and the species becoming common a fortnight later. It disappears towards the end of October. Probably, however, the Drongo we observed above 7,000 feet on the Safed Koh belonged to the allied species *D. longicaudatus*, the differences not being very marked and the latter being a common bird in the Murree Hills. Unfortunately no examples were procured.

[341.] CERTHIA HIMALAYANA. The Himalayan Tree-Creeper.

Fulton, J. B. N. H. S. xvi. p. 48 (shot in August); Rattray, t. c. p. 424 (Murree Hills: very common); Ward, op. cit. xvii. p. 111 (abundant up to 10,000 ft.).

623. ♀ ad. Kohat, 1,760 ft., 29th February.

690. ♀ ad. „ „ 16th March.

A common cold-weather visitor to the District from September till April, occurring on the Samana up to 6,000 feet. It does not by any means restrict itself to trees: I have often noticed it climbing up walls.

Breeds in fair numbers on the Safed Koh, from 7,000 to 9,000 feet.

The call-note is a faint squeak, rarely heard in winter. In summer its loud but rather monotonous song is constantly uttered.

[348.] TICHODROMA MURARIA. The Wall-Creeper.

Marshall, J. B. N. H. S. xiv. p. 602 (Quetta: occurs in winter from 1,000 feet upwards); Fulton, op. cit. xvi. p. 48 (Chitral: common from October till April); Ward, op. cit. xvii. p. 111 (winter visitor, sometimes assuming black throat-feathers.)

40. Ad. ? Khushalgarh, 1,200 ft., 16th December.

315. ♂ juv. Safed Koh, 15,000 ft., 12th July.

A winter visitor to the District from October till mid-March ; common on the Samana, but less so elsewhere. Generally found singly or in pairs about cliffs, but occasionally some distance from rocks on earth-banks.

An example shot on the 13th of March had the black feathers on the throat and breast well developed.

On the 12th of July, 1906, I came across a newly-fledged family at 15,000 feet on the Safed Koh, in the shale screes, and shot one specimen. The wing-and tail-feathers were only partially grown, the bill was quite soft and very short, and bits of down were still adhering to its plumage. It would therefore appear that the Wall-Creeper nests within Indian limits. When touring through the Kaghan Valley, Hazara District, this year (10th of July, 1908) my shikari minutely described to me a bird that he had seen that day, which could scarcely be anything else but a Wall-Creeper.

Mr. S. L. Whymper also informed me in a letter (I have not got this by me, but, so far as I remember, it was to the following effect) that a friend of his had actually found a Wall-Creeper nesting somewhere on the North-West Frontier, but had been unable to get at the nest.

ANORTHURA MAGRATHI. Whitehead's Wren.

Whitehead, Bull. B. O. C. xxi. p. 19 (1908).

343. ♂. Safed Koh, 12,500 ft., 6th August.

344. ? Safed Koh, 8,500 ft., 8th August.

Bill blackish, base and gape yellow ; tarsus brownish flesh-coloured ; iris brown.

This appears to be a well-marked race of *A. neglecta*, differing from it in being almost uniform in colouring above, the barring being scarcely perceptible, and in having the throat ashy grey. In summer it is found fairly commonly on the Safed Koh, from 8,000 feet upwards, chiefly in the juniper-scrub. I have met with it on the very summit of the range, picking about amongst the rocks.

In habits and song it closely resembles *A. parvula* and *A. neglecta*.

[358.] REGULUS CRISTATUS. The Goldcrest.

Ward, J. B. N. H. S. xvii. p. 111, and xviii. p. 461 (not common ; eggs taken in May, June, and July in the Liddar Valley, Kashmir).

Fairly numerous in summer amongst the firs and deodars of the Safed Koh from 8,000 to 11,000 feet.

[359.] AEDON FAMILIARIS. The Grey-backed Warbler.

Rattray, J. B. N. H. S. xii. pp. 225, 339 and 579 (fairly common at Thall ; found several nests) ; Watson, op. cit. xv. p. 144 (occurs at Chaman, near Quetta, in August and September) ; Cumming, op. cit. xvi. p. 686 (very common in Seistan in summer).

246. ♀ ad. Kohat, 1,760 ft., 6th May.

Fairly common up to 3,500 feet, from April till September, in dry scrub-jungle ; round Thall it is particularly common. In the breeding-season the

male may often be seen perched on the top of a bush, pouring forth its sweet song. In many of its habits it resembles the Indian Robin (*Thamnobia cambayensis*), especially in the way it flirts and spreads its tail, and also in its tame and confiding habits. If the intruder happens to approach the nest, the pair will follow him about uttering their alarm-cry—*wutch, wutch*. If the nest be found they get terribly excited, and will sometimes remain hovering in the air within a few feet. Of five nests found, three were placed in thorn-bushes close to the ground, the other two on the ground under low shrubs. They were cup-shaped and loosely constructed of coarse grass and roots. I looked in vain for the bit of serpent-skin which Mr. Dresser, in the 'Manual of Palæarctic Birds,' states is always found in the nest of this species.

The specific title (*familiaris*) is very appropriate, but the trivial name (Grey-backed) seems to be only misleading, for the back is fulvous-brown, the most noticeable feature being the bright red, white-tipped tail which the bird is so fond of displaying.

[362.] LOCUSTELLA STRAMINEA. The Turkestan Grasshopper-Warbler.

742. ♀ ad. Kohat, 1,760 ft., 25th March.
749. Sex? „ „ 26th March.
776. ♂ ad. „ „ 2nd April.

Passes through the District in fair numbers from the third week in March till the middle of May. Not observed in autumn. It is chiefly found on the grass-farms and in young crops, occasionally in gardens. It is not such a skulker as one would expect; there is no difficulty in flushing it, but it is not easy to observe or to shoot, except on the wing.

[363.] ACROCEPHALUS STENTOREUS. The Indian Great Reed-Warbler.

Ward J. B. N. H. S. xvii. p. 112 (breeds in Kashmir in June).

Common on migration from the end of March till well into June, and again in August and September; possibly a few stay to nest in Kohat.

I found a small colony nesting in a reed-bed near Dandar, (4,700 ft.), in the Kurram Valley, on the 9th of July.

[366.] ACROCEPHALUS DUMETORUM. Blyth's Reed-Warbler.

Ward. J. B. N. H. S. xvii. p. 112 (summer visitor to the Valley of Kashmir).

203. ♀ ad. Kohat, 1,760 ft., 13th April.
231. ♂ ad. „ „ 29th April.
247. ♂ ad. „ „ 6th May.
360. Juv. „ „ 30th August.

Like the last species, this Warbler passes through in great force in April, May, and early June, returning in August and September. Not often found in reed-beds, preferring shady gardens and orchards. The sweet rambling song may often be heard issuing from the midst of a thick mulberry-tree. Probably breeds in the Upper Kurram Valley.

The upper plumage of this species is distinctly tinged with olivaceous. Mr. Oates does not mention this in the 'Fauna of British India.'

[367.] ACROCEPHALUS AGRICOLA. The Paddyfield Reed-Warbler.

Ward, J. B. N. H. S. xvii. p. 112 (nest not found).

729. ♂ ad. Kohat, 1,760 ft., 23rd March.

Our commonest Reed-Warbler on migration, passing through from the third week in March till about the end of May and returning in August, September, and October. Seldom found far away from reed-beds or irrigated crops.

Occurs with the last species on migration in the Kurram Valley, and perhaps breeds there. Both Davidson ('The Ibis,' 1898, p. 9) and Lieut. Wilson (J. B. N. H. S. xii. p. 635) found it nesting in Kashmir.

[374.] ORTHOTOMUS SUTORIUS. The Indian Tailor-bird.

Ward, J. B. N. H. S. xvii. p. 112 (occurs in Jammu, but is rare).

751. ♀. Kohat, 1,700 ft., 27th March.

A resident, common in gardens and orchards around Kohat. Not observed in the Kurram Valley.

[377.] LUSCINIOLA MELANOPOGON. The Moustached Sedge-Warbler.

152. ♂ ad. Kohat, 1,850 ft., 19th March.

696. ♀ ad. Lachi, 1,540 ft., 17th March.

A winter visitor in small numbers, largely reinforced in February and March. I have searched for it in May in the plains without success, but, on the other hand, I shot an example at Dandar (4,700 ft.) in the Kurram Valley on the 20th of April and saw others but found none there in July. The wing and wing-muscles, however, are so feeble that it can scarcely go very far away to breed. Has a pleasing song which is often uttered, even in winter.

[381.] CISTICOLA CURSITANS. The Rufous Fantail-Warbler.

77. ♀ ad. Kohat, 1,760 ft., 11th January.

Abundant in summer wherever there is cultivation. The majority leave in autumn, but a few stay through the winter, and are then more often found in and around reed-beds than elsewhere. In the Kurram Valley we observed it as high as Parachinar (5,700 ft.)

[384.] FRANKLINIA BUCHANANI. The Rufous-fronted Wren-Warbler.

121. ♂ ad. Jabba, 2,400 ft., 18th February.

781. ♂ ad. Kohat, 1,760 ft., 3rd April.

A common resident in the scrub-jungle of the District, but does not ascend the hills, usually occurring in small parties or pairs. It is always on the move, either creeping about in bushes or running mouse-like along the ground from one bush to another. In spring the air resounds with its cheery little song.

[392.] HYPOLAIS RAMA. Sykes's Tree-Warbler.

Marshall, J. B. N. H. S. xiv. p. 602 (summer visitor, nesting in May: Quetta); Bentham, op. cit. xvi. p. 749 (nests freely in rose-hedges: Quetta).

546. ♂ ad. Thall, 2,500 ft., 11th May.

759. ♂ ad. Kohat, 1,760 ft., 29th March.

Occurs sparingly on migration.

[396.] HYPOLAIS CALIGATA. The Booted Tree-Warbler.

Ward, J. B. N. H. S. xvii. p. 112 (passes through Baltistan, but rare)

229. ♂ ad. Kohat, 1,760 ft., 29th April, 1906.

551. ♀ ad. Thall, 2,500 ft., 15th May 1907.

Passes through in fair number in April and May, returning in August. Usually found in dry scrub. In appearance very like *Phylloscopus tristis*, but not quite so active. This species probably breeds within our limits.

[Major Magrath procured an example of the rare *Hypolais obsoleta* at Bannu on the 8th September 1907. It was creeping about in grass with others.]

[398.] SYLVIA CINEREA. The Common Whitethroat.

Ward, J. B. N. H. S. xvii. p. 112.

357. ♀ ad. Kohat, 1,760 ft., 30th August.

358. ♂ ad. ,, ,, ,,

Not common. Only a few observed during the autumn migration at the end of August and beginning of September 1906.

[399.] SYLVIA JERDONI. The Eastern Orphean Warbler.

Marshall, J. B. N. H. S. xiv. p. 602 (common in April and May: Quetta); Cumming, op. cit. xvi. p. 687 (common in the Tamarisks: Seistan); Betham, t. c. p. 831 (nests freely in April and May above 7,000 ft.: Quetta); Ward, op. cit. xvii. p. 112 (recorded at Gilgit on migration).

491. ♀. ad. Thall, 2,500 ft., 14th April.

A summer visitor, and not common. Has a very fine song. We found several pairs in the scrub round Thall in April. On picking up the above-example, I noticed some cobwebs in the bill, and on looking round found a nest in a thick bush close by. It was composed of roots, bits of green plants, and a lot of cobwebs, and had not been completed.

[400.] SYLVIA NANA. The Desert-Warbler.

Watson, J. B. N. H. S. xv. p. 145 (occurs near Chaman).

452. Sex? ad. Lachi, 1,500 ft., 24th February.

This example was shot creeping about in a thorn-bush in the desert. Only one other was seen, and that was in a similar spot, the following year.

[401.] SYLVIA ALTHÆA. Hume's Lesser Whitethroat.

Marshall, J. B. N. H. S. xiv. p. 602 (believes that this sp. is fairly common at 8,000 ft. in May); Fulton, op. cit xvi. p. 48 (shot three in May between 5,000 and 7,000 ft.); Ward, op. cit. xvii. p. 112, and xviii. p. 461 (eggs taken in May and July at 8,000 ft.)

232. ♀ ad. Kohat, 1,760 ft., 29th April.

Passes through Kohat and the Kurram Valley in spring and autumn, but is not common. In spring I have generally observed it in Shisham trees (*Dalbergia sissoo*) in company with the next species. These trees are then in flower and attract much insect-life. Birds shot in them generally have their heads covered with pollen. A beautiful songster.

[402.] SYLVIA AFFINIS. The Indian Lesser Whitethroat.

Rattray, J. B. N. H. S. xii. p. 338 (winter visitor, not common: Thall); Betham, op. cit. xvi. p. 831 (a few pairs nest round Quetta); Ward, op. cit. xvii. p. 112 (common in summer in Kashmir).

41. Sex ? Khushalgarh. 1,200 ft., 16th December.

101. ♀. Kohat, 1,760 ft., 5th February.

Passes through in large numbers in spring and autumn, a few staying for winter. Breeds freely in the Kurram Valley in Ilex-scrub and low bushes from 6,000 to 8,000 feet. Like the last species it has a pleasing and remarkably loud song, often uttering it on the wing. Much more confiding in summer than at other seasons.

[403.] SYLVIA MINUSCULA. The Small Whitethroat.

Marshall, J. B. N. H. S. xiv. p. 602 (small flocks on migration in April).

521. ♀ ad. Peiwar, 6,500 ft., 22nd April.

Probably not uncommon, but owing to its close resemblance to the last species must have often been overlooked. Altogether I shot some half dozen specimens around Kohat in the cold weather. It appears to breed, in company with the last species, in the Kurram Valley, this example having been secured in a locality where many of the latter were then nesting.

[407.] PHYLLOSCOPUS TRISTIS. The Brown Willow-Warbler.

Marshall, J. B. N. H. S. xiv. p. 602 (shot one in February); Ward, op. cit. xvii. p. 112 (eggs taken in Ladakh).

56. ♂ ad. Kohat, 1760 ft., 21st December.

110. ♂ ad. „ „ 11th February.

Extremely common up to about 5,000 feet from early September till about the middle of May. Found everywhere, in gardens, groves, scrub-jungle and desert; also on stony hill-sides where there is vegetation, in bare stubbles, and standing crops. It frequents more especially the neighbourhood of water, reed-beds, water-plains, and irrigation cuts. An expert flycatcher and very active. Except in spring, it is very silent.

[408.] PHYLLOSCOPUS INDICUS. The Olivaceous Willow-Warbler.

Ward, J. B. N. H. S. xvii. p. 112 (eggs taken in August in Ladakh, 11,500 ft.)

185. ♂ ad. Kohat, 1,760 ft., 5th April.

Passes through Kohat in small numbers on migration in March and April. I only once observed it on the return migration, *viz.*, a solitary example on the 16th of September. Nests freely in parts of the Safed Koh Range. Differs in habits from other Willow-Warblers in being rather a skulker, as it is usually found hopping and creeping nuthatch-like about in the undergrowth. Its loud call-note of "Tack" often indicates its whereabouts.

[411.] PHYLLOSCOPUS NEGLECTUS. The Plain Brown Willow-Warbler.

Ward, J. B. N. H. S. xviii. p. 461 (eggs taken and parents secured at Kargil in May and June).

706. ♀ ad. Kohat, 1,760 ft., 18th March.

This species is so difficult to distinguish from *P. tristis* until actually examined in the hand, that it is impossible to say whether it is fairly common or merely a straggler. The above-mentioned example was the only one secured. It was busily fly-catching in a willow just like *P. tristis*.

[415.] PHYLLOSCOPUS PROREGULUS. Pallas's Willow-Warbler.

Rattray, J. B. N. H. S. xvi. p. 424 (nests freely in the Galis); Ward, op. cit. xvii. p. 112 (common in Kashmir).

664. ♀ ad. Marai, 3,000 ft., 9th March.

667. ♀ ad. Kachai, 2,700 ft., 10th March.

Not common. I have met with it in spring at the foot of the hills and in summer on the Safed Koh at 8,500 feet. Its song is very characteristic. Call note "*tchit*".

[416.] PHYLLOSCOPUS SUBVIRIDIS. Brooks's Willow-Warbler.

102. ♂ ad. Kohat, 1,760 ft., 5th February.

113. ♀ ad. „ „ 10th February.

276. Sex? Samana, 6,500 ft., 12th April.

319. ♀ ad. Safed Koh, 8,800 ft., 13th July.

Fairly common in the District from October to April. Generally found solitary or in pairs in scrub and wild olive-groves, more rarely in orchards and gardens. Occurs on the Samana in large numbers on migration. Nests freely on the lower slopes of the Safed Koh from 7,000 to 9,000 ft. A nest found on the 13th of July, 1906, evidently an old one re-lined, was placed in the bank of a nullah under cover of a small bush. It was of the usual Willow-Warbler type and contained four fresh eggs (this was the full clutch, the female having no eggs in the oviduct). They were white, thickly spotted with dark red, and averaged ·55 × ·4 inch.

In summer this Warbler frequently utters a loud monosyllabic call-note, not unlike that of the next species but not so loud. In winter this is only occasionally heard.

[418.] PHYLLOSCOPUS HUMII. Hume's Willow-Warbler.

Fulton, J. B. N. H. S. xvi. p. 48 (only two obtained in Chitral); Rattray, t. c. p. 424 (very common in the Murree Hills); Ward, op. cit. xvii. p. 113 (breeds in Kashmir).

48. Ad. Kohat, 1,760 ft., 23rd December.

55. ♂ ad. „ „ 31st December.

119 & 120. ♂ ad. Kohat, 1,760 ft., 16th February.

153. Ad. Kohat, 1,760 ft., 18th March.

Abundant in the cold weather in Kohat from September till the end of April, frequenting gardens, orchards and groves—usually singly. It has a loud call-note resembling the syllable "*pchwey*" which is constantly uttered. Occurs on the Samana on migration, and nests in large numbers on the Safed Koh from 7,000 to 11,000 feet. Its curious song, which may be rendered "*pi-pi-piaz-z*" (this being repeated with variations) is first heard in March, whilst still in its winter-quarters, and is continued throughout the summer being usually uttered from the midst of a thick tree.

[421.] ACANTHOPNEUSTE NITIDUS. The Green Willow-Warbler.

Ward, J. B. N. H. S. xvii. p. 113.

766. Ad. Kohat, 1,760 ft., 31st March.

784. ♂ ad. „ „ 2nd April.

Passes through Kohat and the Kurram Valley in large numbers from the last week in March till the end of May, returning in September, when comparatively few are seen. This is the last Willow-Warbler to leave, and I have met with it at Kohat up till the 28th of May. Major Magrath says that this species is extremely common in Bannu in September and October. Its relative scarcity at that season in Kohat, together with that of many other species, may perhaps be accounted for by its following the Kurram River down through the Bannu District instead of turning off at Thall up the Ishkalai, an insignificant stream which connects the Miranzai and Kurram Valleys.

[424.] ACANTHOPNEUSTE MAGNIROSTRIS. The Large-billed Willow-Warbler.

Rattray, J. B. N. H. S. xvi. p. 425 (fairly common in the Galis); Ward, op. cit. xvii. p. 113 (apparently rare).

I have only met with this species on the lower slopes of the Safed Koh, where its nests in small numbers between 7,000 and 8,000 feet. The call-note is loud and characteristic, resembling the syllables "*dirtee*." Song monotonous and poor.

[428.] ACANTHOPNEUSTE OCCIPITALIS. The Large-crowned Willow-Warbler.

Rattray, J. B. N. H. S. xvi. p. 425 (very common round Murree); Ward, op. cit. xvii. p. 113 (nests from 7,000 to 8,000 ft. in Kashmir).

535. ♂ ad. Kurram Valley, 6,800 ft., 28th April.

Occurs sparingly in the Kohat orchards in April and May, but not observed in autumn. Abundant, however, on the Safed Koh Range in summer from 6,000 to 10,000 feet, being quiet the commonest Willow-Warbler there. Its loud monotonous song may be heard from dawn to dusk all the summer through.

[434.] CRYPTOLOPHA XANTHOSCHISTA. Hodgson's Grey-headed Flycatcher-Warbler.

Rattray, J. B. N. H. S. xvi. p. 426 (rare in Murree Hills, one nest found) Ward, op. cit. xvii. p. 113.

624. ♀ ad. Kohat, 1,760 ft., 29th February.

629. ♂ ad. (testes big). Kohat, 1,850 ft., 1st March.

665. ♂ ad. Marai, 3,000 ft., 9th March.

A fairly common winter-visitor to the district, arriving about the third week in October and leaving early in April. This species and *Suya crinigera* are the only Warblers found on the Samana above 5,000 feet all through the winter; it is difficult to understand how they manage to pick up a living, the hill-side being often covered with snow for days together. Frequents scrub-jungle, gardens, and orchards, going about in small parties and often uttering its pretty little song even in mid-winter.

[445.] SCOTOCERCA INQUIETA. The Streaked Scrub-Warbler.

Rattray, J. B. N. H. S. xii. p. 338 (Thall: common); Watson, op. cit. xv p. 145 (very common round Chaman, near Quetta).

436. ♀ ad. Banda 1,900 ft., 27th January.

608. ♂ (testes very big.) Lachi, 1,540 ft., 25th February.

A common resident among scrub on dry stony hill-sides, but not seen above 3,500 feet, nor far from the foot of the hills. The specific name is very appropriate: it is never still, but is always flitting or running mouse-like about from bush to bush, only pausing occasionally to sing a few notes of its cheery little song.

[456.] CETTIA ORIENTALIS. The Eastern Bush-Warbler.

167. ♂ ad. Lachi, 1,540 ft., 27th March.

701. ♂ ad. Kohat, 1,760 ft., 17th March.

732. ♂ ad. „ „ 23rd March.

734. ♀ ad. Chillibagh, 2,100 ft., 24th March.

Bill dark brown, lower mandible flesh-coloured, gape yellowish; tarsus flesh-coloured; iris brown.

Passes through Kohat in fair numbers in March, frequenting reed-beds, gardens, and generally thick cover near water. A great skulker, usually occurring singly. My attention was first drawn to this species by a loud note, resembling the syllable "*chey*," proceeding from the midst of a tamarisk. After much peering, I made out a small brown bird vigorously flirting its tail and evidently much resenting my presence. It was in this way that I always met with it.

[458.] SUYA CRINIGERA. The Brown Hill-Warbler.

Rattray, J. B. N. H. S. xvi. p. 426 (nests freely in Murree Hills); Ward, op. cit. xvii. p. 113 (common in Kashmir).

663. ♀ ad. Marai, 4,000 ft., 9th March.

677. ♂ ad. Thall, 2,500 ft., 14th March.

A resident on the Samana and fairly common. In winter it descends to the Miranzai Valley, occurring commonly in the scrub jungle near the foot of the hills, also in the low hills of S. Kohat.

We did not meet with it in the Kurram Valley, though I shot one at the entrance near Thall.

[462.] PRINIA LEPIDA. The Streaked Wren-Warbler.

Cumming, J. B. N. H. S. xvi. p. 687 (fairly common amongst the Tamarisks: Seistan, 1,700 ft.); Ward, op. cit. xvii. p. 114 (occurs in outer hills, but not in Kashmir proper).

617. ♂ (testes very big). Lachi, 1,540 ft., 26th February.

697. ♀ ad. Lachi, 1,540 ft., 17th March.

698. ♂ ad. „ „ „

A resident in the plains, and not uncommon about reed-beds and tamarisk-scrub, being particularly abundant in the Lachi Plain. Nesting operations are begun in March, and from then till May its curious reeling song is constantly to be heard.

[463.] PRINIA FLAVIVENTRIS.

Major Magrath has found this species common in the reed-beds of Bannu, the adjoining District on the south, and has forwarded examples to the British Museum.

[466.] PRINIA INORNATA. The Indian Wren-Warbler.

Rattray, J. B. N. H. S. xii. p. 337 (Thall : occurs in the reeds) ; Ward, op. cit xvii. p. 113.

683. Ad. Thall, 2,500 ft., 14th March.

750. ♂ ad. Kohat, 1,600 ft., 26th March.

Resident but rather rare, except along the banks of the Kurram River.

In Bannu, however, where the country is more suited to its habits, Major Magrath has found it extremely common.

[469.] LANIUS LAHTORA. The Indian Grey Shrike.

Rattray, J. B. N. H. S. xii. p. 338 (Thall : an uncommon summer visitor) ; Marshall, op. cit. xiv. p. 602 (in April near Quetta) ; Ward; op. cit. xvii. p. 479 (occurs in Jammu).

567. ♂ ad. Kohat 1,760 ft., 6th February.

658. ♀ ad. Hangu, 2,650 ft., 8th March.

A resident, chiefly found in the desert, but not commonly, more numerous in winter than summer. Major Magrath found a nest containing four slightly incubated eggs on the 12th of May near Thall. Not met with above 3,500 feet in the Kurram Valley.

[473.] LANIUS VITTATUS. The Bay-backed Shrike.

Rattray, J. B. N. H. S xii. p. 338 (very common and resident at Thall) ; Marshall, op. cit. xiv. p. 602 (Quetta ; an uncommon summer visitor) ; Fulton, op. cit. xvi. p. 48 (Chitral : common in summer up to 6,000 ft).

520. ♂ ad. Kurram Valley, 6,500 ft., 23rd April.

Fairly common from the last week in March (single birds noted on 1st and 2nd March) till September in Kohat and the Kurram Valley. I noted it in Lahore, some 200 miles S.-E., early in February.

[476]. LANIUS ERYTHRONOTUS. The Rufous-backed Shrike.

Rattray J. B. N. H. S. xii. p. 338 (Thall ; abundant) ; Marshall, op. cit. xvi., p. 602 (Quetta : very common in summer) ; Fulton op. cit. xvi. p. 43 (common in Chitral in summer up to 7,000 ft.) ; Betham, t. c. p. 750 (breeds freely) ; Ward, op. cit. xvii. p. 479 (widely distributed in Kashmir).

A resident, and extremely common in summer everywhere up to 7,000 feet. The majority leave for warmer climes in autumn.

[479.] LANIUS ISABELLINUS. The Pale-brown Shrike.

Marshall, J. B. N. H. S. xiv. pp. 602, 606 (Quetta : a summer visitor, nesting in May between 7,000 and 9,000 feet.

109. ♀ ad. Kohat, 1,700 ft., 8th February.

A fairly common winter visitor from October to April.

I shot an example in the Kurram Valley at 6,500 feet on the 2nd of May ; possibly a few pairs nest up there.

[480.] LANIUS PHOENICUREIDES. The Rufous Shrike.

[867.] RAISAN, 2,400 ft., 5th March.

A scarce winter visitor.

[495.] PERICROCOTUS BREVIROSTRIS. The Short-billed Minivet.

Fulton, J. B. N. H. S. xvi. p. 49 (Chitral : summer visitor, nesting commonly from 7,000 to 9,000 ft.) ; Rattray, t. c. p. 426 (Nests freely in Murree Hills) ; Ward, op. cit. xvii. p. 479 (breeds in Kashmir).

A common winter visitor to the District from the end of September to April. Nests freely on the Safed Koh between 6,000 and 8,000 feet. Captain Keen observed a few on the Samana all through the summer, and believes that they nested there. An example collected by Major Magrath in Bannu and now in the National Collection, is typical.

[500.] PERICROCOTUS PEREGRINUS. The small Minivet.

Ward, J. B. N. H. S. xvii. p. 479.

Very rare. I came across a pair in some camel-thorn scrub (*Acacia modesta*) three miles west of Makhud on the Indus, but unfortunately failed to secure one. It is a bird I know well, however, having frequently met with it near Rawal Pindi (100 miles east).

[518.] ORIOLUS KUNDOO. The Indian Oriole.

Rattray, J. B. N. H. S. xii. p. 330 (common on migration) ; Marshall, op. cit xiv. p. 602 (a summer visitor to Quetta) ; Watson, op. cit. xv. p. 145 (Quetta : common in gardens, mostly immature) . Fulton, op. cit. xvi. p. 49 (very common in summer in Chitral up to 8,000 ft.) ; Rattray, t. c. p. 426 (common near Murree at 5,500 ft.) ; Ward, op. cit. xvii. p. 479 (breeds in Kashmir up to 6,000 ft.).

A large number pass through Kohat in April and the beginning of May returning in August and September : many breed in the orchards of the Kurram Valley ; a few also in Kohat.

[528.] PASTOR ROSEUS. The Rosy Pastor.

Rattray, J. B. N. H. S. xii. p. 338 (Thall: passing through in vast numbers) ; Marshall, op. cit. xiv. p. 602 (common at Chaman at the end of April).

Major Magrath has written the following note on this species in Kohat:— Passes through this district in vast flocks during the spring and autumn migrations. At the spring passage the birds are slaughtered in hundreds by the natives, every man possessing a firearm turning out for the sport. They arrive about the middle of April and the rush continues till the middle of May. The mulberries, which are ripe at this season, are eagerly devoured by them, and the ripe corn also suffers from their depredations. A few young birds remain in the district throughout the hot weather. The return passage begins about the end of July, being at its height by the middle of August, and lasting into September. Very few adult birds are to be seen at this time. The direction of the flight through the district is N.-W. and S.-E. for spring and autumn migrations respectively. The vast flocks which roost in and about the cantonments become an unmitigated nuisance while they are with us." Since writing the above, Major Magrath has noted the appearance of small flocks of adult birds in the middle of summer, as also have Captain Keen and I; in fact, between us we have noted them at short intervals throughout the summer, and it seems probable that some of them at least breed a good deal

nearer India than Asia Minor. Small flocks of immature birds stay with us till November. Curiously enough, in the spring of 1907, only a few small flocks were observed passing through the Kohat district. The migration appears to have been diverted elsewhere, though whether this was due to the district being invaded at the time by vast armies of young locusts in the crawling stage, I cannot say. One would have imagined that this would have had an opposite effect.

[529.] STURNUS HUMII. The Himalayan Starling.

Rattray, J. B. N. H. S. xii. p. 338; Marshall, op. cit. xiv. p. 602 (rare at Quetta, shot in March and April); Ward, op. cit. xvii. p. 479 (very common in Kashmir in summer from 5,000 to 7,000 feet).

We must have overlooked this Starling. Colonel Rattray records it from Thall as "not common, but a fair number may be seen any day during April and May . . ." A Starling shot by me on the 14th of April (the last date on which a Starling was seen) proved to be *Sturnus menzbieri*.

[530.] STURNUS PORPHYRONOTUS. The Central Asian Starling.

Watson, J. B. N. H. S. xv. p. 145 (in flocks in Chaman, near Quetta, in December); Ward, op cit. xvii. p. 479 (does not appear to breed in Kashmir); Perreau, op. cit. xviii. p. 186 (occurs in Chitral).

62. ♂ ad Kohat, 1,760 ft., 4th January.

688. ♂ ad Kohat, 1,760 ft., 16th March.

719, 721. ♂ ♀ ad. Kohat, 1,760 ft., 21st March.

A winter visitor, not so common as the next species, occurring singly or in flocks, often in company with *S. menzbieri*.

As Dr. Sharpe has pointed out to me, both Major Magrath's examples from Bannu and mine from Kohat show signs of the mixing of this race with some other, the head being generally marked in places with purple gloss.

[532.] STURNUS MENZBIERI. The Common Indian Starling.

Rattray, J. B. N. H. S. xii. p. 339 (Thall; common in winter); Fulton, op. cit. xvi. p. 49 (Chitral; common winter visitor); Cumming, t. c. p. 687 (probably the Starling which occurs in flocks in Seistan in winter); Ward, op. cit. xvii. p. 479 (the majority migrate through, a few nest).

63. ♂ ad. Kohat, 1,760 ft., 4th January.

117. ♂ ad. ,, ,, 13th February.

718 & 720. ♂, ♂. Kohat, 1,760 ft., 21st March.

Abundant in the cold weather, arriving about the third week in October and leaving towards the middle of April.

[544.] TEMENUCHUS PAGODARUM. The Black-headed Myna.

Fulton, J. B. N. H. S. xvi. p. 49 (very common in summer in Chitral at 5,000 ft.); Rattray, t. c. p. 427 (rare in the Murree Hills); Ward, op. cit. p. 479 (occurs in Kashmir, but is rare).

A summer visitor to the district. I have only twice met with this species, once on the 25th of August, when I observed about a dozen feeding in a garden in company with the Common Myna, and again a pair on the 4th of June.

Mr. Donald, the Political Officer, however, tells me that a few pairs nest regularly every year near Hangu (2,700 feet), usually selecting holes in the Boquain tree (*Melia azedarach*) as nesting-sites.

[549.] ACRIDOTHERES TRISTIS. The Common Myna. Rattray, J. B. N. H. S. xii. p. 339 (common and resident); Marshall, op. cit. xvi. p. 602 (a few occur in spring); Fulton, op. cit. xvi. p. 49 (resident in Chitral, occurring up to 8,000 ft. in summer); Rattray, t. c. p. 427 (common around Murree); Ward, op. cit. xvii. p. 479.

Resident and extremely common, occurring up to 7,000 feet in the Kurram Valley in the summer, and at Fort Lockhart (6,500 feet) all the year round, in spite of the heavy snowfall.

[551.] ACRIDOTHERES GINGINGIANUS. The Grey-Bank Myna.

Small flocks occur in the District in February and March, and are usually seen following cattle on the grass-farms. Major Magrath has found the bird fairly common in Bannu, and has sent an example to the British Museum.

AMPELIS GARRULUS. The Waxwing.

Whitehead, Bull. B. O. C. xxi. p. 19.

416. ♀ ad. Samana, 6,500 ft., 16th December 1906.

I first met with this handsome bird on the 11th of December, in a small garden near the Fort, but just as I had sighted it with my glasses, up flew a flock of Gold finches and began mobbing it, and away it went, uttering a soft whistling note. Five days later, on visting the same spot, I was lucky enough to again find a Waxwing there. It was in fine condition with four wax-like tips to the secondaries of each wing. In addition to this example, Major Magrath shot one, a male, extremely fat, in his garden in Bannu, lat. 33° (apparently the farthest southern record for this species), on the 20th of March. Colonel Ward records another secured on the 8th of the same month at 7,000 feet in Kashmir.

[*To be continued.*]

A TAMARIX ASSOCIATION.

BY

WILLIAM BURNS, B. Sc. (Edin.).

(*From the Botanical Laboratory of the Agricultural College, Poona.*)

In the uncultivated areas along the banks of the Nerbudda near Broach run lines of tamarix. The zone occupied by this plant is comparatively narrow, but it is often possible to distinguish two regions within the zone, of apparently different ages, the older being higher up the banks. The tamarix is an organism well adapted to the conditions in which it occurs. These are sandy or alluvial soil, saline water, and a lowlying but rather exposed situation. It has been supposed that tamarix is rather a salt-plant than a sand-plant. How far this is the case remains to be proved. In any case tamarix occurs where both physical and physiological drought are imminent, and all its adaptations are for resistance of drought. The roots are deep, the leaves are minute and clasping, and on these leaves are peculiar impresso-punctate glands in which salts accumulate.

It is believed that the function of these deposits is to attract moisture hygroscopically from the atmosphere and pass it on to the leaf tissue. In the leaves of *Tamarix articulata*, according to Solereder, storage tracheids occur for the preservation of water.

I was curious to know what other plants were associated with the tamarix in its peculiar zone at Broach and so, in October 1909, I collected from a small area (about 100 by 15 yards) all the plants I could find. Where the tamarix grew it was the dominant plant, but the habit of the tamarix is not such as to exclude the growth of other plants amongst it. The area I examined was of recent growth and close to the water. The tamarix was from three to five feet high and thickly planted, yet the slenderness of its branches permitted sufficient air and light to enter for numerous subsidiary plants. In marked contrast to the tamarix in this respect was *Typha angustata*, of which I found one clump growing in a swampy spot where no tamarix had rooted. This Typha formed a compact and exclusive community, growing so close and high that nothing else had a chance amongst it.

Of tamarix I found three species, namely, *Tamarix dioica*, *Tamarix articulata* and *Tamarix ericoides*. These were all in flower and easily identified. *Tamarix ericoides* has ten stamens, whilst the other two have five. *Tamarix dioica* has unisexual flowers, whilst *Tamarix articulata* has hermaphrodite flowers in interrupted spikes. Two other species are reported in Cooke's Flora as occurring in Sind, namely, *Tamarix gallica* and *Tamarix stricta*; but these were not found in the Broach group. *Tamarix gallica* has five stamens like *Tamarix articulata*, but has racemose panicles. *Tamarix stricta* has ten stamens like *Tamarix ericoides* but differs in having the glands of the disc passing into the bases of the staminal filaments instead of separating them. *Tamarix dioica* and *Tamarix articulata* become tree-like in habit. *Tamarix*

ericoides remains shrubby. The distribution and biology of these species will be the subject of further study.

The following is a list of the plants found amongst or beside the tamarix with the exception of one or two lost in drying :—

LYTHRACEÆ :	*Ammania salicifolia.*
COMPOSITÆ :	*Ageratum conyzoides.*
	Eclipta alba.
	Sphæranthus indicus.
FICOIDEÆ :	*Trianthema monogyna.*
AMARANTACEÆ :	*Achyranthes aspera.*
	Celosia argentea.
	Amarantus paniculatus.
	Alternanthera sessilis.
GRAMINEÆ :	*Chloris montana.*
	Eragrostis pilosa.
	Eragrostis interrupta.
	Panicum colonum.
	Isachne australis.
	Andropogon halepensis.

For the identification of these plants I am indebted to Messrs. Bhide, and Paranjpe, Assistant Economic Botanists, Agricultural College, Poona.

The *Lythraceæ* are subdivided by Hooker into two tribes, the *Ammaniæ* and the *Lythreæ*. The *Ammaniæ* are a distinctly moisture loving group.

Several of its members are weeds of rice fields. I have found *Ammania* species in damp saltish lands in the Konkan and near Baramati. The species found at Broach, *Ammania salicifolia*, is exceedingly widely distributed in India, being reported from practically every province. According to Solereder, the *Lythraceæ* very often have epidermal mucilage cells in the leaf. The genus *Ammania* possesses these and they have doubtless some biological significance.

The *Compositæ* found are of wide distribution in all warm climates. *Ageratum conyzoides* and *Eclipta alba* are common weeds of fields and waysides in India. *Sphæranthus indicus* is reported in rice fields.

The distribution of *Trianthema monogyna* is also very wide. It is found in Malaya, Western Asia, Africa and Tropic America. The anatomy of the *Ficoideæ* has been the subject of repeated study. The stem structure has been shown to be anomalous. Successive arcs of meristem appear in the pericycle giving rise to concentric rows of secondary vascular bundles and intermediate tissue (Morot). As an adaptation to the dry regions which the members of this order inhabit, they are provided with water storing cells in the leaf epidermis.

The *Amarantaceæ* cannot be said to be distinctly haloplytic or xerophytic though they can put up with fairly dry conditions. The *Amarantus paniculatus* found was a single specimen, probably an escape. It was small, only about thirty centimetres high, with no fasciation. *Achyranthes aspera* is a well known

weed in dry places all over Tropic Asia, Africa, Australia, and America. *Celosia argentea* has an almost equally wide distribution and is a common field plant in India. *Alternanthera sessilis* is fond of damp places throughout the hotter parts of India and Ceylon. The stem structure of the *Amarantaceæ* is similar to that of the *Ficoideæ* in having concentric rings of vascular tissue (see Solereder and others).

The *Gramineæ* cited are all of very wide distribution and inhabit all sorts of situations. Dalzell and Gibson give *Eragrostis interrupta* as occurring in waterholes in Gujarat.

The analysis of this Association brings to light one or two curious facts. The first is that, in one Association, we have, growing side by side—

(1) plants of limited habitat and xerophytic or halophytic type—*Tamarix* species.

(2) plants of general xerophytic type—*Trianthema*.

(3) plants of the open field and of no distinct type—the grasses, composites, and *Amarantaceæ* other than *Alternanthera*.

(4) plants of distinctly hygrophytic type—*Ammania salicifolia*, *Alternanthera sessilis*.

The occurrence of a general xerophytic type along with the tamarix is to be expected. The occurrence of the plants of the open field shows that these have a long range of adaptability. The occurrence of hygrophytes points, I think, to an invasion of odd dampish corners by plants accustomed to these situations.

A second interesting fact is that all the plants associated with the tamarix are plants of exceedingly wide distribution throughout the tropics. Wide distribution of a species indicates considerable flexibility of constitution, and it is precisely such plants that one would expect to find in conditions so trying and special as those among the tamarix.

A third point is the occurrence of the several *Amarantaceæ* and of *Trianthema*, all with anomalous stem anatomy. I hardly think we can as yet say that this structure means any special advantage in gaining a foothold in unusual situations.

A NOTE ON THE CIRCULATION OF *CALYCOPTERIS FLORIBUNDA*.

BY

JOHN WALLACE, C.E.

In the early days of the Indian police the way in which law breakers could remain in the jungle, at seasons when all springs and streams were dry, and when the village wells were watched, was very puzzling to the authorities. Travelling through jungles or over uncultivated and rocky ground in hot weather, and without drinking water, is a serious hardship, as many a shikari knows to his cost, but the mystery was cleared up when it was discovered that drinking water could be had from one of the largest climbing plants, the *Calycopteris floribunda*, that is common in many parts of India and may even be seen in and around Bombay. Examples are found on Gibbs Road, Malabar Hill, outside the Bombay Gymkhana and also on the lawn in front of the University Library, where a fine example of the plant grows upon an isolated Pepul tree.

The "Ukshi," as the plant is called in the Thana District, is known in two forms; as a scandent plant in the jungles where it climbs the whole of trees, turning from left to right, forming great loops and festoons and reaching long distances from one tree to another, or travelling along the ground for the same purpose, and meanwhile throwing out roots to form new plants. At times it will also send out fresh shoots from the ground which will coil so tightly around its older stems as to present the appearance of a hard twisted rope. Its other form is that of a dense shrub when isolated and cut annually for twigs and leaves, which are burnt on rice fields as manure. At the commencement of the hot weather its pale golden flowers form a pleasing contrast with the surrounding foliage.

The chief interest of this plant lies in its property of storing water, and in the means by which this water is raised, stored and distributed. Mr. George Ryan of the Indian Forest Service described the *Ukshi* in a paper read before this Society, on the 29th September 1904, and told how four pieces of stem, totalling 9 feet 8 inches in length, and of an average diameter of 3½ inches, discharged when newly cut one quart of clear potable water. This water tends to rise in the stem above the incision under the influence of some unexplained force. The wood of the *Ukshi* is stringy, and filled with unusually large water vessels which may be seen in the cross sections exhibited. These sections when held against the light have the appearance of a delicate textile fabric sparkling with luminous points. The cutting of them presented some difficulty, as sawing produced a woolly surface, and sand-paper only filled all the pores with dust. They were finally sawn nearly to size, fixed in a lathe, and cut with keen edged chisel which was held with a vertical edge. The upward movement of the water in the *Ukshi* represents a considerable force, for the surface resistance of the innumerable vessels must be very great, even if the movement of the

water be very slow. The water helps to feed the plant with mineral solutions on its way to the leaves from whose surface it escapes by evaporation at a varying rate, according to the season or time of day. Botanists seem to agree in saying that plants have no organs for absorbing water or vapour through the leaves. The movement of water must therefore be always in one direction which would seem to imply the existence of some kind of valve on the surface of the leaves, which prevents a reverse movement, even when under the influence of atmospheric changes of temperature and pressure. In Bombay we learn from figures kindly furnished by Mr. N. A. Moos at the Observatory, that the mean monthly solar radiation as recorded by the black bulb thermometer in the month of January, is 133·5 degrees Fahrenheit and that the minimum grass radiation thermometer at night indicated 62·5 degrees, shewing a range of 71 degrees to which plants are exposed. These are only mean figures. In Allahabad the sun temperature rises to 163 degrees, giving in all probability a much greater range. Confined air under an increase of temperature equal to 71 degrees would increase in pressure by about 2·8 lbs. per square inch or approximately 403 lbs. per square foot. The range of barometric pressure in Bombay is small as compared with that of other countries. It occurs in two daily waves having their maxima at ten o'clock, morning and evening, and their minima at four o'clock, morning and evening. The maximum range is equal to a column of water 7·936 inches high, which corresponds with a pressure per square foot of 41·98 pounds. The atmospheric influence acting on the *Ukshi* are thus a wave of temperature, rising from sunrise until half past two o'clock in the afternoon and falling until sunrise ; and two waves of barometric pressure of an amplitude already indicated. It is hard to believe that such forces, acting on the outside of a plant, whose juices have to be raised against gravity and friction, should have no useful influence in assisting its functions. This assistance would seem to involve the existence of valves, and as this matter has been the subject of contrary opinions there is still a lack of unanimity about it. Col. Kirtikar recently examined a vertical section of a local fresh plant, and observed that it has innumerable pitted cells which Prof. Strasburger of Bonn University in 1903 found to act apparently as valves.

We all know that it is not the heart alone that circulates the blood in an animal body, because the whole work, if thrown on that organ alone, would rupture it. We may with safety assume that the water column circulating through the comparatively wide vessels of the *Calycopteris floribunda* are not continuous, and it remains for us to ascertain exactly the form of interruption which supports the water column, and the extent to which the meteorological changes, above referred to, affect the circulation of the plant whose extremities are open to absorption of water at the lower ends and to evaporation of moisture at the upper ends, while both extremities, owing to their conformation, do not permit a reverse current. It seems as if the regularly recurrent changes of temperature and pressure represent forces sufficient to carry on the work of circulation if the organs of the plant are adapted to utilise them.

REVIEWS.

THE FAUNA OF INDIA—DERMAPTERA.

BY M. BURR.

This, the latest volume of the series, and the first under the editorship of Mr. A. E. Shipley, deals with the Earwigs, *Dermaptera*, better known as the *Forficulidæ*. The new editor writes a preface which details the new volumes in preparation which we may notice before dealing with this volume.

Volumes have been sanctioned as follows :—

1. *Cicindelidæ* and *Paussidæ*, with a general introduction to *Coleoptera* by W. W Fowler.
2. *Orthoptera*, by W. F. Kirby.
3. *Dermaptera*, by M. Burr. (Now issued.)
4. Butterflies Vol. III.
5. *Curculionidæ*, by G. A. K. Marshall.
6. *Cetoniidæ* and *Dynastidæ*, by G. Arrow.
7. *Ichneumonidæ*, by C. Morley.
8. *Longicornia*, by C. J. Gahan.
9. *Buprestidæ*, by E. P. Stebbing.
10. *Rhynchota*, Appendix. W. L. Distant. (In the press.)
11. *Blattidæ*, by R. Shelford.
12. *Mollusca* II, by Godwin-Austen.

The above volumes have been sanctioned but are not all likely to be seen. The first is apparently not commenced nor is material called for ; the second has been in preparation for years and is not likely to be prepared, although collections for it have been in England several years. The fourth, the concluding volume of butterflies, *Lycænidæ* (part) and *Hesperiidæ*, is in the hands of Mr. Druce and much material is available. The fifth is under way and Mr. Marshall has worked through part of the material to the great advantage of Indian collectors. Mr. Arrow has examined the material for the *Cetoniidæ* and *Dynastidæ* and Mr. Morley has been at work on the *Ichneumonidæ* ; we have no knowledge of the *Longicornia* beyond the fact that one volume has appeared and that collections for the second have not yet been called for. The *Buprestidæ* are not likely to be done at present. Mr. Distant's volume on the *Rhynchota* is almost done, owing to his untiring activity in describing species and for Mr. Shelford's volume no collections have as yet been called for. The editor makes no mention of a volume on *Microlepidoptera*, for which Mr. E. Meyrick has for years been describing material in this journal, but the matter is so enormous, one volume will not suffice.

The Fauna of India is of immense service to Indian workers and it behoves all workers in India to help in any way they can. In response to an appeal

* The Fauna of British India, including Ceylon and Burma—Dermaptera. M. Burr. (Taylor and Francis, London.)

for beetles recently issued by this Society, much material has been received which is being pinned, set, identified and the new material arranged for the furtherance of the future Fauna volumes. In view of the above projected volumes, we would urge that members should collect insects likely to be of value for these volumes. The appeal for beetles has met with a good response ; we would appeal now for cockroaches, grasshoppers, locustids, stick insects, mantids and especially crickets. These are, with the beetles, the really important groups required now ; it should be needless to say that collections of *Lycænids* and *Hesperiids* are badly wanted, but this will appeal only to butterfly collectors, while every member can collect and send in the other groups, notably the crickets and grasshoppers. Members of this Society alone in India can help in this work and can assist in providing the material on which the volumes will be provided ; when a volume is projected, its ultimate value depends very largely on the fresh material available for examination and this can be supplied very largely by the members of this Society.

Turning to the present volume, we would congratulate the author upon it ; the general introduction is extremely good, taking account of the life-history and habits in a way rare among authors of systematic works. The author describes 133 species of earwigs of Ceylon, India and Burmah, and gives a revised scheme of classification. He appeals for more material, as there are many questions unsettled, and he takes a broad view of the value of the present classification. Like other specialists he is desirous of emphasising the importance of his group and makes it an order under the term *Dermaptera*. The section on geographical distribution is notable and the paragraphs on determination of species form a feature of the utmost value, as former volumes have been really used only by trained entomologists very largely because the layman could not get an explanation of the terms used in the volume ; Mr. Burr's paragraphs make the volume one that can be used at once by any one who will take the trouble to master the introduction and carefully read this section.

The author describes 133 species from India, Burmah and Ceylon. Of these, 32 are from widespread localities in the Himalayas, Ceylon, Burmah and other subtropical areas, 30 are from Burmah alone, 18 from Ceylon alone, 25 from Himalayan localities only, 6 from Burmah and Ceylon alone, while 20 only are recorded from localities in the plains of India, *i.e.*, from tropical India as I understand it. The species recorded from tropical localities are usually also found in subtropical areas, and there is practically nothing found in tropical India which is peculiar to it in the sense that the 25 Himalayan species are, as at present known, only Himalayan. *Forficulidæ* are not a large part of the fauna of the tropical plains but are more abundant in species in moister hill areas. Our Forficulid fauna in the plains is a "derived" one of recent times, not an indigenous "original" one.

The volume is well illustrated with text diagrams and ten plates, one in colour. We trust it will stimulate workers in India to turn to the *Orthoptera*,

not for collecting only but for the observation of habits, season and life-history. The Society will be glad to receive specimens, to name what they can and to collect all the material possible for future volumes of the Fauna.

H. M. LEFROY.

"INDIAN INSECT LIFE."

A MANUAL OF THE INSECTS OF THE PLAINS (TROPICAL INDIA).

BY H. MAXWELL-LEFROY, M.A., F.E.S., F.Z.S.,

ASSISTED BY F. M. HOWLETT, B.A., F.E.S.

Twenty-five years ago there was very little available literature on Indian Entomology and the new arrival in the country, however enthusiastic in the pursuit of insects and their ways, soon found his ardour evaporate under the continued disappointment of not being able to determine or put a name to any of his captures. At least this was true of everything except, perhaps, butterflies. Even about these, there was only Marshall and de Nicéville's partially completed work to be had. And this was expensive. On Beetles and Flies, on Bugs and Grasshoppers and Dragonflies, &c., there was nothing, absolutely nothing. In 1888 the Government of India authorised the compilation of "The Fauna of British India, including Ceylon and Burma" dealing, in a series of volumes, with the zoology of the countries mentioned. Up-to-date several volumes on Insects have appeared and these constitute so far the only works published dealing exclusively with Indian Entomology by means of which captures can be named. But as yet very few families of insects have been treated in those books and the field entomologist is to-day nearly as badly off as he was a quarter of a century ago. The study of Insects has been tremendously advanced in the last twenty years but nearly all the information gathered is disseminated throughout Europe in the different journals or magazines of the Zoological and Entomological Societies. Little of it is therefore available to the working entomologist. The "Fauna" above mentioned has as yet dealt only with the Moths, the Butterflies, the Bugs or Hemiptera and a few of the Coleoptera, none of which have been completed at the present hour. No attempt had been made to deal with Indian Entomology as a whole or for any considerable part thereof until Mr. Maxwell-Lefroy published his "Indian Insect Life" last year. It is not necessary to say that the want of such a book has been felt for many years back. There was no one before with sufficient leisure or sufficient energy to write it. There have, of course, been good entomologists in this country in the past but most of them have been Government Officials who were only able to pursue the subject as a hobby in the intervals of their legitimate duties. Mr. Lefroy has been luckier, being an Entomologist by profession, employed by the Government of India under the title of Entomologist, Imperial Department of Agriculture for India, with a good library of reference at his disposal, a sufficient staff of artists and a good

type collection of material to work on. All these are requisites not available to the ordinary individual. There is no wish or intention of detracting from the worth of the work done by him in the compilation of the book under review, but he has had exceptional opportunities, and he has produced an exceptionally able treatise.

From the first page to the last "Indian Insect Life" is as perfect a work as could be expected with the knowledge of the subject dealt with attained up to the present day. It is replete with information imparted in a pleasant and lucid style and contains a great amount of matter which in the past has been only available to the very few. The subject dealt with is a very large one and it is surprising how the author has managed to get all the facts and observations he has alluded to into the space he has allowed himself. The book is, naturally, largely a compilation, as can only be, but there are many original observations and notes incorporated in it and the fact that all the material has been collected in a short six years reflects infinite credit on the writer and those who have helped him.

It is a book of some 800 beautifully printed pages of good stout paper, and 536 text-figures besides 84 full page plates of which a great number are coloured. There is a map of India as Frontispiece showing the region dealt with which, we are informed, is the Tropical portion only or the "Plains." The cover is pretty and original, simple but very suitable. The binding, however, is bad; it is not strong enough and the pages break loose and come out. This is probably the result of weight and it would have been better had the book been issued in two volumes instead of one. It would have been a great deal handier also were it of smaller size notwithstanding that this would have interfered with the area of the fine plates; but the advantage gained in convenience of handling would have perhaps more than compensated for this. The objection to reduced plates could have been got over by multiplying their number, though this would have of course increased the cost of production. The final result might, however, have been more satisfactory in that there would probably have been a greater sale for the work in the more convenient form. The wider circulation it has the better for everybody.

The text-figures are uniformly good and, in the majority of cases, they represent typical insects, their eggs, larvæ, cocoons, nests, &c., and should be of considerable use to those desirous of learning to distinguish between the different forms. The plates, both coloured and uncoloured are on the whole also good; some of them are excellent and should be a great help to the beginner. They represent insects in all stages, many of them magnified, their eggs, larvæ, chrysalides, imagines, cocoons and foodplants; in many cases accompanied by the parasites characteristic of each. The plate of lepidopterous larvæ (XXVIII) contains caterpillars of some common types of butterflies and moths some of which have been apparently wrongly identified. For example, the larva No. 1 is given as that of *Junonia orithya* while it is evidently that of *Hypolimnas bolina*: both are nymphaline but differ in

that the head of the former is never horned; the colour is also slightly different. The figure No. 6 is said to represent a sphingid moth larva but it is not true to life having no horn on the 12th segment: the eighth abdominal segment. It is evidently one of the *Charocampa* or *Theretra* class by the attenuated fore-part and the thickened thoracic segments, but none of these caterpillars are without the horn on the eighth abdominal segment. Plate X is badly executed; the wasps depicted are all too pale in colour, the lines are coarse and the colours are bad; the same may be said of Plate XIII. Although the figures are enlarged, which might account for a certain amount of apparent coarseness, still they compare very unfavourably with the figures in, for example, "Genera Insectorum." Plate XVI (upper half) is perhaps the worst of the lot; the beetles look more like hedgehogs than anything else. However it is perhaps unfair to carp at the few bad pictures when there are so many of them, in fact the very large majority, which are so excellent. There are none that are not recognizable at a glance for what they are intended to represent and many of them are very perfect. The coloured plates of the locusts are extremely good.

The amount of information contained in the book is very great and the whole of it is exceptionally accurate; the arrangement of the matter is very good and complete. The introduction is an able exposition of the whole subject treated of. General entomological questions affecting sex, duration of life, relations to flowers as influencing cross-fertilization of plants, relations of insects to each other such as the habits of certain groups connecting them with ants, protective colouring and shape, &c., are treated of in appropriate places throughout the book, in short well written articles full of interest. These articles add to the value of the work from all points of view; they draw attention to most that is known about the ways and habits of insects, suggest many points that require study and elucidation and impart quite a large amount of information in a very small space.

Mr. Lefroy has produced a very valuable work that marks a distinct advance in Indian entomological literature. His name will be remembered for long years as the writer of the first text-book on Indian Insects, and "Indian Insect Life" will be the only source of information available to schools and colleges in this country for the next dozen years. Would that it had been published before. May it have the sale it richly deserves.

"INSECT INTRUDERS IN INDIAN HOMES."

By E. P. Stebbing.

Mr. E. P Stebbing has written a little book entitled "Insect Intruders in Indian Homes" which, he informs us, in the Foreword, is "a modest and altogether popular account of a few of the commoner Insect Intruders" met with in homes, gardens and jungles in this "Land of Exile." It is quite prettily got up, is illustrated with many illustrations of the subjects dealt with on a very broad margin of page round a somewhat meagre column of print, an

arrangement which, however, undoubtedly adds to the fresh look of the whole. It rejoices in a somewhat stiff though ingenious title-page, a rather artistic reverse side to the covers, a dedication-page backed by quite a long list of authorities consulted and a page with the quotation "To the solid ground of Nature trusts the Mind that builds for eye." There is list of Contents, a Foreword and an Introduction. All this *plus* the three Chapters into which the real book is divided occupy 158 half-pages of large clear print. The paper is good and the binding also.

The illustrations are, on the whole, good though some of them are somewhat rough and stiff. Many of them are unnecessarily repeated. They are placed so as to represent the insects alluded to on the page on which they are depicted and are easily recognisable as well-known types. The author deals only with types of "Intruders" and abstains from mentioning scientific names. He does this on purpose in the interests of "popularity." We take this to be a mistake. It would have been easy to give names without in the least detracting from the interest of the book for the lay reader, while it would have greatly added to its value for the scientifically inclined individual. As it is, the insects alluded to represent nothing definite to either the one or the other except known by sight.

We have perused the book more than once. We have given it to friends to read so as to have the opinions of people acquainted with insects only as insects; that is in the popular way, not scientifically. They pronounced it to be pleasant chatty reading well fitted to while away an idle hour. Perhaps it is, but personally we think the grammar often faulty, the style artificial and the humour decidedly forced. In a vague way it reminds one of the writings of EHA, as if the author had tried to imitate him. But what a difference! The allusions to insects as "little chaps" and "beggars" and "he" gets monotonous and jars. We also wish the author had abstained from introducing "The Girl" who gets upon our nerves and comes as a shock each time she is mentioned.

On page 44 he refers to a *Megachile*—departing from his intention of avoiding scientific terms—which makes mud nests and provisions them with pollen. We wish he could have told us more about the insect, for a Leaf-cutter bee that builds free mud cells for itself like an *Odynerus* or *Eumenes* wasp is decidedly interesting. We know *Megachile* bees will take possession of the mud cells of other wasps and make use of them, sometimes lining them with leaf pieces; but we were ignorant of their constructing such things independently. In fact we always considered that the Hymenopter that built a mud nest for its eggs in India could not and must necessarily be a wasp and not a bee, and this notwithstanding the example of *Chalicodoma* described by Fabre. Perhaps the *Megachile* alluded to lines natural cavities, tubular holes and so on with mud—that would be not quite so surprising for other *Apidæ* do that.

What are "Fossorial parasitic Wasps" mentioned on page 48? From the habit of storing spiders the author evidently means Fossorial Wasps; none of

the spider-storing ones are parasitic of course. On page 58 he mentions the Sawfly larva, figuring an ordinary moth-larva in the margin ; on the next page, by misplacement of a comma, he has made the difference of the number of legs possessed by a moth larva and that of a sawfly somewhat difficult to understand. When talking of "a silky little black beggar vividly picked out with orange and red and white spots and little stripes" on page 65, he describes it as being "pretty well omnivorous" which is another misstatement. The moth larva alluded to is that of *Polytela*, probably *gloriosæ* and it feeds only upon lilies. Mantis egg-masses on page 113 are said to be "easily crumbled between the fingers". As a matter of fact they are exceptionally tough except when very old and weathered. The little holes are made by parasites and not by the young emerging Mantis brood ; these slip out between little edges, proceeding from the successive layers by which the mass is built up, overlying each other generally down one side.

TRANSACTIONS OF THE BOMBAY MEDICAL CONGRESS, 1909.

It is a matter of every day knowledge that within the past half-century the Science of Medicine and the Art of Surgery have been well-nigh revolutionised by the study of one branch of Natural History, to wit, Bacteriology.

A glance at these Transactions will convince the reader of a much less known fact. Medicine, especially in the Tropics, owes most of its advances during the past quarter of a century to the Science of Zoology.

Year by year one disease after another has been found due to some minute animal parasite, and others, though perhaps caused by vegetable organisms, like the bacteria, owe their transmission to some specific animal host or carrier.

Medical research in the tropics has therefore become largely the study of Biology or the Life History of particular parasites, or particular animals concerned in the transmission of disease. Omitting such obvious diseases as those due to snake poison, intestinal worms, to vermin, such as lice, "jiggers," itch mites, guinea-worm, etc. we find malaria, chyluria, sleeping-sickness, "kala-azar," the black fever of Assam, hæmaturia of Egypt, relapsing fever, tick fever, syphilis, yaws, Delhi boil or Aleppo evil, miner's anæmia, the "anæmia of coolies", which causes such havoc in Ceylon and Assam, the enlarged liver of Japan are all now proved and universally admitted by pathologists to be directly due to animal parasites.

Most pathologists believe that Elephantiasis is caused by a minute worm transmitted by the common Culex mosquito, that most cases of liver abscess and one form of dysentery are due to a specific animal parasite, an amœba. They are most certainly associated with it.

Of late most protozoologists and cytologists have come to the conclusion that certain minute bodies found in the skin and throat during scarlet fever, those found in the vesicles of small-pox and cow-pox, others found in the nerve cells during rabies and hydrophobia are minute animals, the living contagium, the exciting cause of those diseases.

No one now disputes that Malta fever is transmitted by the goat, malaria by one family of mosquitoes, chyluria by many mosquitoes, and yellow fever by one species, sleeping-sickness by the Tse-tse fly.

Evidence has been brought forward that relapsing fever and kala-azar are transmitted by some biting animal, probably the bug or the louse.

Before re-infecting man many parasites require to pass through some intermediate animal host, the recognition and destruction of which are important matters for the medical man and sanitarian.

The life history of the malarial parasite in mosquito and man must now be "familiar to every school-boy." The agency of rats and fleas in the transmission of plague is sadly familiar to most of us in India.

Less well-known is the fact that the embryos of the guinea-worm on leaving man pass through a stage in the body of a small crustacean, Cyclops, that the Liver-Fluke which in Eastern Bengal is not uncommon in man, almost universal in sheep and goats, must of necessity pass certain stages of its life in the common water snail.

After this introduction we feel no need to apologise for the lay Naturalist venturing a little friendly criticism on the work of an Indian Medical Congress.

From a Natural History point of view, we must confess we have found little that is new or original. As a work for reference, the volume, a portly quarto of 632 pages, is rendered almost useless by the absence of an index. This want is the more obvious, as the sections into which the Congress was divided, were based on no recognised method of classification, pathological or otherwise.

We venture to think the editor would have been well advised to have had an index drawn up rather than occupy the space devoted to an Editor's Preface "to enumerate briefly some of the principal lessons which have been gleaned from the deliberations," and to appraise after the manner of a Commander-in-Chief in despatches, the value of different contributions.

The various authors might well resent as a usurpation the assumption of this role by the one official whose onerous and well-carried-out duties must of necessity have prevented him from hearing the majority of the papers and the criticisms published and unpublished which they evoked.

We doubt if many physicists will agree with the Editor's commendation of the evidence given in support of a theory that Hill diarrhœa is due to diminished atmospheric pressure.

In the department of Natural History a paper on Trypanosomiasis and Tse-tse Flies by Captain Greig, an observer who had lately returned after much practical research in Africa, is "mentioned in despatches" by the Editor as merely "exhaustive." We venture to think our readers will find it the best account written of what is known on the subject at the present day.

On the other hand the Editor pronounces "important" a paper by Dr. J.

T. Nash on the Non-Biting Flies, in which we must confess we cannot trace one new or original observation.

A good and popular account of some Indian Sand Flies is given by Mr. Howlett, who also contributes a useful table with helpful diagrams of the Blood-Sucking Flies, which has modestly concealed itself at the back of the volume in a "Catologue of Exhibits."

The discussion on the Treatment of Snake Bite would seem to have been a lively one, and will doubtless have an interest for the field naturalist. A startling line of treatment is recommended by our own valued contributor, Major F. Wall, which we would take for a slip of his facile pen but for the fact it is twice repeated. As we find no comment from the numerous keen critics present, we doubt if his advice can have been read at the meeting. He advises in all cases of colubrine and viper poisoning when the appropriate antivenene cannot be obtained, "*the intravenous injection of* 350 *c. c. of a 5 per cent. solution of Permanganate of Potash*" !!!

As this is the equivalent of half a gallon of undiluted Condy's Fluid, the immediate effect of which would be to coagulate all the blood with which it came in contact, it is needless to say the patient would be dead long before the injection was completed.

Simond's theory that plague is mainly transmitted by rat fleas, the truth of which he had established for most observers in 1898, but which the Indian Plague Commission dubbed "hardly deserving of consideration," seems to have been generally accepted at the Congress.

Long papers on water supply were contributed by Dr. Dadachanji, the scientific value of which may be judged by a single paragraph. "The terrible scourge of cholera in London in 1854 was believed to have had its origin in the upturning of the earth in which the plague-striken victims of the year 1665 had been buried." Truly a striking phenomenon in evolution, the *Bacilus pestis* of 1665 developing into the *Comma vibrio* of 1854!!! Lengthy papers on the sanitation of Bombay by Drs. Cursetji and Master are illuminated by flashes of unconscious humour and the play of a little poetic license. They tell us the City of Bombay "in every respect the pioneer City of India "having *enterprising and intelligent citizens* and being ahead of most of the "other cities in adopting the latest and newest measures for its sanitary "improvement and owned extensive water-works, the largest and most costly "of their kind . . . perhaps in the whole world."

Having given us this and other original information, on the very next page they fall foul of the Municipal Executive. "The peculiar habits and customs "of the *people born of sheer ignorance and stupidity* must have surely been "known to the Municipal Executive for over so many years," and we learn that there is practically nothing good from a sanitary point of view in Bombay.

The impression left upon us by the whole 160 pages devoted to Sanitation in India is that they could have been conveniently condensed into a Chapter like that on 'Snakes in Ireland,'—"There is no Sanitation in India."

Interesting as a psychological study may be mentioned, Dr. Kulkarni's remarks on page 158 on the comparative value of cow-dung and buffalo-dung in the prophylaxis of "all diseases." Interesting from the same point of view, and we should have thought deserving of some special award from the Congress is Sir Bhalchandra Krishna's statement that in *all cases of plague* treated by him with serum "success had been invariable." So mote it be!

Of the purely Medical and Surgical matter in this volume, we are not competent to offer any criticism, such would doubtless be out of place in a Journal of Natural History.

MISCELLANEOUS NOTES.

No. I.—THE CALL OF THE SLOTH-BEAR.

Mr. Roscoe Allen's interesting Note on the Call of the Sloth-Bear in the last Journal (p. 745) reminds me of an incident which may be of interest to him and to other readers of the Journal. In February 1904 I was in camp among the foot-hills of the Bara Pahar range in Sambalpur district, which was then part of the Central Provinces, but is now a district of the Orissa Division of Bengal. I had 16 kills out for a pair of man-eaters which were known as the Ambabhona Tigers.

My tent was open as the weather was warm, and one night about 1 A. M. I heard a call which was quite unfamiliar. It was, as Mr. Allen describes it, a long-drawn and rather melodious note. Near my tent were sleeping my Shikari and Khalasi, both of whom had been out all day inspecting the buffaloes tied up. I found both asleep and did not wake them. The same call was repeated, and I located it in a steep hill north of my camp. I heard no answering call, and went to sleep.

In the morning an old Binjhal from the village came over to tell me about it. He had been awake too. He described it as the sex-call of the she-bear and said that she evidently was calling up her mate from a great distance, three "*kos*" at least.

I wished to go out at once, but the sun was already well up and the old Binjhal said that we could safely wait till evening. His argument was "She would not have called him up from a distance, if she had not found very good feeding. They will be on this hill for two days."

In the evening I found both bears feeding on the reverse of the hill in thick jungle. The male got away wounded, but the she-bear got my second-barrel in the neck and died, after throwing herself savagely on her mate and biting him. He, when wounded, did not attack her.

F. DEWAR, I.C.S.

CAMP: BALAGHAT, C.P.
7th January 1910.

No. II.—DISTRIBUTION OF THE SLOTH-BEAR OR INDIAN BEAR (*MELURSUS URSINUS*).

It is stated in the *Fauna of British India—Mammalia*—by Blanford, that the Sloth-bear is found to the West of India, in *Kathiawar*, and has occasionally been met with in Cutch. As regards Cutch, I am unable to advance anything; but I can safely say that it is not to be met with, nor as far as I am aware has it ever been so, in the Province of Kathiawar. It is difficult to conjecture what reason there can be for its absence, as many parts of the Gir forest are just the places, one would suppose, for holding bears. The same remark applies to

the tiger. I have questioned many an old inhabitant of the Gir, but not one of them ever remembered to have seen, or ever even to have heard of one in the district.

This is the case also with the jungle and spur fowls. There are none in the Gir.

L. L. FENTON, Lt.-Col.

South Molton, North Devon, England.
8th January 1910.

No. III.—THE BALUCHISTAN BEAR.

This bear is identified by Blanford in his *Mammalia* (*Fauna of British India*), as *Ursus torquatus, i.e,* the Himalayan Black Bear, which has the inverted white crescent or horse-shoe mark on the chest.

Some years ago when shooting in the Pubb Hills on the Sind border, I was informed by a local authority that the Baluchistan bear locally known as the *Mam* carried no horse-shoe mark. I did not go far enough north to find a *Mam*, and was unable therefore to personally verify the statement.

It is an interesting point on which perhaps the Superintendent of the Karachi Zoological Gardens, or a local Member of our Society may be able to throw some light? I am told that specimens of the animals were to be seen at the Gardens a few years ago, and if it is a fact that they were not possessed of the horse-shoe marks, it would seem that they are entitled to be classed as a separate variety?

L. L. FENTON, Lt.-Col.

South Molton, North Devon, England.
8th January 1910.

[This is a point which perhaps the Baluchistan Natural History Society may be able to definitely settle.—Eds.]

No. IV.—A RECORD PANTHER.

According to a short paragraph in the *Indian Field* for March 10th, a panther measuring 9 ft. 3 in. was shot by a villager at Uttar Khasi, Tehri State. Into Rowland Ward's *Records of Big Game*, the largest panther mentioned measures 8′ 6″ but this animal exceeds that measurement by 9 in. If any Members should have heard or can find out further particulars about this large panther, we shall be very glad to hear from them.

At the same time we should like to call attention to the fact that in all records of the measurements of tigers, panthers, etc., it should be distinctly stated what the measurements of the head and body are and how much the tail measures, also whether the head and body has been measured between uprights or not.

The head and body measurement of a panther give a much better idea of its size than that of the total length, since there is a considerable variation in

the length of the tail. For instance, Jerdon records a panther measuring head and body 4'-9" with a tail of 3'-2" and in *Shooting in Cooch Behar* one is mentioned with head and body of 4' 9" and a tail of 2' 9½". Surely from these measurements a far better idea is got of the sizes of these panthers than if they had been given as measuring 7'-11" and 7'-6½" respectively in total length.

BOMBAY NAT. HIST. SOC.
6, APOLLO STREET,
BOMBAY, *April* 1910.

N. B. KINNEAR,
Keeper of the Museum.

No. V.—JACKAL HUNTING WITH WILD DOGS.

During March last my two shikaries while proceeding to tie up a goat as a "kill" for panther met a small pack of wild dogs on the high road. I had warned them to be on the look-out for the pack and take a gun with them. The dogs sneaked into the jungle as soon as they saw the men, and the latter tied up the goat at the side of the road and climbed on to a large boulder out of sight As soon as the goat began to bleat, the pack came up and the men shot this animal (skin and skull sent) as it was about to attack the goat with another. They also wounded another one which came out on to the road about 40 yards down to have a look at the goat; they describe the last one as very red and big. It got away. I send you this skin and skull, because I think that the animal is a jackal. I have questioned the men closely, and they say there was a great variety of colouring in the 7 or 8 animals they saw. Some were quite red, unmistakably wild dogs, one was "bilkul kala." After they had broken up the pack by firing these two shots, they said the wild dogs were calling in the jungle in different directions. As they have been with me when I have shot wild dogs and seen and heard me decoy them into the open by imitating their whistling call, I have no doubt about their knowledge of the dogs' call.

I have seen some of the same pack of wild dogs running in the very same spot a few months ago. They invariably drop excreta there; and on this occasion it showed that they had recently killed and eaten a sambhur. The jackal killed was very full, but I did not unfortunately examine the contents of its stomach.

I do not doubt the following facts:—

1. The animal was a member of a pack of which some were wild dogs.
2. It came out to attack the goat with another animal.

It is so long since I have seen a jackal at close quarters that I cannot identify it; but it appears to me to be rather too rufous in places for a jackal and not sufficiently rufous in the general colouring of the body for a wild dog? The mask is too "foxy" for a wild dog. The brush is also too "foxy" along the entire length.

Therefore I have come to the conclusion that it is either a hybrid or a jackal hunting with wild dogs.

H. W. BERTHON, MAJOR.

AMBOLI, SAWANTWADI,
8th April, 1910.

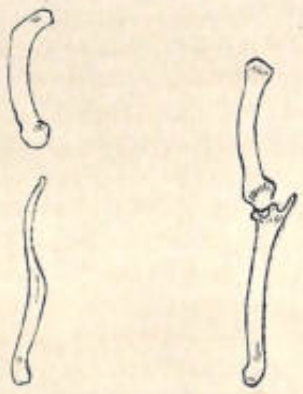
[The skin and skull sent are undoubtedly those of a jackal, the former being rather red on the legs and underside and the latter having seven molar teeth in the lower jaw, whereas in the wild dog there are only six.—EDS.]

No. VI.—THE RUDIMENTARY CLAVICLES OF A PANTHER.

I send herewith a drawing to scale of the rudimentary clavicles I took out of a panther yesterday morning. The panther was 6'-6" (between uprights), a fully grown male (tail 28½ inches). We could not feel the bones for some time, and when we cut them out thought they were both *broken*.

A—boiled out into 2 separate pieces, the top piece flattish and the bottom piece roundish. No trace of a fracture.

B—also consists of 2 similar pieces, but they are joined by slight gristle which can easily be broken through, and now that it is dry shows that the bones are about 1/10th of an inch apart. But, again, there is no trace of a fracture, the lower bone tapering off into a curving point and the upper one flattish like a very diminutive collar-bone. One emerged from the boiling still joined as shown. These bones do vary in curves and shape, but I have never seen a panther with such absurdly small ones. Even, if we assume that B had been broken, the two pieces are not as big as an ordinary clavicle in an old male panther.



A B

Abnormal rudimentary clavicles.

It would be interesting to know if any one has ever come across similar bones? Have these bones been broken? I have never seen any like them before. The panther was about 4 years old I estimate, from the appearance of the skull.

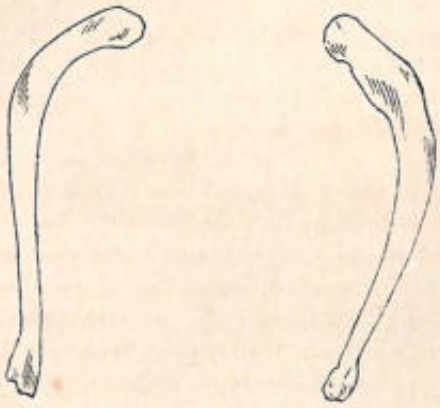
I have taken perfectly formed rudimentary clavicles out of a three-quarters grown panther, 6 feet in length, with hollow eye-teeth.

The teeth of this panther might, from their appearance, have belonged to a very old beast, but the ridge at the back of the skull does not show abnormal growth.

H. W. BERTHON, MAJOR.

AMBOLI, SAWANTWADI,
6th April 1910.

[These collar bones appear to be so different to the usual ones found in panthers that we also figure below a normal pair to show the difference.—EDS.]



Normal rudimentary clavicles of a panther.

No. VII.—SLOTH BEAR CALLING HER YOUNG WHEN ATTACKED.

The following account of an incident which occurred in the hills of Central India the other day (written by a lady) may interest you.

"When stalking over the hills the other morning my husband and I discovered a bear in a very deep valley, and my husband had a long shot at it, on which it leapt up with a "whoof" and charged uphill in the direction of the firing. He fired again, and again it charged in our direction, then the bear commenced calling and making a tremendous din and I said:—"I believe there is a cub," and sure enough we presently heard a little answering call and away down under the trees we saw a small cub. My husband did not shoot again as he felt sorry for the cub. The old bear hesitated for a long time as to what she should do, and then, as the firing had stopped, she decided to return to her little one, and we could hear the gurgle of delight on her return. The cub then jumped up on her back and away they went into the jungle. It was all most interesting."

SECUNDERABAD, W. GAYE.
27th March 1910.

No. VIII.—BIRDS FEEDING THEIR YOUNG.

On page 227-228 of his valuable book *Birds of the Plains* Mr. Dewar discusses the possibility of birds storing water in their crops and subsequently bringing it up in order to feed their young. I have a small female Blue-winged Paroquet (*Palaeornis columboides*), which is now about one year old. I have been observing her for the last three weeks and several times have noticed that she brings up her food, chews the same and again swallows it. She especially does this when slightly annoyed. She runs about loose (her wings being cut) and invariably tries to bite anyone who passes her. I have taken great care to see that she has nothing in her mouth. On placing my finger near her, she tries to bite, but owing to the finger nail can do no damage. On these occasions, it is quite easy to see that she has nothing in her mouth. She then makes a beckoning motion with her head and brings up a light yellow substance, very much like a chewed piece of plantain.

G. S. P. PERCIVAL, A. S. P.

MERCARA, COORG, *7th January* 1910.

No. IX.—NIDIFICATION OF THE SARUS CRANE.

In Vol. XIX, No. 2 (p. 524) of the Journal, Captain O'Brien mentions finding a newly hatched sarus chick on the 12th February, remarking that he thought sarus (*Grus antigone*) laid during the monsoon. Is that the case ? I certainly was of the same belief ; but in 1903 I found a sarus sitting on a half-set egg, on strangely enough the same date as Captain O'Brien mentions, the 12th February. This was also in the Mahi Kantha Agency (Mahisa District).

CAMP MALWASAR, OKHAMANDAL, KATHIAWAR, 12*th January* 1910.

A. H. MOSSE, CAPTAIN, I. A.

No. X.—THE FOOD OF THE RUFOUS-BACKED SHRIKE (*LANIUS ERYTHRONOTUS*).

Returning one day from shooting in the Bannu District and while driving along the Bannu Dera Ismail Khan Road, which runs through a marshy locality, I observed flying up from a stream by the roadside a Rufous-backed Shrike (*Lanius erythronotus*) with a small fish (*Chilwa*) about 2 inches long in its beak. Whether the fish was taken alive from the stream I cannot say ; but it is probable that it had been so captured by the Shrike in shallow water. It was conveyed by the bird to the telegraph wires near by and there broken up and devoured.

I have never previously heard of a Shrike catching fish and would be glad to know if any of our members have ever noticed this abnormal habit in any of the Shrikes ?

LONDON, 17*th December* 1909. H. A. F. MAGRATH, MAJOR.

No. XI.—OCCURRENCE OF THE BRONZE-CAPPED TEAL (*EUNETTA FALCATA*) NEAR ROORKEE.

I am sending you to-day the skin of a duck, which I find some difficulty in identifying and should be extremely obliged if you would give me your opinion on it. Judging from Baker's *Indian Ducks and their Allies* and Hume and Marshall's *Game Birds of India*, it appears to be the female of a Bronze-capped Teal. I shot it on the evening of the 9th instant on some jheels fifteen miles south of Roorkee. It came over me alone, and I at first took it to be a Gadwall, of which the bag with some Mallard chiefly consisted. My boatman told me it was a cross between a Gadwall and a Teal!

E. H. KELLY, LT., R.E.
(1st P. W. O. Sappers and Miners.)

ROORKEE, U.P., 13*th January* 1910.

[The skin proves to be that of a young male Bronze-capped Teal (*Eunetta falcata*). On 3rd March we also received a fully adult ♂ from Capt. Mainprice, also from Roorkee.—EDS.]

No. XII.—WOODCOCK (*SCOLOPAX RUSTICOLA*) IN KANARA.

I send herewith a female Woodcock shot by me on the 17th of December 1909 in the Shivpur Nalla of the Supa Petha of the Kanara District. The country is very hilly all round, the nalla-bed is about 300 feet above sea level, some forty odd miles from the coast line. On each side the valley is shut in by steep slopes to a somewhat extensive plateau above, all covered with grand high forest, much of it pure evergreen 1000′ on the plateau. The country is well watered throughout, the Shivpur Valley especially so, its waters flowing into the Kalanadi river, which drains the whole of the northern part of the District. The temperature of these parts is as low as 46° at this time of the year in the evenings and thereafter heavy mists at night, lasting often up to nine o'clock in the morning.

I had shots at a pair of Woodcock some fifteen years ago on the plateau of Gund above; another settled under my ladder during a tiger-beat about the same place and I came across a fourth on still another occasion. The bird however is exceedingly rarely met with in Kanara.

Colonel Peyton shot one some thirty years ago about the same place, and curiously enough, on the same day that Mr. Laird-MacGregor, then Divisional Forest Officer, Belgaum, accounted for one somewhere in the Ghats of that District.

T. R. BELL,
Conservator of Forests.

KARWAR, 10*th January* 1910.

No. XIII.—OCCURRENCE OF THE EASTERN SOLITARY SNIPE (*G. SOLITARIA*) AT HAKA, CHIN HILLS.

The first day of the New Year found me exploring the nullahs and streams around here for game as my gun had just returned from being overhauled and cleaned.

From a bend in one of these streams a bird got up and flew slowly and silently away and I managed to secure it. When I shot it I thought it was a Woodcock ; but on picking it up I was struck by its very bright plumage, and came to the conclusion that it might be an immature one. On my return to my house I sat down at once to identify it and found that it was a Solitary Snipe, a species I had not met before.

On the 2nd instant I was out again and "bagged" a Woodcock, a Pintail Snipe (*G. stenura*) and a Partridge (*Bambusicola fytchi*). As the two species of Snipe bear some outward resemblance, the following notes may be of interest to other beginners like the writer. Placed side by side there is no difficulty in recognising the Solitary Snipe by its greater size, by the very much more restricted area of plain white on the under surface, and by the uniform olive brown upper tail coverts, the corresponding feathers of the Pintail being faintly but distinctly barred. *G. solitaria* bears, of course, no real resemblance to the Woodcock with his pale forehead and distinctly marked crown and nape, etc., and it was only the very cursory glance bestowed on it in the field and the abysmal ignorance of a beginner that made such a confusion possible.

The following is a table of a few measurements of the two species of snipe.

	G. solitaria.	*G. stenura.*
Length of bill from gape	2·83 inch	2·4 inch.
Tip of shortest secondary to tip of longest primary	3 „	?
Wing	6·82 „	5·2 „
Total length	12·5 „	10 „
Tarsus	1·37 „	1·3 „
Tail feathers total number	18	24 }
„ „ broad middle ones	8	10 } variable.
„ „ narrow ones on each side ...	5	7 }

As regards other characteristics enumerated in *The Fauna of British India*, I did not find that the white bands on the under-wing coverts and axillaries were broader than the brown ones.

I might add that a printer's error in the Volume referred to has given the Pintail only 2·25 inches of wing.

It appears from Blanford's works that the Eastern Solitary Snipe is rather a rare winter visitant to such southerly latitudes as these, and as I have not seen it reported from this part of the country before, I thought its occurrence here might be worthy of record in our Journal.

F. E. W. VENNING.

HAKA, CHIN HILLS,
4th January 1910.

No. XIV.—DOVES NESTING ON THE GROUND.

With regard to Mr. C. W. Allan's letter on the above subject in Vol. XIX., No. 2 (p. 523) of our Journal, he may be interested to know that I found,

some years ago at Chorwar in Kathiawar, the nest of *Turtur cambayensis* (The Little Brown Dove) placed on the ground, on a large bare plot surrounded by the ordinary Indian Cactus. The nest contained two young birds. Besides the almost impenetrable jungle of Cactus round the spot, there were only a very few low bushes and stunted trees in its near vicinity. It is difficult to imagine how the old birds had succeeded in rearing their offspring as far as they had done, considering what timid birds they are in the face of danger and without any of the habits universally possessed by birds which always lay their eggs on the ground.

L. L. FENTON, Lt.-Col.

South Molton, North Devon, England.
10*th January* 1910.

No. XV.—OCCURRENCE OF THE LESSER FLAMINGO (*PHŒNICONAIAS MINOR*) IN KATHIAWAR.

Stuart Baker in his *Indian Ducks and their Allies*, remarks in respect of the above bird that we have no record of its occurrence in Cutch or in Kathiawar, it is therefore perhaps worthy of record that when serving in the last-named Province, some few years ago, I both saw and shot the bird in the Porbandar State. They were not plentiful. I had no difficulty in identifying the only bird I shot in mistake for the larger kind.

L. L. FENTON, Lt.-Col.

South Molton, North Devon, England.
8*th January* 1910.

No. XVI.—BREEDING OF THE GREAT STONE-PLOVER (*ESACUS RECURVIROSTRIS.*)

While out snipe shooting in the bushes along the banks of the Kistna River, in Kurnool District, on 29th June 1909, my dogs killed a young *Esacus recurvirostris*. It was a week or 10 days old, as the wing feathers were lurking through the quills. According to Oates their breeding is from March to June, and according to Finn from February to May. There was no mistaking the young bird and there were at least 12 old birds flying about in the neighbourhood.

H. R. S. HASTED.

Moravahonda, 29*th January* 1910.

No. XVII.—TWO BIRDS' NESTS FROM TIBET.

1. The Red-necked Mountain Finch. (*Montifringilla ruficollis*—Blanf). This bird nests in the disused hole of the Mouse-hare (*Lagomys*). I have only obtained one nest, which was made about one foot below the surface of

the ground at the end of a tunnel about four feet long from the entrance. This nest was very roughly made of roots and grass and was lined with feathers, wool and the fur of the Mouse-hare. The nest contained four white eggs which measure 21×15, 21×15, 19×12mm.

This clutch has been given to the Society. These eggs were taken at Phari-Tibet on the 8th June 1908, at an altitude of 14,300 feet. The bird was common, and I saw several pairs making their nests. I also obtained several nests of *M. adamsi*, which nests in the same place and in the same manner; indeed, the nest and eggs of these two birds are indistinguishable, except that the eggs of *M. adamsi* are slightly larger.

2. Robin Accentor. (*Accentor rubeculoides*—Hodgs.)

I took a nest of this Accentor near Dochen in Tibet at an altitude of about 15,500 feet on the 2nd July 1908. The nest was neatly constructed of moss lined with hair and wool, and was placed under a tuft of rushes in the bank of a stream overhanging the water. It contained four blue eggs from 20·2 to 21·2 millimetres in length by 15mm. in breadth. The bird is common in that part of Tibet, and I had previously found a nest near Phari under a bush of dwarf rhododendron at a height of 14,500 feet above sea level.

Edinburgh, *January* 1910. F. M. BAILEY, Capt.

No. XVIII.—BIRD NOTES FROM A HOMEWARD BOUND STEAMER IN NOVEMBER.

Before slipping our moorings in Bombay Harbour on one of those pleasant afternoons, when having just obtained leave one looks at India over the stern, I noticed among the flocks of Laughing Gulls (*Larus ridibundus*) flying around, a very small gull which may possibly have been the Little Gull (*L. minutus*) ?

About 350 miles out a small bird either pipit, bunting or lark, much to my astonishment, appeared flying round the ship. What could have induced this lonely waif to traverse such a vast waste of waters? There could have been no question of the unfortunate bird having been blown out to sea by storms for the weather was fine and calm, as it usually is at this season. Nor were we on, what might in any sense be called, a migration route. Reflection in such circumstances reveals the tragic nature of these occasional, erratic, straying flights of small land birds, but leads one to speculate in vain regarding the origin of an impulse which so remorselessly misleads and drives its feathered victims to their doom.

The 3rd day out, I saw some white Tropic-Birds probably *Phaëthon flavirostris*.

At Aden the Sooty Gull (*L. hemprichi*) was most abundant in the harbour. There were also a few *L. ridibundus* among which were probably The Brown-Headed Gull (*L. brunneicephalus*). It needs a practised eye to detect the differences between the two last species in winter plumage.

In the southern end of the Red Sea, the Booby (*Sula leucogaster*) was particularly numerous. It was interesting to see these gannets beating up

from their feeding grounds at sea to roosting quarters on the numerous rocky islets, that stud this stretch, in the teeth of a stiff breeze and over a choppy sea. The formation was invariably in single file, each bird about a length in rear of and in echelon to the lee of the preceding one. The flight was maintained a few points off, not directly into the winds' "eye" and just above the water, the troughs and crests of the waves being followed so as to obtain the shelter afforded by the retarded air currents near the surface.

The distant spectacle of these long strings of brown objects rapidly moving across and appearing and disappearing above and below the surface of the sea made it easy to imagine how in former and less sophisticated seafaring times the wonderful mariners' yarns of "Monstrous sea serpents careering o'er the Deep" arose.

Speculation regarding the significance of the echelon formation above referred to raises some interesting questions on bird aviation. Why should this flight formation be usual in flocks of some species and not in others, and how are the former (as they evidently are or the formation would not be employed) aided in their flight by such formation?

A little consideration will call to mind those species in flocks of which it is in vogue, *e.g.*, the Cranes, Storks, Geese, Ducks, certain Waders and sea-birds etc. Also flocks in which it is not seen or is not noticeable such as those of the smaller passerine species, the Gulls, Rooks and Lapwings, and in coveys of partridges or packs of grouse, etc. If we bear in mind how species in both of the above categories fly in flocks the suggestion will occur that the formation in question is intimately connected with uniformity and compactness of flocks, with weight and size of the component individuals, with velocity with the powers of sustained flight required by migrant species and with capacity, in spite of size, for making headway in adverse winds. Conversely that it confers no advantage on flocks in which the individuals do not fly in very close proximity to each other, in which the formation is a loose and straggling one, in which the individuals, although fast fliers, have little power of sustained flight, and in those composed of birds whose small size offers comparatively little resistance to the air.

The answer to the first half of the question must then, I think, lie in the characteristics of the different species of gregarious birds and the necessities of their existence.

To the second half the answer must, I think, be sought for in the behaviour of the atmosphere on the passage at speed of a heavy body through it. A large or heavy bird in rapid flight in a still or slowly moving atmosphere must continually displace a volume of air equal to its bulk and thus be the cause of a powerful indraught in its immediate rear. Behind the same bird flying against a high wind if there is no indraught there is yet a certain space in which the air is comparatively still. In the former case a bird immediately behind would be in a strong following wind, a state of things birds dislike intensely as it upsets their equilibrium. In the latter the bird would be to

some extent in still air necessitating a difference in effort of wing stroke. In both cases this would quickly lead to disintegration of the flock, accurate keeping of station and equality of speed becoming impossible.

It is probably the case therefore that the echelon formation renders important aid to large birds in keeping the flocks intact when on the wing by enabling the individuals composing the same, while keeping close to each other, to avoid the air disturbances set up by those immediately in front, at the same time ensuring to each a uniform air pressure and outlook to the front.

The V formation commonly and the Y occasionally seen must necessarily result from the echelon when the rigidity of the flock lines becomes relaxed.

Half-way up the Red Sea I noticed a falcon (not identified) flying close to the ship.

At Suez there were a few cormorants (*Phalacrocorax carbo*) perched on the buoys in harbour, numbers of *L. ridibundus* possibly among them, the Adriatic Gull (*L. melanocephalus*) and a few *L. hemprichi*. Just before we dropped anchor a single Booby (*S. leucogaster*) flew across our bows and shortly after a flock of Sandgrouse, species undetermined, was observed crossing from the African to the Asiatic Shore. Steaming slowly into the Canal the mudflats behind Suez came into view covered with flocks of waders bunched together to face the cold north-east wind blowing off the desert and out of a leaden sky. Chiefly consisting of Curlew, Whimbrel and Oyster catchers there was one flock of 15 or 20 Spoonbill (*Platalea leucerodia*) which showed up a vivid patch of white against the dark grey background. Here and there a solitary Heron (*Ardea cinerea*) stood patiently fishing in the shallows.—Indian waters were left behind !

H. A. F. MAGRATH, Major.

December 1909.

No. XIX.—THE SMEW (*MERGUS ALBELLUS.*)

Mr. E. C. Stuart Baker in his book *Indian Ducks and their Allies* writes regarding the Smew (*Mergus albellus*) that "there seems to be no record of single birds or pairs being obtained."

While shooting on the River Indus on the 22nd February 1910, I was walking up the bank of a tributary, a stream some 50 yards wide, when I saw two birds in the water some distance ahead of me. Hiding myself, I sent the Shikari round to drive them past me, and succeeded in getting one which proved to be a male Smew in fine condition. The other I failed to get, as it gave me a wide berth the next time this ruse was tried.

Perhaps this might prove useful as a record of a pair of Smews having been seen.

R. FRANCIS, Lieut.,
47th Sikhs.

Dera Ismail Khan,
N. W. F. Province,
27th February 1910.

No. XX.—ROLLER CATCHING ITS PREY IN THE WATER.

On the 14th September, I saw from my window a Burmese Roller (*Coracias affinis*) fly from his perch on the top of a bush, and dive head-first into a tank, king-fisher fashion, and emerge immediately afterwards, returning to his perch on the same bush, where he swallowed whatever it was that he had caught. I was very surprised, as I have never seen or heard of a Roller behaving in this manner. I got my field glasses and watched the bird very carefully. He was only 120 yards away, and I saw him repeat the operation four times altogether and each time he returned to the top of the same bush. Though I looked very carefully, I was not able to see what it was that he caught, although I could see quite plainly that he plunged bodily into the water, and was momentarily submerged. After each dive he returned to his perch on the bush on the bank above the tank and he swallowed his prey quickly, also shaking his feathers very vigorously several times to dry his plumage.

The bush he sallied from, and returned to, was about 4 feet high, and growing on a bank about 10 yards from, and 8 or 10 feet above, the tank.

The tank is full of fish, but I hardly think it could have been for fish he was diving. I thought at the time it must have been some water insect which he was after, but unfortunately, even with my glasses, I could not make out what it was. I would have attempted to get closer to the bird to see what he was catching, but unluckily a native came along with some mules and the Roller flew right away behind the Fort.

Some days later one of my servants, who had also observed the bird at the time when I saw it first, told me he saw the bird, probably the same one I think, behaving in a similar manner at the same place, while I was out.

On the following day I saw a Roller fly up and settle in a tree about 20 yards in front of my bungalow in the corner of the compound. He had something in his bill which he was evidently trying to swallow. I quickly got a pair of field-glasses and was in time to see that what the bird was trying to swallow was a frog, but unfortunately I did not actually see him swallow it, because a man passing close to him disturbed him, and he flew on to another tree further away, and there I think swallowed it ; but he was too far off for me to see properly.

There are two of these birds, *Coracias affinis*, always about near the tank which is outside the Fort wall, but is overlooked by my upper rooms. I now watch them with my glasses, whenever I get an opportunity ; but I have not again seen either of them diving into the water.

I believe the two birds are always the same. One of them I have noticed when looking at him through my field glasses is a beautiful specimen, I think this is probably a cock and the other a hen bird. I do not think a Roller could catch a fish, but it is possible that he is catching various prey when he dives—sometimes a frog, at others a water-beetle or larva, etc., etc.

It was very pretty to see the bird emerge from the water after diving. The great blue wings, seen through the glasses, looked beautiful, with drops of water rolling off them and sparkling in the light.

The above is, I consider, a most interesting case. I personally am of opinion that individual birds of whatever species are full of character and individual peculiarities just as much as human beings are. If one is able to observe birds in their wild life, acting naturally as they do when they either do not know they are observed or have no fear of the observer, one sees what very highly intelligent beings they are, how versatile are their moods and how much individual specimens of the same species can and do vary, and I also think they develop habits just as human beings do.

It is quite possible that very few Rollers develop this habit of diving into water which I observed, and probably this bird was an individual of a bolder nature than the usual run of this species, and was willing to take the risk of a plunge to obtain some prey in the water which had taken his fancy.

Since my notes were first written, I have been in correspondence with Major Harington on this subject. He informs me that he has never observed a Roller diving, but that he does not see any reason why they should not, as they are related to the king-fishers, which habitually dive; and some king-fishers, notably *Halcyon smyrnensis*, the common White-breasted Blue King-fisher, feeds very similarly to the Roller.

H. DELMÉ RADCLIFFE, Major,
R. W. F.

Bhamo, 8*th November* 1909.

No. XXI.—SHRIKES' LARDERS.

Last year in January, when out riding in the early morning, I saw a Grey Shrike (*Lanius lahtora*) fly into a babul tree with some thing in its beak. On going over to investigate, the bird flew out and perched in a neighbouring bush. He had nothing in his bill when he flew out. On searching about, I found his larder in the tree; it was near the top about twelve feet from the ground. In it were four or five locusts neatly impaled on thorns. What I had seen him fly in with was evidently one of these which he managed to impale in the short time, while I was approaching the tree or perhaps had dropped when I frightened him away; but if so I did not see any sign of it on the ground. The larder could be easily seen from the ground and could have been at once found by a crow alighting in the tree which was quite a small one. The tree was one of two or three in a quite open maidan.

While I was examining the larder, the Shrike sat in a neighbouring bush and as I rode away I saw it fly back again into the tree. Unfortunately, I had not an opportunity of visiting the place again for some time, but when I did there was no sign of the larder.

I remember to have seen a larder some years ago in a small babul bush, but I have forgotten the details, but I remember the owner was not visible.

J. R. J. TYRRELL, CAPT., I. M. S.

SIRDARPORE, BHOPAWAR AGENCY, C. I.,
16*th April* 1910.

No. XXII.—OCCURRENCE OF THE LESSER FLORICAN OR LIKH (*SYPHEOTIS AURITA*) OUT OF SEASON.

On two occasions last week while motoring near here I flushed a Lesser Florican from off the side of the road. On both occasions the bird got up about the same place, so it may have been the same bird.

On the 13th instant while out riding in quite the opposite direction I again put up a florican. They all looked like females but may have been males in winter plumage. A good many florican come here during the rains, but I have not heard of them being seen so late as April. There is a good deal of long grass all about and water in several nallas.

J. R. J. TYRRELL, CAPT., I.M.S.

SIRDARPORE, BHOPAWAR AGENCY, C. I.
15*th April* 1910.

No. XXIII.—SHRIKES' LARDERS.

Shrikes' larders in India, concerning which there would appear to be some scepticism, I for one can vouch for. Incidentally in my wanderings I have come across at least three of the Rufous-backed Shrike (*Lanius erythronotus*). One such was in the Vale of Kashmir, the meat being a fat black cricket impaled on a thorn within 10 yards of a nest of this Shrike.

Two others were in Bannu, the meat in one case being either a wasp or a cricket (I cannot now quite recollect which) impaled in a rose bush. In the other a small piece of what looked like dirty butchers' meat impaled on one of the sharp pointed leaves of a small date palm just outside the walls of the City. The Shrikes were seen flying up from the bushes in the case of the last two. In addition I have a note dated January 10th of a larder of The Grey Shrike (*L. lahtora*) which I discovered in a thorn bush in a desert track in Bannu. It was stocked with a large locust and a species of striped moth.

These larders were situated in dense and prickly bushes and were quite safe from crows. I have no observation to show that the contents of any suffered especially from ants or other insects or what subsequently became of them.

While on this subject I may mention that last hot weather in my garden in Bannu a Rufous-backed Shrike rifled a nest full of young Purple Sunbirds (*Arachnechthra asiatica*). As the Shrike could hardly have devoured all the young

at a sitting. I have little doubt that a search in the surrounding bushes would have disclosed his larder well stocked with the remains of the young sunbirds.

H. A. F. MAGRATH, MAJOR.

CARRON-STRATHSPEY, SCOTLAND,
26th April 1910.

No. XXIV.—A SNAKE FLIRTATION.

Your correspondent's note under the above heading in the last Journal, sounds as if this were a matter of very rare occurrence. But is this so? I have on various occasions come across snakes so entwined, and have looked upon it as usual, if perhaps somewhat seldom actually witnessed, and I find in my notes that on two occasions last June, I saw the same thing with the same snakes as mentioned by Mr. Millett *viz. Zamenis mucosus*, and have entered it merely as an occurrence of coming upon snakes "in cop"—to use a term common among lepidopterists.

Both these occasions were in the foot hills of the western slopes of the Nalamalais in Kurnool District. On June 10th I heard a struggling noise just off the path, and found two very large Dhamans entwined and throwing themselves about—whether struggling or not I could not see. On my approach they immediately separated and went different ways, one into an adjacent old ant hill. One of those must have been nearly 9 feet long.

The other occasions noted in same locality, and only about a mile from same spot, was on June 23rd when I again came upon a very large pair of these snakes in the same position. This time both were quiet, with heads and free parts of body slightly off the ground, facing each other. Again I was unable to make any close observation as unlike the case reported by Mr. Millett, they again immediately uncoupled and went their ways. I tried to catch one, to examine the parts, but though I got hold of the tail, he or she, turned and savagely bit my hand and forearm and got away.

CAMP BOYIRANI, GANJAM DT. COLERIDGE BEADON.
2nd January 1910.

No. XXV.—THE FOOD OF CROCODILES.

Can any of your readers inform me whether it is usual to find stones inside the belly of a crocodile?

On the 30th December last I shot a 16 feet male Gharial (*Gavialis gangeticus*) on an island in the Sarda River near Chuka Dhya, Pilibhit. I found inside it a quantity of round stones such as are found in the river bed. I estimate there were about ten pounds weight in all. I kept three of the largest which weigh about eight ounces each.

There was nothing else in the animal's stomach except the remains of a bird and some weed. Natives who were with me suggested that the crocodile had swallowed the stones because he was hungry and could get nothing else. Is

this the explanation, or does a crocodile require stones to aid its digestion in the same way that birds require sand?

HARDWAR, U. P.,
9th January 1910.

H. W. FORSYTH, CAPTAIN, R. E.

No. XXVI.—REMARKS ON THE VARIETIES AND DISTRIBUTION OF THE COMMON GREEN WHIPSNAKE (*DRYOPHIS MYCTERIZANS*).

Since my article on the green whipsnake (*Dryophis mycterizans*) appeared in the Popular Treatise Series in this Journal (Vol. XVI, p. 542), further allusions to this snake have appeared from time to time in literature which I think deserve collation.

No less than five varieties may be recognised, four of these being colour varieties.

Variety *typica*. This is the common form. It is dorsally of a uniform leaf-green colour, and ventrally between the lateral white or yellow stripes which run down the whole belly length on to the tail, it is green of a lighter shade and peculiarly brilliant hue.

Variety *lepidorostralis*. Dr. Annandale (Mem. Asiatic, Soc. Bengal., Vol. 1. No. 10, p. 196) alludes to a new variety which differs from *typica* in having the nasal appendage covered with small scales, such as occur in the species *pulverulentus*, only that they are larger (in this variety of *mycterizans*). That this is not a colour variety of *pulverulentus*, he states, is shown by the nasal appendage being shorter than the diameter of the eye. This variety appears to be peculiar to Bengal. The Superintendent in the Zoological Gardens, Calcutta, told Dr. Annandale that he frequently noticed this peculiarity among specimens from Midnapore. I saw such a specimen in the Zoo in Calcutta last time I visited it, and was allowed to remove it and inspect it closely. I have never seen such a specimen from any other part of our Indian Dominions. It is coloured exactly like *typica*. It is such a distinct variety that I suggest the name *lepidorostralis* for it.

Variety *cephrogaster*. This differs from *typica* in that the belly between the lateral ventral stripes is of a cinereous grey. The first allusion to such a specimen is that reported upon and figured by Dr. Russell in 1796 (Ind. Serp., Plate XIII).

I had a similar specimen brought to me in Trichinopoly in March 1896. Later I alluded in this Journal (Vol. XVIII, p. 783) to three specimens which I believed came from Burma, but which might possibly have been received with a collection from Ceylon. I am more than ever convinced that these specimens came from Burma because since then I have twice heard from Colonel G. H. Evans of similar specimens. In March 1908 he wrote of two such specimens that he had captured alive and examined, and in December of the same year told me he had acquired two others. All of these he had

encountered in burnt Kaing grass. In Russell's specimen the ventrals and subcaudals were 174+148, in my Trichinopoly example they were 179 +138, and in three Burmese specimens they were 176+146 ?, 176+153, and 181+151.

Variety *rhodogaster*. In Vol. XVIII., p. 919 of this Journal I mentioned a new colour variety received by our Society from Shwebo, Upper Burma, which differed from *typica* in that the belly between the ventral lateral stripes was rose-pink. Since this I have received a similar specimen from Mr. W. A. Jacob, I.F.S., from Jalpaiguri, only that the colour on the belly in this case is a pinkish-buff. In the Shwebo example, the ventrals and subcaudals were 191+140 ? (tail broken), in the Jalpaiguri specimen which was a ♀ 201+148.

Variety *isabellinus*. This variety is uniformly buff or khaki colour above, and a similar colour only of a lighter shade on the belly between the two lateral stripes. Like the other varieties it appears to be rare. Boulenger (Catalogue 1896, Vol. III, p. 181) mentions it without specifying from where he had received it. I obtained a ♀ specimen from Paralai, near Valparai, Anamallay Hills, last year, the only one I have ever seen. It was one of four, the rest being of the typical variety. The ventrals and subcaudals were 168+136. These same shields in the other specimens were ♂ 173+154, ♀ 179+?, and ♀ ? 169+140. I suggest for this the name *isabellinus*. The species as a whole is distributed as follows.

It does not occur in the Indus Basin, nor seemingly in the Ganges Basin West of Purneah. (The solitary specimen recorded from Purneah which is in the Indian Museum was purchased, and may have been introduced, as Indian jugglers very frequently carry this snake about in their stock in trade). South of the Ganges Basin it is more or less common, but especially so in Southern India and Ceylon. On the Western side of Peninsular India it has been obtained as far North as Mount Abu (Sclater. The specimen is in the Indian Museum). On the East, Blanford (Jourl. Asiat. Society, Bengal, Vol. XXXIX, p. 373) reported it common in Orissa and Bengal, and it would appear to be so towards the Gangetic Delta, judging from specimens in the Indian Museum. A specimen in the British Museum is recorded doubtfully from Assam. In the Irrawaddy—Salween Basins—it is not a very uncommon snake, and has been recorded as far North as Bhamo (Anderson, Ann. Zool. Res Yunnan, p. 826). Further East it occurs as far as Indo-China, but is not found anywhere in the Malayan Peninsula or Archipelago.

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

CHITRAL, *9th February* 1910.

No. XXVII.—NOTE ON THE BREEDING OF *ECHIS CARINATA*.

In his article on *Echis carinata*, Major Wall tells us (Society's Journal, Vol. XVIII, p. 537) that the records of the breeding of this snake are very meagre.

It may therefore be of interest to put on record the laying of 8 eggs by an *Echis carinata* kept in captivity in the Bombay Bacteriological Laboratory. The eggs were laid on the 8th of July 1909, and all appeared to be infertile. They measured 13 millimetres ($\frac{5}{16}$ of an inch) in length by 10 millimetres ($\frac{4}{16}$ of an inch) in breadth, after having been kept for a couple of months in formaline solution. The eggs are reported to have been covered with slime and to have been yellowish white in colour. There were six phoorsas in the cage, the latest arrival having been received on the 10th of February, that is six months previously.

The seasons in which young are noted as having been found by the authorities quoted in Major Wall's paper, are April, May and June for Ratnagiri, July for London, August for Trichinopoly, Multan and Quetta. Now we have one additional record of July for Bombay.

W. B. BANNERMAN, M.D., D. Sc.,
LT.-COLONEL, I.M.S.,
Director, Bombay Bact. Laboratory.

PAREL, BOMBAY, 17*th February* 1910.

No. XXVIII.—NOTES ON THE VIVIPAROUS HABIT OF JERDON'S PIT VIPER (*LACHESIS JERDONI*) AND OBSERVATIONS ON THE FŒTAL TOOTH IN THE UNBORN EMBRYO.

Amongst other snakes recently received from Mr. F. E. W. Venning collected in Haka, Chin Hills, Upper Burma (6,500 feet) is a gravid specimen of Jerdon's pit viper which is of exceptional interest.

I believe I am correct in saying that hitherto we have had no certain evidence to show whether this snake is viviparous or oviparous, but the point is settled now for I found six membraneous sacs containing embryos in an advanced stage of development "in abdomina parentis." The sacs measured about one and a half inches in length, and one inch in breadth, two being developed in one oviduct, and four in the other. The contained embryos in every case occupied the upper half, that is the vertebral half, where they were plainly visible through the transparent investing membrane. The lower half of each sac contained yolk.

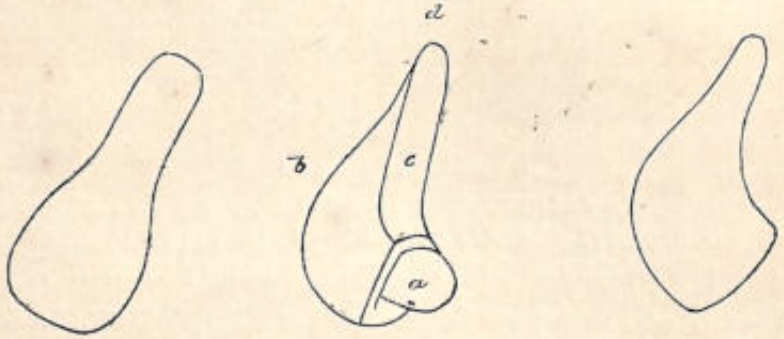
I extracted the embryos, and found there were two males and four females, two of the latter being in each oviduct. In the males the genitals were extruded, as I have found them in all other snake embryos, and the retraction of these organs into the sheaths at the base of the tail where they lie invaginated in all snakes after post-oval, or post abdominal life, must occur at a late stage of intra-maternal life judging from these fœtus. Each ♂ clasper was observed to be bifid as I have noted in other vipers.

By far the most interesting observation brought to light is the fact that the embryo developes a special tooth-like organ to enable it to liberate itself from its investing membranes, just as the embryos of an oviparous parent are pro-

vided with a cutting instrument to incise the egg-shell and release themselves from their ovicular imprisonment. As far as I am aware this is an observation new to science.

One might have supposed that a very moderate pressure from the snout of a vigorous embryo would suffice to rupture membranes which appear so delicate, but this is evidently not the case.

I was able after some trouble arising from the minute proportions of this structure—which when removed is only just visible as a speck to the naked eye—to view it under the microscope, and it will be seen from the accompanying figures that in conformation it is very different from the analogous organ of an oviparous embryo, some remarks upon which and a figure were published in this Journal some time back *.



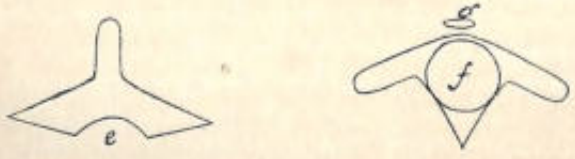
A B C

Fœtal tooth of Lachesis jerdoni.
(much enlarged).

A. INFERIOR SURFACE.

B. SUPERIOR SURFACE :—
(*a*) root ; (*b*) inferior surface ; (*c*) flattened superior surface of bill ; (*d*) cutting anterior edge.

C. SEEN IN PROFILE.



D E

D. PRÆMAXILLA of fœtus of *Lachesis jerdoni* seen from front, showing arch (*e*) beneath which the bill (*d* in fig. B) projects.

E. PRÆMAXILLA seen from below showing the socket (*f*) into which the root of the fœtal tooth (*a* in fig. B) fits. (*g*) shows anterior surface.

* Vol. XVIII, p. 504.

As in an oviparous embryo, the organ is embedded in the præmaxilla, its dome-like root (*see a* in figure B) being received into a socket in the lower aspect of that bone (*see* figure E). The whole structure is extremely like a duck's head in shape. Its rounded aspect (*b* in figure B) is the lower, and its flattened aspect the upper (*see c* in figure B). Its bill-like extremity ending in a rounded, horizontal incising edge (*see d* in figure B) projects forward beneath the præmaxillary arch (*e* in figure D). The root is yellow in colour, and all the rest of the structure white. Figure A shows the lower surface and C a profile seen from below and in front.

The measurements of the brood and the ventrals and subcaudals are given below, and it will be seen that they do not show any sexual differences.

Sex.	Length.	Ventrals.	Subcaudals	Ventrals between navel and anal.	Costals.		
					Two heads-lengths between head.	Midbody.	Two heads-lengths before anus.
♂	7½	174	59 ?	17	21	21	17
♂	7⅛	174	56 ?	20	21	21	17
♀	7⅛	172	56 ?	15	21	21	17
♀	7¾	173	60 ?	15	21	21	17
♀	7½	175	54 ?	13	21	21	17
♀	7⅛	174	57 ?	13	21	21	17

The parent was killed on the banks of a nullah on the 1st of August 1909. She measured 2 feet 5 inches, of which the tail accounted for 4¾ inches. The costals were the same as those of her brood *viz.* 21—21—17, and the reduction of rows from 21 to 19, and 19 to 17 occurred very close together, and in both steps was due to a fusion of the 5th and 6th rows above the ventrals. The ventrals numbered 175, and the subcaudals 52.

Another interesting point brought to light is that in this species there are no palatine teeth, unlike other species of the same genus of which I have skulls (*anamallensis, monticola, gramineus, macrolepis, purpureomaculatus* and *trigonocephalus.*) The dentition is as follows :—*Maxillary* 2 large fangs placed side by side. *Palatine* none. *Pterygoid* 5 to 6. *Mandibular* 10.

Another specimen measuring 10½ inches from the same source killed on the 26th August 1909 is obviously this year's production and indicates that the embryos in the gravid ♀ would probably have grown an inch, or two more before being born. These dates of capture serve to fill in another gap in the breeding history of this species, *viz.*, the season when the young are pro-

duced. The costals in the hatchling were similar in number to those of the and her brood. The ventrals 170 and subcaudals 60.

F. WALL, C.M.Z.S.,
CHITRAL, 1*st March* 1910. MAJOR, I.M.S.

No. XXIX.—LARGE MAHSEER.

In *The Field* for November 13th, 1909, Mr. C. E. Murray-Aynsley gives an account of the capture on September 20th of a large (Mahseer *Barbus tor*) in the Cauvery river which he eventually landed after an exciting fight lasting over half an hour. The fish weighed 103 lbs. and measured as follows :— length, 64 inches ; girth, 39 inches ; mouth across, 8½ inches ; tail across, 19 inches. This is the second large Mahseer Mr. Murray-Aynsley has been fortunate enough to catch and in *The Field* for November 10th, 1906, he gave an account of how he caught the first one.

The weight of the fish caught then was 104 lbs. and it measured : length, 66 inches ; girth, 37 inches ; mouth, 8½ inches ; tail, 19 inches.

There are not many records of the weight of large Mahseer which can be relied on. Thomas in The *Rod in India* says :—" We hear of captures of fish weighing more or less about 100 lbs." and he goes on to give extract from a letter from G. P. Sanderson, with reference to the weight of a large Mahseer the latter had caught on a night line but was unable to weigh. He (Sanderson), however, estimated it at 150 lbs., though it only measured " length including tail 60 inches ; greatest girth 38 inches ; inside lips when open circumference 24 inches," but he adds :—" Of course my rough estimate of the fish's weight is valueless as fact, but you may believe that I was not out many pounds. It was an astonishingly thick and heavy fish for its short length. I have caught them 5 feet 6 inches, but not much more than 80 lbs. It had a shoulder like a bullock, steeply hanging over. I have caught about fifty of them, but my next largest was about 90 lbs. I have no doubt in my own mind that they run over 200 or 250 lbs. as I have seen teeth and bones of them far larger than my 150 pounder ; they are often caught by the natives."

Dr. Day records a Mahseer caught in the Poonch river near Jhelum which measured " from snout to bifurcation of tail 3 feet 11 inches and weighed 62 lbs." Writing in the *Anglers Handbook* the late Captain G. H. Lacy and Surgeon-Major Crelin say :—" It runs to 200 lbs. and 5½ feet." Sanderson in his *Thirteen years amongst the Wild Beasts of India* describes and figures a monster Mahseer caught with a night line in the Cauvery river. " I saw a similar Mahseer caught with a net in the Gogra at Fyzabad. The length of each of these fish was about equal to the height of a man 5 feet 6 inches. Sanderson underestimates his at 150 lbs., the other was estimated at 100 seers. The late Captain Lacy caught a female Mahseer at Taugrot 61 lbs. in weight, 4 feet 7 inches in length and 2½ feet. in girth."

" Skene Dhu " in his recent work *The Angler in Northern India* (1910) says the Mahseer " runs to 200 lbs. in weight " and adds that " the largest Mahseer

caught to date fairly on rod and line was caught within the last two years by Mr. Murray-Aynsley, . . . if I remember rightly, 104 lbs." In the Society's room there are the remains of two large Mahseer captured in the Bowani river (S. India) by the late N. S. Symons weighing 71½ and 65½ lbs. respectively

From the above it will be seen that there are no actual records of a Mahseer weighing over 104 lbs., which have been properly weighed. There is no value in the statement that Mahseer weighs up to 200 lbs., unless evidence can be produced of a fish of that size which has been actually weighed. Our Society will always be glad to hear of the size and weight of any large Mahseer or indeed any sporting fish caught by members or their friends.

N. B. KINNEAR,
(Keeper of the Museum.)

BOMBAY NATURAL HISTORY SOCIETY,
BOMBAY, *April* 1910.

No. XXX.—ENTOMOLOGICAL NOTES.

(EDITED BY H. MAXWELL-LEFROY.)

(*a*).—WHAT IS A CUCKOO-SPIT?

One commonly finds upon grass or herbaceous plants, a white mass of frothy liquid which usually contains a flattened white insect. This froth is the production of the insect itself, presumably a protection from enemies and is formed only during the immature stages, the mature winged insect being extremely active. The insect is one of the Aphrophorine division of the *Cercopidæ*, our common species belonging to the genera *Poophilus*, *Ptyelus* *Clovia* and *Aphrophora*. A good deal has been written about the formation of the Cuckoo-spit, the latest being Guilbeau's paper (Amer. Naturalist, XLII. p. 783) wherein the author reviews previous work and adds observations of his own. The frothy mass of bubbles is composed of liquid and excretion which on being extruded runs to the lower side of the abdomen where it is mixed by the hind pair (or two pairs) of legs with a secretion derived from glands in the skin of the 7th and 8th segments of the abdomen. This secretion is to make the anal excretion gummy and the action of the legs is to mix it well. This being done, the insect makes a bubble by protruding the end of the abdomen beyond the liquid, opens up the pair of lateral appendages on the abdominal segment and draws in air, making a bubble. By continually making bubbles the insect keeps itself covered with the frothy mass. Like all of the family, these insects feed on plant sap, absorbing the nutriment and excreting large quantities of liquid.

(*b*).—IDIOCERUS AND ITS BROODS.

Leafhoppers of the family *Jassidæ* are not generally familiar, except in the form of those which come abundantly to light and those which swarm on the mango-trees in March, covering the leaves with sticky gum and blighting the blossom. The latter are species of *Idiocerus* and usually breed in March when the mango puts out green shoots, providing soft tissues for egg-laying and abundant sap for food. During the rest of the year, the *Idiocerus* waits,

growing less in number till the next season, and in five years' observation of this genus, we have never seen breeding at any time but March. This season has been an exceptionally wet one and the mango trees shot out freely in September. Whether from this reason or not, the *Idiocerus* also bred and one distinct brood was produced at a season when we have never before observed it breed at all. One hesitates to put this down definitely to any cause except that the very curious breeding times of this insect are accounted for in no other way but by saying that the growth of new shoots in March actually does provide a tissue soft enough for egg-laying and also abundance of sap as food for both young and adults. One would imagine that a tree such as the mango provided abundant sap all the year round but it evidently does not.

(*c*).—The Eggs of Tettigoniella.

Tettigoniella spectra is a very common white Jassid found upon rice and grass; like most of our obscurer insects it has been very little investigated and only its bare occurrence noted. Its eggs were recently found, laid side by side in the tissues of the leaves of the rice plant, the usual cigar-shaped eggs found in this family. Those found here were submerged and were kept in water to hatch. They hatched but while a few yielded nymphs, most yielded a tiny winged Proctotrypid parasite which was perfectly at home under water, walking about and evidently accustomed to going under water in search of eggs in which to oviposit. In the present state of entomology it is impossible to identify *Proctotrypidæ*, which are extremely abundant in India. Other aquatic Proctotrypids are known, predaceous on aquatic insects, notably *Prestwichia*, parasitic upon the eggs of Caddis flies in water and *Polynemia* in the eggs of a dragonfly.

(*d*).—What do dragonflies eat?

Practically all day long there are dragonflies on the wing, hawking in the air and, presumably, getting something for their trouble. At times the air is full of them, as it were, and seeing them against the setting sun, one sees simply a multitude of shining forms, darting here and there in incessant activity. They congregate in spots, not always the same but varying from day to day, perhaps as food is to be found and as the insects they prey on are to be found here and there.

During the last month (November) there have been abundant May-flies, of the genus *Chlæon*, dancing up and down in the still air as the sun rises; each one goes steadily up, then goes down straight in a rush and then up again with steady flight; sometimes a number will swoop down together and the dancing groups, seen with a shimmer as the level rising sun strikes them, are extremely beautiful. These are the prey of dragonflies, and one can see very distinctly the dragonfly, moving back and forward on a level height, striking at and feeding on the May-fly that comes within its range; so far as one can estimate the dragonflies can see a May-fly perhaps a foot off, and as the May-fly company dances, one sees the dragonflies striking out at those on the outside but apparently not seeing any others. Dragonflies are known to be short-sighted and in this case one can see clearly how their short-sight works. This case is

an exceptional one, as the level sun shows up clearly both the hunter and its prey but the flight of the prey is so distinct one can easily recognise the insect. In most cases it is practically impossible to determine by observation what dragonflies are getting.

Another method has suggested itself; in the field one sees dragonflies sitting on a convenient plant or support and darting off every now and then on the chase. Below such a point, to which the same dragonflies come back constantly, one finds their excreta; we examined some of these, crushing them gently in water on a slide and examining them with a quarter and a sixth inch objective. In those we saw, the excreta were a solid mass of chitinous remains of insects' legs, antennæ, the facetted coverings of eyes, odd pieces and so on. These are not determinable to species, but they are more or less referable to groups ; the characteristic legs of Orthoptera, the hairy legs of Aculeates, the scales of Lepidoptera, the elytra of beetles, the spinous tissues of flies, the scales of Mosquitoes, the scutella or hemelytra of bugs, the legs of Homoptera, are more or less distinguishable, even after exposure to the digestive fluids of a dragonfly. In some we saw the remains were exclusively dipterous, so far as anything definite could be traced, but there was no sign of anything belonging to a mosquito.

In a single instance recently we saw a very small pale-blue Agrionid deliberately eating a Caddis-fly (*Trichoptera*), the common *Æthaloptera serpunctata* Kol., nearly as big as the little slender dragonfly.

The subject is interesting as we see dragonflies constantly in great abundance; we believe them all to be predaceous; we believe that nearly always they feed on only small insects they can dispose of on the wing, and such small insects are probably in many cases mosquitoes and other small insects which fly in the still air and are easily caught. The mosquito in these days is so important, and so many investigators are on his track that even incomplete observations may give a clue and clearly the dragonfly question is worth attention. The only other method of investigation that occurs to me is to catch and kill dragonflies and investigate their stomach-contents. The direct observation of dragonflies, the investigation of their stomachs and excreta should give data on which to decide what it is dragonflies do eat.

In Poulton's "Predaceous Insects and their Prey" (Trans. Ent. Soc., London 1906, p 399 *et seq*) are given records of the food of dragonflies; 26 cases only are cited showing how very little is known and recorded; the prey includes a fly, a dragonfly, a wasp, a tabanid fly, a Malacoderm beetle, a wasp, another dragonfly, a Coccinellid beetle, a Lycænid butterfly, a May-fly, a Crambid moth, a Syrphid fly, a Galerucid beetle, a Skipper (Hesperiid) butterfly, a Danaid butterfly, and a Termite. The records are probably very one-sided as the prey to be identified must be large enough to be clearly seen, and dragonflies more usually prey on small insects. The subject is one that may be of importance and may perhaps commend itself to some observer in India gifted with patience and leisure.

In Pusa this year, dragonflies are extraordinarily abundant, and have the appearance of a locust swarm when they hawk together in the still evenings; I have never seen anything approaching the number there are, and not in one place only but all over the country-side. The abnormal rainfall (75 instead of 45 inches) has perhaps enabled them to breed more than usual; it is the larger forms, not the Agrionids, which are abundant. There is also an abundance of *Culex fatigans*, *Stegomyia fasciata* and *Anopheles fuliginosus*; whether the last really conveys the fever that is raging all round or not is not known, but there is a very great abundance of this *Anopheles*, which is now coming more into houses and which particularly shelters in thatched huts and buildings; the enormous abundance of dragonflies has not checked them nor other mosquitoes, and considering the habits of dragonflies it is hardly likely that they would kill mosquitoes.

(*e*)—WHAT IS A SPECIES?

The *Bulletin Scientifique de la France et la Belgique, fasc* 3, contains a long memoir by A. Delcourt, entitled "Recherches sur la Variabilite du genre *Notonecta*" (Enquiry into the Variability of the genus *Notonecta*). Commencing with a discussion of the described European species, the author details researches into the genus *Notonecta* in Europe, founded on collecting and interbreeding, his collecting alone covering 30,000 specimens. The enquiry is directed into determining how far the genus *Notonecta* consists of distinct species, *i.e.*, how far the systematist's recorded species *are* species. He reduces the six or more definitely described species into four "categories valables de classification" which we may roughly describe as "distinct classifiable forms," with variable forms due to habitat. He suppresses one species, creates a new definite one, and extends one to cover so-called species and varieties separated owing to degrees of pigmentation. He concludes that a systematist, describing new species from a collection say, necessarily makes mistakes because he takes account only of morphology and cannot take account of differing habitat, etc.; that is, species as described may not be distinct, and what the real conclusion is amounts to this; that there are no definite species, that forms have been derived from each other and from common ancestors, that there are intermediates between so-called species and no clear limits between species can be founded on Morphological characters alone. We give a free translation of what the author believes is the result of this enquiry. "What matters, is not to give names to forms of organised beings, but to distinguish that they are those which are perpetuated in the same state till they vary and to ascertain what are their relations, as much to each other as to their surroundings. Classification is a means, not an end, and, if taken as expounded here, the conception of evolution follows, for, as Tower remarks, new forms are the result of a rapid change in response to external factors. It does not require centuries to show them, it is enough to know how to see them, but for that one must use approximate terms."

We apologise to the author if we have misunderstood or wrongly translated him, but the gist of his remarks is apparently that the close study of a genus shows that the limits of species are not, in *Notonecta*, definite, cannot be fixed by Morphological characters and that in fact a species as a single definite entity does not exist. Probably all entomologists will agree with the author but not every one will, in the present state of Science, push his conclusions to the practical test and cease to use specific names. It is in every group impossible to fix the limits of species; two authors naturally cannot agree, as it is not a matter of fact but of personal interpretation of fact, and the two have not before them the same series of facts. The end we seem to be travelling to is chaos and confusion, because no systematic nomenclature will be possible without referring to a *Notonecta* say, as "*Notonecta glauca*, near to *furcata*, Kashmir summer form."

This is however yet to come as few genera have been studied in the detail that Mons. Delcourt brings to it; the moral is to deal lightly and tolerantly with names and with author's interpretations of them, to realise that systematist's species are not real species, and to make a bad job as good as we can by getting to a reasonable method of classification and nomenclature which will make intercommunication possible between workers and yet not violate too much the natural "species" evolved by Nature and which we must try to define as working entities if progress is to be made at all.

At the present time a "name" is merely a reference to a full description by a specialist and not anything more at all; the fact that two specimens are given two specific names means that one specimen is referred back to one description and the other to another; it will be years before specific and generic names can convey any ideas of relationship and descent, and it is useless trying, at present, to make them do so.

The layman is naturally mystified by names, and attributes too much importance to them, as, unfortunately, do many systematists and workers. They are conventions and to be treated as such, to be altered and molested as little as possible, and specific names above all to be regarded simply as reference terms of a wholly artificial kind, due to our profound ignorance not only of what constitutes a species but what species there really are in the world around us.

(*f*).—"INDIAN INSECT LIFE"

We take this opportunity of drawing attention to a serious mistake in this volume; fig. 331 on page 495 should be entitled *Hypsipyla robusta*, M.p., and be placed on page 514, where this species is mentioned. The error has been pointed out by Mr. E. E. Green (*Tropical Agriculturist*, December 1909), who has also drawn attention to minor misprints most of which will be obvious to our readers.

(*g*).—THE "COLEOPTERORUM CATALOGUS."

We have received the first five parts of this publication edited by S. Schenkling with a list of contributors well known as specialists in the different

groups of beetles. It is designed to replace the Munich catalogue published from 1868 to 1876.

Part I deals with *Rhysodidæ*, recording *Rhysodes* with six species from India and *Clinideum* with one.

Part II deals with the *Nilionidæ*, *Othniidæ*, *Aegialitidæ*, *Petriidæ* and *Lagriidæ*; of the first we have none, and India is credited with no *Othniid*, though *Othnius delusus*, Pasc., recorded from Borneo, has been found by Andrewes in the Nilgiris. Of the *Lagriidæ*, we have thirty recorded species from sub-tropical India.

Part III lists the *Cistelidæ*, here called *Alleculidæ*; there are thirty-one recorded species from India, also sub-tropical.

Part IV lists the *Scolytidæ*, exclusive of *Platypodinæ*, here called *Ipidæ*.

It is deplorable in the extreme that this term should be used on grounds of priority solely; the genus *Tomicus* has become *Ips*, the genus *Scolytus* has become *Eccoptogaster*, and, if this nomenclature is to be adopted, the confusion will be awful. If it is not adopted, then this valuable reference work is useless, unless one works up all the changes, and the catalogue might as well not be written.

Scolytidæ are one of the most important families economically; a very large amount of literature exists, none of which will be intelligible in after years, unless the student works up the synonymy first of all. We have nothing but condemnation for this kind of name changing, and it is to be hoped that the body of entomologists will combine together and stop it. If not, the division between the systematists and the biologists (with the economic workers) will widen till there are two sets of nomenclature, the present daily changing one of the systematists, and an arbitrary unchanging one of the practical worker.

Part V takes in *Cupedidæ*, which are not Indian, and *Paussidæ*, of which forty-two Indian species are recorded.

We congratulate the editor and his collaborators on the start made with this great task; such a catalogue is of the very greatest value to all workers, if absolutely authoritative, and it will be welcomed by all who work with Coleoptera; and we hope it will not be marred with radical changes in nomenclature, but that the editor and his collaborators will adhere to the established nomenclature that has been in use for the last fifty years.

Part VI *Apioninæ*.—The author includes in this sub-family the groups *Cylades* and *Eurhynchides* of Lacordaire; *Cylas* is represented in India by three species, of which *C. formicarius*, Fabr., is the well-known Sweet-Potato Weevil. It is amazing that a catalogue such as this is should not record more carefully the geographical distribution of species; *C. formicarius* is given as from India and Ceylon; it occurs also in Australia and the West Indies as a well known pest of sweet-potato. The author also separates *C. turcipennis*, Boh., as a distinct species of Java, Borneo and Sumatra; this is usually reckoned the same species; the author is either in error or has cause for separating them, in which case it should be cited.

Of the Apionini, 27 Indian species are listed, apart from those of Ceylon and Burma; many of these are Motschulky's species of 1858; very few are recent descriptions, and the group is but imperfectly known in India probably. The author has wholly omitted Motschulky's *A. pruinosum* (Ent. Stud. 1858, VII, p. 92), and Desbrocher's *A. strobilanthi* (Ind. Mus. Notes II, p. 32). The latter was bred from seeds; the only economic species is the "Jute Stem Weevil" which is injurious in Eastern Bengal to this plant. We have *Apion gagatinum*, Mo., and several unidentified species in the Pusa collection. These small weevils occur little in collections and are usually unnoticed by collectors.

(*h*).—GENERA INSECTORUM.

Fascicule 97 is a volume of great bulk dealing with the family *Chalcidæ*, by Dr. O. Schmiedeknecht. The number of described species is enormous, and this volume, like the rest of the series, gives the characters marking the genera and lists the species.

The *Chalcidæ* include the abundant small parasites which destroy insects; many are egg-parasites, many are parasites in such small insects as Aphids, Scale Insects and the like. The fig insects are also included, which occur so abundantly in India.

The Indian species recorded are very few; fifty species are enumerated, of which three are real fig insects, nine are inquilines and parasites of the fig insects, while a bare 38 others have been actually named. There are actually hundreds of species in India but they have been little collected and not described.

Fascicule 98 deals with the sub-family *Nanophyinæ* of the Curculionidæ (Weevils). Nine Indian species of *Nanophyes* are listed. The habits of our Indian forms are wholly unknown, but in Europe, *Nanophyes* are known to live as larvæ in galls, or the larvæ live freely in flowers, feeding on the ovary, or concealed in the flower as in *Tamarix*. These weevils are small, similar to the small *Apion* which also lives in the tissues of plants.

Other recent fascicules do not contain Indian species and need no mention here. The editor, Monsieur P. Wytsmann of Brussels, is to be congratulated on the success of the publication; 99 fascicules have been issued, from the pens of the best experts in each family, beautifully illustrated and well got up; the series is in a fair way to become complete, and entomologists will owe to the editor a great debt of gratitude for having produced a work of such immense value.

H. MAXWELL-LEFROY.

PUSA, *November* 1909.

(*i*).—LIFE-HISTORY OF A LYMANTRID ON CASTOR (*Orgyia postica*, Wlk.).

In December last the castor crop on the Coimbatore farm was found attacked by a species of hairy caterpillar not noted till now. The insect did some

appreciable injury by defoliating the plants though it was checked by persistent hand-picking. The life-history of the insect was studied and the following is a brief summary of the same.

Egg.—The parent moth lays hundreds of creamy white eggs in clusters and groups, these being very often found attached to old pupal cocoons. Each egg is spherical in shape with a small depression on the upper surface. In measurement each egg is $\frac{3}{4}$ m.m. across.

Larva.—Eight days after laying, these seed-like eggs open and the small caterpillar hatches out. The just-hatched caterpillar is slender, 2 m.m. in length and of a dark colour. The body is fringed with long hairs. The young caterpillars all feed gregariously like several other hairy caterpillars at this stage, moult and grow in size. As it grows and moults take place, changes in structure, size and colour take place. When full-grown the caterpillar measures $1\frac{1}{4}$ inches. The body is more or less cylindrical. The head is hemispherical and of a reddish-brown colour with interrupted yellowish bands along each lateral side. The whole body is covered with hair, the hairs at the tail segment being longer. In addition to the uniform hairy coat, there are other hairy structures very often characteristic of these tussock moth larvæ. On the dorsal surface of the first four abdominal segments are cushion-like pads of white hair one on each segment; these hairy cushions stand upright. At the lateral sides of segments 1 and 2 in the abdomen there is a slender whitish hairy tuft protruding at right angles to the body. On each side of the prothorax is a long dark pencil of hairs pointing forwards and extending a good distance beyond the head. On the median dorsal line of the tail segment is a long tuft of hairs more or less corresponding in position and appearance to the tail spine of sphingid caterpillars. Most of these long tufts of hair are full of small branched spines and are irritating to the touch. The ventral side of the body is of a pale white colour with the legs and prolegs (5 pairs) brownish. The caterpillar when fully fed builds a dirty white transparent cocoon of silk and hair mixed up and pupates within this. The cocoons are generally located in hidden parts of the plant. The pupa is of two kinds. Those of the male are smaller and measure 8—9 m.m., while those of the female are bigger. In colour both are of a pale white colour, that of the female however being of a whiter shade, length 13 m.m. The pupation period lasts from six to eight days.

The male.—The male insect is an active moth, dark brown in colour, with the front wings having patterns of pale blue and brown and the hind wing uniformly dark. The wings expand to 23 m.m. across. The antennæ are prominent and pectinate. The structure of the limbs and the position of the front legs in repose are typically Lymantriid in nature.

The female.—The female insect is apterous and can hardly be distinguished at a glance from the chrysalis out of which it emerged. It is a fleshy mass of dull white colour with the head and limbs very minute, the antennæ are very small and pectinate. The wings are represented by minute pale rudiments at

the sides of the thoracic region. It measures 13 m.m. in length. On coming out of the pupal case the female clings firmly to the cocoon by means of its tiny limbs. In this posture it remains evidently awaiting the male. Whether impregnated by the male or not, it lays eggs in some hours. Hundreds of eggs are laid and these are cemented in clusters by means of a shiny fluid which hardens on exposure, and all these eggs become attached to the cocoon. When the female has unloaded itself of all the eggs it becomes very much reduced in size and gradually dies.

Experiments in attracting males by taking the apterous female at dusk to the castor plot was tried and numbers of males were attracted. Thus the whole life cycle occupies from egg to imago roughly a month and a half as below :—

Egg	8 days.	roughly 1½ months.
Caterpillar	25 ,,	
Pupa	8 ,,	

The most interesting feature of this insect is the marked sexual distinction. As a pest, the insect is a leaf-eater and feeds gregariously like other Lymantrids and during the younger stages of the larva it can be easily hand-picked with the leaves and destroyed.

T. V. RAMAKRISHNA AIYAR.

(*j*).—Breeding Notes on *Eumenes conica*.

A good deal has been observed and recorded of the habits of different species of potter wasps by eminent observers like Horne, Bingham, etc., but I believe that the complete life-history of no Indian species of Eumenes has yet been recorded [Horne, Maindron and Cretin have all published accounts and a short one occurs in *Indian Insect Life*, p. 211. As these notes will interest readers of the Journal, they are inserted in full. H. M. L.]. I venture to think, therefore, that the following rearing notes on *E. conica* will not be uninteresting. In the Coimbatore Agricultural College farm, *E. conica* appears to be the commonest species that boldly enters dwellings and public buildings and builds its nest in odd corners. In December last the red gram crop on the farm was rather badly attacked by caterpillars—chiefly the Noctuid *Chloridea obsoleta*—and a number of these wasps were in evidence. Advantage was taken of this and with the idea of studying the life-history of the wasp, one of these was followed and the results of the observations are as below :—

On the 13th December by about 7-25 a.m. the mother wasp commenced building a cell and by about 2 p.m., the cell was complete with the exception of a small circular opening above. The egg was then laid ; this was concluded from the fact that after finishing the cell outline, it went in and came out after some time. In about half an hour more three big caterpillars of *Chloridea obsoleta* were brought and stored into the cell one after the other in succession. These caterpillars were all full-grown and measured 1¾ inch each. The fourth time the insect instead of returning with a caterpillar as I expected,

came with a pellet of mud and began closing up the cell opening. Two or three trips more, and the cell was completely sealed up. Soon after this was done I scared away the wasp which was lingering and had the cell with its contents gently removed intact to a breeding cage. The parent wasp, meanwhile returned to the spot where the cell was and searching for about 7 or 8 minutes, flew away in evident despair.

The egg must have been laid at about 2-15 p.m. The cell was then gently opened and the contents examined. Attached to the inner wall by a slender thread was found the egg and within the rest of the space of the cell were closely packed together the three big caterpillars with hardly any extra space for these paralysed creatures for any motion. The egg is a very slender rod-shaped delicate object and measures 3½ m.m. in length. In colour it is whitish. In two days more, *viz.*, by the 15th December the egg was found hatched and the little grub attacking the caterpillar close to it. The grub on hatching measures 4 m.m. and has the same whitish colour with a small shining head and is footless. Within three more days the caterpillars are all consumed and the grub grows in size remarkably. It assumes a stout cylindrical structure and has a ventrally bent posture like that of a cockchafer-grub ; it is of a shining whitish green colour at this stage. For the next ten days the grub continues in the same stage without food, but it spins silk and paves the floor of the cell (the grub was removed to a small pill-box after the three caterpillars were consumed) with a soft matting of transparent white silk. On the 11th day, *viz.*, on the 29th December, the grub moulted and entered the pupa stage.

At this stage the insect acquires all the future organs in miniature ; the wings are found as very minute pads. In colour it is golden yellow. The abdomen is bent ventrally and attached to the slender pedicel by a thin white membrane. The notched eyes gradually turn red, dark-brown and then black in course of a few days. The wings appear as brown patches and gradually enlarge. The insect remained in the pupa stage for 18 days, *viz.*, up to the 16th January, when it cast away the pupal skin and emerged as the adult with all the specific colour markings and features. The wasp, however, is only able to freely move and fly about in two more days. On the 18th the insect completely attained the mature stage. The period of life from egg to imago in this case was briefly as below :—

Egg stage 13th to 15th Dec. 2 days.
Grub stage 15th to 29th Dec. 14 days.
Pupa stage 29th Dec. to 16th Jan. 18 days.

Thus one generation from egg to imago was found to occupy a little more than a month.

T. V. RAMAKRISHNA AIYAR.

(*k.*)—Entomological Notes from a Recent Tour.

During a recent tour in the Southern Maratha Country, in which only a

very short time could be devoted to entomological matters, the following notes were made :—

1. At Dharwar, during a walk at 9 a.m. in sunlight on October 29th, 1909, along the Railway cutting, immense numbers of a large pentatomid bug were observed among the stones in which the Railway lines were set. Both males and females were present in abundance and a number of samples were obtained. The bug was sent to Mr. W. L. Distant, and turns out to be a very interesting one belonging to a genus new to the Oriental region. This genus *Anasida* is limited, I understand, to South West and East Africa, and the occurrence of a new species nearly an inch long, is both unexpected and interesting. Mr. Distant has named this *Anasida orientalis*, and will publish a technical description in the near future.

2. On the same day at Dharwar, during a spare hour, I spent my time beating a large number of Lantana bushes in the neighbourhood of the station. From almost every one of these I obtained specimens of the pentatomid bug, *Plautia fimbriata*, in every stage of development. The Lantana is evidently a very suitable host for this bug.

3. A few days later, at Hubli, near Dharwar, about midday, I found the very common pentatomid bug, *Nezara viridula*, playing a new role. On going into a cotton field, I noticed that castor plants were growing at intervals all over the field. I asked the reason for this, and immediately one of the castor leaves was opened out and revealed a full-grown *Nezara* on the leaf. Nearly all the castor plants examined showed these bugs on them, some even in copulation on the leaf. In one case one of the brownish yellow variety was observed in copulation with a pure green type. The castor was ostensibly planted as a trap crop for these bugs among the cotton, to avoid damage to the latter crop.

4. During the same journey, the following bug was obtained at Castle Rock at 5-30 p.m. in flight : *Canthecona parva* and two specimens of a beetle, *Pseudocolaspis longicollis*, Baly., in copulation on grass at 5-30 p.m.

H. H. MANN.

POONA, *February* 1910.

No. XXXI.—THE DISTINCTIONS BETWEEN *TERIAS SILHETANA* AND *TERIAS HECABE*.

These two species are frequently confounded, which is no matter for surprise, as certain specimens are extremely difficult to discriminate. Their life history, however, shows them to be abundantly distinct, and the following characters can, I think, be relied on. The eggs, larvæ and pupæ conform to the usual Pierine type: —

Terias silhetana.	*Terias hecabe.*
EGG.—Laid in rows on the upper-side of a leaf in batches of about fifty.	EGG.—Laid singly at the edge of a leaf on the upperside.

LARVA.—Gregarious living on a web; food plant usually *Albizzia moluccana*.

Skin somewhat rough greenish yellow or green, with yellowish green lateral line; head glistening black.

PUPA.—Usually found spun up close together in considerable numbers, usually blackish brown, sometimes pale olivaceous brown with darker mottlings; rarely pale green.

IMAGO.—Larger. Average ♂ wet form. 40-m. ♀ dry form. 42-m.

More constant in markings. Costa of forewings usually yellow with black scales; almost always with three spots in the cell on under surface of forewings (53 out of 55). In pronounced dry weather form the large quadrate chocolate spot on under surface of forewings touches the apex and outer margin.

LARVA.—Solitary; usual food plant the "Madras Thorn," *Pithecolobium dulce*.

Skin smooth pale apple green with whitish green lateral line; head green, the same colour as the body.

PUPA.—Solitary; pale green, very rarely pale brownish green.

IMAGO.—Smaller. Average ♂ wet form. 35-m. ♀ dry form. 38-m.

Variable. Costa of forewings usually black or with many black scales (13 out of 16 examined) the black of the outer border sometimes carried along inner margin. Never with more than two spots in cell on under surface of forewing. Sometimes two on one wing and one on the other. Chocolate markings of dry season form linear or triangular with base on costa rarely reaching the apex or outer margin.

The angulated inner border of the black outer margin of the forewing is too variable in both species to afford a useful character for separating them. The other species of this group in Ceylon is *Terias sari*; Mr. E. Ernest Green informs me that "it is well characterized by the single black streak in the cell on underside of forewing and by the more highly arched costa". It is widely distributed but much rarer than either the above. He also writes:—"The eggs (of *T. silhetana*) are usually deposited more in the form of a dense cluster rather than in definite rows. Bred specimens occasionally have scattered orange scales on the costal area (upper side). The larvæ are very commonly found on *Cassia alata* and *P. dulce*. *T. hecabe* also feeds on various species of Cassia."

N. MANDERS, LT.-COL., R.A.M.C.

COLOMBO, *March* 1910.

No. XXXII.—A GIANT SUNFLOWER (*HELIANTHUS ANNUUS*, LINN.)

The seed was sown in a bed in my garden on the 4th of July last. The soil was very loose; in fact this once formed a pit into which all the refuse

from the kitchen, including broken glass and china was thrown, but which is now filled up with broken tiles and some earth. The depth of this pit is about 2 feet.

2. The seed germinated in five days and after 2 weeks the plant began to grow very rapidly. In the beginning of September the lamina of the largest leaf on the plant measured 17″ broad and 16″ long, the petiole of the leaf being 8″ long. The plant attained a height of 9 feet, (I still possess the stem of another plant which grew to the height of 10 feet but its flower head is slightly smaller), and the diameter of the stem at six inches above the ground was 5½″ (in a third plant I had a diameter of 6½″ at 6 inches above the ground and fully 9″ at the base). The terminal flower head appeared in the third week of August and continued to grow in size long after opening, and soon obtained a diameter of 13 inches excluding the ray-flowers which themselves were three inches long. After the corolla shrivelled up the head began to grow very rapidly, indeed at the same time the *seed* was setting. The plant was cut down on the 24th of October, when all the *seed* was perfectly ripe and white. The weight of the whole head immediately after cutting, without any portion of the stem, was 150¼ *tolas*, *i.e.*, nearly 4 lbs. The diameter of this head measured 17″ excluding the bracts. The number of *seeds* was 2,820 out of which 21 were double. The weight of the *seeds* was 14¼ *tolas*, and they were ¾ of a *seer* by the native volume measure.

3. This was the only flower head that the plant produced.

4. It was found necessary to protect the ripening capitulum, by means of a piece of cloth tied round it, from birds such as sparrows and wild pigeons which seem to be fond of the *seeds*.

5. *Helianthus annuus* is very susceptible to influences of heat and light. Thus the cotyledons, when they come up, keep open during the day but close by night, in order to prevent excessive radiation of heat and also to protect the young bud that lies between them. There, however, appear to be some mistaken notions about the heliotropism of the flower-heads, the common belief being that all flowers are turned towards and move with the Sun, which is not exactly correct.

6. When the first (*i. e.* terminal) bud appears, it continues to move with the Sun for some days. Thus in the morning it is turned towards the East, in the middle of the day it points vertically upwards and in the evening towards the West. The duration of the period of these mutations, depends upon the condition of the weather and the vigour of the plant. Once the flower-head is open, all movement ceases, the peduncle taking a definite position and becoming rigid. Most of the terminal flowers face the East. The secondary heads which are produced on the axils of leaves show no power of movement. About the time that the whole plant is ripe and about to dry up, resin has formed in abundance in all the parts of the plant (especially the apical ones), which give out a sweet scent.

7. There are many interesting problems connected with the growth and

the process of fertilization of Sunflowers, and I hope to arrive at some important results after another season's trial.

S. V. SHEVADE,
Asstt. Imperial Economical Botanist.

KIRKEE, *9th November* 1909.

No. XXXIII.—SCIENTIFIC NOMENCLATURE.

With reference to Mr. Meyrick's correction of my note regarding the gender of the word "Lygosoma" I should like to be allowed to make a few remarks in defence of my plea. First, then, I must thank Mr Meyrick for pointing out the error, and can only offer my apologies to Major Wall and any others whom I may have temporarily misled. At the same time I would remark that the note was written as a "plea for uniformity," and I had no desire to set myself up as an authority on the subject (*vide* the words "I fancy" in my note); though I admit that I did not doubt at the time that the word should be neuter. Thanks to Mr. Meyrick, I now see the error and admit it, but I would not withdraw the plea. Instead I would address it to the attention of Mr. Boulenger, Sir Joseph Hooker and other authorities to whom we look for our information in matters scientific. I mention Sir Joseph Hooker, because, if what Mr. Meyrick tells us is correct which I do not doubt, then we must surely say *Melastoma malabathrica*, etc. Surely also we must not say "*Lycodon aulicus*" nor "*Oligodon dorsalis*" in speaking of those snakes, but must make them neuter. Another matter of nomenclature which has always annoyed me is the apparently arbitrary way in which the final "i" of proper names attached to species is doubled or not. Either it is correct to double it or it is not. I imagine that it is not to my mind, even euphony does not require it, but perhaps Mr. Meyrick will be able to spare a moment of his valuable time to inform us definitely? There is no lack of instances, thus Blanford, though usually writing but one "i" in the volume dealing with Mammals of the *Fauna of B. I.* series, has written "*Hardwickii*" (page 340). It is only the very great importance, as it seems to me, of accuracy in all details connected with Natural History, which induces me to continue the subject, and not any desire to open in our columns a controversy on the vexed question of priority and usage, which does not appear to be affected seriously by such minor alterations. By way of further apology for my own inaccuracy, I may say that, though I am now a constant reader of *Nature*, I have not been so for very long, and consequently did not see Mr. Meyrick's note on the subject to which he refers.

F. E. W. VENNING.

HAKA, CHIN HILLS,
19th January 1910.

No. XXXIV.—THE PRESERVATION OF NATURAL HISTORY SPECIMENS.

With reference to Mr. Comber's interesting series of papers on the preservation of Natural History specimens, I should like to give you a few of my experiences which I trust may prove of benefit to some members.

FORMALIN.

This is no doubt of the greatest service to the field naturalist when travelling, as has already been pointed out, when spirit is not available. But it has serious drawbacks. Fishes immersed for any length of time in this medicine are apt to get brittle as regards their fins and tails. Mr. Boulenger at the Natural History Museum was pointing this out to me the other day, and he says it is exceedingly annoying when the identification of a particularly valuable specimen is desired, to find when attempting to count the fin rays this organ break right off. Formalin, too, is a dangerous medicine to recommend to the tyro, who, ignorant of the right strength to use, will doubtless ruin many a valuable specimen until he has learnt, as I have done, from sad experience, the right proportions of formalin and water; and here no hard and fast rule can be laid down. If used too strong specimens curl up in it. If this be the case it can to a certain extent be remedied thus:—take out the specimen from the formalin and soak for about 24 hours in water. Then dry with a clean cloth and stretch the fish or other specimen out on a piece of wood or stick fastening it to this by binding round with stout thread or string Next immerse the specimen in strong spirit for several days after which the support may be removed, and the specimen will then retain much of its former straightness. Formalin also completely destroys the silvery and golden lustre on many fishes. I have found it excellent for reptiles batrachians, and have at the present time a lizard and snake which I kept for over two years in a 25 per cent. solution of formalin. These were subsequently transferred to spirit and to-day retain all their colours and marking as they did when freshly killed. By the way I have found snakes "go wrong" more quickly in spirit than any other specimens. Fishes I have kept for about three weeks in a fairly weak solution of formalin and then transferred, retain much of their natural brilliancy, but as colour is of little or no importance for the determination of a species this counts as trifling. I would strongly urge whenever possible the use of spirit and leave formalin—severely alone. For soft bodied animals, such as tadpoles, jelly fishes, and the ova of frogs formalin is of the greatest use, but a very weak solution should be used, say, about 4 per cent. These should be allowed to thoroughly harden in this before being transferred to spirit. The colours of fishes, if desired, may be preserved, to a great extent, so Mr. Boulenger informs me, by being kept in weak spirit in the dark. But in a hot climate like India this is not always practicable. My advice to the amateur would be to experiment with common specimens first in different solutions of formalin and spirit keeping a careful watch daily

to see how they are getting on, before trying his hand on valuable specimens. It may not be out of place here to urge the absolute necessity for the collection of fishes for the National Museum. Things Indian are to a great extent but poorly represented there as regards other countries, and a case in point came under my notice when I was showing Mr. Boulenger some fishes from Bengal, he expressed a wish to retain them in the collection, as it appears the Museum had no fishes whatever from that particular locality, with the exception of a few I presented some years ago. Specimens, however common, have often a particular value as coming from some little known locality.

GORDON DALGLIESH.

BROOK, GODALMING, SURREY.
March 1910.

[We cordially endorse Mr. Gordon Dalgleish's appeal for specimens of Indian fishes for the National collection, and trust that our members will be able to help in this direction At the same time we should like to add that our own Museum is sadly lacking in specimens of fishes and batrachians.—ED.]

PROCEEDINGS

OF THE MEETING OF MEMBERS HELD ON 3RD FEBRUARY 1910.

A meeting of the members of the Bombay Natural History Society took place on Thursday, 3rd February 1910, at the Society's Rooms, Mr. C. L. Burns presiding.

The election of the following 127 new members since the last meeting was duly announced :—

Mr. H. G. W. Meikle, Bombay ; Capt. R. E. Lloyd, I.M.S., Calcutta ; Mr. R. D. Austead, B.A., Bangalore ; Rev. J. Redmond, Mysore ; Mr. Neville B. Parish, Alwar ; The Rector, St. Mary's College, Bombay ; Mr. N. Mosley, Multan ; Mr. M. S. Jayakar, M.A., Alibag ; Capt. R. S. Kennedy, I.M.S., Calcutta ; Miss A. Thompson, Beetul ; Mr. H. M. M. Davidson, Assam ; Mr. C. H. Craven, Chittagong ; Mr. A. C. M. Binny, Ferozepore ; Capt. C. Hudson, I.M.S., Bangalore ; Capt. C. Saunders, Wellington ; Mr. W. S. Davis, Kurram ; Dr. D. A. Turkhud, M.B., C.M., Satara ; Mr. C. Bateman, Jalpaiguri ; Mr. F. Dewar, I.C.S., Balaghat, C. P. ; Mr. J. Doyle, Balaghat ; Major C. A. Sykes, R.H.A., Bangalore ; Lt. E. J. Headlam, F.R.G.S., R.I M., Bombay ; Mr. S. R. Parsons, Mandla ; Lt.-Col. H. C. Bernard, Nasirabad ; Mr. Walter J. Smith, Ceylon ; Mr. Charles Innes, B. Sc., Rangoon ; Capt. A. C. Wilkinson, Rawal Pindi ; Capt. R. T. Wells, I.M.S. ; Capt. J. Cunningham, I.M.S., Bombay ; Capt. W. D. H. Stevenson, I.M.S., Bombay ; Capt. J. Taylor, Bombay ; Mr. R. P. Scott, Bombay ; Mr. Aga Cassem Shah, Poona ; Mr. N. O'Reilly Blackwood, Secunderabad ; Mr. H. J. Shaw, Bombay ; The President, Leicestershire Regiment, Belgaum ; Capt. W. B. T. Abbey, I.A., F.R.G.S., Kyaukse ; Mr. Clarence E. Rushton, Mandalay ; Mr. R. S. Lister, *via* Ghoom ; Mr. A. A. Blake, Sara ; Mr. H. F. Bowden, Rangoon ; Mr. F. B. Thomas, Kanchrapara ; Mr. A. O. Weller, Kanchrapara ; Mr. E. G. P. Phythian-Adams, Poona ; Mr. George Evans, Hoshangabad ; Mr. E. F. G. Bourchier, Peshawar ; Mr. Arthur E. Devas, Quetta ; Mr. Philip Shepherd, Quetta ; Mr. H. H. Jenkyns, I.C.S., Lahore ; Capt. George C. Lambton, D.S.O., Nilgiris ; Mr. H. L. Dutt, Sabour : Mr. G. P. Hector, M.A., B. Sc., Dacca ; Mr. Charles Mackinlay, Edinburgh ; Mr. E. Norman, Dacca ; Lt. C. S. Carter, R.N., E. I. Station ; Mr. J. E. Armstrong, Katha ; Mr. J. N. D. La-Touche, Bombay ; Mr. N. B. Baxter, Dhulia ; Mr. A. L. Bacon, Mogok ; Mr. C. H. Harrison, I.C.S., Punjab ; Mr. F. L. Core, Deesa ; Mr. L. M. Stubbs, I.C.S., Jalaun ; Mr. A. P. Morris, B. Sc., U. Burma ; Major A. G. Kemball, Nowshera ; Mr. N. L. M. Carruthers, Jhansi ; Mr. A. E. B. Parsons, Dargai ; Mr. W. P. Field, Jalpaiguri ; Mr. R. R. Gales, Calcutta ; Mr. R. P. W. Strong, Bombay ; Mr. E. G. Drake-Brockman, Dacca ; Mr. W. S. Coutts, Dacca ; Major J. H. Hudson, Meerut ; Lieut.-Col. Simpson Powell, M.D., R.A.M.C., Rangoon ; Col. A. R. Denne, Manipur ; Mr. P. N. Arthur Lucas, Bellary ; Dr. W. D. Jones, Kyaukse ; Lt.-Col. A. Short, R.H.A.,

Mhow ; Mr. E. G. Gregson, Peshawar ; Mr. J. E. Aspinwall, Bombay ; Mr. W. E. M. Campbell, I.C.S., Allahabad ; Mr. Charles Legard, Mercara ; Mr. A. S. Brook, Ferozepore ; Mr. T. E. Bromley, I.C.S., Khandwa ; Mr. N. J. Roughton, I.C S., Khandwa ; Capt. J. L. Lunham, Aurungabad ; Mr. G. P. Andrew, I.C.S., Mergui ; Mr. A. D. Spence, Rangoon ; Mr. J. C. MacGeorge, Moulmein ; Mr. T. S. Pipe, Nasik ; Mr. V. A. Herbert, Moradabad ; Mr. F. Roddis, Dacca ; Mr. H. S. Warburton, I.C.S., Lucknow ; Major P. Wheatley, R.F.A , Jubbulpore ; Mr. Charles H. Bury, Meerut ; Mr. J. W. G. Davis, Mandla ; Mr. Carl. H. A. Muller, Lahore ; Mr. E. W. Stoney, C.I.E., Coonoor ; Mr. E. H. Hudson, A.M. I.C E., Jalna ; Mr. R. St. J Mitchell, Nanded ; Mr. Herbert Clive, Myitkyina , Major C. F. Harrison, Rangoon ; Mr. Walter Armiston, Haldummulle, Ceylon ; Mr. T. M. Evans, Panchgani ; Mr C. H. Bennett, Chatrapur ; Capt. Godfrey Heseltine, Madras ; Mr. Edgar de Lantour, Sitapur, U.P. ; Mr. N. A. Macleod, Calcutta ; Major F. G. Bayley, Trimulgherry ; Lt. G. P. A. Bracken, R.A.M.C., Trimulgherry ; Mr. P. S. Patuck, I.C.S., Wardha ; Mr. E. P. Comber, Bombay ; Mr. R. C. Bellairs, Almora ; Mr. E. J. Murphy, Rangoon ; Mr. F. M. Wainwright, Kistna ; Mr. H. F. Saunders, Gwalior ; The Curator, Central Museum, Lahore ; Major R. Bird, I.M.S., Calcutta ; H. H. the Raja of Cochin ; Mr. T. H. Waddingham, Phillaur ; Mr. L. B. Holland, Lahore ; Mr. A. G. Tweedie, Calcutta ; Mr. H.P Herbert, Travancore ; Mr. R. W. L. Cater, I.C.S., Sibi, Baluchistan ; Mr. P. H. Welman, Bombay; The Mess President, R.A. Mess, Colaba, Bombay ; Mr. A. F. Gradon, I.F.S., Jubbulpore ; The Principal, Veterinary College, Palghat, and Mr. H. Sharp, Shillong.

CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary, Mr. W. S. Millard, acknowledged the following contributions to the Museum since the last meeting :—

Contribution.	Locality.	Donor.
Wild dog (*Cuon dukanensis*) skin	Kumaon.	N. F. Troup.
Do. do. do. do.	Burma	C. Hopwood.
Walton's Mountain Fox (*Vulpes waltoni*).	Gyantse	Capt. F. Bailey.
Small Palm civet (*Paradoxurus niger*) ...	Madras	Capt. W. S. Patton, I.M.S.
Small Indian Civet (*Viverricula malaccensis*)	Panvel, Colaba Dist.	Rev. J. H. Lord.
Large Red Flying Squirrel(*Pteromys oral*).	Chandanpura ...	O. O'Donell.
2 Squirrels sp.?	S. Shan States	Capt. R. D. Macgregor, I.M.S.
2 Rats (*Mus rattus*), ...	Laccadive Islands...	R. H. Ellis, I.C.S. and Comdr. Huddleston.
2 Sind Mole Rats (*Gunnomys sindanus*).	Karachi	E. Comber.
A large number of Rats in spirit, including examples of *Tatera*, *Gunomys*, *Mus*, &c.	Lahore Dist.	Capt. G. Davys, I.M.S.

Contribution.	Locality.	Donor.
1 Markhor head	Chitral	H. H. the Mehter of Chitral.
Ibex head	Do.	Do. do.
Urial head, picked up, 39½ ins.	Seistan	Major Kennion.
8 Goral heads	Kathgodam	H. E. Johnston Stewart.
Brow-antlered Deer (*Cervus eldi*)	Thayetmyo	J. B. Leach, I.C.S.
3 Chinkara heads (*Gazella bennetti*)	Cutch	H. H. the Rao of Cutch.
Mounted head of Musk deer	Chamba	Major Rodon.
21 Bird skins including specimens of Tibetan Sandgrouse and Waddell's Babbler.	Gyantse, Tibet	Capt. Kennedy, I.M.S.
3 Red breasted Paroquets (*Palæornis fasciatus*)	Assam	E. O. Shebbeare.
Woodcock (*Scolopax rusticula*)	Kanara	T. R. Bell.
Eastern Solitary Snipe(*Gallinago solitaria*)	Assam	E. C. Stuart Baker.
Wood Snipe (*Gallinago nemoricola*)	Do.	Do.
Semi-albino Fan-tailed Snipe (*G. cœlestis*)	Panvel (Bombay)	H. C. Wright.
Semi-albino Pin-tailed Snipe (*G. stenura*).	Ratnagiri	J. H. Garrett, I.C.S.
Several birds including Cotton Teal (*Nettopus coromandelica*), Spotbill (*A. pœcilorhyncha*), Garganey (*Q. circia*)	Daman Road	R. L. Sinclair.
Crested Teal (*Eunetta falcata*)	Roorkee	E. H. Kelly.
Semi-albino Babbler	Vellore	J. C. Battie.
39 Snakes including a new variety of Cobra (*Naia tripudians, Dip. ceylonensis, Trop. platyceps, Trop. beddomi, O. erythrogaster*)	Various	Major F. Wall, I.M.S.
4 Green Vipers (*Lachesis gramineus*) (alive)	Tindharia	A. Wright.
12 Snakes including *V. russelli* and *S. theobaldi*	Burma	Lt. F. W. Wells.
3 *Zamenis rodorachis ladacensis*	Mohammerah, Persian Gulf	Lt. A. T. Wilson.
A collection of Snakes, including a new species (*Trop. venningi*)	Chin Hills	Lt. F. E. W. Venning.
10 Snakes, including *Ablabes fronatus* and *Trop. subminiatus*	Burma	D. H. M. Boyle.
8 Snakes	Khandesh	S. D. Smith.
1 Himalayan Viper (*Ancistrodon himalayanus* and *Trop. platyceps*)	Dalhousie	Col H. W. Barrow, R. A. M. C.
A collection of 27 Snakes, 2 Mammals and a number of Insects	Rangoon	Dr. H. Marshall.
1 Krait (*Bungarus candidus*) and 1 *Trop. piscator*	Santa Cruz, Salsette	R. W. Dunlop.
1 *Dryophis pulverulentus*	Castle Rock	P. Gerhardt.
2 Chameleons	Ahmedabad	W. Bulkley.
A number of Beetles	Chin Hills	F. E. W. Venning.
Do.	Mussoorie	C. Batten.
Do.	Burma	Capt. R. D. Gregory
Do.	Darjeeling	E. Ollenbach.
Do	Garhwal	A. G. Lyell.
Do.	Salem Dist.	Capt. E. S. Gillett.
Do.	Colombo	F. M. Mackwood
Do.	Cuddapah	O. Beadon.
Do.	Sonapur, Assam	L. G. Middleton.

Contribution.	Locality.	Donor.
A number of Beetles	Trimulgherry	Capt. E. B. Fredricks
Do.	Kurseong	E. A. D'Abrue.
A large number of Lepidoptera	Kanara	T. R. Bell.
A number of various insects	Karachi	E. Comber.
Do. do.	Khandesh	S. D. Smith.
Several snakes, fishes and crustaceans	Persian Gulf	Lt. F. J. Blackman.
Some Marine invertebrates	Bombay	S. H. Prater.
The collection of Marine shells belonging to the late E. H. Aitken	Colaba and Karachi	Anonymous.
Double Cocoanut	Bassein	Hurgodum Vunmali

Minor contributions were received from Messrs. B. Aitken ; F. H. Abraham ; P. C. Briscoe ; B. C. Carter ; A. T. Evans ; W. P. Field ; Miss Goldney ; Mr. F. Hannyngton, I.C.S. ; Dr. E. Hunt ; Messrs. H. R. Hume ; F. G. Hutchinson ; A. E. Lowrie ; E. Lund ; Mrs. Millard ; Dr. H. H. Marshall ; Messrs. P. L. Piris ; J. M. Rebello ; B. D. Richards ; C. J. Silvester ; Dr. D. A. Turkhud and Mr. A. Wright.

ELECTION OF THE COMMITTEE.

The following gentlemen were elected as office bearers for the present year :—*President* : H. E. Sir George Clarke, F.R.S., G.C.I.E. *Vice-Presidents* : Mr. J. D. Inverarity, B.A., LL.B. ; Rev. F. Dreckmann, S.J. ; and Mr. N. C. Macleod. *Managing Committee* : Mr. E. C. Stuart Baker ; Lt.-Col. W. B. Bannerman, I.M.S. ; Mr. T. R. D. Bell, I.F.S. ; Mr. H. Bulkley ; Mr. C. L. Burns ; Mr. E. Comber, F.Z.S. ; Lt.-Col. G. H. Evans ; Prof. G. A. Gammie ; Mr. E. Ernest Green ; Lt.-Col. K. R. Kirtikar, I.M.S. (Retd.) ; Mr. H. Maxwell Lefroy ; Mr. J. McNeill, I.C.S. ; Mr. G. M. Ryan ; Major F. Wall, I.M.S., C.M.Z.S. ; Mr. John Wallace, C. E. ; and Mr. N. B. Kinnear. *Honorary Librarian* : Mr. B. D. Richards. *Honorary Treasurer* : Mr. L. H. Savile (*ex-officio*). *Honorary Secretary* : Mr. W. S. Millard (*ex-officio*).

THE ACCOUNTS FOR 1909.

The Honorary Treasurer, Mr. L. H. Savile, presented the statement of accounts for 1909, which, he remarked, showed a satisfactory result. The subscriptions for the year were Rs. 16,831-8-4, showing an increase of Rs. 2,374-8-7 over the previous year. The entrance fees were Rs. 2,770 compared with Rs. 1,480 for 1908 and 294 new members had been elected during 1909 against 160 in 1908.

The accounts were duly passed subject to the usual audit.

Mr. C. D. Mahaluxmivala exhibited a specimen of a bamboo (*Bambusa arundinacea*) which was now flowering in the Victoria Gardens, Bombay. One clump flowered last year and it was considered abnormal, but the same clump

had flowered again this year and also another clump in a different place. Unfortunately there was no trace as to when these bamboos were planted or from whence they came. Some of the seed was exhibited and a young plant raised from the seed last year.

Mr. Mahaluxmivala also exhibited some seeds of the Talipot palm (*Corypha umbraculifera*), one of which flowered last year in the Victoria Gardens and another in the Elphinstone Circle Gardens.

Mr. John Wallace, C.E., and Lt.-Col. K. R. Kirtikar, I.M.S. (Retd.), read a paper on "The Giant Creeper" (*Calycopteris floribunda*), exhibiting specimens of the plant and sections of the trunk.

PROCEEDINGS OF THE MEETING HELD ON 7TH APRIL 1910.

A meeting of the members of the Bombay Natural History Society took place on Thursday, 7th April 1910, at the Society Rooms, Colonel W. B. Bannerman, I.M.S., presiding.

The election of the following 34 new members since the last meeting was duly announced:—Mr. S. F. Ellis, Jacobabad; Mr. Liladhar Sunderji Roy-Sampat, Bombay; Mr. C. T. Symons, Colombo; Mr. Herbert A. Heath, Matugama, Ceylon; Mr. W. Lilburn, Lucknow; Mr. H. P. Thomasset, Cascade, Mahe, Seychelles; The Superintendent, University Museum of Zoology, Cambridge, England; Mr. Melville Leslie, Bombay; Major W. H. Kenrick, I.M.S., Khandwa; Mr. Harold Fowler, New York City, U.S.A.; The Principal, P. R. Training College, Ahmedabad; Mr. W. A. H. Miller, Karwar, Kanara; Mr. G. S. Butterworth, Belgaum; Hon'ble Mr. Justice S. M. Robinson, Rangoon; Major A. D. Greenhill Gardyne, Cawnpore; Sub-Lt. D. Webster, R.N., (H.M.S. "Fox"), East Indies Station; Miss M. Hazlewood, Rangoon; Mr. W. S. Thom, Paletwa, N. Aracan; Capt. G. H. T. Graham, London; Mr. J. M. Wright, I.C.S., Shwegu, Burma; Mr. L. Donaldson, Phillaur, Punjab; Mr. K. J. Luke, Chatalpara, E. Bengal; Mr. Robert T. Harrison, A.M. I.C.E., Sukkur; Mr. R. B. MacLachlan, Sukkur; Mr. F. A. Wrigley, Rangoon; Mr. J. V. Young, I.F.S., Pyinmana; Dr. P. W. Quinn, Betul, C. P.; Mr. E. S. Thomas, I.C.S., Palghat; Lt.-Col. R. H. Penton, R.A.M.C., D.S.O., Poona; Mr. H. D. Rice, Maritranve, Mysore; Capt. R. P. Quin, Cawnpore; Mr. J. S. Fraser, Madras; Mr. D. Squire, Cannanore, S. Canara; Mr. W. Harrold, Ahmedabad, and Mr. F. M. B. Rosenthal, Secunderabad.

CONTRIBUTIONS TO MUSEUM.

The Honorary Secretary, Mr. W. S. Millard, acknowledged the following contributions to the Museum since the last meeting:—

Contributions.	Locality	Donor.
2 Panther cubs (alive)	Kanara	W. H. Miller.
2 Indian Pine Martens (*Mustela flavigula*)	Kangra Dist., Himalayas.	General W. Osborn.

Contribution.	Locality.	Donor.
1 Jackal (*Canis aureus*)	Savantwadi	Major F. W. Berthon.
1 Fox (sp. ?)	Persian Gulf.....	Lt. Carter, R. N.
1 Hairy-footed Flying Squirrel (*Sciuropterus pearsoni*)	Aracan Hills.....	C. W. Allen.
Head-skin and skull of Four-horned Antelope (*Tetracerus quadricornis*)	Jamoocee, E. B. S. Ry.	A. G. Tweedie.
Head of Pelzelin's Gazelle (*Gazella pelzelni*).....	Somaliland.....	Lt. Hunt, R. N.
Head, skin and skull of Thar (*Hemitragus jemlaicus*)	Kulu	General Osborn.
2 Himalayan Serow (*Capricornis sumatrensis*) skulls	Naini Tal	Lt. G. Whittel.
Deformed Sambhar (*Cervus unicolor*) skull.	Burma.....	Lt.-Colonel H. B. Thornhill.
Muntjac (*Cervulus muntjac*)	Madura	C. B. Beadnell.
8 Bats (sp ?)	Darjeeling	E. A. D'Abrue.
105 bird skins, including White-spotted Blue-throat (*Cyanecula wolfi*) Red-spotted Blue-throat (*Cyanecula suecica*) Robin Accentor (*Tharrhaleus rubeculoides*), Brown Accentor (*Tharrhaleus fulvescens*), Jerdon's Accentor (*Tharrhaleus jerdoni*), Black and yellow grosbeak (*Pyrrhorhamphus icteroides*), White-winged grosbeak (*Pyrrhorhamphus carneipes*), Ibis bill (*Ibidorhynchus struthersi*), Temmincks Stint (*Tringa temminckii*) and Brahminy Duck (*Casarca rutila*) in down	Kumaon, Garhwal and Kashmir.	S. L. Whymper.
60 bird skins, chiefly Cuckoos, including Common Cuckoo (*Cuculus canorus*), Himalayan Cuckoo (*Cuculus saturatus*), *C. poliocephalus*, *Hierococcyx sparverioides*, *H. varius*, *Cacomantis merulinus*, *Chrysococcyx maculatus*, *C. xanthorhynchus*, *C. maculatus*, *Coccystes coromandus*, *Surniculus lugubris* and *Eudynamis honorata*	Various	E. C. Stuart Baker.
Scops Owl (*Scops giu*)	Kanara	T. R. Bell.
Pied Imperial Pigeon (*Myristicivora bicolor*) and Sheldrake (*Tadorna cornuta*)...	Arakan	.....
2 Aracan Hill Partridges (*Arboricola intermedia*).....	Do.	C. W. Allen.
Crested Teal (*Eunetta falcata*) ♂	Roorkee	Capt. Mainprice, R. E.
1 Snake (*Dipsadomorphus forsteni*).....	Orcha.....	H. H. Raja Bahadur Orcha.
200 Insects including 155 Butterflies of 76 species, some Moths and Dragonflies (*Neuroptera*)	Various	Capt. G. H. Graham
A small collection of Beetles	Darjeeling.....	E. A. D'Abrue.

Minor contributions from L. H. Savile; G. L. Corbet, I. C. S.; Col. Bull; E. R. H. Jackson; Major F. W. Berthon and S. Navalkar.

PAPER READ.

The following paper was read:—"The Natural History of Bombay malaria" by Dr. C. A. Bentley.

Dr. Bentley, in the course of his paper, said :—

Modern Preventive Medicine has had to borrow very largely from other sciences and in particular has received immense assistance from students of Natural History. This is clearly shown by the present state of our knowledge regarding malaria. Laveran's discovery first attracted Naturalists to the study of malaria, but it was Ross' magnificent work which led to real alliance between Natural History and Sanitary science.

The Natural History of malaria can be approached from three different aspects : (1) As it relates to the malarial organism ; (2) as it affects men, the human animal ; (3) and lastly as it applies to the alternative host—the *anopheles* mosquito.

It is the latter aspect with which we shall deal to-night. In November 1908, Capt. Liston announced his discovery, that the species of mosquito responsible for the dissemination of malaria in Bombay was *N. stephensi*. This discovery is of very great importance, as a careful examination of Bombay shows that we are justified in assuming that *N. stephensi* is the only mosquito able to carry malaria that is present in the greater part of the city. This being so, it is necessary to learn everything we can about the Natural History of this mosquito in order.

Dr. Bentley described at length the different type of breeding places in which *N. stephensi* was to be found, and after discussing the habits of the insect and the causes which lead to its spread, indicated the measures which could be adopted for reducing the number of the insects and eventually control it. He exhibited specimens of the small mosquito destroying fish " Piku " and some of the water-weed *Wolffia arhiza*.

Col. Bannerman called attention to the fact that the first intimation that *N. stephensi* was the cause of the epidemic of malaria in Bombay was in a paper read before this Society by Capt. Liston, I.M.S., in 1908, and that another member of the Society, the late Mr. E. H. Aitken, had been the first to call attention to the mosquito devouring fish " Piku " referred to and exhibited here by Dr. Bentley.

Col. Bannerman also said it would be a good thing if all the members of the Bombay Corporation were members of the Society, so that they could obtain some information from such papers as these, since the information would be of great value to them.

A hearty vote of thanks was passed to Dr. Bentley for his interesting paper which will be published in full in the Society's Journal.

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723A

732A

THE WOODCOCK.
Scolopax rusticula
3/4 size.

J. Green. Chromo.

JOURNAL
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Bombay Natural History Society.

Oct. 1910. Vol. XX. No. 2.

THE GAME BIRDS OF INDIA, BURMA AND CEYLON.

BY

E. C. Stuart Baker, F.L.S., F.Z.S., M.B.O.U.

Part II.

(With Plates II & III.)

(Continued from page 32 of this Volume.)

Family—CHARADRIIDÆ.

Genus GALLINAGO.

The Genus Gallinago contains seven species of Snipe as found in India in addition to the sub-species *G. raddei*. Of these seven species one is the Jacksnipe, *G. gallinula*, which is by many naturalists placed in a separate genus, *Limnocryptes*. The differences, however, between this and the other Snipe consist mainly in their internal structure, such as the sternum which has four instead of two emarginations. These differences are not apparent to the Field Naturalist or sportsman, and I therefore follow Blanford and unite all our Indian Snipes in one genus.

Since the fourth volume of the "Avifauna of British India" was written we have added both *Gallinago major* and *Gallinago megala* to our list of Indian birds so that these have now to be incorporated in the key to the species.

The differences between the Common Fantail, *G. coelestis typica*, and the Eastern Fantail, *G. coelestis raddei*, all depend upon comparison and are dealt with when these birds are described.

The following key is one which should suffice to enable any one to distinguish the various Snipes and the distinguishing measurements given in it allow for an ample margin on either side. Thus it will be found that whereas the Jacksnipes bill rarely exceeds 1·8, that of the other Snipes will but seldom be found under 2·2 and that, probably, only in birds of the first year.

KEY TO SPECIES OF GALLINAGO.

A.—A pale median band on crown, bill exceeding 2".

a. Wing exceeding 6", borders of scapulars white. *solitaria.*

b. Wing under 6", borders of scapulars buff or rufous buff.

a^2 Distance between tip of shortest secondary and that of longest primary not exceeding 2". *nemoricola.*

b^2 Distance between tip of shortest secondary and that of longest primary exceeding 2".

a^3 Outer tail feathers narrow and stiff, under ·3" broad.

a^4 Tail feathers 26 in number, the 8 outer on each side less than ·2" broad ... *stenura.*

b^4 Tail feathers 20 in number, the 6 outer on each side less than ·3" broad ... *megala.*

b^3 Outer tail feathers not exceptionally narrow or stiff.

a^5 Three outer tail feathers not pure white and marked with dusky spots and bars ... ... *coelestis.*

b^5 Three outer tail feathers pure white unmarked ... ... *major.*

B.—No pale median band on crown, bill always less than 2" ... ... *gallinula.*

GALLINAGO SOLITARIA.

The Eastern Solitary Snipe.

Gallinago solitaria.—Hodg. Gleanings in Science, iii. p. 238, (1831); *id.* J. A. S. Bengal, vi, p. 491; Blyth, Cat., p. 272; Jerdon, B. of I., iii, p. 673; Stoliczka, J. A. S. Bengal, xxxvii, pt. 2, p. 70; Blanford, *ibid*, xli, p. 73; Hume and Hender, Ladak

to Yarkand, p. 286; Prjev. In Rowley Orn. Misc., iii, p. 91; Hume Cat. 869; Scully, S. F., viii, p. 353; Hume and Marsh, Game B., iii, p. 333; Hume, S. F., ix, p. 283; Sculley, J. A. S. Bengal, lvi, p. 87; Hume, S. F., xi, p. 319; Fletcher, "Asian," Feb. 1898; Sharpe, Cat. B. M. xxiv, p. 654; *id* Hand-list, Vol. i, p. 166; Blanford, Avifauna B. I., iv, p. 290; Oates, Cat., Eggs, B. I., ii, p. 64; *id*, Game B. of In., ii, p. 446; Finn, Indian Waders, p. 142.

Scolopax solitaria.—Seebohm. Charadriidæ, p. 475.

Vernacular names.—Bon chaka, *Hindi*; Bharka, *Nepal*; Simpoo, *Khasia*; Daodidap gophu, *Cachari*; Boner kocha, *Assamese*.

Description.—*Adult male.*—Crown black, spotted with rufous and with a narrow white median band often much broken up with brown. A broken supercilium narrowing behind the eye white, more or less mixed with brown. Loral streak dark brown, more or less mixed with rufous. Chin, sides of head and throat white, speckled with dark brown and rufous, the centre of the throat almost pure white. Neck all round rufous brown, much mixed with white below, darker and less mixed with white above but having also dark brown or black bars. Back and scapulars black with numerous broken bars and spots of rufous and the scapulars with broad white outer edges, in some cases tinged with rufous. Lower back deep brown with whitish tips and bars, rump with rufous spots, shorter tail coverts dark brown with rufous bars and longer coverts almost uniform olive brown, rayed darker and with white bars at the tips. Median tail feathers black, tipped whitish and with a narrow black and a broad subterminal band of rufous; outer tail feathers irregularly barred black and white. Breast brown, more or less speckled and spotted with white which forms into broad bars where the breast and abdomen meet. Abdomen white, faintly barred at the sides; flanks, axillaries and underwing coverts barred brown and white, the latter predominating. Undertail coverts white, sometimes practically unmarked and sometimes faintly barred with dusky brown and often with a faint rufous tinge.

Wing coverts brown, speckled with rufous next the scapulars and elsewhere barred with rufous and black and tipped white;

the edge of the shoulder is also barred with white; primaries dark brown edged and tipped with white, the edges broadest on the outermost quill and almost disappearing on the innermost; secondaries dark brown, tipped white with frecklings of rufous and black at the tip which in the inner secondaries become regular bars throughout the whole length of the feathers.

Bill greenish plumbeous, darkest at the tip where it is almost black, and yellowish at the base of the lower mandible; iris dark brown; feet and legs pale yellowish plumbeous, the soles yellow ochre and claws horny brown.

"Bill plumbeous, black at tip, base of lower mandible yellowish brown; feet dull olive or pale yellowish green, the soles yellowish; claws horny black; iris dark brown" (Scully).

"Total length 11 inches, culmen 2·9", wing 6·3", tail 2·3", tarsus 1·3" " (Sharpe).

"Wing 6·25" to 6·8"; bill 2·52" to 2·87" (no male above 2·77"); weight 5 oz. to 8 oz." (Hume).

"The irides are dark brown; the legs and feet in adults are dull olive or yellowish green, or greenish or dull pale yellow—in young birds ashy with a greenish tinge; the claws black or brownish black; the terminal one-third of the bill is black or brownish black, the basal portions generally yellowish brown, bluish along commissure, but the upper mandible often has a greenish ashy or plumbeous, or vinous or fleshy tinge, and sometimes is plumbeous everywhere except at the dark tip." (Hume).

Adult female.—Similar to the male.

"Total length 11 inches, culmen 2·8", wing 6·0", tail 2·5", tarsus 1·3" " (Sharpe).

"The sexes do not, judged by my measurements, appear to differ appreciably in size, but the three largest birds measured were females and the two smallest males, so that probably, age for age, if one could make sure of this, the females are the largest" (Hume).

Measurements of the specimens in the Bombay Natural History Society's possession and in the Asiatic Museum together with a few others which have passed through my hands do not shew much variation in size between the male and female. The average

THE WOOD-SNIPE.
Gallinago nemoricola.

J. Green, Chromo.

measurements for both sexes are, Wing 6·41"; Bill from gape 2·76"; Tarsus 1·30." The smallest bird, a ♀ from the Indian Museum, has a wing of 6·02" and the largest, an unsexed bird from the same place, has the wing 6·68". The bills vary in length between 2·62" and 3·02" and the tarsi between 1·12"—that of a curiously short-legged bird—and 1·5."

The depth of the bill at the extreme base is only ·32" as against ·5" in that of the Wood Snipe and the length and slenderness of the bill of the Solitary Snipe is alone sufficient to distinguish it from the other. In general appearance the Solitary Snipe is a far paler coloured bird than any of the other snipe and this difference is even more conspicuous in life than when the bird is made into a skin. In build it is also slighter, its neck longer and it seems to stand higher on its legs, though its tarsus is really no longer than that of the Wood Snipe.

The British Museum has a fine series of this Snipe, over 40 specimens, but of these only 11 are sexed, 7 females and 4 males, and it is hardly safe to generalize as to comparative size of the sexes on such scanty material. It is, however, more than possible that a large series of sexed birds might show that the female Solitary Snipe is bigger than the male, a fact usual, indeed, with most known species of the Genus *Gallinago*. An examination of those species of *Gallinago* of which the British Museum has fairly big series shews the following comparative measurements of males and females :—

	Males.		Females.	
	Bill	Wing	Bill	Wing
Gallinago stenura	2·3 ...	4·9 ...	2·45 ...	5·1
,, *megala*	2·3 ...	5·4 ...	2·6 ...	5·6
,, *major*	2·45 ...	5·55 ...	2·5 ...	5·3
,, *nigrigenis*	2·75 ...	5·1 ...	2·9 ...	5·1
,, *coelestis*	2·8 ...	5·2 ...	2·8 ...	5·3
,, *frenata*	2·8 ...	4·9 ...	2·9 ...	4·7
,, *paraguayae*	2·6 ...	5·0 ...	2·8 ...	5·25

From the above we find that in the species *stenura*, *megala*, and *paraguayae* both culmen and wing are longer in the female than in the male; in *major* and *frenata* the bill is longer but the wing shorter, but of the latter species there are only 4 females sexed

out of the whole series; in *nigrigenis* the bill is longer and the wing the same and finally, in *coelestis* we have the bill the same and the wing longer in the female.

My own experiences go to shew that both in the case of *stenura* and *coelestis* the female though, perhaps, a less bulky bird, has wing and bill consistently though but slightly longer than it is in the male. At the same time, I have not had sufficient material to work on, as regards the other species, to enable me to assert that such is always the case with birds of this genus.

Distribution.—The Solitary Snipe is found throughout Eastern Asia from Japan as far West as the Altai mountains and as far South as the Himalayas and the Chin Hills extending further South during the Winter into the plains of China and India.

Within the limits of the Indian Empire the Solitary Snipe breeds throughout the Himalayas from Western Kashmir to the extreme East of Assam, both North and South of the Brahmaputra, and thence through the Chin and Shan Hills wherever these are of sufficient elevation. At this season it may be found at all heights between 15,000ft. and 9,000, possibly breeding at rather lower elevation than this as I shot a specimen in May in N. Cachar at 6,000ft. The testes of this bird were much swollen and it was evidently breeding either in the place where shot or in the adjoining Naga Hills which ran some 2,000ft. higher.

As soon as the cold weather sets in the Solitary Snipe moves further South and to lower elevations, but it is in no sense migratory in India as is the Woodcock, seldom leaving the foot hills for the plains and only occurring in the latter as a rare straggler. On September 14th, 1879, Mr. A. Guthree obtained a specimen near Benares and in 1898 Mr. F. W. F. Fletcher and Mr. W. Hamilton shot a bird of this species near Devala in the S. E. Wynaad.

I have records of its occurrence in Cachar (W. Cathcart), Sylhet (St. J. Hickman), Dibrugarh, Chittagong Hill Tracts, Chittagong, N. Cachar, Khasi and Garo Hills, and between October and March it undoubtedly occurs regularly in small numbers all along the foot of the Himalayas throughout the Dooars.

The extent to which the Solitary Snipe is migratory has never been well worked out. In Japan it would appear that it is resi-

dent throughout the year, perhaps working South during the cold season, but in China it is more truly migratory in its habits, breeding in North-Eastern Siberia and extending well into China in the winter. On the other hand in Turkestan, the Altai and possibly also Tibet the bird is probably only locally migratory to the extent of altering the elevation of its haunts with the varying seasons.

Mr. H. E. Dresser, who has lately been working at this genus, has very kindly sent me *in epistola*, the result of his researches in regard to the destribution of this snipe. He writes:—

"*Gallinago solitaria* breeds on all the mountain ranges of Asia between about 57° and 27° N. lat., also on the Commander Islands, in Kamchatka, Saghalien, Japan, the Corea, North China, Manchuria, Mongolia, Dauria, the Southern half of the Irkutsk, Government, the Bureja and Stanovoi mountains, Sajan, the Altai Tarbagatai, Alatan, and the mountains of Turkestan at an altitude of from 4,000 to 14,000 feet, also in Tibet and the Himalayas. In the autumn and winter it is found near Irkutsk, Krasnojarsk, Ust Kamenogorsk, on the Irtesh at Askabad and in Eastern Persia where Mr. Zarudny obtained it on the 2nd of October 1898 at Neizar in Seistan, on the 19th of October at Tebbess, on the 21st and 22nd of October at Kelata-Marg, on the 23rd of October at Pud-i-Akhangerun, and on the 31st of October at Kerat, all these places being in Seistan. The typical form is found in Turkestan, the Altai, the Altyn-Tag mountains, Zaidan, the Southern Koko-Nor mountains, Nan-shan, Upper Goango, and South-Western Mongolia—the Eastern form (*Gallinago solitaria japonica*) from the Sayans, East to the Commander Islands, and South to Pekin. Some specimens from Krasno Yarsk on the Yenesei are intermediate, whereas others belong to the Eastern form."

The Solitary Snipe is by no means a common bird anywhere within our limits, although Hume says that "in the Himalayas at all seasons it is at least ten times as numerous as the Wood Snipe. It is just as commonly met with in twos and threes as singly, whereas (in the hills at any rate) the Wood Snipe is always solitary." Scully also reported that "the Solitary Snipe is not uncommon in the Valley of Nepal from October

to the beginning of March, being represented in larger numbers than either the Woodcock or Wood Snipe." As, however, Scully also says that the Woodcock "is not at all common in the Valley and can only be obtained by hard work," we need not infer that the Solitary Snipe occurs in any great numbers.

This bird is in all its ways far more a true snipe than is the Wood Snipe and in flight and voice is very similar to the Fantail and Pintail. On the wing it is strong and quick and it indulges in the same twists and turns as does the Pintail, rising with the same loud "pench" as does that bird, though its voice is shriller and louder, and its flight, perhaps, not so quick.

Hume says "they do not seem to care much for cover. I have constantly seen them along the margins of little streams, in bare rocky ravines and valleys, where there were only small corners and nooks of turf and mossy swamp, and no cover a foot high. I have, no doubt, found them in small open swamps in the middle of jungle, but they stick to the grass and low rushes, and I never observed them in scrub or rinjal jungle. I have known Wood Snipe and the Eastern Solitary Snipe flushed within a short distance of each other; but, as a rule, the Wood Snipe is to be seen only in tiny swamps or morasses, partly or wholly surrounded by thick cover—the Solitary Snipe in little swampy places on open, grassy hill-sides or along the margins of rocky-bedded bare banked streams."

It however does sometimes actually frequent forest land, for one shot by Major Wilson in Shillong was found in grass land more or less covered with pine forest and the breeding male shot by myself in North Cachar was put up out of bracken in oak forest, the trees being quite close together and much matted and covered with orchids and other parasites.

Such records as I have of birds shot along the foot-hills of the Himalayas seem to have been all obtained from grass bordering patches of swamp, situated either at the bottoms of grassy hills or else in comparatively open ravines.

Major Wilson, writing to me about this snipe, says "I have only killed about half a dozen of these in my time and all round about Shillong. I found them in the same sort of ground as the

ordinary snipe and never in matted grass such as the Wood Snipe inhabits."

"On March the 13th, 1890, when shooting with Mr. W. H. Dobbie, I killed three Solitary Snipes all within a few yards of one another."

Hume found, in the stomachs of those he examined, small insects and tiny grubs, in two or three were found masses of tiny black coleoptera and in one some minute shells. In the one bird I have examined there were numerous tiny shells and what looked like the remains of some grey-coloured caterpillars.

From the formation of the bill of birds of this sub-family one would expect to find them all more or less addicted to boring in the earth for their food. The bills of all Snipes are so constructed that by elevating the end of the maxilla, or upper mandible, they can be opened for about one-third of their length whilst the gape itself is still kept closed. This enables the Snipe to thrust its bill into the soft ground or slush in which it feeds and having found its prey to grasp it without resorting to the great muscular effort which should be necessitated by an attempt to force open the whole bill from gape to tip.

Knowing this fact, an examination of the bill of each species may be found to be some guide to help us to ascertain the food on which it principally subsists, for we shall find the nervous and muscular structure of the bill most developed in those species which resort most to boring in their search for food.

In *Gallinago solitaria* we do not find the retractile muscles and nerves very highly developed and there are not the strong terminal pits which we see in the bill of the Common Snipe and, to a lesser degree, in the Pintail and Woodcock. It is probable, therefore, that the Solitary Snipe feeds principally upon such insects and surface shells, etc., as it can obtain above ground, resorting to boring for worms and similar food only when forced to do so by the absence of any other.

During the breeding season the Solitary Snipe *bleats* or *drums* in much the same manner as does the Fantail. Hume observes: "In May . . . the males are often to be seen and heard in the higher portion of the hills soaring to a considerable height, repeatedly

uttering a loud, sharp, jerky call, and then descending rapidly with quivering wings and out-spread tail, producing a harsh buzzing sound something like, but shriller and louder than, that produced by the Common Snipe, and this though they do not descend as rapidly as this latter."

The Solitary Snipe is a most excellent bird for the table, though as Hume says, perhaps less so than some other members of the genus.

Nidification.—Gallinago solitaria is known to breed throughout its Indian range at suitable elevations. Hume records: "The breeding season commences in May . . . . . The nest, such as it is, is usually placed on grass or moss, close to some stream, often more or less overhung by some tuft of grass or rushes. It consists at most of a few dead rushes or scraps of dry grass or moss, surrounding or at times lining a little depression in the moss, turf or ground. In one case I was told there was no nest at all, the eggs being laid simply in a circular shallow depression in deep, spongy club moss, apparently merely hollowed by the pressure of the bird's body."

"I have never myself seen a nest, but have this information from natives who have repeatedly seen the eggs, always at places high up on snow-capped ranges, and on snow-fed streams."

"I have never succeeded in securing or even getting a sight of the eggs, though on one occasion several (subsequently unfortunately destroyed) were collected for me in Kashmir."

Oates has shewn however in his "Game Birds," p. 442, that the eggs Mandelli obtained from Sikkim and believed to be those of the Wood Snipe were almost certainly of this species. As regards these eggs, Herr. Otto Möller gave Hume the following details:—

"The eggs were found in Native Sikkim, just opposite Darjeeling. Mandelli several times pointed out to me the spur where they were found, the elevation of which is, I should say, between eight to nine thousand feet. The eggs, eleven in number, were procured during the latter part of June . . . . . but the eggs, though clearly all belonging to the same species, equally clearly belonged to four different nests and the men could not point out the clutch to which the skin belonged."

Hume describes these eggs as being broad ovals of regular peg top shape with stout compact shells, very faintly glossed. He adds: "The ground is a pale pinky stone colour of varying shades sometimes almost white, sometimes browner, sometimes more decidedly pink, densely and boldly blotched (the blotches often longitudinal in their character and radiating in curved lines from the broad apex) with a rich, at times brownish, maroon, almost black in some spots, browner in some eggs, redder in others, this blotching being generally intermingled with very similarly shaped, subsurface looking pale grey or inky purple patches or clouds."

"In some eggs the markings are almost entirely confined to the upper one-third of the eggs, where they are in places all but confluent. In others the markings, though in such cases often less densely set, extend over the entire upper half of the egg; but as a rule but few markings, and then much reduced in size, extend over the lower half of the egg."

"The eggs, I have measured, varied from 1·66 to 1·76 in length, and from 1·2 to 1·28 in breadth, but the average of 10 eggs is 1·71 by 1·24."

Oates, in describing the eggs of the Solitary Snipe in the Collection of the British Museum, notes that "they are easily distinguished from the eggs of all other snipes in the collection by reason of their pinkish-buff ground colour . . . . . Many of the blotches are streaky and make an angle with the major axis, seeming to be, as it were, twisted round the egg from right to left, when the specimen is viewed with the broad end uppermost."

The Collection contains 3 of Mandelli's eggs, so the above reference to the pinkish ground colour may be considered applicable to those as well as the others and agrees with Hume's own description. The other Solitary Snipe's eggs in the Collection are two clutches from Ta-tran-la, Tibet, and were taken at an elevation of 12,000 ft.

In my own Collection I have a clutch of four eggs from Turkistan and a single egg from Innakul, the latter of which was given me by the Hon'ble Walter Rothschild out of a clutch of four eggs in the Tring Museum. All the eggs have the drab-yellow ground colour and vandyke brown markings of ordinary snipe's eggs with no

trace of the pink tinge mentioned by Oates and shewn in the plate (III No. 9) in the second Volume of the *Catalogue of Bird's Eggs in the British Museum*. All, however, have the same curious twisted character in the markings.

THE PLATE of the Solitary Snipe is decidedly good. Many birds are considerably paler in general tone than the bird depicted which, indeed, must have been darker than the average, though I have seen specimens even darker than this. The staring white rim round the eye is *not* correct and the colours of the soft parts are not normal. I doubt if any bird ever possessed quite such vivid green legs as these and the greater number have them more a dull yellow-green with a distinctly livid tinge.

The bill is correctly coloured, but that the terminal third should be darker. It must, however, be remembered that though the brown tinge given here is correct for some birds, in many the bill will be found to be coloured a livid green at the base, more especially about the gape.

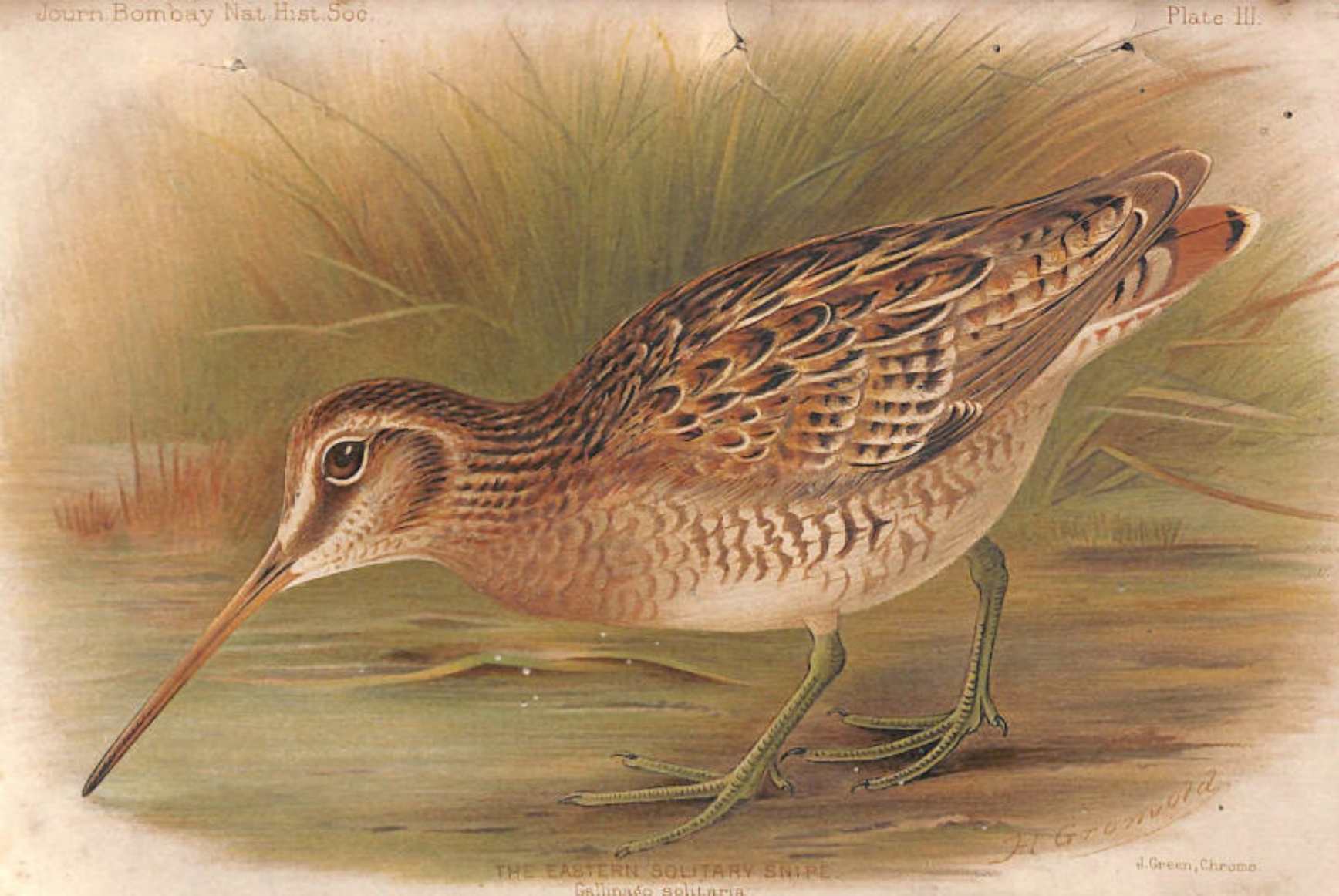
GALLINAGO NEMORICOLA.

The Wood Snipe.

Scolopax gallinago.—Hodg., Gleanings in Science, iii, p. 240.

Gallinago nemoricola.—Hodg., J. A. S. Bengal, vi, p. 490; Blyth, Cat., p. 272; Jerdon, B. of India, iii, p. 672; Hume and Davidson, Str. F., vi, p. 459; Hume Cat. No. 868; Hume Str. F., viii, p. 112; Legge, B. of Ceylon, p. 814; Hume and Marshall, Game Birds of India, iii, p. 325; Butler Str. F., ix, p. 428; Reid, Str. F., x, p. 68; Ditmas, *ibid*, p. 173; Oates, B. of B. ii, p. 385; Barnes, B. of Bombay, p. 344; Davison, Str. F., x, p. 413; Hume, *ibid* xi, p. 318; Oates, Hume's Nests and Eggs Ind. B., iii, p. 350; Sharpe, Cat. B. M., xxiv, p. 657; Oates, Cat. Eggs B. M, ii, p. 64; Sharpe, Hand List of B. of B. M., i, p. 166; Blanford, Aviffauna of B. I., iv, p. 285; Oates, Game B. of In., i, p. 439; Finn, Indian Waders, p. 141.

Scolopax nemoricola.—Jerd., Ill., Ind. Orni., pl. ix; Nevill, J. A. S. B. (Ceylon), 1867-70, p. 138; Seebohm, Geogr. Distr. Charadriidæ, p. 474.



THE EASTERN SOLITARY SNIPE.
Gallinago solitaria

J. Green, Chromo.

Description.—Adult male.—Forehead brown, changing to black on the crown and nape; a rufous median stripe; supercilium and sides of the head white, fulvous white or pale fulvous, speckled with brown and with broad brown bands running from the bores and from under the ear coverts to the nape. Chin white, generally unspeckled, sometimes faintly dotted with brown. Upper back and scapulars velvety black, the former near the nape much marked with rufous and the latter broadly edged with the same; lower back and rump duller black with rufous bars, more or less whitish in front on the former; upper tail coverts barred rufous and blackish brown, the former colour predominating. Central tail feathers black with two rufous bars and tips, the subterminal bars very broad; outer tail feathers barred dull white and black. Breast fulvous, or fulvous white barred brown, remainder of lower parts, *including the abdomen*, white barred closely with brown and with the undertail coverts generally strongly tinged with rufous. Auxillaries and underwing coverts dark brown with narrow white bars. Wings brown, the coverts edged and barred with fulvous, the primaries and primary coverts tipped with a pale edging, inner secondaries barred throughout with fulvous or fulvous rufous.

Irides dark brown, bill horny brown, more or less tinged with green, the tip darker and the basal two-thirds of the lower mandible yellowish; legs dark plumbeous green.

Wing 5·25" to 5·75"; bill from gape 2·4" to 2·65"; tarsus 1·2" to 1·5".

Eliminating the largest and the smallest birds the tarsus only varies between 1·3" and 1·4" and the extremes both ways are probably abnormal.

Adult female.—Does not differ from the male and is probably about the same in size or very little bigger, though with a longer bill. The two longest bills I have personally measured were 2·60" and 2·65" and both belonged to female birds.

Young bird.—Judging from a single specimen of a young bird in the Indian Museum with a wing of 5·02" and a bill of 2·38" it would appear that in young birds the darker colours predominate over the paler more than in the adult. The dark bars on the lower plumage are distinctly broader and more close together, and

the whole appearance in this specimen is far darker than I have seen in any adult bird.

Sharpe does not differentiate between the male and female, but the average measurements of the British Museum birds, including both sexes, are bigger than those I have handled. In the former the wing is given as 5·7" and the culmen as 2·65".

The depth of the bill in those I have measured averages about ·5", the heavy base being very conspicuous when compared with other Snipe.

The sportsmen will generally be able to recognise the Wood Snipe by its comparatively dark plumage and rather squat heavy shape and beak.

"Length 11·0" to 12·5"; expanse 18" to 19·75"; wing 5·4" to 5·7"; tail from vent 2·5" to 2·9"; tarsus 1·41" to 1·49"; bill from gape 2·41" to 2·62"; weight 4·9" to 6·1" oz." (Hume).

Jerdon gives the weight as up to 7 oz. and Hodgson, amongst some 20 birds weighed, obtained one of 6·75 oz.

"The irides are hazel to deep brown; the front of the legs and toes are grey, sometimes, perhaps commonly, bluish, sometimes more plumbeous or slaty and sometimes again with a drabby shade, or again greenish, and generally everywhere paler in the female, the back of the legs and soles fleshy, sometimes pinky, sometimes bluish or dusky; the claws horny brown to almost black; of the bill nearly the terminal one-third is brown to blackish brown; the basal two-thirds much paler and with a tinge sometimes reddish fleshy, sometimes yellowish fleshy, sometimes livid, sometimes drab" (Hume).

Distribution.—Blanford thus defines the distribution of the Wood Snipe within our limits, outside of which it has not yet been obtained. "In the Himalayas as far as Dalhousie to the westward and Sikkim to the east, and probably further in the latter direction; also in the hills south of Assam and in Manipur occasionally in Burmah even as far south as Tenasserim, and as a winter visitor only, in the hills of Southern India—Coorg, Wynaad, Nilgiris, Anaimalais, Shevroys and probably others. In one case this species is said to have been recognised in Ceylon. A very few specimens have been obtained whilst migrating, one at

Calcutta by Blyth, two at Russelkonda by Macmaster, one in Serguja by Bull, and probable occurrences have been recorded at Nasik and Dharwar."

The Wood Snipe extends all along the Himalayas from the Eastern point mentioned by Blanford, and I have had either records of its occurrence or specimens sent me from the Dooars, Buxa, Jalpaiguri, Barpeta (South of Bhutan) and Tezpur (South of the Dafla Hills), Cachar, Sylhet and Myitkyina (Capt. Clifford), thus linking up its range almost from point to point.*

As regards these birds' visits to the Southern Hills these are, no doubt, more or less the result of a migratory movement but as we get to know more about this rare Snipe it will probably be found that its migrations are of a very local character and it would not surprise me to find that over the greater portion of its habitat it is a permanent resident. The dates on which specimens of the Wood Snipe have been obtained, for me, shew that in some cases it is not a bird of high elevations alone and that it almost certainly breeds well below 2,000 feet.

From Jalpai I have received a bird shot in May in the swamps at the foot of the Hills; my father, E. B. Baker, shot several specimens in Purnea and Maldah in April and May whilst returning from Tiger shoots, and Major Wilson records his seeing many of these Snipes in May in Manipur at about 2,000 feet elevation. It is quite possible that if we knew the haunts of this Snipe and if we could visit them at the proper season we should not find them nearly as uncommon as they have been hitherto considered.

Damant said that he found it common in Manipur and that one morning he killed five shooting in long grass from the back of an elephant.

Baldwin also came upon a number together when shooting in the Philibet district in January 1872. He writes:—"I came across not one, but over a dozen of these birds; they were close to one another . . . . . we soon put up several Common Snipes and presently my companion fired at one, and I then saw a large dark bird, which I thought at the time was a Solitary Snipe, rise up with a croak, and after curving about, drop close by. We went

* There is in the Society's collection a specimen of a Wood Snipe (in spirit) shot at Thana, near Bombay, by Mr. Thos. H. Moore in January, 1896.—Eds.

up and not one, but three rose—two of which fell to our shots. We soon found several more and nine were killed altogether; they offered the easiest of shots, and did not rise until the elephants were close on them. They were particularly fine gamey birds and proved most excellent for the table."

Major Wilson has been good enough to send me copies of his notes on this bird as found in Manipur and these I quote *in extenso*.

"The only time I ever made what may be called anything like a bag of Wood Snipe was in the year 1896, close to Manipur. I was sent out into cholera-camp in May and while there discovered a valley about 4 miles from our final camp, which seemed absolutely crawling with Black Partridges and where also I saw many Wood Snipes. The Gurkha, as is well known, is an extremely keen shikari, and unfortunately one regardless of the breeding season. I accordingly issued orders that no one was to fire a shot in this valley, till I could shoot it myself. In October of the same year I managed to get away. The following is a copy of an entry in my shooting diary :—

"October 1, 1896.—Went over to the Choonbutti (there was an old Manipuri lime kiln, near which we camped, in my reserved valley) with H—of my Regiment, we did not find nearly so many partridges as I expected, and the grass was very heavy, still we killed fifteen brace of black partridges, five and-a-half couple of Snipe, of which two and-a-half couple were Wood Snipe, and one quail. The grass was so stiff the dogs rubbed their noses sore.

"October 2.—Twenty-two and-a-half brace of partridges, eight and-a-half couple of Snipe, of which four couple were Wood Snipe.

"We could have killed a good many more Wood Snipe had we troubled to go after them, but if a bird flew out of the line we were beating, we never followed it up, as we wanted to make a really good bag of partridges.

"These birds were all lying in heavy grass up to our knees.

"I think the name of this bird somewhat of a misnomer because out of those I have shot, a fair number, I have never once flushed one in a wood, though once I flushed one in a jheel in the midst of tree jungles and he pitched in the forest and I killed him there.

"The Wood Snipe lies in covert which is too thick for the ordinary Snipe to run about in and he also sometimes favours very high grass. The places he seems to like best are valleys in the hills which are full of thick matted grass growing on the sites of old rice khets.

"He lies very close and is consequently rather difficult to flush even with a dog and when flushed flies heavily, and seldom goes more than a couple of hundred yards.

"Occasionally when flushed he utters a croaking note, which sounds like 'Tok-Tok'."

The Wood Snipe obtained by my father in Purnea and Maldah were shot by him in 1882 in company with Mr. J. Shillingford, Mr. G. Hennessy and others during a couple of tiger shoots held in April and May in the two districts.

My father told me that one day late in April when coming back from a successful tiger shoot in Maldah the line was engaged in shooting anything that might get up before the elephants as they wended their way home to camp. In this way a few hog deer and various birds were added to the bag, and whilst going past a number of tiny swamps covered with dense sungrass, one of the line put up and dropped a bird; he thought to be a Woodcock. On search being made for this, several more were put up and a good many shot, my father himself securing four. Further on the same evening whilst working through similar places others were disturbed and two more shot and on following days yet others were brought to bag.

The same year and in the succeeding month, May, whilst shooting in Purnea, a similar experience was met with and more of these birds killed. I cannot now remember what was the actual number brought to bag, but from what my father told me they must have been fairly numerous, especially in Maldah.

He described the birds as being very slow and *owlish* in their flight. They rose with a low croaking cry, flattered heavily over the grass and ekra in a fitful and undecided manner and then flopped into cover again before they had covered a hundred yards.

The Wood Snipe, not only in appearance but in flight and habits, is far more like the Woodcock than is the Solitary Snipe-

It may not perhaps haunt forest and brake as does the Woodcock, but on the other hand it is never found in the short grass and open swamps frequented by the Solitary Snipe. Its favourite haunts seem to be those described above by Major Wilson or, when in the plains, huge fields of dense sungrass, ekra or elephant grass which have in their midst small pools and swamps hidden away by the rank vegetation. In Maldah and Purnea they were found in tiny pools only a few yards across, which were covered with coarse weeds and grass so high and dense that they would have been unworkable except from elephants.

In flight, as may be seen from the descriptions already given, it closely resembles the Woodcock and is, perhaps, even slower. It pursues the same wavering, bat-like course in its mode of progression, makes the same unlooked-for darts to one side or the other and finally has the same headlong tumble into cover, giving one the idea that it has died suddenly and fallen to earth.

It is, however, a very shy retiring bird and never, like the Woodcock, frequents the haunts of men. This shyness and also the unhealthiness of its habitat along the Terai will probably always prevent us learning very much about it.

Nidification.—There is nothing on record about the nidification of the Wood Snipe at present except in connection with the eggs obtained by Mandelli in Sikkim. Three of these eggs are in the British Museum, but one of them is marked "869 *Gallinago solitaria*, Native Sikkim, 18-6-79" and, as Oates remarks, it seems possible that Mandelli's reputed eggs of the Wood Snipe were afterwards discovered to be the eggs of the Solitary Snipe, probably by the identification of a skin.

At the same time it must be noted that Hume distinctly states that when Mandelli's collectors brought in these eggs they brought in with them the skin of a Wood Snipe. The date and name on the eggs, however, would seem to shew that this skin afterwards proved to be that of a Solitary Snipe.

My own experience, meagre as it is, as regards their nidification, would appear to confirm Oates' opinion. On the 11th June 1908, one of my Khasia collectors brought in to me a Wood Snipe together with a single egg and some fine tangled grass, which he

said had composed the nest and which was clogged and matted with the contents of other eggs which had been broken by the trapped bird. Unfortunately the egg, which was saved, is undoubtedly an abnormally small one, and my collector informed me that when he set the nooses for the bird he saw that there were three big and one much smaller egg, but that in colouration they were all alike.

The single egg measures only 1·5" × 1·04" and is much like many eggs I have seen of *Gallinago cœlestis*, but is unusually brown in tint. The ground is a pale stone colour and the markings consist of heavy blotchings of vandyke brown with a few underlying ones of grey or lavender. The smaller half of the egg is but very sparsely marked, but on the larger third the blotches form a deep dark ring, inside which again the markings are numerous but not confluent.

The texture is fine and smooth with a faint gloss and the shape is the ordinary sub-pyriform shape of most Snipes' eggs.

Hume, writing of the breeding of this snipe, writes :—"That they breed in the Himalayas between elevations of about seven and ten thousand feet (and perhaps, though I doubt it, considerably higher) is certain. That they begin to lay early too is probable. Hodgson notes that on the 10th March the eggs in the ovary of a female were swelling, and another shot early in April contained a nearly full-sized but unshelled egg. But no European, I believe, has ever yet taken the nest, though Mr. A. G. Young writes that he *knows* they *do* breed in Kulu."

It is more than probable that we shall eventually find that the Wood Snipe breeds at far lower altitudes than 7,000 feet. My own nest was taken near Shillong at under 4,000 feet, and in Manipur it is almost certain that they breed at but little over 2,000 feet, whilst it also seems possible that they are permanent residents at the foot of the Himalayas throughout the Dooars.

THE PLATE of the Wood Snipe is excellent, both in colouration and attitude. In many birds the bill has a faint green tinge about the base but normally, I think, the colour is much the same as that shewn, though perhaps not quite so clear and hard as here depicted.

The legs and feet are very well coloured, but the colouration varies much and is often just as distinctly greenish as they are here shewn bluish.

The attitudes of the birds in this plate and that of the Solitary Snipe show well the characteristics of the two species; the active, quick moving character of the Solitary Snipe, as compared with the heavy, slow disposition of the Wood Snipe.

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA

(INCLUDING THOSE MET WITH IN THE HILL STATIONS OF THE BOMBAY PRESIDENCY).

BY

T. R. BELL, I.F.S.

Part VIII.

(Continued from page 879 of Volume XIX.)

58. Vanessa cardui, *Linn.*—(Plate B, fig. 9 ♂). Male and female *upperside*: forewing: interspace 1 and extreme base of wing dusky-black, irrorated with golden scales; apical half of wing and termen dusky-black; discal and medial area of wing ochraceous orange with the following black markings: an irregular oblique band consisting of two detached spots across middle of cell, a patch in base of interspace 2 and a curved transverse bar across interspace 1; on the black apical area an obliquely placed series of three quadrate white spots from costa followed by a curved transverse series of four white spots and on the broad dusky-black terminal margin an obscure transverse series of pale, slender, lunular marks. Hindwing dusky-brown covered with long, silky, brown hairs at base; a large spot beyond apex of cell, a broad, transverse, discal, irregular band and the termen ochraceous orange; the ochraceous discal band does not extend to the costa and bears a round black spot in each of the interspaces 2-6; on the termen there is an inner transverse series of black lunules and an outer series of black spots at the apices of the veins. *Underside*: forewing, cell and discal area from vein 1 irregularly to vein 4 ochraceous orange, rest of the wing greyish brown; base of cell red, apical portion white, black marking in and below cell much as on the upperside; beyond the cell the white markings on the apical area and on the termen as on the upperside. Hindwing mottled with olive-brown and ochraceous, the olive-brown markings with slender white margins; a postdiscal transverse series of ocelli in interspaces 2-6, those in interspaces 3 and 4 with blue, the rest with black centres; all with inner rings of ochraceous and outer rings of black; a series of black subterminal lunules and terminal black spots as on the upperside but not so distinct. Antennæ brown, ochraceous yellow at the apex; head, thorax and abdomen with ochraceous pubescence, the thorax beneath the pubescence metallic green; on the underside the palpi, thorax and abdomen pale ochraceous white. Exp. 58-68 mm.

Larva.—The larva is the type of *Junonia* larvæ. Head parallel-sided, flat-faced, with distinct central depressed line; covered with erect, rather long, white setæ which are shortest on the face; a few brown tubercles on vertex of each lobe bearing black setæ; colour from light red-brown to

black. Segment 2 slightly smaller than the head with a double row of numerous erect, long, white hairs as a collar and two bunches of similar hairs in front of each spiracle. Segments 3 and 4 have a subdorsal and lateral branched spine, or a pedicel with spinules. Segments 13 and 14 have only the lateral pedicel. The dorsal spines of the segments 5-12 are nearer the front margin than the others. The usual little spines on leg-bases (for disposition of all these pedicels see *Junonia* of any species). Spiracles oval, large, black. Body surface velvety, covered densely with longish white hairs. All spines or pedicels arise from a more or less deeply rose-coloured, truncated, conical tubercle. Ventrum slightly hairy. Colour of body bright yellow smudged and spotted black to a varying degree, sometimes so much as to be completely black; always a broad marginal yellow band and a double yellow dorsal line; spines are translucent white, the spinules black. L: 40 mm.; B: 5·5 mm.

Pupa.—Is of the *Junonia* type but slender. Head and segment 2 to base of shoulder-point quite square seen from above, blunt in fron where the margin is slightly concave between the eyes; there is a slight carination over each eye reaching back to front margin of segment 2, these carinations converging backwards. Dorsal line of the head, segment 2 and thorax in one plane: at 45° to the longitudinal axis of pupa as far as apex of the last, the descent from it to segment 5 over segment 4 short; both segment 2 and thorax convex transversely to length of pupa, the former not broad between its margins, the latter carinated lowly from front margin to apex where the carination ends in a low triangular pyramid. Constriction behind thorax slight dorsally, slighter laterally. Abdomen dorsally somewhat convex from segment 5 to cremaster, circular in transverse section; ventral line straight, somewhat bulged along wing-junction-line. Wings expanded slightly laterally from a small shoulder-point in a concave line very shortly to a second point immediately behind and opposite segment margin 3-4, after which the expansion gradually narrows to lose itself in body-surface at segment 6-7. Cremaster ordinary, oblong in shape, rounded at extremity with rather strong ventral and slight dorsal extensor ridges. Spiracular expansions of segment 2 indicated by a flush, longly oval, grey surface on front margin of segment 3 on each side; the other spiracles longly oval, of ordinary size, flush, brown. Surface of pupa finely and superficially corrugated-rugose; segments 6-13 have a minute dorsal, pointed tubercle; segments 8-12 a still smaller supra- and subspiracular point; segments 4-12 a small, conical conspicuous, subdorsal point, those on segments 7-10 being slightly largest. Colour of pupa is variable, green and gold in some cases, gold in others, pink-brown and gold again in some, the gold being always strongly developed dorsally and on the points. L: 23·5 mm; B: 8·25 mm. at shoulders; the height is equal at apex of thorax and at segment-margin 7-8.

Habits.—The imago lays single eggs on the young shoots of the foodplant. The larva, after emerging from the egg, makes a hiding place amongst the young leaves by drawing them together with silks; when larger, from the third moult onwards, it makes a cell at the point of a leaf with a lot of untidy web, eating the same leaf the cell is on. It lies with its head turned round on its side when at rest and shams death when disturbed, falling to the ground when possible. The pupa is fixed to a horizontal or vertical surface, hanging perpendicularly down, the suspension free but firm. The insect is our English "Painted Lady" and is found all over India, most plentifully in the hills, though it exists in great numbers in certain years also in the plains. It is a quick, strong flier and at times goes long distances. Generally, however, it takes short flights, rising from the ground to rest again a short distance off. It nearly always sits with its wings closed and often draws the front wings into the hinder ones, leaving just the costa and apical part visible. The underside is so designed as to harmonise perfectly with gravelly, sparsely grass or herb-covered soil which it nearly always affects and, once settled, it is difficult to see. It frequents flowers, generally preferring those of creeping, low plants and, when feeding thus, it holds the wings half open; also when basking in the sun. The distribution of the insect is all but worldwide; it has been found in all parts of India, Ceylon, Assam, Burma and Tenasserim. The foodplants of the caterpillar in England are thistles, upon one species of which it has been bred in Kashmir also; Mallow, Burdock, Viper's Bugloss, and Nettles even, belonging to the botanical families *Compositæ* (*Carduus*, Thistle and *Arctium Lappa*, Burdock), *Malvaceæ* (*Malva*, Mallow), *Borragineæ* (*Echium*, Viper's Bugloss), *Urticaceæ* (*Urtica*, Nettle) are eaten at home in England; in Kanara, here in Bombay, the larva has been found on *Zornia diphylla* of the *Leguminosæ* and the compositaceous *Blumea*. By which it will be seen that there is no limit to the distribution arising from the want of things to feed on. The butterfly has been found in great numbers in the Sind deserts as well as in the dense forests of Kanara, though in the latter it is really plentiful only in certain years.

59. Vanessa indica, *Herbst.*—Male and female resemble *V. cardui*, but the

ground-colour is darker both on the upper and under sides and the orange markings deeper and richer in tint. Differs also as follows:—*Upperside* forewing: the ochraceous red on disc and across cell proportionately of less extent and uniform, not getting paler towards apex of cell; the upper four spots of the preapical series on the black apical area minute. Hindwing: the postdiscal transverse band much narrower and shorter, not extending below vein 1, margined inwardly by a series of broad, black, subcrescentic marks; the tornal angle with a small patch of violet scales bordered inwardly by a short, thick, black, transverse line. *Underside* very much darker than in *V. cardui*, the orange-red on disc and cell of forewing restricted as on upperside; three small, transversely-placed, blue spots beyond the cell. Hindwing: the mottling comparatively very dark, purplish black with slender white margins, shaded on disc with rich dark olive-brown; the postdiscal series of ocelli dark and somewhat obscure; an inner, subterminal, transverse series of blue and an outer, very much slenderer, transverse series of black lunules. Cilia of both fore and hindwings white, alternated with brown. Antennæ black, tipped with pale ochraceous; head, thorax and abdomen with dark olive-brown pubescence; beneath, the palpi, thorax and abdomen pale ochraceous brown. *Exp.* 58-70 mm.

This butterfly has not been bred as far as is known. It is a very close relation of our English Red Admiral, differing only in the greater irregularity of the orange markings on the upperside. It is not really a butterfly that ought to have been mentioned in these papers but, on second thought, it was thought advisable to include it because it has such a wide range in India. It hardly ever occurs in the plains and certainly never breeds there; it is found generally above 2,000 feet in the hills: the Himalayas, the Nilgiris, &c., but not, as far as has yet been ascertained, anywhere in the Western Ghats from Thana to Kanara in the Bombay Presidency. The butterfly extends to Southern Europe and the Canaries, eastwards to China, Japan and the Malay Peninsula.

The following is a description of the larva, pupa and habits of the Red Admiral or *Vanessa atalanta*, which will probably be similar to those of the above.

Larva.—The larva is of the typical nymphaline sort, all spines of equal length, branched on all segments except head and segment 2, where they are much shorter and simple; body cylindrical with anal end sloping, the anal flap triangular with somewhat tumid end or point. Segment 12 is somewhat triangularly produced back in the dorsal line. Head heart-shaped, flat-faced, somewhat bi-lobed, shiny, bronze-black covered with light hair-bearing ochraceous tubercles; ten short, cylindrical, blunt, simple spines round margin of face with four more in a row in front; two slightly larger lower down, subdorsal, one on each side of clypeus apex; antennal

basal joint ochreous, the other two black; eyes prominent, black; labrum black. Clypeus large, triangular, not very distinct. Segment 2 the same breadth or somewhat broader than head but not so high, with a row of eight simple, short, triangular, black teeth or tubercles from spiracle to spiracle, and a simple, cylindrical, short, spine underneath spiracle; on segments 3 and 4 this simple spine is present in the same position and, besides, a subdorsal and lateral black spine, pointed and set with fine hair-like spinules directed out and upwards, also black. Segments 13 and 14, the former segment being short, have each a dorsolateral similar watery-ochraceous spine, situated near the hinder margins. Segments 5-12 have each a dorsal, subdorsal, supraspiracular and subspiracular similar spine, all more or less ochraceous and set with black spinules, all except the subspiracular spines on segments 3-9 being surrounded at the base with orange somewhat broadly. Spiracles shiny black, oval, of usual size. Surface of body set all over with very minute, white, depressed tubercles, each bearing a fine, white short hair; spiracular region rather more thickly white haired. Colour of larva black, speckled yellow all over—or yellow speckled all over black with a broad yellow subspiracular band from segment 5 to segment 12 interrupted broadly by the tubercles; belly dark; legs black. The subspiracular spines are somewhat shorter than others, those on segments 3 and 4 being, perhaps, just a little stronger than any. L: 35 mm. stretched; B: 6 mm. without spines, 9 mm. with them.

Pupa.—The pupa is of the usual *Vanessa* type, *i.e.*, when seen from above the lateral outline is as follows: head parallel-sided, the front concave with the head-points short, broad and blunt; breadth of pupa increasing somewhat suddenly to a sharp tooth at shoulder; then concave to another similar tooth in a line with apex of thorax, where the breadth of pupa is very much the same; then concave again, but very shallowly, to segment 7-8, where the wings are slightly bulged and the pupa is not so broad; then decreasing in a straight line to the strong, truncated-triangular cremaster with slight dorsal and strong ventral extensor-ridges, the clasper-scar being a double circle inside the latter. The dorsal outline seen from the side is: head and vertex, segment 2, both short, the front slope of thorax at an angle of 45° to the longitudinal axis; the thorax is carinated in dorsal line strongly, ending in a small triangular pyramid just before hinder margin to which the fall is nearly perpendicular, segment 4 being inclined at 45° towards segment 5 which is parallel to longitudinal axis and forms the bottom of the considerable dorsal constriction; the dorsal line again rises in segment 6, very slightly in 7, whence it is strongly curved down to end. Ventral line slightly bulged out towards centre though fairly straight from head to segment 11, after which, bent down. Surface of pupa smooth in the main, with an irregular net-work of thin, slightly impressed lines all over, the antennæ ringed, the proboscis slightly longer than wings;

there is a slight carination from each head-point to the dorsal carination of thorax at hinder margin of segment 2 and another from apex of this latter carination to hinder margin of thorax laterally; there is a lateral, small, conical, pointed tubercle centrally on segments 3-12, slight on segments 5 and 12, strongest on 7, 8, 9; signs of dorsal similar tubercles on segments 5-12; hardly a vestige of the supra or subspiracular ones. Spiracles of segment 2 mere red-brown slits; the rest oval, colour of pupa slightly convex, with red-brown, narrowly oval centres. The abdomen is somewhat laterally compressed; the lateral constriction is much slighter than dorsal. Colour is a light violet grey-brown with golden reflexions; each tubercle being touched with gold, the dorsal ones surrounded with gold on the abdomen, the lateral one on thorax also and on segments 4, 6, 8, those on 3 and 8 largely; the golden reflexion on the wings is greenish and subcutaneous in appearance. L: 21 mm.; B at shoulder-points: 8 mm.; 4·5 mm. at head; 7 mm. at segment 8; H. at segment 8: 8 mm.

Habits.—Egg laid underneath point of leaf, larva makes a little untidy web-cell by turning over point; continues this in after stages, but of course has to use whole leaves later on; uses much web; lies generally on the upper surface of the chamber thus made and very generally curled round with its head on its side and the body contracted to appear thicker and shorter than it really is. Pupates in a dark corner, if possible, either against a perpendicular surface or from a horizontal one, the attachment being free but firm. Butterfly is fond of the sun, perches and basks on the ground with wings fairly widely open, is fond of sucking at flowers, rotten fruits, &c.; can fly well and rapidly and takes long flights; rests with wings closed, the front wings sunk within the hinder. The place chosen for ovipositing is generally in a sunny place along a wall or hedge or ditch. The larvæ are somewhat liable to be parasitised by ichneumons. The food plants are nettles (*Urtica.*)

Bingham enumerates twelve species of the genus *Vanessa* as inhabiting British India, besides two races and one variety. Some of them are very like the Tortoise-shells at home, others like the Comma. The genus is world-wide in its distribution, existing in both hemispheres, and the majority are palæarctic and nearctic, only a few species extending to the Tropics. The majority of the Indian species are found in the Himalayas and along the northern limits of British India. All feed in the larval stage on nettles,

willows, poplars, some *Saxifragaceæ* (Gooseberry and Currant), the Painted Lady on Thistles and other *Compositæ*, *Leguminoseæ*, *Malvaceæ*, &c. The type of the genus is the Red-Admiral.

60. Hypolimnas bolina, *Linn.* [Pl. B., fig. 7 ♂, 7*a* ♀]—*Wet-season form.*—Male *upperside* velvety black. Forewing: an oval shining irridescent blue patch, broadly centred with white and traversed by the black veins obliquely crossing interspaces 3, 4, 5; two preapical, obliquely-placed, elongate, white spots and a postdiscal, inwardly-curved, transverse series of minute white dots. Hindwing: a central, oval, shining, irridescent blue patch, broadly centred with white and traversed by the black veins as on the forewing, but larger; a postdiscal series of minute white dots, in continuation of that on the forewing. Fore and hindwings: cilia white, alternated with black. *Underside* deep purplish brown. Forewing: some minute white flecks on and just below basal half of costal margin, with a row of three or four larger spots below them, an oblique discal series of three very slender streaks and elongate oval spots from costa to interspace 3, two preapical white spots continued as a postdiscal transverse row of white spots as on upperside, followed by an inner and an outer transverse subterminal series of lunular white marks and a terminal dark line. The series of lunular white marks sometimes complete but generally well defined only below vein 5. Hindwing: a tolerably broad, discal, white band traversed by the black veins; a postdiscal transverse series of minute white dots in continuation of that on the forewing; an inner subterminal series of elongate whitish markings and an outer subterminal slender, white, lunular, broad line, followed by a terminal dark line. Antennæ, head, thorax and abdomen black; beneath, the palpi, thorax and abdomen dark purplish brown.

Female *upperside* dark velvety brown, paling towards the outer margins. Forewing: three or four irridescent blue spots from base of cell along and just below costa to before the middle, from the middle of costa an oblique series of rich irridescent blue marks to interspace 3; a postdiscal, sinuous, transverse series of white spots, an inner subterminal series of short transverse white, narrow markings in the interspaces and an outer subterminal series of white lunules. Hindwing: a postdiscal transverse series of white spots followed by a series of double cone-shaped white marks, one in each interspace, and an outer subterminal series of white lunules. *Underside* dull brown. Forewing: minute white flecks on, and one or two white spots just below basal half of costal margin; an oblique discal series of spots, two preapical spots, a postdiscal transverse series of spots, an inner subterminal series of somewhat cone-shaped marks and an outer subterminal series of lunules white, often sullied with yellowish. Hindwing as on upperside but with the addition of a very broad discal, somewhat diffuse and obscure, whitish, transverse band and the cone-shaped inner subterminal

white markings of the upperside more continuous, separated only by the slender brown veins. Antennæ, head, thorax and abdomen as in male.

Dry season form.—Male and female similar to the male and female of the wet-season form but with the following differences:—larger; the irridescent blue patches proportionately larger; the hindwing in the male with, on the upperside, a more or less well-marked subterminal highly sinuous pale line; the forewing in the female with, on the upperside, one or two irridescent blue spots just below basal half of the costa; the inner subterminal transverse line of white markings much broader, each emerginate on the inner side. *Underside*: male: ground-colour hair-brown; basal half of forewing dark brown. Hindwing: the discal band and inner subterminal markings broader, diffuse and irrorated with dusky scales.—Female: hindwing entirely without the transverse broad, discal, whitish band, or sometimes this band represented only by a pale shading. Exp. Male: 52-96 mm.; female: 62-114 mm.

This is a variable insect.—Male: the blue patch on the upperside of the hindwing is sometimes in both seasonal forms entirely devoid of the pale centering, and, in the "dry season" form, specimens occasionally occur in which the inner and outer subterminal markings on upperside of hindwing are just as prominently developed as in the female, but they are then always nearly pure white. Female: the discal oblique irridescent blue spots on the upperside of the forewing in both seasonal forms occasionally reduced to one spot. The underside in both seasonal forms is also variable as to the preserce or absence of the discal white band and subterminal white markings on the forewing, these latter are often much reduced in size.

In the above description the forms are alluded to as "wet" and "dry" by Colonel Bingham. This is not really quite correct. The size and brilliance and depth of colour depend more upon the plenty and succulence of the food-plants than upon the actual state of the atmosphere. It is in the wet season that the weeds upon which the larvæ feed are most numerous, and, generally, from the middle to the end of the period, that is, from the end of July onwards to, say, in low-lying damp situations, the end of December or even later. During the rest of the year to well on into the monsoon, the herbaceous growth is poor and sparse. So it comes about that the larva of the so-called "wet" form is not so well nourished as that of the later one and produces consequently a smaller and less brilliantly coloured imago. It would thus appear that instead of "wet" and "dry" seasonal forms, it would be more accurate to speak of, say, "starved" and "well-fed" seasonal insects.

The pictures of the male and female in the coloured Plate B are, on the whole, very good, except that, in the male, the postdiscal series of minute white dots on the upperside of forewing is absent. The dots are invariably present in the butterfly. The tone of the ground-colour in both figures is

reddish; there should be no red in it. This tint is particularly strong in the figure of the female and especially on the underside. The blue irridescence is wonderfully well reproduced.

Egg.—Is nearly spherical, broadest at a third of height from base. There are 10 thin, high, distinct meridional ridges from base which lose themselves on the vertex where there is a round, smooth, shiny space. Colour is glassy green. The egg is very small for the size of the insect. Breadth 0·6 mm; height very nearly the same.

Larva.—The larva is spined, has a cylindrical black body with greyish satiny marbling; the head has two long horns, these horns being generally black, while the rest of the head is yellow. Head is heart-shaped, the face is very slightly convex in centre and is broadest across apex; on the vertex of each lobe is an erect, spinous, hard process or horn in the same plane as the face and diverging one from the other, separated somewhat narrowly at bases by a triangular sinus; the top of each horn is more coarsely and densely spined than the stems, where the little spines are sharp and thickened at the bases; the colour of head is brown-yellowish and shiny with a round black spot at the base of each cheek; the horns are generally black. Segment 2 is nearly as broad as the head. The body is cylindrical, constricted at the segment-margins somewhat, perpendicular and high at anal end which is rounded. Spiracles are oval, black and rather large. Surface of the body is velvety looking; there are the following spines: on segment 2: a central row of 8 small simple spinous hairs, four on each side of dorsal line, and 2 antespiracular, spinous processes one below the other, the lower being the larger of the two, though both are small; segments 3 and 4: a large subdorsal and lateral spinous process and 2 small subspiracular ones both on the same level, one behind the other, and half the size of the others; segments 5 to 11 have each a dorsal, subdorsal, supraspiracular and subspiracular spinous process as well as 2 small ones below the last, one below the other on segments 5 and 11, both at the same level on segments 7 to 10 and a triangle of 3 on segment 6; segment 12: 2 large dorsal spinous processes, one near front margin, one near hinder margin, a subdorsal one, a supraspiracular one somewhat nearer the front margin, and a subspiracular one as well as a single small one underneath the last; segment 13 has a single lateral process and the anal flap has one on the margin about middle. The colour of the body is velvety black indistinctly marbled with satiny greyish; the neck or front part of segment 2 is orange; latter half of anal flap is dirty brown as well as prolegs and true legs; all spinous processes are dirty light reddish-yellow in colour. The processes are about equal in length to each other throughout, except the small ones above mentioned, which are much smaller. L: 57 mm.; B: 5 mm.; L of head-horns: 3·5 mm.; L of spinous processes: 3 mm.

Pupa.—It is a thick, stout pupa, as broad at the shoulders as at segment 7-8, where it is nearly quite circular in transverse section; the thorax at its highest point is as high as the abdomen at segment 7-8; constriction behind thorax is dorsally pronounced but wide and gradual laterally. Head is thick, square and short, not visibly separated from segment 2, and has a small, rounded, flat-edged projection on each eye pointing forwards. Segments 2 and 3 and head are all in one piece so to speak. Thorax is high, carinated in dorsal line somewhat on front slope, the shoulder produced into two stout short points. Wings somewhat expanded laterally from shoulders to constriction. Transverse section of abdomen circular, the last five segments contracted a good deal, especially ventrally, so that the last segment and cremaster are nearly at right angles to the longitudinal axis of the pupa. Cremaster large, stout, triangular, flattened above and below with the suspensory hairs or hooklets at the very extremity. Spiracles blackish, shiny, oval, convex. Surface of body is rough; there is a conical lateral tubercle on thorax, a dorsal row of 6 sharply conical tubercles on segments 6-11, one to each segment; a subdorsal row of similar rather larger ones on segments 7-11, one to each; these subdorsal tubercles existing also on the other segments but being there smaller than the dorsal ones; a lateral row of 6 similar ones on segments 6-11, of which only those on segments 7 and 8 are of the size of dorsal ones, the others being mere dots; anal segment has two small thick tubercles, one on each side of base of cremaster. Colour of pupa is dark brown-grey splotched with grey on wings and segments 4-5 principally. L: 20 mm.; B: 8 mm.; L of longest tubercle: 1 mm.

Habits.—The eggs are laid singly or in groups of six or seven on the undersides of very young leaves just above the ground; the larvæ is generally found, when full grown or moderately large, crawling about on the ground, but rests, if possible, half on the stem of its plant, half under a leaf. The butterfly is one of the commonest in the better wooded parts of India, the female especially being one of those most often met with in gardens, plantations and woods where there is a plentiful ground-flora of urticaceous plants which constitute the food of the larvæ. These butterflies may be seen at all times of the year, but more especially in the damp months, flying about near the ground upon which they constantly settle, often walking from one small plant to another; at times they fly into the verandahs of houses and settle on the ceilings and walls with their wings folded over their backs and remain stationary for hours together; in the jungles they are constantly found resting similarly on the undersides of branches, leaves, &c. The males are fond of the sun and sit upon leaves and sticks with the wings

often outspread exposing the glorious irridescent purple and blue colours so characteristic of the insect; they are very pugnacious and attack any other butterfly flying past with great zest and pertinacity, chasing it for considerable distances, to return always to the same perch on leaf or stick. This is perhaps the reason why so many ragged specimens of the sex exist as compared to the females; and it is not an easy matter to catch a perfect male. The males are found even on the tops of the highest hills, where the females are rarely met with; they go up to enjoy the sunlight and free air; perhaps, also, they are fond of company and enjoy the pleasure of hunting the males of other species that come up to bask in numbers during the hottest hours of the day. The larvæ are active and eat voraciously. The pupa is formed on the under-side of a leaf, sometimes from the perpendicular face of a rock or from a branch of a tree; and always hangs loosely, though it is quite strongly attached to a copious pad of silk. By colour, shape and general appearance it is "protected" and is not easily discovered. In the months when the food-plant is plentiful (generally from October to January) the development from egg to imago is very rapid, in the really dry weather the time is more prolonged. The food-plants of the larva are all urticaceous, that is belonging to the same family as the figs and jack-fruit; only they are herbaceous and not trees. Two of the plants it has been found on are *Fleurya interrupta*, Gaud, and *Elatostemma cuneatum*, Wight. It is said that the larva feeds also on the food-plant of the next species, *viz.*, *Portulaca oleracea*, Linn., but this requires confirmation. This species is distributed throughout Indian limits and extends to the Malayan subregion and China.

Dr F. Moore gives the genus *Hypolimnas*, Hübner, as a synonym of *Apatura*, Fabricius. The type of *Apatura* is *Apatura iris*, the purple Emperor of Europe and the larvæ of it and *Hypolimnas bolina* and *misippus* have nothing to do with each other, being very dissimilar. As remarked before, the larvæ of *Apatura camiba*, *Euripus consimilis* and *Apatura iris* are very similar, those of *Charaxes* and *Eulepis* are rather like them; they are all naked except the heads which are armed; those of *Hypolimnas* have armed bodies like in the vanessine group.

61. Hypolimnas misippus, *Linn.* (Pl. B., figs. 8 ♂, 8*a* ♀).—Male *upperside* rich velvety dark brownish black. Forewing: a broad, oval, oblique white spot from below vein 3 to vein 7 and a preapical smaller similar white spot; both spots crossed by black veins and surrounded by irridescent blue. Hindwing with a much larger, similarly rounded, white spot surrounded by irridescent blue, but the veins crossing it yellowish, not so prominent as on the forewing; two or three minute specks of white at the tornus. Cilia of both fore and hindwings white alternated with black. *Underside* forewing: bases of interspaces 1 and 2 and cell rich light castaneous, discal area fuscous brown; apical half golden brown; basal half of costal margin flecked with white; cell anteriorly black with three white spots; a narrow, transverse, very short, white mark beyond apex of cell; a very broad somewhat oval discal white patch from costa to middle of interspace 2 edged with diffuse dusky black; the preapical white spot as on the upperside but not surrounded with blue, continued posteriorly as a transverse series of small postdiscal white spots; an outer transverse series of white lunules divided by a sinuous black line followed by a terminal black line. Hindwing: basal and postdiscal areas chestnut-red; a black spot at base of vein 8 defined by white lines; a very broad medio-discal white band from costa to dorsum, crossed at apex of interspace 1*a* by a transverse black mark, beyond the middle of interspace 7 by a broad black bar and, in interspace 7, bordered inwardly by black; a postdiscal series of small white spots in continuation of those on the forewing; an inner subterminal series of paired, subtriangular, small white spots, an outer subterminal line of slender white lunules, an intervening black sinuous line between the two series and a black terminal line. Cilia of both wings white alternated with black. Antennæ, head, thorax and abdomen dark brown; beneath, the palpi and thorax white, the abdomen black banded white. Female is polymorphic, that is, has several different forms.

First form.—Upperside: rich tawny. Forewing: the costa, the apical half of the wing and the termen black, the inner margin of this black area follows a line crossing the cell obliquely and curving round to near the apex of interspace 1*a*; a white spot beyond apex of cell; an oblique band of elongate white spots, a more transverse, short, subapical series of three or four much smaller white spots, and an inner and an outer subterminal transverse series of very small, slender, white lunules. Hindwing: a transverse round spot in centre of interspace 7, a dusky spot showing through from underside at end of cell, the terminal margin broadly black, the latter traversed by two transverse series of paired, white, small lunules. Cilia of both wings alternated white and black. *Underside*: paler tawny yellow, the disc of the forewing deeper tawny; the markings are much as on the upperside but differ as follows:—Forewing: three white spots along the anterior margin of cell, the black on the apical area beyond

the oblique band of white spots replaced by golden. Hindwing: a black spot at base of vein 8, another at base of interspace 5, and a postdiscal transverse series of small white spots in addition to the markings as on the upperside.

Second form.—Similar to the above but the disc of the hindwing on both upper and under sides white.—*alcippoides*, Butler.

Third form.—Similar to the first form, but on the forewing, the oblique series of elongate spots yellowish and the middle portion of the black apical area tawny. Exp. 70-90 mm.

Larva.—The caterpillar is extremely like that of the preceding species; body thickest in the middle, tapering to head in the front three segments and very little to anal end in segments 13 and 14; these last two segments have the dorsal line a quarter-circle curve, the anal flap itself being in a plane at an angle of 90° to the longitudinal axis of the larva: this flap is rather large, triangular in shape, with the apical portion somewhat swollen in the centre; the legs are not large, the prolegs are cylindrical and stout. The head is nearly square, somewhat convex laterally, conspicuously bilobed with a cylindrical, not very stout, tuberculate horn or process on the vertex of each lobe, these horns being very slightly curved and directed somewhat forwards out of the plane of the face; the face is nearly flat; the clypeus fairly large and triangular; the surface distantly lowly-tuberculate, each tubercle bearing a short hair; some longer hairs at base and sides of face; the colour of head is orange with a broad black line on each side of clypeus, not reaching its vertex nor its base and a shorter and narrower one above, nearer the vertex of head; the horns and eyes are black, the jaws and ligula dark coloured, the labrum and second antennal joint dirty watery white. The surface of the body is dull and somewhat velvety with the usual spinous processes: one subdorsal, one dorsolateral, one supra and one subspiracular and two or three more small ones below that again—as in *Hypolimnas bolina*; all processes are dirty glassy white as well as the spines at their bases; the spines further up are black; the surface is covered also distantly with minute white tubercles arranged more or less in transverse rows across the segments. Spiracles deep black with narrow, raised, shiny, black borders and are oval, flush, rather large. The colour of body is chiefly black, velvety in a dorsal, rather narrow band and in the lateral centre of each segment, smoky with a greenish tinge elsewhere; many minute, orange circles surrounding the minute tubercles; the spiracles also surrounded with orange and the subspiracular region blotched orange; belly smoky black; pseudo-legs and true legs shiny orange. L: 48 mm; B: 7 mm; L. of body spinous processes: 2·5 mm; of horns: 3 mm.

Pupa.—The chrysalis of this species is very similar indeed to that of the last; there is so little difference in shape, colour or anything else that it

needs no separate description. In size the variation is less, as might be expected from the small difference in the measurements of the imagines of the present species as compared to those of the preceding.

Habits.—The ways of the larva are much the same as for the last species except that, the food being somewhat more limited, it is not so commonly met with; it is not so plentiful in the regions of heavy rainfall and forest as *H. bolina*. The butterfly has also much the same habits as that species though the female is very much more rarely seen than the male, which is not the case with *H. bolina*. The male sits on the undersides of leaves within two to six feet of the ground when resting during the day-time and at night when the wings are closed over its back, the forewings sunk between the hindwings; it is not quite so pugnacious as the preceding species and is only very occasionally seen in houses—probably because the individuals are not numerous enough. The insects are not often seen at flowers. The flight is strong, though never long sustained, of the ordinary "skipping" type, though less pronouncedly so than, for example, that of *Charaxes*; the pace is sometimes very fast, at other times fairly slow and it never carries the insect to any great height above the ground. The males are fond of basking on low bushes and even on the ground in the sun. The food-plant is *Portulaca oleracea*, Linn., (*Portulacaceæ*), a spreading weed with succulent branches, thick fleshy leaves, and yellow flowers, lying more or less flat on the ground, belonging to the botanical family containing the spinach and is itself often used as a vegetable in India. The plant is commoner in the open, drier parts of the country than in the forest-clad hills where there is plenty of rain. Like the plant, the insect is naturally more plentiful in regions of moderate rainfall than where the monsoon is heavy. It is, however, found throughout Indian limits, Ceylon, Burma and extends to the Malayan subregion and China.

62. Kallima horsfieldi, *Kollar.* (Pl. D, fig. 21).—*Dry-season form.*—Male and female *upperside* indigo-blue; in some specimens with a decided green tint. Forewing with a broad, oblique, slightly curved, sinuous-edged, pale blue band turning to white on the anterior half; the distance measured on the costa of the outer edge of this band from the base of the wing greater than half the length of wing; its inner margin bordered by short, obliquely placed, detached, linear, black markings; apical area beyond the band jet-black with a preapical white spot; medial hyaline spots, the lower variable

in size, in interspaces 2 and 3. Hindwing uniform, the costa and apex broadly and the abdominal fold, brown; vein 1 with long, soft, greyish-brown hairs along its length, extending also over the abdominal fold. Fore and hindwings with a dark-brown, subterminal, zigzag line commencing below vein 3 on the forewing. *Underside* resembling a dry leaf; ground-colour variable but usually some shade of brown (rusty, greyish and ochreous brown being the most common), always with scattered dark dots or little patches having the appearance of fungous-like or lichenous growths so common on dead leaves in the tropics. When the insect closes its wings over its back the likeness to a dead leaf is most striking and is heightened by a straight, narrow, transverse, dark band running from the apex of the forewing to the tornus of the hindwing, often with oblique narrower, similar bands or lines given off from it, all simulating the mid-rib and lateral veins of a leaf; the hindwing in all specimens has a more or less obsolescent or faint series of postdiscal ocelli, traces of which are also apparent on the forewing. Antennæ dark-brown; head, thorax and abdomen very dark greenish-brown; beneath, the palpi, thorax and abdomen ochraceous earthy-brown.

Wet-season form.—Male and female similar. Differs in colour of the discal band on the upperside of the forewing; this is of a uniform pale blue of a slightly lighter or darker shade, varying individually, but not turning to white towards the costal margin as in the dry-season specimens. *Underside:* ground-colour on the whole darker than in the dry-season form but with the same protective colouring.

The apex of the forewing and the tornal angle of hindwing are more produced in the female than in the male and much more produced in the dry-season form than in the wet-season form; the hyaline spots on the disc of the forewing may be large, small or entirely wanting in both sexes of both forms.

Egg.—Is lengthened dome-shaped, the top hemispherical, the transverse section of the rest circular, smallest at the base, the breadth slightly greatest at origin of hemisphere; twelve thin, distinct, raised meridional ridges from base, losing themselves towards apex of egg; surface smooth; colour exceptionally dark-green. B: 0·9 mm.; H: 1·2 mm.

Larva.—The larva is of the type of *Hypolimnas*. Head shiny black surmounted by two divergent horns pointing up and out at an angle of 135° with the plane of the face; their surface rugose with small hair-bearing, mostly thinly conical, but some cylindrical and longer tubercles, all black and shiny; surface of head with some long, cylindrical tubercles on cheeks and a few hairs elsewhere; clypeus rather large, triangular; the whole head shiny black, labrum only whitish. Spiracles small, oval, black. Body surface covered with fine hairs; the spines are all longly conical, rather finer than those of *Hypolimnas*, all flesh-red, ending in a fine black bristle,

rising from a swollen short-conical black base. Segment 2 has, on each side of dorsal line, four black, hair-bearing, cylindrical tubercles in a line one below the other, two blunt red spines one below the other in front of spiracle and two more below them in a line on base of leg; 3rd segment: one subdorsal bristle-bearing tubercle, one supraspiracular and three subspiracular in a triangle; segment 4 is like segment 3; segment 5 has one subdorsal, one dorsolateral, one supraspiracular, one subspiracular, all alike and two where the base of leg would be, one below the other; segment 6 has the same, but three on base of leg in a triangle; segment 7 the same, only two in a line under the subspiracular one; segments 8-10 like segment 7; segment 11 like segment 5; segment 12 has two dorsal, one near front margin, one near hinder margin, one dorsolateral, one antespiracular, one subspiracular and no more; segments 13 and 14 have one only supraspiracular; the latter segment is semicircular in outline, the end dull black in a dorsal triangular space. Colour is a fine rich reddish brown with a greenish tinge; prolegs with their outer faces shiny black; true legs shiny black. All spines the same length with a few fine black bristles set at an angle of 45°. L: 43 mm.; B: 7 mm.; L of horn: 4 mm.; of spines: 2·5 mm.

Pupa.—The pupa is of the type of that of *Hypolimnas bolina*. The head is produced into two short, conical, stout points, separated narrowly by a curved sinus; the points are directed straight forwards, one in front of each eye. Thorax strongly and highly carinated in the dorsal line with a strong tooth at shoulder and another immediately behind it on the line of wing, *i.e.*, the shoulder is double-toothed. Abdomen as stout in the centre of pupa (segments 7 and 8) as pupa at shoulders and as high as at apex of thorax, curved rather much at extremity so that the cremaster is nearly at right angles to the longitudinal axis of the pupa; this cremaster exceptionally large, slightly hollowed out above and below, consisting of a square basal piece followed by a smaller square piece, the attachment surface being at the extreme edge-centre. Spiracles of ordinary size, yellowish in colour with black central slit, longly oval in shape. Surface of pupa somewhat rugose; on abdomen are rows of conical bosses or tubercles: one dorsal, one subdorsal, lateral and spiracular; the dorsal tubercles large on segments 8 and 9; the subdorsal ones of segments 7-11 still larger and recurved, those on segments 8 and 9 being largest of all; the tubercles on other segments and in other rows are mere little knobs. Wings expanded as in *H. bolina* and the line of expansion is slightly curved. The colour is black-brown and yellow-pink; thorax, segment 8 and the regions of segments 11 and 12 being lightest in colour. L: 25 mm.; B: 9 mm.

Habits.—The egg is laid, generally single, on the underside of a leaf low down near the ground; the young larva emerges about three days after the egg is laid. It is a shiny light brownish-green at first with a shiny black head with a stiff, simple, curved

shiny black bristle on the vertex of each lobe; all the body-spines or processes are also simple, shiny black, curved bristles. It is 5 mm. in length by 1·5 mm. in breadth at the end of the stage. An egg laid on the 11th of August produced a larva on the 15th. This entered on the 2nd stage on the 19th and was then already like it was to be in the later stages, that is, the head was shiny black with a tubercled horn on vertex of each lobe and the body processes were tubercled and black, each ending in a black hair; the dorsal spines or processes of segments 5 to 12, which are not represented at all in the first stage, were now fully developed; the colour of the body was light greenish yellow-brown and shiny all over; the size at the end was 8 mm. by 1·5 mm.; that was on the 25th. It was in the 3rd stage on the 29th—had entered on it some time before—and the head was black covered with some longish spine-like black hairs and some light ones about jaws; basal antennal joint and labrum watery whitish. Colour of body red-chocolate, slightly ochreous at anal end with subdorsal spines or processes of segments 2-12 bright ochreous and the supraspiracular ones slightly ochreous on segment 3-9; all the rest shiny black. Spiracles oval, flush, black in colour. Surface of body shiny, rather greasy looking. L: 17 mm.; B: 3 mm. without processes. The larva generally sat on the underside of a leaf; latterly, as often as not, on the stem of the plant, generally slightly contracted and straight. It is sluggish in its movements and feeds generally in the mornings and evenings. It is fond of the shade and does not like the sun. The pupation takes place on the underside of a leaf or from a twig or against the stem of the plant and generally low down near the ground. The pupa is firmly attached though it hangs loosely. The butterfly is not likely to be found away from the hills and forest, neither will it be met with where the rainfall is scanty; indeed it is an insect of the dampest parts of India. The flight is very like that of *Hypolimnas bolina*: fast, somewhat devious and of short duration, of the usual up-and-down type where the wings are brought together over the back between the strokes; though it is sometimes varied by a short "sail" with the wings kept outstretched. *Kallima* keeps to the thick jungles, rarely visits hill-tops or open spaces, but is fond of clear nalla-beds in evergreen

forests where it may be met with sitting on a leaf or underside of a branch, or on a tree-stem ; occasionally taking a short flight after an intruding individual of its own species, that has a beat further along, to return to its post. It generally rests low down near the ground and very rarely rises far into the air ; when disturbed suddenly from the underside of a leaf or from a plant-stem it will fly up some short distance and then drop down into a thicket where it speedily disappears from sight among the leaves and twigs. Its habit of sitting with its wings closed over its back when at rest, added to the colouring and pattern of the underside and their shape make this an easy matter. The resemblance of the insect when at rest on a stem or twig to a dead leaf, always with head pointing downwards as is its habit, has been alluded to more than once already in these papers. It is, as has also been before stated, one of the Leaf-Butterflies of India and the name is known to nearly everybody, if not the insects themselves. The species mentioned here is depicted on coloured plate D, figure 21. The picture is very fairly good, though the colour is somewhat too reddish and the left-hand wing is not green enough. Place your hand over the left wing and the resemblance of the sitting insect to a dead leaf will be at once apparent ; though the particular type of underside chosen for representation is one of the least "dead" of the many types. It is taken from a wet-season male and these are always the most boldly marked and therefore the least "deceptive." *Kallima horsfieldi* hardly ever rests on the ground, except when drinking toddy under a palm that is being tapped, and is never seen at flowers ; it is fond of oozing tree juices and the gums exuding from ripe fruits. A whisky and soda in the jungles will often attract more than one. A sponge saturated with toddy is a very good bait, but it must be placed in spots frequented by them. They are difficult to catch with a net because of the sort of places they live in ; it is generally impossible to get a sweep with a decent-sized net, and they are extremely difficult to capture in a small one because of their quickness and "deviousness" of flight. So the best dodge to secure specimens is a toddy-sponge on the edge of a cleared space in an evergreen or nalla-bed and a smallish net. It is quite a pleasant occupation on a hot day.

Kallima inachus, Boisduval, is the Leaf-Butterfly with the broad orange band across the disc of the forewing one sees so often in collections; it comes from the lower elevations in the Himalayas from Kashmir to Sikkim and is found in Orissa, the Eastern Ghats, Pachmarhi, Assam, Burma and Tenasserim. *Kallima horsfieldi* is found in Western and Southern India from Bombay southwards, Ceylon, Burma and Tenasserim. There are two other species within British-Indian limits, more in the Indo-Malayan Region.

The foodplants of the larva of *Kallima horsfieldi* are of the botanical family *Acanthaceæ*; it has been found on several species of the genus *Strobilanthes*, the commonest being *S. callosus*, Nees, which covers the jungles on the Western Ghats as an undershrub in many places for miles and miles. It is a plant growing to 20' in height with a stem that may reach 2" in diameter but is generally less, rough, longly elliptical leaves which are pointed at one end and pink or bluish flowers with extremely sticky bracts that appear every seven years, after which the whole plant dies down. The flowers smell rather strongly but the scent is not disagreeable, and all the jungle animals are perfumed with it at such times from passing through the thickets. The plant being so plentiful, it is not to be wondered at that the larvæ are not easy to find; indeed, although the butterfly is very fairly common, it is rare to meet with more than one or two caterpillars during a whole year's wandering in the jungles where it exists.

The specimen figured in the Plate is a male of the wet-season form. The figure is fairly good though not bright enough; there is, as usual in these three-colour reproductions, too much red in it.

65. Cethosia cyane, *Drury*.—Male *upperside* tawny, in fresh specimens a rich reddish tawny. Forewing: anterior and apical two-thirds black, the margin of this colour waved and irregular, following a line dividing the cell longitudinally and circling round to near the posterior angle; a short, broad, oblique, white bar beyond apex of cell, the veins crossing it and a spot in interspaces 3 and 4 black; a transverse, indistinct row of small spots and a terminal series of ‹-shaped lunules white. Hindwing: three or four spots just beyond apex of cell, a subterminal row of spots and the termen broadly black, the last with a series of white lunules as on the forewing. *Underside* variegated with red, white, pale blue, ochraceous and black; the terminal margins of both wings broadly black with white

lunules as on the upperside ; in the middle of each lunule a short white streak from the margin ; cilia alternately black and white. Forewing : the cell with transverse bands of red, blue and black ; the base and disc below the cell red, spotted with black followed by pale blue, ochraceous and black; the white oblique band as on the upperside, beyond it a transverse incomplete row of lanceolate, white marks, with three black spots in each, followed by a terminal, ochraceous band paling inwardly. Hindwing : the base and cell pale blue and red, crossed by several broken, incomplete, black lines, then alternate bands of white and ochraceous, two of each ; the outer white band narrow and marked in each interspace with three black spots arranged as a triangle. Antennæ, head, thorax dusky brown ; abdomen above tawny, beneath white.

Female similar to the male in markings but the tawny ground-colour replaced by pale greenish-white, somewhat brownish on the upperside of forewing, the extent of black on this wing larger. *Underside* with all the markings paler than in the male, the red at the base of the wing replaced by brownish yellow on the fore, white on the hindwing. Antennæ, head and thorax dusky brown ; abdomen dusky above, white beneath. Exp. 90-100 mm.

Moore gives the larva as "Cylindrical, purplish-black, segments with alternate yellow and crimson bands ; head armed with two long spines, segments with dorsal and lateral rows of fine spines. Feeds on *Passiflora*, July."

The insect is found in the Himalayas, Mussooree to Sikhim, rare towards the west, Bengal, Orissa, Assam, Cachar, Arrakan, throughout Burma and Tenasserim.

64. Cethosia mahratta, *Moore*. (Pl. D, fig. 20).—Male *upperside* tawny yellow ; often with a rosy tinge on the basal half of forewing. Forewing : cell anteriorly along its length and the outer half of the wing, following an irregular line from apex of cell to tornus, black, the black in cell formed of coalescent transverse bars ; a broad, discal, oblique white fascia traversed by the black veins, followed by a postdiscal series of black-centred, outward-turned, slender, white lunules, a transverse series of white spots and another subterminal series of similar white lunules ; interspaces 1 and 2 with three or four black spots. Hindwing with broad black costal and terminal margins ; interspaces 1 and 1*a* with the markings of the underside showing through ; cell with some dull black transverse bars ; interspaces 1-5 with broad, median, short streaks from bases followed by a large spot margined with white, all black ; followed by a postdiscal series of black lunules with their points turned inwards, then a subterminal tawny-yellow band and a row of slender white, outward-turned lunules beyond. *Underside* variegated with ochraceous red, bluish white, yellow and black; the terminal margins of both fore and hindwing broadly black with white lunules, as on the upperside and median white short lines from the margin

in each lunule; cilia alternately black and white. Forewing: basal area ochraceous red, cell with transverse short bands of black and bluish white; below the cell: the ochraceous red at base, followed by whitish and then yellow, the disc spotted with black; the oblique white band as on the upperside, succeeded by a transverse postdiscal series of large black spots ringed narrowly with white with a row of paired black dots beyond and a subterminal, broad, yellow band, its inner margin sinuous. Hindwing: the basal area bluish crossed by broken transverse, broad, black lines and followed by a red, a bluish white, a yellow, a purer white and lastly a subterminal yellow band with rows of black spots between; on the white band a median series of large black spots. Antennæ black, head and thorax brownish-black, abdomen ochraceous; the thorax beneath ochraceous banded with black. Female similar, but the tawny yellow on the upperside paler, the markings larger and somewhat diffuse. Exp. 72-100 mm.

Egg.—The egg is cylindrical, round-topped, with a central, flat-bottomed cell surrounded by 7-9 little fossets from each one of which 2 moderately coarse "meridians" or ribs run to the base; each two ribs are connected by 7-10 parallel, transverse, finer ribs at right angles to them from top to base of the egg. The colour is shiny yellow; the height considerably more than the diameter.

Larva (Pl. I, fig. 9).—The larva is cylindrical, the head is horned, the body spined; the colour black, banded broadly red and yellow. The head is square seen from in front, depressed in the centre of vertex with a depressed line down centre of face; the vertex of each lobe surmounted by a long, fine, cylindrical, very finely spined horn, the two diverging and half as long again as the head is high; the colour of head is black, shiny all over, the surface covered sparsely with fine, erect, black hairs. Segment 2 smaller than head. Body quite cylindrical, the anal segment with dorsal slope, nearly perpendicular to longitudinal axis of body. Spiracles oval, with raised edges, conspicuous and black. Surface of body velvety, the connecting membrane between segments shiny; each segment with a subdorsal, long, pointed, very finely-tubercled spine; those of the 14th segment reduced to mere tubercles; an intersegmental similar, lateral spine between segments 2 and 4 and between segments 3 and 4; segments 5-13 with a similar central lateral spine, though somewhat shorter; segments 5-13 with a subspiracular similar, still shorter spine; the subdorsal spines are nearly as long as the head-horns, except those of segment 2 which are slightly shorter. The colour of body is very dark black-red with broad, central bands across the body, transverse to the length, bright red on segments 3-5, 7, 9-13, yellow on segments 6 and 8; the horns are shiny black as well as the spines. L: 42 mm.; B: 6 mm.

Pupa (Pl. I, fig. 9*a*).—The pupa is of the shape of *Hypolimnas* or *Kallima*, but is abnormal in having some of the abdominal tubercles developed into flattened expansions; the colour is also somewhat similar though more

variegated. Head quardrate, square in front with a flattened, spirally twisted process proceeding from the front of each eye, diverging one from the other at first, then converging towards the tips; they are not very long and are widely separated at their bases, they are toothed on the outer edge and have some small tubercles on the somewhat thickened extremities. Segment 2 is oval in shape (the dorsal visible portion, that is,) is convex transversely and is nearly 2/3 as broad as long. The sides of head and segment 2 are parallel, the shoulders have each a small, flattened, short, double-toothed process. The wings are suddenly expanded behind the shoulders into a short flat process which as suddenly ceases about segment 4: this expansion is also double-toothed at extremity. The thorax "hump" is hemisphere-shaped and is highly carinated in dorsal line from the front margin to apex. The constriction behind the thorax is wide and slight dorsally and laterally. Abdomen is circular in transverse section, decreasing in diameter from the stoutish segment 7 to the thick, broad, hexagonal, not very long cremaster which is hollowed out above and below. The wings are slightly curved in their ventral line of junction with each other; the ventral line of abdomen is nearly straight. The whole aspect of the pupa is slight for its length. On segments 2-12 is a subdorsal, longish, pointed tubercle, those on segments 6-9 and segments 11 and 12 have a thin, flat wing to each side of them, the plane of this wing being parallel to the dorso-ventral plane of pupa, the wings of the tubercles of segment 7 being exceptionaly large, those of segment 8 half the size, those of the other small. Segments 6-11 have a lateral pointed tubercle, segments 8-11 a subspiracular one also. There are paired ventral tubercles on the ventrum as also one at base of proboscis. Spiracles longly oval, dark in colour, of ordinary size. Surface of body finely rugose, transversely aciculate. Colour of pupa is brown marbled with white and grey and black, with a subdorsal gold patch on segments 2, 4, 5. L: 29 mm.; B at broadest part which is at the expansion of wings: 9·5 mm.; H at segment 7: 9·5 mm.; L of head process: 2 mm.

The figure is that of the male and is good although, as usual, not bright enough.

Habits.—The eggs are laid in groups of 15 to 20 and more on the undersides of leaves, generally of fairly fresh leaves. The little larvæ emerging, live gregariously there and continue the same mode of life up to the end, feeding in rows along the edge of a leaf. These larvæ are very active, eat voraciously and, consequently, grow fast; they are not very subject to insect parasitism; perhaps the vivid colouring makes them look rather dangerous. The pupation takes place, in rows very often, along and from a twig or stem, not necessarily of the food-plant. The pupa hangs loosely but

is very firmly fixed to a pad of black silk. It wriggles when touched. The larvæ drop to the ground when alarmed, especially when they are young. The imago or butterfly is, like the larva, protected from enemies by its taste; it is, consequently, somewhat difficult to kill by the ordinary thorax-pressure. Its flight is, as a very general rule, slow and, what is called, weak, somewhat like that of a danaine butterfly; it keeps near the ground amongst low jungle, always goes straight ahead, though by no means in a straight line and does not affect "beats" like *Danais* and *Euploea* often do. It does not bask, and stays a long time on the wing, resting near the ground in wet weather and at nights with wings closed over the back. It visits flowers. Its distribution is throughout Southern India in jungly places. The larva feeds upon *Modecca palmata*, Lamk., the wild Passion-flower of the family *Passifloreæ*, with grey-green, somewhat fleshy, lobed leaves and long, trailing tendrils, a globular, orange coloured fruit, about one inch in diameter, and a woody rootstock. The leaves and young parts are cooked and eaten as a vegetable by the coast people in Kanara. The caterpillar will eat the leaves of the cultivated passion-flower also.

There are six species of *Cethosia* found in Indian limits; others frequent the Indo and Austro-Malayan Regions.

65. Atella phalantha, *Drury* (Pl. C, fig. 10).—Male and female *upperside* bright ochraceous yellow, spotted and marked with black. Forewing: cell crossed by three short, sinuous lines and one along the discocellulars, a series of spots beyond, bent inwards below interspace 4 and continued immediately below the median vein, followed by two transverse series of discal spots, a postdiscal series of continuous lunules, a subterminal slender line, and a terminal series of spots at the apices of the veins. Hindwing: basal half with three or four transverse rows of obscure spots, better defined anteriorly, a discal series of four spots, a postdiscal series of slender lunules, a subterminal sinuous line, and a row of terminal spots as on the forewing. *Underside* paler ochraceous, the markings much as on the upperside but fainter and paling to reddish-brown; the terminal spots of the two discal rows on the forewing large, conspicuous and black. Forewing stained with pale purple between the transverse lines across the cell and beyond its apex, also broadly along the terminal margin in the middle of the wing. Hindwing: the outer half more or less suffused with pale purple. Antennæ, head, thorax and abdomen dark ochraceous; thorax and abdomen beneath whitish. Exp. 50-63 mm.

Larva.—The larva is spined like that of the last species but has the head without horns and quite-smooth; the colour is oily brownish-purple with black spines. Head dark brown-yellow, with a still darker brown clypeus, centred at base by a white triangle; a large oblique black spot at base of each lobe over eyes reaching half way up face in some specimens; the shape is that of a heart, the broadest side being the vertex. The body is cylindrical, slightly constricted at segment margins; anal end perpendicular to longitudinal axis of larva, rather high; the head is somewhat broader than segment 2, nearly as broad as the body is in middle at segment 7, which is the broadest part of the larva. Spiracles black, bordered narrowly with white, oval. Surface oily-shiny, with the following spines, themselves set with fine setæ: segment 2 with one subdorsal, a lateral one on segment margin 2/3; segment 3 with one subdorsal and one on segment margin 3/4; segment 4 one subdorsal; segments 5 to 12 have each a subdorsal, lateral (might be called supraspiracular) and subspiracular; the 13th has a subdorsal spine and segment 14 a lateral one on margin towards middle of segment. All the spines are of nearly equal length, not as long as the body is broad in the middle. The colour of the body is purple-brown, oily looking, with a subspiracular waved white line; belly reddish-brown, spines and their setæ shiny black rising from black tubercles, except the subspiracular ones which are whitish and rise from yellow-brown tubercles. L: 30 mm. B: 5 mm.

Pupa.—The pupa is of more or less ordinary shape, bright green, marked with black, rose-crimson and mother-of-pearl. The head is square with two minutely black-tipped, conical tubercles, one on each eye, directed straight forwards; the eyes bordered with red in front. Segment 2 is flattish on top; thorax is rather square seen from above, convex; shoulders angled; constriction at segment 5 dorsally little, laterally wide and shallow. Wings expanded latterally slightly from just behind shoulders to segment 6. Abdomen stout, curving at end, so that the last segments have their axis nearly at right angles to the longitudinal axis of the pupa. Cremaster compressed laterally, the extremity being longer than broad, and set with suspensory hooklets, so that the pupa hangs horizontal to the surface to which it is fixed. Spiracles of ordinary size, oval, slightly raised. Surface shiny, smooth except for a pair of small, conical, sharp tubercles to each segment, subdorsal, one on each side; they are hardly visible on segments 4, 13, 14; small on segments 6, 8, 10, 12; larger on segments 7, 9, 11; those on segment 2 are also small; on thorax there is an additional lateral one. The colour is a bright, clear, grass-green; all the tubercles are mother-of-pearl, tipped with black and rose-crimson; the wings have one long mark along the inner margin, mother-of-pearl bordered with rose-crimson, reaching from shoulder to near the tornal angle, and another, similar, reaching from just behind shoulder to half way towards

costal margin on the disc. When the pupa is formed away from a surrounding of green leaves, say in a breeding-cage, then the colour may be grey with black patches and marks but no red or mother-of-pearl. L: 17 mm.; B: 6 mm.

Habits.—The egg is laid upon young shoots; the trees are generally all and wholly a mass of young shoots during the great laying time in March-April. The larva lives on the underside of a leaf, is extremely active, running about at a great pace and falls by a silk when touched or alarmed at very slight provocation. It turns green before pupating but is otherwise always of the colour given in the description above. It is very common in most parts of India all through the year except in the seasons of heavy rain. In Kanara, for example, it is hardly to be found at all in the months of June to October and there is little doubt that this off-time is passed in the egg state. The growth of the caterpillar is extremely rapid, the time from the laying of the egg to the newly-born butterfly occupying but the short space of twenty-one days! Truly a most marvellous performance when the number of changes the insect goes through is considered; the egg-stage, five moults during the larval life, then the pupal state. The butterflies emerging in the cold weather are lighter in colour above and have much more purple suffusion beneath than the ones that see the light in April and May when the shoots are possibly more succulent than the earlier ones; indeed the latter insects may have hardly any purple at all and have, in that case, the black spots much more clearly defined on the underside. The flight is powerful and quick, like most of the *Argynnis* tribe, for to that type the present insect belongs. It is not long sustained, however. The insect is fond of flowers and basks in the sun on leaves of trees and bushes, generally not far from the ground, sometimes, though sufficiently seldom, on the earth itself; it is an insect of open, sunny places and shuns the shade, being more numerously represented, therefore, on the borders of the heavier jungle tracts and out in the open plain country than in the jungles and hills of India. It rests with its wings closed very generally and always on the top of leaves; but often, when sporting in the sun-light, it settles with the wings half open, working them towards and away from each other while sitting. The flight consists of an exceptionally quick motion of the wings

towards and away from each other with very little "skip" up and down, though there may be much deviation to either side from the straight course. The butterflies are rather pugnacious amongst themselves, pursuing each other on the wing with great vigour and determination. The food-plants are, as far as is known, all belonging to the same genus, *Flacourtia* (*Bixineæ*); the two species the caterpillar has been found on are *F. ramontchi*, L'Herit. and *F. montana*, Grah., both common in the Western Ghats, the former spread throughout Continental India. The insect is found also nearly throughout Continental India, in Ceylon, Assam, Burma and Tenasserim, extending to China, Japan and the Malayan Sub-region. The Assamese species of the food-plant, *Flacourtia cataphracta*, Roxb., extends to China and the Malay Islands and probably Japan.

There is another species of *Atella*, occurring very locally in the District of North Kanara, which has been obtained lately in Travancore and is known from Ceylon; it exists also in Sikhim, Assam, Cachar, Arrakan, Burma, and extends into the Malayan Sub-region. No specimen has ever been got from any part of India between Assam and Kanara, nor from anywhere on the East Coast. The larva is very like that of *A. phalantha*; so is the pupa. The food-plant is *Alsodeia zeylanica*, Thwaites, belonging to the *Violaceæ*, a family of plants nearly allied to *Bixineæ* and containing most of the food-plants of the *Fritillaries* (genus *Argynnis*) at home in Europe, which are not far removed from our genus *Atella*. *Alsodeia zeylanica* is known to exist in Malabar and Cochin and Ceylon but was unknown in Kanara until the caterpillars of the butterfly were discovered; and the plant is as locally distributed there as the insect. The name of this interesting species is *Atella alcippe*, Cramer.

66. Cupha erymanthis, *Drury.* (*placida*, Moore), (fig. 10)—Male and female *upperside* ochraceous light brown. Forewing: some loop-like, slender, dark, cellular markings; a broad, somewhat curved, yellow discal band from the costa to vein 1, not reaching the termen, broadening posteriorly, the margins irregularly sinuous, the inner defined broadly with black and produced outwards in interspaces 3 and 4, squarely indented in interspace 2 inwards and outwardly convex in interspace 1; a curved series of three black spots, the lowest the largest, in interspaces 1-3; apical area beyond

the band black with a conspicuous yellow subapical spot in interspace 5 and a paler ill-defined, similar spot above it in interspace 6; posteriorly the black area is produced narrowly to the tornus and encircles a yellow spot near apex of interspace 2. Hindwing: a transverse, sinuous, very slender black line followed by a slender, somewhat lunular line, a transverse discal series of five black spots in interspaces 2 to 6, a postdiscal medially disjointed series of broad black lunules, a subterminal series of similar but straighter lunules, and a narrow terminal black band. The outer subbasal transverse line broadens at the costa and is outwardly margined by pale spots in the interspaces, these are anteriorly white, well defined, posteriorly obscure and often absent. *Underside* much paler, the discal band on the forewing also much paler; the black on the apical area replaced by pale brownish-ochreous; some obscure marking in cell of both fore and hindwings. Forewing: a discal, transverse, slender, chestnut-brown, lunular line, bent inwards above vein 5 and bordered outwardly by a series of dark spots; the large black spot in interspace 1 as on the upperside and the inner and outer transverse subterminal series of small, dentate spots. Hindwing: some indistinct cellular markings; the outer subbasal, dark, transverse line as on the upperside but more clearly defined, very sinuous; a transverse discal series of uneven lunules, paler than the ground-colour, followed by a series of dark spots, a postdiscal, very obscure, pale lunular band and a subterminal series of dentate, dark spots which are often obscure or obsolescent. Antennæ, head, thorax and abdomen ochraceous brown; beneath, the palpi, thorax and abdomen very pale ochraceous white. *Exp.* 58-74 mm.

The above description is that of typical *Cupha erymanthis*, Drury, of which *C. placida* is merely a race. There seem to be certain constant differences however; as for example, on the *upperside*, the discal band on the forewing in *C. placida* is distinctly darker yellow and its margins much less irregular, the black line defining the inner margin more slender; the spots on the band in interspaces 1, 2, 3 much smaller, especially the first, which is no smaller than the rest and diffuse; the subapical yellow spots are entirely wanting or very indistinct. On the hindwing the outer subbasal line with outer border of pale spots generally more clearly defined. Both wings shaded at base with olivaceous brown. *Underside* markings more heavily defined than in *C. erymanthis*.

C. erymanthis is "from along the foot of the Himalayas and up to 5,000 feet from Mussooree to Sikkim; hills of Assam; Burma; Tenasserim; the Nicobars; extending to China and the Malayan Sub-region; Andamans."

C. placida, Moore, exists in South India and Ceylon.

The transformations of typical *C. erymanthis* have not been observed as far as is known. Those of the race *placida* are as under:—

Larva.—Like that of *Atella phalantha* except that the spines are some-

what longer and look finer from their colouration which is black and translucent whitish in bands; the head also differs. The shape of the head is heart-shaped, broadest across vertex, with a depressed line down the centre of face; is light yellow in colour with a large, shiny, black spot near vertex of each lobe and another lower down, smaller; the head is as broad as segment 2. The body is cylindrical, slightly constricted at segment-margins; anal segment perpendicular to longitudinal axis of body, rather high. Spiracles black oval, large, flush. The surface of the body is covered with minute white tubercles, of which there is a more or less distinct subdorsal row; head, base of legs as well as prolegs with moderately long, fine hairs; the body is besides armed with six longitudinal rows of cylindrical, finely setiferous, flat-topped spines, one subdorsal, lateral and subspiracular to each segment 5-12; segments 2-4 and 13 have each a subdorsal spine and there is a lateral one on the common segment-margins 2/3 and 3/4 and one, subspiracular (where the spiracle would be where there one), half the way between front margin and extremity of segment 14. Each spine proceeds from a black swelling or tubercle and is colourless with five or six black rings, the last two rings being at the extremity of the spine; from each ring proceeds a whorl of fine setæ; the basal setæ shortest; the top ones black; the basal ones white as a rule. The colour of larva is an oily looking rose brownish, the rose colour being more pronounced at the two extremities; anal segment with yellow flap; there are some black subdorsal spots between the spine on segment 13 and that on segment 14 on each side; there is a subspiracular, zigzag white line from segments 4-12; the belly is bluish-green and the legs yellow. L: 30 mm.; B: 5 mm. Spines all of equal length and very nearly as long as body is broad.

Pupa.—Similar to that of *Atella phalantha* except that some of the tubercles have long curved spines from their tips. Head square; rather flat dorsally; eyes each with a short conical, porrect tubercle; segment 2 with a slight ascent towards thorax in dorsal line; thorax square seen from above, convex; the wings slightly expanded from shoulders to about segment 5; the constriction dorsally little: laterally wide and shallow. The abdomen is circular in transverse section after segment 9, short, thick and curved down at the end so that the pupa hangs parallel to the surface it is attached to, the suspensory surface of the cremaster (the extremity) being longer than broad for that purpose; the cremaster is at right angles to longitudinal axis of the pupa. Spiracles are the same colour as the body, oval and of ordinary size. The surface of the body is shiny and is set with the following tubercles: a lateral one on segments 2, 7, 9, 11, and a laterodorsal one on segments 3-6, 8 and 10; the lateral ones (segments 2, 7, 9, 11) being prolonged each into a long, thin, curved, conical spine, the pair on segment 7 the longest (6 mm), those of segments 9 and 11 shortest (3 mm), being only half the length of the longest. The colour of the pupa is generally a bright, light or darker blue-green, the colour varying somewhat in different individuals.

When green there are two black spots on segment 2, mother-of-pearl spot margined with rose-crimson posteriorly on each eye; all spines and tubercles surrounded at base with mother-of-pearl, inside which the cones are generally crimson; the spines are yellow tipped with black, the extreme point being white; the tubercles of segments 4, 5, 8, 10 may be green like the body; on segment 12 are two minute tubercles; anal segment has a circle of six black spots round base of cremaster; wings are slightly striated; a mother-of-pearl blotch at shoulder with two black spots; a long mother-of-pearl mark bordered by crimson along each inner wing margin from near the shoulder to segment 6; another similar one, oval in shape, starts a little posteriorly to this and runs along inside costal margin of wing but does not reach the ventral line of pupa; the pair of spines of segment 7 as also others may have the mother-of-pearl spots surrounding their bases coalescing over dorsum of pupa and there is black subdorsal spot in front of the coalescing marks on segment 7. L: 17 mm.; B: 6 mm. H: 6 mm.; L. of spine of segment 7: 6 mm.

Habits.—The egg is laid on young shoots. The larva is very active and lives on the underside of a leaf, falling to the ground by a silk when disturbed, or rather towards the ground, for it stays suspended in the air; it is of the same excessively quick growth as the larva of *Atella phalantha* taking only 21 days from the depositing of the egg to the appearance of the butterfly. The insect is much more a jungle species than *Atella phalantha* and is found mostly in regions of heavy rainfall, though it is occsionally met with on the borders of the Plains. In flight it is somewhat weaker than the species just mentioned, is fond of the shade rather than the sun, basks occasionally with the wings half opened and is not particularly pugnacious. It keeps near the ground as a rule but is found flying about the tops of the trees its larva feeds on in the jungles, that is at a height of some 50 feet and more, though trees of this size are not of common occurrence. The best place to look for the butterfly is always the food-plant of its larva. This is also true of the last species. The plants are the same for both: *Flacourtia montana* being that most affected by *Cupha* while *F. Ramontchi* is the favourite of *Atella*. *Cupha placida* is much more plentiful in the heavy monsoon regions in the months of September, February and March than at any other time, whereas *Atella* is hardly ever seen in September as already remarked.

67. Argynnis hyperbius, *Johanssen* (Pl. A, figs. 1 ♂, 1*a* ♀).—Male *upperside*: forewing rich orange-yellow, hindwing paler yellow with the following

black markings: forewing: cell with a short, basal, transverse streak, a medial, broad, oval loop, its outer margin waved; a broad transverse streak beyond cell not reaching the median nervure; a broad streak along the discocellulars; a zigzag discal series of large spots angulated outwards in interspace 4, inwardly in interspace 2, a minute spot at base of interspace 1; a somewhat diffuse, large postdiscal spot in interspace 6; a postdiscal sinuous series of round spots, those in interspaces 1, 4 small; an inner subterminal, complete series of spots and an outer subterminal line, widening on the veins and a terminal line. Hindwing, a basal, transverse, obscure, narrow mark in cell, another above it in space 7, a transverse lunule across middle of cell; a small spot outwardly bordering the lower discocellular; a discal series of transverse spots in spaces 1-7, sinuous posteriorly; a postdiscal series of five spots in spaces 2-6; a subterminal series of somewhat lunular spots; finally a narrow band on termen traversed posteriorly by a series of blue, anteriorly by a series of ochraceous lunules. *Underside*: forewing pale terra-cotta red, shading into ochraceous towards the apex which is broadly suffused with that colour; markings as on the upperside with exceptions as: subcostal spot in space 6, upper two spots of postdical series, upper four of inner subterminal series and the anterior portions of the outer subterminal and terminal lines olivaceous brown; the upper two postdiscal spots centred white, with a white spot on each side; the upper four spots of the subterminal series touching, forming a short, curved band. Hindwing variegated with ochraceous, olivaceous brown and silvery-white markings, the last mostly narrowly margined outwardly by short, black lines; the veins clearly pale ochraceous; the medial silvery markings form a well marked, discal, sinuous series followed by a curved, postdiscal series of five olivaceous, round spots; each spot and the olivaceous, quadrate patch near base of cell each with a minute white centre; a slender, black, subterminal line widening at veins, followed by an ochraceous, narrow, lunular band and an outer, slender, black anticiliary line; the subterminal, black line margined inside by a series of slender, white lunules, bordered inwardly by a series of broad, olivaceous brown markings in the interspaces. Antennæ brown above, ochraceous red beneath; head, thorax and abdomen olivescent tawny; beneath, palpi, thorax and abdomen pale ochraceous. Female.—Similar, differing from the male in that, on the *upperside*, the apical half of the forewing from about the middle of the costa to just above the tornus is black, inwardly suffused with purple, crossed by a broad, white band from costa to the subterminal series of black spots; four preapical white spots, the upper three bordering, on each side and above, a very obscure ocellus, scarcely visible on the black back-ground; an inner and an outer subterminal, transverse series of slender white lunules. *Underside*: forewing: markings similar to those on the upperside, but the apex of the wing beyond the white band, ochraceous green. Hindwing as

in the male, but the markings slightly broader. Antennæ, head, thorax and abdomen as in the male, the abdomen paler beneath. Exp. 80-98 mm.

Larva.—"Head and legs black; body black, the colour, however, obscured by orange-tawny markings. A broad orange-tawny dorsal stripe. Four straight, horizontal, simple, black spines on head; spines on pectoral segments black; on abdominal segments pink tipped with black, on caudal segments pink faintly black-tipped."

Pupa.—"Head and wing-cases pale Indian-red; ten pale metallic spots on back; abdomen dark pink; spines faintly black-tipped." This is amplified as follows: "The head ends in two well-separated blunt points; there are a pair of spines anteriorly, another in the middle, and a third smallest pair posteriorly on the thorax, the latter being hunched and keeled: on the abdominal segments there are eight pairs of spines, the third anterior pair longest."

Argynnis castetsi, *Oberthür.*—This is the Southern Indian form of the insect, differing from typical *hyperbius* which it otherwise closely resembles, differing, in the male, in the *upperside* being of a richer, brighter shade of orange-yellow; the black markings smaller, darker, subterminal transverse lunules of black terminal margin of hindwing of the same shade of orange-yellow as the ground-colour, no lunules being blue. *Underside*: the olivaceous brown on apex of forewing and variegating the hindwing of a greenish golden tint. There is a sex-mark of specialized raised scales along the middle of vein 1 on the upperside. It is probably a good species.

The females seem to be dimorphic locally. The *Nilgiri form* resembles the female of typical *hyperbius*; it differs on the *upperside* in the ground-colour being pale golden-yellow; in having the basal half of both wings shaded with metallic green, in some specimens olivaceous; the white oblique band of forewing smaller, the purple-blue shading along its inner margin less conspicuous, as is also the bluish tint on the white preapical spots and subterminal marking; the blue on subterminal lunules of hindwing also less marked. *Underside* the same as in *hyperbius* but the ground-colour on forewing paler terra-cotta red; the variegating olivaceous brown of hindwing distinctly greener.

As described from Trichinopoly the female is similar to the male, differing as follows:—*Upperside*: ground-colour pale golden-yellow; basal half of wings suffused dark olivaceous green; black markings larger; on forewing spots of subterminal series very large, coalescent or nearly so with one another, dentate spots on veins on inner terminal line; upper two postdiscal spots also very large, coalescent, the upper of the two joining on above and below to postdiscal spot in interspace 6, thus enclosing a prominent lunule of ground-colour. *Underside* paler.

The transformations of *Argynnis castetsi* have not been observed as far as is known but they are not likely to differ much from those of *A. hyperbius*

though the description of caterpillar and chrysalis of this latter is meagre enough as given above.

Habits.—Nothing is to be found as to the habits of either species in any books and the writer has never come across the insect. It is not likely to differ much from the stronger-flying *Argynnis* at home. They are fast-flying, strong, active insects, fond of flowers and sunshine, keeping much to the neighbourhood of the ground though they occasionally fly high and far. The flight is that of *Atella phalantha*. The eggs are sure to be laid on or near a leaf of some species of *Viola*, of which a few exist even in Southern India, though most are of temperate zones. The larva would probably eat the leaves of the garden violets or pansies readily. The genus *Argynnis* contains our home Fritillaries and is Neararctic as well as Palæarctic and Indo-Malayan in distribution. *A. hyperbius* is found from the Himalayas (Panjab to Sikkim) to Assam; Agra; Manbhum in Bengal; Khasi Hills; Upper Burma to China and Formosa; Sumatra and Java. A variety *A. taprobana*, Moore, slightly darker, is found in Ceylon. *A. castetsi* is confined to Southern India in the Nilgiris and Palni Hills. Some sixteen species are enumerated as occurring in India. The males of many of the *Argynnis* group of butterflies are much smaller than the females and this is the case very often with *A. hyperbius*.

68. Cirrhochroa mithila, *Moore.*—Male *upperside* is rich fulvous tawny, the basal area limited by the transverse, discal, black line, darker on both fore and hindwings than the discal and terminal portions of the wings. Forewing with a transverse, dusky, obscure, short, narrow band along discocellulars; a transverse dusky black, slightly sinuous, discal line terminating in an oblique, short, black streak in interspace 7; a transverse series of very obscure diffuse dark spots; apex broadly, termen narrowly black; from the former is emitted downwards a subterminal, rather heavily marked, zigzag, black line, complete from apex to vein 1, the black at apex somewhat diffuse. Hindwing with a transverse dark, discal, sinuous line and series of black spots in continuation of those on forewing, the spots much more clearly defined; a postdiscal, transverse series of slender, lunular, dark markings followed by an inner and an outer dark, subterminal line, the inner lunular, the outer straight. The discal transverse line and postdiscal series of lunules each bordered by a prominent, white, subcostal spot. *Underside* rather dark, uniform ochraceous, often suffused with purple to a more or less degree. Both wings with a common, pinkish white, conspicuous transverse, discal fascia, its inner margin highly sinuous, its

outer straight, followed by a transverse series of spots as on the upperside; a common subterminal, transverse, lunular, narrow band and a straight, narrow border to the termen, the latter two of darker ochraceous than the ground colour. Basal area of both wings with some dark ochraceous, transverse, sinuous, short lines; the subterminal lunular line on hindwing bordered inwardly and outwardly by obscure, broad, pinkish white lunules; a distinct shade on middle of terminal half of both fore and hindwings, darker than rest of ground colour. Antennæ brown; head, thorax and abdomen fulvous brown; beneath, the palpi white, the thorax and abdomen ochraceous.

Female *upperside* has the ground colour a rich, bright yellow. Forewing: apex and terminal margin somewhat narrowly black; a subterminal black, zigzag line; a broad, bright yellow, discal, transverse band with somewhat irregular, sinuous margins defined by obsolescent blackish lines and medially traversed throughout its length by a narrower brown band bearing a transverse superposed row of obscure, diffuse, dark spots; beyond the discal band is a transverse series of broad, light, lunular markings. Hindwing: differs little from the forewing in markings. *Underside* ochraceous drab; the discal band as in the male but lilacine white, inwardly bordered by a sinuous, pale brown, narrow band, a transverse, sinuous, narrow, subbasal pale, brown band and short, similar bands defining the apices of the cell areas in both wings; beyond the discal band the transverse series of spots and the subterminal and terminal markings similar to those in the male but the latter much paler. Exp. 63-83 mm.

The transformations of the species have not been chronicled, but they will probably not differ much from those of the next, *C. thais*. The habits are not known either. The distribution is "Sikhim; Behar; Assam; Burma; Tenasserim; the Andamans; Malayan Subregion to Java."

69. Cirrhochroa thais, *Fabr. Wet-season form.*—The male has the *upperside* rich tawny with the following black markings:—Forewing: a narrow band along the discocellulars; three transverse spots in the interspaces beyond; a spot at the base of interspace 3, short transverse, slender lines in continuation of it in spaces 1 and 2; the three spots beyond the apex of cell in echelon forward of the last-mentioned three markings; a postdiscal transverse series of lunules inwardly diffuse in spaces 5 and 6, obsolescent in space 1; the apex and termen broadly black, the latter coalescing with an obscure, transverse, subterminal, lunular line and enclosing a series of detached obscure lunules of tawny ground-colour sometimes completely wanting. Hindwing: the markings dusky black, very similar to those on the hindwing of *C. mithila*; the white, subcostal patch on the outer margin of the discal line as in that form, but more prominent; the costal margin beyond it to apex fuliginous grey. *Underside* dark ochraceous tawny suffused with purplish; basal area with some short, slender, trans-

verse, dark lines; the discocellular transverse streak on the forewing as on the upperside; a prominent, transverse, discal band across both fore and hindwings, very broad at costa of forewing, narrowing to dorsum; similarly, but not quite so broad at costa of hindwing, narrowing to the dorsum, its inner margin sinuous, its outer straighter, both obscurely defined by dark lines; faint lunular markings beyond on terminal half of both wings; the black spots in the transverse discal series on the hindwing very small. Antennæ brown; head and abdomen more or less fulvous tawny; thorax with bright pale green pubescence; beneath pale ochraceous. Sex-mark: the veins on the upperside of the disc of the forewing black; veins 5, 6 and apical portion of 7 with very narrow short bands of specialized scales on each side; no such scales on the hindwing. Female *upperside* similar, the black edging to the apex and termen conspicuously broader as are all the black markings. *Underside* similar; ground colour paler, more ochraceous, not suffused with purplish, the markings similar to those in the male, but the inner margin of the discal band more than sinuous, zigag; Antennæ, head, thorax, abdomen as in male.

Dry-season form.—Similar to the wet-season form but on the upperside the ground colour is a shade duller and paler, the markings more restricted and of a dusky black. On the underside the transverse discal band is sometimes margined outwardly with a diffuse dusky black band, the white being sometimes completely obscured by a suffusion of the ground colour.

Larva.—The larva is similar to that of *Cupha* in general aspect, the body being set with spines in the same way. The head is round and slightly bilobed, yellow in colour, shiny, smooth, with two exclamation-marks, half the length of face, down each lobe and some markings about the eyes, black. Segment 2 is narrower than the head by a good deal and is yellow in colour with a dark dorsal line. Spiracles are large, oval, black with a light central slit, shiny, the lower half hidden often by a fold near base of subspiracular spine. On segments 2 and 3 there is a subdorsal and lateral setiferous spine on each side about 7 mm. in length; on segment 4 there is a subdorsal one and a lateral one near front margin; segments 5-12 have each a subdorsal, lateral and subspiracular setiferous spine on each side; segment 13 has one subdorsal on each side, the anal segment one, lateral, before the hinder margin. The spines are all equal in size and black in colour, shiny, except the anal four which are white; anal segment is yellow. Colour of the body is dark-brown with a violet tinge and with a subdorsal, lateral and subspiracular white longitudinal line, the spines being placed between these lines; abdomen green. L: 25 mm.; B: 6 mm.

Pupa.—Is similar in shape to that of *Cupha*, but is bone-white all over in colour and has many more curved processes. Head with very prominent eye-balls underneath, rounded moderately at sides, rather bowed ventrally; a small point in front of each eye curving upwards; segment 2

indented in centre of front margin, flat on dorsum with a subdorsal "boss" on each side, each giving rise to a 6 mm. long, stiff, outwards-curved spine; thorax moderately high, convex, slightly carinated in dorsal line, the carination splitting into two at centre of segment backwards; there is a subdorsal, central spine similar to that of segment 2 on each side; segment 4 has similar though slightly shorter spines; segment 5 has them also, but a good deal smaller again; segment 6 also, twice the length of those of segment 5; segment 7 has a subdorsal spine twice the length of that of segment 6 and a lateral one besides, curved forwards, the same length as the thoracic subdorsals; the surface of the pupa is covered with minute hooked hairs and is slightly rugose. The shoulder is produced into a flattened point or tooth; the wings are expanded somewhat along thorax and segments 4, 5. Spiracles dull, oval, rather large, black, with a light central slit, the hinder ones being half covered by the hinder margin of preceding segment. Colour of pupa is whitish grey with the following black spots; segment 2 with two spots in front of each spine, four spots on the flat part of each shoulder-tooth, two spots along wing-line on segment 4; a semicircle of four spots with hinder margin as base on segment 5; a similar semicircle on segment 6 besides four between wing and spine on each side; segments 7-12 with a similar semicircle of spots, segment 7 having two spots between the spines on each side and one at junction of wing and segment. The size of the pupa is variable, but has much the same proportions as that of *Cupha*, though generally somewhat larger.

Habits.—The larva feeds upon young leaves, grows fast, eating voraciously, sits generally with all the segments contracted on the underside of leaves and is very active, running about at a great pace; when suddenly disturbed, it lets itself fall by a thread by which it pulls itself up again when the danger is past. The larvæ are much ichneumoned; they eat their cast skins after moults. The pupa is formed against a perpendicular surface, generally low down in a shady situation and hangs parallel to the surface, being firmly and rigidly attached. Occasionally, of course, it is found suspended from the under-surface of a leaf, horizontal or otherwise. The larva objects strongly to the hot sun. The butterfly is found only in the hills but is very plentiful where it occurs, and will certainly be met with at Matheran or Mahableshwar, also probably in Thana District; it is quite common further south on the Western Ghats and extends thence to Ceylon. It is confined to these places. The insect likes the neighbourhood of evergreen jungles and damp nallas, and keeps entirely to wooded parts, ven-

turing but rarely into the open. It is never seen basking on the tops of hills, for, like its larva, it is not partial to the sunlight, except when diluted through the dense shade of trees. It is a fast flying active insect, generally, seemingly, on the wing and very busy either, in the case of males, looking for females or, in the case of the latter, choosing a fit leaf whereon to deposit an egg or two; these are laid generally on the underside, but often, also, on a shoot, stem or even, if conveniently situated, on a dead creeper-stem or dry twig. The style of flight is that of *Cupha*, though stronger and faster; the insects bask on leaves in shady places with their wings half open; they rest with them closed over the back. They do not visit flowers much. They may be found in great numbers round their food-tree in the monsoon months. This tree is *Hydnocarpus wightiana*, Blume, of the botanical family *Bixineæ*, common in the evergreen forests of Kanara and the Konkan generally, the large woody brown fruit of which yields a yellow oil used in native medicine for skin diseases; it is also used for lighting purposes.

The genus *Cirrhochroa* contains seven species, according to Bingham, occurring in British India; others are found in the Malayan region.

70. Byblia ilithyia, *Drury.— Wet-season form.*—Male *upperside*: deep orange. Forewing: the costa broadly jet-black to within a short distance of apex; cell crossed by three narrow, short, black bands, the inner and the outer not reaching the median vein; a very irregular, black, discal blotch from dorsum to vein 4, continued very narrowly along that vein to meet an oblique, irregular band, from just beyond the middle of the costa; a post-discal, broad, transverse, black band from dorsum to vein 5, with the portions of the veins beyond it defined in black. The apex of the wing beyond the broad black edging to the costal border has its upper margin and the terminal portions of the veins defined in black; finally a narrow terminal band. Hindwing: an elongate black, subcostal patch near base, continued posteriorly across the cell by an inner and outer series of small transverse spots; a complete, broad, black, postdiscal band with the portions of the veins beyond it lined with black, and a narrow black terminal band as on forewing. Cilia of fore and hindwings white, alternated with brown. *Underside*: paler orange. Forewing: black markings as on the upperside, but the cell and upper discal markings obscurely margined on both sides by white; an oblique, black line from costa to apex of postdiscal transverse band, followed by an oblique, preapical series of

diffuse white spots, the terminal black band as on the upperside but traversed by a broken white line. Hindwing: a subbasal and a discal, broad, transverse, white band, both bordered inwardly by a series of black spots and outwardly by a broad black line; a somewhat narrower, postdiscal, transverse, black band traversed by a series of paired white spots, followed by a row of cone-shaped marking of the ground colour, the apices of the cones turned inwards and broadly white; finally a black, terminal band traversed by a series of white lunules. Antennæ black; head, thorax and abdomen dark dusky, fulvous red; beneath, palpi white, head, thorax and abdomen dark ochraceous, variegated with some black lines and spots.—Female similar, with similar markings, but on the upperside the ground colour is paler, the black markings narrower. Forewing: the postdiscal black band nearly complete, interrupted only in interspaces 1 and 4; the terminal black band traversed by a broken white line. Hindwing with no subcostal black patch, instead three series of transverse spots; a postdiscal, transverse, broad, black band bordered inwardly by a series of slender black loops; between these and the postdiscal band a series of spots of the ground colour; the terminal black band traversed, as on the forewing, by a whitish broken line. *Underside*: similar to that in the male, but the ground colour paler. On the forewing the black markings comparatively narrower, less-well defined; on the hindwing the white on the bands and spots replaced by pale yellow.

Dry-season form.—Male and female *upperside*: similar to that in the wet-season form; black markings on the whole not so sharply defined. *Underside*: ground colour darker; on the hindwing dark ochraceous; the transverse subbasal and discal bands in both sexes white. *Exp.* 50-56 mm.

Larva and pupa.—In Khandesh and the Deccan the larva has been reared along with those of *Ergolis* on *Tragia cannabina*, L. It was possible to distinguish them only by the fact that the light dorsal line was continued the whole length of the body in this species and was comparatively uninterrupted. The pupa was undistinguishable.

Habits.—The habits of the larva and pupa are the same as for *Ergolis*; those of the imago also, though this species inhabits the plains and is not found in the hills in forest country. The butterfly is a weak flier like *Ergolis*, and is generally found about the foodplant of the larva; it does not fly far and rests with its wing closed over its back and the forewings drawn in between the hind wings. It basks low down near the ground on leaves, &c., with the wings horizontally expanded. It occurs in Central and Southern India and Ceylon.

This is the only species found within the limits of British India, but there are others in Africa.

71. Ergolis ariadne, *Johanssen.* (Pl. F, fig. 36).—Male and female: forewing truncate at apex; termen angulated at interspace 5 and again at apex of vein 3, concave between; tornus obtusely angulate. Hindwing: termen more or less deeply scolloped. Male *upperside*: ochraceous rufous; a prominent white, small, subcostal spot before apex of forewing; two or three dark brown marks in cell of both fore and hindwings, followed by subbasal, discal, two postdiscal, subterminal and terminal slender, sinuous, dark brown lines, crossing from costa of forewing to vein 1 of hindwing; discocellular nervules of both wings defined by short, dark brown lines; cilia white, alternated with brown. *Underside*: ground-colour brown with an ochreous tint, and sometimes a slight greyish suffusion. Fore and hindwings: some dark chestnut-brown spots or loop-like marks at base, followed by subbasal, discal and postdiscal, broad, chestnut-brown, sinuous bands, interrupted on the forewing by the sex-mark of specialized scales (the subcostal vein and veins 6 and 7 on the upperside of the hindwing are prominently pale and shining and there is a large, discal patch of specialized, very dark, shining scales on the underside of the forewing extending to the base of wing, upwards into the cell and to vein 4); the postdiscal band on the hindwing traversed by series of transverse, dark spots in the interspaces. Lastly, both wings crossed by a subterminal zigzag and a terminal, irregularly sinuous, dark brown line. Antennæ, head, thorax and abdomen ochraceous rufous. Female similar, slightly paler in colour, of course without the specialized sex-marks. Exp. 52-56 mm.

Larva (Pl. I, fig. 11).—The larva is like those of *Cupha*, *Atella*, except that the head is furnished with a pair of long horns; the colour is black with a striated white, broad, dorsal band on segments 6—11. Head square from front view, rather small, with two very divergent, long, hard, cylindrical horns, one from the vertex of each lobe, as long as segments 1—4 together, in the plane of the face, set with a cluster of short spines at tip and a few along the shafts; they are separated widely at base and more or less squarely; the surface of head is smooth except for two rows, of spines one slightly anterior to the other, down each cheek; a few hairs about jaws; colour of head is black. The body is cylindrical with the segments well marked; anal segment high, overhanging the anal prolegs or claspers; neck narrower than head. The body spines are all more or less of the same size, except the subspiracular ones which are small; the pedicels or shafts of the subdorsals of segment 4 and segment 12 are thicker than others; the spines of segment 2 are also small; each spine consists of a shaft from the extremity of which proceed three or four fine, sharp, smooth spinelets at an angle of 45° to the shaft; all spines are perpendicular to the surface of body and slightly swollen at the origin; they are arranged as follows:—segment 2 has a subdorsal, simple one and a lateral and subspiracular spine branched at extremity into four points: the subspiracular spine on base of leg; segments 3 and 4 have a

similar arrangement of spines, all branched at extremity: segments 5—10 similar; segment 11 has a dorsal, subdorsal and subspiracular one as well as another underneath this last; segment 12 is similar to segment 11 except that the last spine underneath the subspiracular is wanting; segment 13 is very narrow, a mere strip, and is quite bare; segment 14 has a lateral spine on hinder margin; there is a small spine on base of prolegs 7—10 and one in a similar position on segments 5 and 6; the lateral spines are really nearly supraspiracular. The surface of the body is covered with transverse rows of minute setiferous tubercles besides the spines. The spinelets at extremity of shafts are nearly as long as the shafts themselves. The spiracles are small, oval, flush, black, those of segment 12 conspicuously larger. The colour of the larva is dull black with a short, diagonal, subspiracular, white band near the hinder margin of each segment and a broad dorsal band composed of short lines at right angles to the longitudinal axis of larva on segments 6—11, besides a transverse row of fine dots just before the hinder margin of each segment, all white; belly red-black; legs shiny black. L: 22 mm.; B: 9·4 mm. with spines; L of spines: 2 mm. with spinelets; L of head—horns: 5 mm.

Pupa (Pl. I, fig. 11*a*).—The pupa is slender with the wing-cases somewhat dilated, a dorsal protuberance and two small head-points; colour variable, generally green. Head trapeze-shaped seen from above, with two divergent, laterally compressed points, one from each eye, directed forwards, ridged on top (dorsally), separated by a sinus in front of head which reaches the front margin of segment 2; these points are well developed and conical. Segment 2 has the front margin curved in a semicircle and a waved hinder margin, is flat dorsally and fairly broad between the margins. Thorax is carinated in dorsal line on the anterior half which is inclined at an angle of 45° to the longitudinal axis; it runs up into a point and is flat on the dorsal decline from this point to hinder margin, this decline being in a plane nearly perpendicular to longitudinal axis of pupa: so that the point (apex of thorax) is a triangular pyramid of which the lateral slopes are also nearly flat. The pupa is a good deal broader at shoulders than at segment 2 with a short, low ridge on each shoulder; the wings are expanded from just behind shoulder, first in a little semicircle, the lateral outline of pupa then running concavely to lose itself in dorsum of segment 5, to widen out again in a curve at segment 6 which finally runs into the general level of body ventrally about segments 7 and 8; the constriction between segments 4 and 5 is considerable dorsally because of the high thorax-apex and a dorsal tubercular rising on segment 6. The body is as broad at segment 7, owing to the wing-expansion at shoulders, as at shoulders, perhaps a little broader; section of abdomen from segment 8 to anal end is circular; the cremaster is short, strong, square, with two large extensor ridges and with densely disposed suspensory hair-hooklets at

extremity and dorsally ; ventral line of wings convex from segment 8, thence to anal end, straight. Spiracular stigma of segment 2 hardly apparent ; rest of spiracles oval, not particularly small, nearly the same colour as the body, with a central, raised, light brown slit. Surface of pupa dull, irregularly transversely aciculate-lined on abdomen. Colour of the body is a dark olive-green ; apex of thorax shortly yellow ; a green-black, dorsal, triangular patch on segment 9 ; the dorsal edges of wings as well as the lateral margins of segments 1 and 2, the centre of front dorsal slope of thoracic pyramid and a broad dorsal abdominal band speckled densely very light green ; antennæ whitish. L : 18 mm. ; B at segment 6—7 : 7 mm. ; at shoulders : 6 mm. ; H. at apex of thorax : 5 mm.

Habits.—The egg is generally laid on the upper side of a leaf ; the larva lives on the upper side, making a slight bed of silk, at first anywhere, afterwards in the centre along the midrib ; it eats much, grows fast and is very active ; it lies full stretched with the horns held straight out in front which means that the face is bowed down and applied to the leaf-surface. It wriggles when touched roughly, but does not, as a rule, leave its resting place. It walks fast, moving its head from side to side, spinning silk as it goes. The pupa is formed from the underside of a leaf or from a twig and hangs perpendicularly down or at an angle, as it is rigidly fixed to the pad of silk woven for the purpose by the copious suspensory hooklets ; it also wriggles from side to side when touched and will stay bent from segments 9 and 10 for a long period after being disturbed. The butterfly is a weak flier and keeps generally to a circumscribed area in the vicinity of its food-plant ; it flies for a short distance at a time only, always low down near the ground within easy reach of a net and is easily captured ; the style of flight is a series of ups and downs with the wings held horizontally open between each ; it basks with them thus held open, though it rests with them closed in rainy weather and at nights. The insect is common everywhere throughout India in the plains and in the hills, in the open country and in the jungles wherever the food-plant of the larva is to be found. This plant is a creeper of the family *Euphorbiaceæ*, called *Tragia involucrata, L.* ; the larva also feeds upon *Tragia cannabina*, L., both with nettle-like leaves covered with little urticating hairs which are not always comfortable to touch. The former is more or less confined to regions of heavy rainfall and the hills, while the latter grows in the drier parts of

the open country. This butterfly is found throughout Continental India, east of Mussoorie in the Himalayas and of the Punjab; also in Ceylon, Assam, Burma, Tenasserim, and extends to the Malayan Subregion and China. The figure of the butterfly in the coloured Plate is too red, and the patch of specialized scales on underside of forewing too dark; interspace 8 on upperside of hindwing should be grey as far as it is visible in the picture.

72. Ergolis merione, *Cramer.—Wet-season form.*—Male *upperside* brownish ochraceous. Fore and hindwings crossed by slender, somewhat obscure, very sinuous or zigzag, dark, basal, two subbasal and two discal lines, disposed in pairs, followed by a single, sometimes double, postdiscal and a single subterminal, slender line. All these lines more or less interrupted anteriorly on the hindwing which has a smooth, unmarked, uniform appearance from the costa to subcostal vein and vein 5. On the forewing there is in addition a series of obscure spots between the postdiscal and subterminal markings and a small, white, subcostal spot before the apex. *Underside* much as in *E. ariadne*, but the transverse chestnut bands broader, more diffuse. Antennæ, head, thorax and abdomen brownish ochraceous. Sex-mark on the underside of forewing as in *E. ariadne*; no sex-mark on upperside of hindwing.—Female similar, but on *upperside* the transverse lines broader, more diffuse, with a greater tendency to form bands; the postdiscal line always double, forming a band traversed by a series of dark ochraceous spots in the interspaces; these lines and bands continuous, not interrupted anteriorly on the hindwing as they are in the male. *Underside*, except for the sex-mark, as in the male.

Dry-season form.—Male and female *upperside*: ground-colour much paler, the transverse lines more distinctly in pairs, forming bands, the ground-colour between each pair more dusky brown. *Underside*: similar to that in the wet-season form, but the ground-colour paler, the bands more diffuse. Exp. 52—62 mm.

Larva.—"Cylindrical, slender; segments armed with two dorsal and two lateral rows of short, branched spines; head with a pair of long, straight, branched spines. Colour green with longitudinal dark-brown lines." (*Moore*).

Pupa.—Moore also gives the pupa as "similar to that of *E. ariadne*." It is not likely that the larva or pupa differ much from those of the next insect, *Ergolis taprobana*, which Bingham treats as a race of the present one, but which has here been kept as a separate species.

This species is not likely to differ in any important particular as regards the habits in any stage from the next to which it is so closely allied. It is found in the northern half of Continental India, in the Himalayas from Simla to Sikhim and has been recorded from Rajputana and Bengal, Assam.

Burma, Tenasserim and the Malayan Subregion. The Tenasserim specimens are dark and often without the white subcostal spot on the forewing, approximating thus to the Southern Indian and Ceylon *E. taprobana* according to Bingham. The food-plant is nearly certainly *Tragia cannabina*, L., though it is nowhere recorded as far as is known.

73. Ergolis taprobana, *Moore.*—This differs as follows from the last :—*Wet-season form.*—Male *upperside* with the ground-colour dark ferruginous ; white subcostal spot on forewing rarely present ; the transverse lines black, more clearly defined ; the anterior half of the hindwing as in *E. merione* smooth, uniform, unmarked. *Underside*: with the ground colour darker than in *merione*, the markings on the anterior half of the forewing and in the centre of the hindwing obscured by a superposed, very dark chestnut shading ; on the forewing this dark shading does not extend to the base, apex or termen ; on the hindwing it does not extend quite to the costa. Sex-mark as in *merione*. Female similar to the female of *merione* but differs as follows :—*upperside* : the ground-colour lighter ferruginous than in the male ; the transverse lines and markings very distinctly defined ; the two postdiscal lines formed into more or less broad cordate marks in the interspaces. *Underside* : ground colour darker than in *merione* female, sometimes a sort of purplish brown ; the chestnut transverse bands well defined and continuous on both fore and hindwings.

Dry-season form.—Male and female similar to the wet-season form but the ground-colour paler. Exp. 49—56 mm.

Larva.—The caterpillar is exactly the same as that of *E. ariadne* in shape of body, arrangements of the spines, their shape and size and the shape of head. Surface of body covered with transverse rows of minute yellow tubercles, each bearing a little seta. Spiracles rather large, oval, the colour of the body, bordered thinly with black. The colour of the body is green with a broad, subdorsal, yellow stripe flanked by a double, interrupted, yellow line ; segments 7 and 11 suffused dorsally with dark-brown ; bases of subdorsal spines of segment 4 brown ; belly light green ; the spines all blue-green and shiny. L : 27 mm. ; B : 4 mm. without spines ; L of head-horns : 5 mm.

Pupa.—The pupa is similar to that of *E. ariadne* in shape and size. It can be separated from that species by the outer margins of the wings being straight instead of slightly waved as it is in *ariadne*. Surface very slightly shiny, smooth. Spiracular stigmata of segment 2 hardly accentuated ; other spiracles oval, not small, colour of the body. The colour is generally light green, veined densely on wings with brown ; head points, carination of thorax, lateral wing outlines also brown ; Suspensory hooklets bright golden-brown. L : 18 mm. ; B : 6 mm. at segment 7 ; 5·25 mm. at shoulders ; 2 mm. between head points ; H : 5 mm. at thorax ; 6 mm. at segment 6.

Habits.—The habits of oviposition are similar to those of *E.*

ariadne; also the habits of the larva and pupa and the imago or perfect insect. This last inhabits the hills and jungles in regions of heavy rainfall generally, although it encroaches on the Plains along the borders where the climate is comparatively fairly dry. It is confined to Southern India and Ceylon. The plant it has been reared on in the caterpillar stage is *Tragia involucrata*, L., mentioned already as one of the species upon which the caterpillar of *E. ariadne* feeds.

Ergolis contains only the above three species in British India but there are others in the Ethiopian and Malayan Regions.

SUB-FAMILY *ACRÆINÆ.*

Only one genus .. .. *Telchinia.*

GENUS *TELCHINIA.*

Only one species. Exp. 2·1″—2·53″ .. .. *violæ.*

The species will be found figured on coloured Plate E, figures 31, male, 31*a*, female. The figures are good; in the female, however, the spots left in the coalescing basal black markings on the hindwing are not light enough.

The sub-family is chiefly African, very few species existing in South America and only two in British India. There are, however, a few in the Malayan Subregion nearly related to our Indian ones. *Pareba vesta* occurs in the Himalayas and extends in the hills eastwards to China and south into Burma. *Telchinia violæ* is confined to Peninsular India but is found everywhere in the area, even in the dry region of Sind where it is not uncommon. There are 200 species in the group and they are all protected insects, exuding a yellow oily, disagreeably smelling liquid from the joints of the legs in self-defence, shamming death when handled, and as regards *Telchinia* and *Pareba* resembling *Danainæ* in shape and colour as well. The colour of the two Indian species is yellow, or tawny suffused with reddish, marked with black spots; the hindwing with a black, yellow spotted border; the whole somewhat oily looking. The flight is weak, slow, fluttering, the wings never being moved far from horizontal; the insects keep near the ground and go straight ahead; they do not bask and rest with their wings closed over the back. They frequent flowers. The larvæ and pupæ are very similar.

DESCRIPTION OF SPECIES OF ACRÆINÆ.

Telchinis violæ, *Fab.* (Pl. E., figs. 31 ♂, 31*a* ♀).—Male *upperside* tawny, with a roseate tinge. Forewing: a transverse spot in centre of cell, another larger along discocellulars, a discal series in interspaces 1, 3—6, 10, the apex and termen, the latter narrowing posteriorly with projections inwards along

veins, all black. Hindwing: a basal series of four or five spots, one in middle of cell, a subcostal one above it, a discal series of obscure spots, a postdiscal dot in interspaces 3—6, and a broad terminal band including a series of spots of ground-colour, all black or blackish showing through from underside. *Underside*: ochraceous yellow or paler tawny, forewing paling to apex with the markings as on the upperside. Hindwing with the same markings as upperside but with the spots more clearly defined, the spots on terminal band large and yellowish white, the band bordered diffused whitish, the roseate tinge stronger, the basal black spots coalescing, leaving whitish spots between, antennæ black; head and thorax black, spotted with ochraceous and white; abdomen black at base, yellowish, with narrow black bands; beneath: the palpi, thorax and abdomen ochraceous, thorax spotted black, abdomen with black longitudinal line at base.—Female similar; *Upperside*: ground-colour somewhat oily looking, duller; black spots on both wings larger, upper discal ones often coalescing; the spots in terminal band of hindwing larger and whitish. *Underside*: ground-colour much paler and duller, markings same as upperside but better defined. Exp. 53—64 mm. Female the larger.

Egg.—Is echinoid in shape, a little higher than broad with 17 raised, transversely striated, longitudinal ridges not meeting on top, the top being shallowly reticulate. Colour shiny yellow.

Larva.—The body is cylindrical in shape with the segments well marked, anal segment high, flap rounded at extremity, not overhanging the claspers, in a plane perpendicular to longitudinal axis of larva; the prolegs are long and moth-like. Head small, round, set with erect hairs, brownish orange, with a triangular clypeus which has the apex black; a black spot at base of each cheek. Segment 2 has a subdorsal spine and a lateral tubercular rising; on the common margin of segments 2 and 3 is a lateral spine; segment 3 has a subdorsal spine with a lateral one on the common margin of it and segment 4; segment 4 has a subdorsal spine; 5—12 have each a subdorsal, supra and subspiracular spine; segment 13 a subdorsal one and 14 a dorso-lateral one; there is also a small chitinous surface or spot on segments 3—10, under the subspiracular spine with bristles from it. All spines are shiny black set with erect, stiff, black hairs arising from thickened bases; all are about the same length except those of segments 2, 3, 13 and 14 which are slightly shorter. Colour is greasy claret brown with segments 2 and 14 yellow reddish; dorsal portions of segments 3, 4, 11 and 12 are yellow; ventrum greeny yellow; legs shiny black; the feet of pseudolegs green; a shiny black shield on base of pseudolegs. L: 21 mm.; B: 10 mm. with spines; 4 mm. without spines; L of spines: 3 mm.

Pupa.—Elongate, slight, head with two blunt points, anal end bluntly rounded. Head quadrate, the front margin straight between two conical short, stout teeth or points directed straight forwards; convex above and below, parallel sided. Segment 2 is the same breadth as head being a

broad band with dorsum in same plane as head vertex. Segment 3 same breadth as segment 2 in front, broader about middle because of the prominent shoulders; the dorsal line of segment rises at nearly a right angle to plane of segment 2, then rounds off suddenly to become nearly parallel to longitudinal axis of pupa, rising only slightly to the apex which is nearly over the posterior margin. Segment 4 forms part of the hinder slope of the thorax, so that segment 5 is the lowest point of the dorsum after which the transverse section of abdomen is a slightly increasing circle up to segment 8, afterwards decreasing continually to anal end which is bluntly rounded, the last two segments forming a nearly perfect hemisphere bearing a short stout cremaster. The surface of the pupa is dull, very slightly wrinked and set with minute erect hairs. The colour is white with a pink and yellow shade in it; segments 2—5 have a subdorsal broad interrupted black line coalescing at the hinder margin of the last segment, the extremities in front being joined by a straight line on the vertex of head; the dorsal space between these lines on segments 3 and 4 is reddish yellow; the abdomen has a broad subdorsal line, a similar spiracular line and a central ventral one: all black; each of these lines or bands enclose a reddish yellow circular spot near front margins of segments, these spots being the scars left by the larval spines (except the ventral spots); last segment and cremaster are black; tips of head points, sides of head, shoulders, antennæ and greater part of proboscis also black; wings margined black with a central bifurcated black mark to each and a short subapical line; all the black markings are dull, not shiny. L: 17 mm. B: 6 mm. at broadest part.

Habits.—The eggs are laid in a batch, up to 15 or so in number, on a young shoot or tendril; the larvæ are gregarious at first but separate in the third stage; they are extremely lively and moth-like in their movements and grow very fast; they generally sit on the underside of a leaf though by no means always, pupate generally on or near the food-plant, the pupa hanging perpendicularly down by the tail like all nymphaline pupæ, freely, though firmly, attached. The larva, pupa and imago have a disagreeable odour. In Bombay the butterfly is to be found at all seasons, in the mountains and plains, forests and open country, even in the region of least rainfall—Sind. The flight is that given for the sub-family. The food-plant is *Modecca palmata*, Lam., in the damper parts, the wild Passionflower, but the larva will also feed on cultivated kinds, perhaps even on certain *Cucurbitaceæ*, these being near allies of the Passionflowers. The butterfly is

confined to Peninsular India and Ceylon, and is fairly plentiful everywhere in these places.

SUB-FAMILY *Libytheinæ.*

Only one genus.....*Libythea.*

GENUS *Libythea.*

Only one species, Exp. 1·8″—2·3″ .....*myrrha.*

This sub-family is composed of the single genus containing some score of species spread throughout the world in Europe, Africa, India, the Malay Archipelago, N. and S. America, Mauritius and the Antilles. In India Colonel Bingham records 5 species and 3 races and of these only the one species is of interest to us; and it is nowhere plentiful. The libytheine butterflies are all very like each other, somewhat like some of the *Vanessæ* in shape and are brown with yellow or white markings on the upperside: the underside shaded and striate-punctate grey; they are fond of water and damp places and of the sun, basking generally on the upper end of a dead twig or bit of stick with the wings closed over the back and the fore-wings sunk between the hinder pair so as to show nothing but the protectively coloured grey parts. They are then very difficult to see. They fly well but not for long, going fast in a jerky, skipping way, and dodging from side to side. They are insects of woodlands and the hills. The egg, according to Doherty, is shaped like a bottle and is ribbed longitudinally; in fact, resembles that of the *Pieridæ;* the larvæ may be said to resemble those of the *Pieridæ* also; those of two species known certainly do so; the pupa is nymphaline in aspect and character of suspension; more particularly, like that of *Apatura, Euripus*: rigid, with the body parallel to the surface on which it is fixed. The food-plant of two species, one spreading west to Europe, the other east to China and Malay, is *Celtis*, a genus composed of trees belonging to the family *Urticaceæ.*

DESCRIPTION OF SPECIES OF LIBYTHEINÆ.

Libythea myrrha, *Godart* (fig. 5).—Male and female *upperside*: ground-colour dark-brown. Forewing: a streak from base along median vein, extending narrowly on each side of it and continued beyond as a large oval spot in interspace 2, two preapical double spots placed obliquely towards costa: orange-yellow. Hindwing: a slight, oblique, narrrow, medial band from vein 1 to vein 5 of the same colour. *Underside* forewing: ground-colour brown; orange-yellow markings as on upperside, but broader and more diffuse; apex and dorsal margin broadly shaded pale grey irrorated with minute dark spots and transverse short striæ. Hindwing greyish-brown irrorated with minute dark spots and transverse short striæ, shaded in the cell, on the middle of costal margin and on middle of termen with diffuse brown; the lower half of cell in hindwing darker in the male; the whole

hindwing much more concolorous in the female. Antennæ, head, thorax and abdomen dark-brown; beneath: palpi, thorax and abdomen greyish-brown. Exp. 46—58 mm.

This is a variable insect in the extent and breadth of the orange-yellow markings and in the mottling and ground-colour of the underside. The variety *sanguinalis*, chiefly Himalayan and Eastern, has the orange-yellow markings very broad. Variety *rama*, the variety occurring in South India and Ceylon, is smaller with the markings much narrower and shorter, the preapical spots white or yellowish-white.

Larva.—In general facies the larva recalls that of *Catopsilia* of the *Pieridæ*. It is dark-green in colour, cylindrical in shape, narrowing somewhat to both ends; the head is small, about half as broad as the larva at centre: and is about the same breadth as segment 2. The head is round in shape, with a shallow broad depression on vertex; the surface is smooth and dull, sparsely set with minute dark bristles and some light hairs about jaws; it is green in colour, with brown markings seen under the lens, the antennæ reddish, labrum green, eyes black. Segment 2 is broader behind than in front and has the front margin very slightly triangularly produced in dorsal line: the anal flap is rounded behind, with the curve of its dorsal line nearly a quarter-circle, the extremity nearly touching the resting surface; and there is a depressed dorsal surface, oval in shape, two-thirds the width of segment, reaching from hinder extremity towards front margin: this surface is hairless and covered with brown streaks. The rest of the larva is covered with transverse rows of minute, black bristles, four to each segment; there are also some bristles on ventrum; the rows are separated by depressed lines, one between each. The prolegs are rather long. The spiracles are light yellow, black-rimmed, oval, flush with the surface and of ordinary size. The colour is dark-green, sometimes with a brownish tinge, with a thin, light yellow, dorsal line from segment 4 to segment 12 and a narrow, yellow, supraspiracular band from head to anal end. L: 26 mm.; B: 4·5 mm. at middle; B at head; 2·25 mm.

Pupa.—This is most like that of *Ergolis* but has no head-points. It has the part formed by the head and segment 2 straight in front (front of pupa), parallel-sided, convex on dorsum transversely to pupa; the shoulders are the broadest part, widening out suddenly at an angle of 135° with the side of head-piece; the dorsal outline seen from the side is, for the thorax, a carination starting from front margin in a straight line at an angle of 45° to longitudinal axis of pupa, culminating in a rounded apex just over the hinder margin to which the outline descends abruptly; thence the line ascends again to the apex of a small, sharp peak at the common margin of segments 5 and 6, to descend again in a slight carination to the hinder margin of segment 8 after which the outline curves in a quarter-circle to end of cremaster; the ventral outline is

nearly straight from head to segment 12, then nearly at right angles; the lateral outline after the shoulders is formed by the wings being expanded very slightly for a short distance, after which the sides converge to meet at the cremaster; the transverse section of abdomen after segment 8 is circular; the abdominal peak is somewhat higher in appearance than the thoracic peak; the cremaster is triangular seen from above and embraces the last segment somewhat, its attachment surface being considerably longer, in the sense of the pupal length, than broad. Surface of pupa is smooth and somewhat shiny, a thin line or carination connects the shoulder with the abdominal peak. Colour is light green with the tops of carinations yellow, and a black speck on abdominal peak. L: 12·5 mm.; B: 5 mm. at shoulders; 3 mm. at front of head; H: 6 mm. at abdominal peak, 5 mm. at thoracic peak.

Habits.—The eggs are laid on the shoots and young leaves, generally of a small tree or shrub near a water-course or in some damp place open to the sunlight, though in forest. The larvæ generally live on the undersides of the leaves, eating all but the ribs or veins in a moth-like way, and on these ribs and veins they may generally be found sitting. They emit much silk or web and fall to the ground by a thread when disturbed, but only when actually touched or otherwise violently molested; they rest with the true legs off the surface, in the air, bunched, the head curved down and often turned to one side. The pupa is formed on the underside of a leaf and the body lies quite parallel to the surface like the pupa of *Elymnias*. The imago is not often seen except in the neighbourhood of the food-plant and, even then, but rarely. This is probably a good deal due to its way of resting and the colouration of its under parts which blends so well with the colour of the grey and brown barks of dead sticks and twigs (see the method of resting above under genus.) Its distribution is throughout the Himalayas from Kulu to Sikkim; Western India; Bombay; Southern India; Ceylon; Assam; Burma to the Malayan Subregion and China. It is not a butterfly of the plains at all. It is found in Kanara and may probably turn up at Matheran or Mahableshwar where the food-plant *Celtis tetrandra*, Roxb., surely occurs.

FAMILY NEMEOBIIDÆ.

Only one genus .. .. *Abisara*.

GENUS ABISARA.

Only one species. Exp. 1·6″—2″ .. .. .. *echerius*.

This species is figured on coloured plate F, figures 40, male, and 40*a*, female. The colouring of both figures is not brown enough, there is too much red in it. The violet gloss on the upperside of male is very good.

The greater number of the relations of *Abisara* are found in Tropical America, some 960 or 970 species. There are 30 or 40 Eastern species, 20 of which occur in British India. One single species occurs in Europe, including England: *Nemeobius lucina*, the Duke of Burgundy Fritillary. These insects are evidently closely related to the *Lycænidæ*, at least they are nearer to them than to any other division of butterflies in all their stages, to judge by Indian representatives and *Nemeobius*. The egg, according to Doherty, is lower than wide, smooth, granulate or prickly, but not reticulate or radiate in the genera examined by him. The larvæ of three out of five Indian genera and of *Nemeobius* are distinctly lycænine in shade, except that the head is not hidden; and the pupæ are certainly more like those of the 'Blues' than anything else. Finally the facies of the imagines is also lycænine. *Nemeobius* and *Dodona*, a Himalayan genus, both contain butterflies that rest with their wings closed over their backs while *Abisara* always keeps them half open, indeed cannot completely close them as the hindwing is not all in one plane, being somewhat warped as it were. The Duke of Burgundy Fritillary is said not to affect flowers and to be fond of shady places. The same is the case with *Abisara*.

DESCRIPTION OF SPECIES OF *NEMEOBIIDÆ*.

Abisara echerius, *Stoll.* (Pl. F., figs. 40 ♂, 40*a* ♀).—Hindwing suddenly lengthened at vein 4, thence gradually decreasing to its ordinary length at anal angle. In the wet-season form the *upperside* of male is a rich purple-brown or maroon-brown with a blue gloss. Forewing with discal and postdiscal transverse fasciæ very obscure and only slightly paler than the ground-colour. Hindwing uniform; two triangular, small, black spots near apex of interspace 1, one larger black spot in each of the interspaces 5 and 6; spots bordered outwardly with white slenderly and obscurely. *Underside*: dull maroon-brown. Forewing with a broad, slightly curved discal, narrower postdiscal and subterminal, transverse, pale fascia, the discal one broader anteriorly. Hindwing: a slightly curved, narrow, discal, pale fascia; black spots as on upperside but bordered inwards and outwards by an obscure pale lunular line. Antennæ black with scattered pale specks; head, thorax and abdomen maroon-brown; beneath: all pale-brown. Female *upperside* hazel brown, terminal halves of wings paler. Forewing: discal and postdiscal broad, obscure, pale transverse fasciæ, the former or both sometimes white in the upper part; followed by an obscure, double, subterminal pale line. Hindwing with a series of subterminal, pale, lunular spots, the black

spots as in the male, the anterior two superposed on the pale spots; terminal margin below vein 4 with double, above vein 4 with single, subterminal line. *Underside*: ground-colour paler on the basal, very much paler on the terminal half; markings as on upperside but fasciæ on fore and hindwings broader, more diffuse. Exp. 41—52 mm.

A variable insect. In the dry season the purple gloss on the upperside of male is hardly present, the fasciæ are more diffuse, the black spots smaller or rarely quite wanting; the underside is paler. In the female the colour is also paler, the contrast between base and outer half of wings more pronounced, the discal fascia on underside very broad, often nearly white: indeed it is often white even on the upperside.

Larva (Pl. I, fig. 12).—The shape of the larva is onisciform, depressed-looking, highest at middle or a little anteriorly to it, broadest at middle, considerably narrowing towards both ends, segment 2 and segment 12 being about the same width; ventrum flat. The larva is distinctly lycœnid in type. Head only semi-hidden, roundish, flattened on face with some few dark, erect hairs; light green in colour. Segment 3 a little wider than, and embracing slightly, segment 2 at the sides; anal segment very convex and narrow (in sense of larval width), rounded at extremity. Segments all well marked and very slightly flanged dorsoventrally. Surface of body covered with tiny, transparent tubercles all over, circular and looking like drops of liquid; segment 2 fringed along margin with long, porrect, light hairs somewhat densely; segments 3 and 4 with a subdorsal and lateral bunch of 4 dark, long, erect hairs; segments 5—12 with a similar subdorsal bunch to segment 3, but with a single hair instead of the lateral bunch; each segment has, besides, a subspiracular line of long, light, straight hairs; anal segment has many white and brown singly disposed hairs. Spiracles are whitish, oval in shape and of ordinary size. Colour of body is light olive-green with the dorsum of each segment, except segment 2, between dark-green, lateral lines reaching the whole length of larva, white; a dark-green dorsal line, along the edges of which the white is suffused with green; a lateral dark green, roundish depression on segments 5—12; the dorsoventral line whitish; ventrum green. L: 18·5 mm.; B: 5 mm.; H: 4 mm.

Pupa. (Pl. I, fig. 12*a*.)—Shape rhomboid, equilateral; a diamond in fact, the breadth at middle, the broadest part, being a little more than ⅓rd the total length. Head square, running out into a flat ledge in front, the contour of which is rounded with a square piece cut out of centre to the depth of the ledge, *i.e.*, there is a point in front of each eye somewhat flattened on top, rounded on outer side and straight on inner side. The anal end is sharply pointed; really minutely truncated at extremity of cremaster. The two lateral angles of the diamond are rounded. Segment 2 and front slope of segment 3 are in the same plane; the latter segment or thorax is somewhat humped, evenly convex from shoulder to shoulder,

apex slightly the highest part of pupa; the wings are slightly expanded behind shoulders in a semi-cylindrical fold. Constriction is slight dorsally, laterally it is nil. Abdomen dorsally gently convex from thorax to anal end; belly flattish. Spiracle of segment 2 indicated by a small, circular, flush, white space; other spiracles oval, light in colour, on the very dorso-ventral line. Surface of body covered densely with colourless, short-pedicelled, star-topped hairs, the pedicels being longer on the anal segment; a fringe of sparse, long, light hairs round dorso-ventral margin, denser on head and segment 2; ventrum and wings glabrous. Colour of pupa grass green, spotted finely with darker green in squares, a whitish dorsal line, four small black spots on front margin of thorax, the two outer ones the most distinct; a lateral row of distinct black spots and a subdorsal row of obsolescent ones on abdomen; belly whitish. L: 16 mm. B: 6·5 mm. at middle; H: 4·5 mm. at apex of thorax.

Habits.—The egg is laid anywhere on stalks, leaves, &c., of any surrounding small plant, on the food-plant itself, very often on a blade of grass; and nearly always in the evenings in dark, cool places in the hills or heavy jungle country where the imago is found. The larva lives on the underside of the leaves but is found sometimes on the upperside, stalks, &c. It wanders to pupate but not far; consequently the pupa is not often to be found on its own plant and is formed on the underside of a leaf, attached by the tail and a tight body-band and is generally on a bed of white powder. Very often the larva slightly draws the part of the leaf, where it rests together by silks and the pupa may be formed in such a half cell. The imago is a shade-loving butterfly, somewhat lycænid in appearance and in its ways; it, however, never quite closes its wings over its back and has the habit of resting on a leaf at no great height from the ground where it first turns this way, then that, rarely remaining quite quiet, taking a short, rapid, jerky and dodging flight every now and then to return to the same place; it is most active in the late afternoons. It is never seen at flowers. The distribution of this insect is in the Himalayas from Chumba to Kumaon, Nepal and Bhutan, in Umballa, Fyzabad, Malda, Calcutta, Ganjam; in Bombay south of Poona and Bombay; Ceylon, Burma, Tenasserim and China.

(To be continued.)

ERRATA.

In Part IV of this Paper (No. 1, Vol. XIX.) the following additional *errata* occurred :—

Page	17,	line	11,	for Niceville ..	*read* .. Nicéville.
„	23	„	1,	omit comma after ..	.. "horny."
„	23	„	8,	for pensils ..	*read* .. pencils.
„	23	„	32	„ *Tarsolepes* ..	*read* .. *Tarsolepis*.
„	24	„	32	„ affected ..	*read* .. affect.
„	26	„	31	„ twelve month ..	*read* .. twelve months.
„	26	„	34	„ seem	*read* .. seems.
„	27	„	15	„ fortnight ..	*read* .. three weeks.
„	29	„	16,	omit comma after	.. "those."
„	36	„	20,	*read* comma instead of full stop after "form."	

A COLLECTION OF THE OPHIDIA FROM THE CHIN HILLS,

(WITH NOTES ON THE SAME BY MAJOR F. WALL, I.M.S.; C.M.Z.S.)

BY

F. E. W. VENNING.

The collection, with the exception of one or two specimens, was made during the latter portion of 1908 and the first few months of 1909 in the neighbourhood of Haka, a small outpost in a remote part of the Chin Hills. This very out-of-the-wayness has its compensations from a naturalist's point of view, for it offers him a rich and practically virgin field for his energies and in the case of the Chin Hills one of special interest in that it is placed between two portions of the Empire which are better known to science but are probably very different in physical characters from the Chin Hills.

The "Imperial Gazetteer of India" describes the Chin Hills as "a "tract of mountainous country inhabited by hill tribes on the N.-W. "border of Burma, lying between 21° 45' and 24° N. and 93° 20' "and 94° 5' E. with an area of about 8,000 square miles. It forms "a parallelogram about 150 miles in length N. and S., and varying "in breadth from 100 to 150 miles.* It is bounded on the North "by Manipur; on the West by portions of the Lushai Hills, and by "the unadministered Chin area that lies to the North and East of "the Northern Arakan District; on the South by unadministered "country and by the Pakokku Chin Hills; and on the East it "borders on the Upper Chindwin and Pakokku Districts. The "tract consists from end to end of a mass of mountains much broken "and contorted and intersected by deep valleys, and is practically "devoid of plains and tablelands. Its main ranges run generally "North and South and vary in height from 5,000 to 9,000 feet."

The whole district forms a portion of the great broken system (? systems) of mountains which divides the Brahmaputra or Assam Valley from that of the Irrawaddy and which reaches its highest points on the Burmese side.

* A curious error as the Chin Hills' Gazetteer, I believe, gives a length of 250 miles and a breadth of 100 to 150 miles *by road*. The area does not much, if at all, exceed 50 miles in breadth "as the crow flies."

Geologically the chain is believed to belong to the Tertiary epoch and consists chiefly of shales of a soft nature, which easily disintegrate to form a stiff clayey soil, and a fair proportion of sandstones. Limestone is uncommon and igneous rocks are perhaps nowhere found near the surface, at any rate in the Haka Sub-division.

The area consists, then, of a chain of mountains of moderate height situated just within the tropics, and as might be inferred a semitropical vegetation exists, changing into tropical in the deeper valleys where teak, palms, and such trees as the papaya are to be found, and into quite a temperate form on the tops of the higher mountains.

Haka Sub-division is the most Southern of the three Sub-divisions into which the Chin Hills District is divided, and Haka station is situated some 6,500 feet above sea-level on the North-Western slopes of a mountain near the Northern boundary of the Sub-division. The point of the mountain range which is immediately above the station is known as Haka peak and is supposed to be 7,500 feet high. A neck of open grassland, about half a mile to the west of the station, connects the range with another running parallel to the Haka range and of about the same general elevation. This neck throws off its waters from one side into the Boinu river, which after flowing in a gigantic S. reaches the sea at Akyab, and from the other into the Manipur river, a tributary with the Myittha river of the Chindwin. On either side of the station a spur runs down from the peak, and the water collected between the two spurs into a marshy hollow between the Civil station and the Military police lines forms the supply of the community. The face of the hill between the two spurs is clothed with dense jungle, practically impenetrable in the rains but easily entered in most places in the dry weather. This jungle stretches rather more than half way down to the station and provides one of the loveliest views from Haka. At one season it is tinged with the rich hues of autumn, a species of Virginia Creeper contributing largely to the effect, at another it is outlined by the brilliant flowers of *Rhododendron arboreum*. In the cold weather the soft pink of the Cherry (*Prunus puddum*) is shown in exquisite relief against the dark-green of the forest, only to give place to the hardly less vivid contrast afforded

by the young shoots of the elm. In February the lower edges of the jungle and the entire hillside to far below the station is whitened by the snowy blossoms of the wild pear *(Pyrus pashia)* and a little later the wild rose *(Rosa longicuspis)* begins to produce its spring flowers, and almost throughout the year covers many a bush and tree with its sweet scented sprays.

Below this jungle are a few scattered trees on slopes of coarse grass mingled with gigantic thistles *(Cnicus sp.? wallichii)* bracken and other herbaceous plants, and the jungle stretches its long fingers down one or two watercourses. Below the grassland a more or less open woodland begins, consisting for the most part of shrubs, small alders, pears, oaks and chestnuts and other similar trees with occasional groves of pine (*Pinus khasia*), and this jungle, broken by patches of short grass having very much the appearance of English commons, spreads down to the valley some 2,000 feet below. The more open nature of this woodland and its stunted character is due, it is believed, to clearance by the Chins at some previous date for their extravagant form of cultivation (Taungya) and to their custom of burning to which reference will be made when dealing with the climate. Below the station is a collection of Chin villages and in the valley a small stream, the Trongvar, flows. The hillside is intersected everywhere by little rivulets, some of which disappear in the dry weather, while in the rains they all become foaming torrents and carve their channels deeper and deeper into the surface the lower they descend. Wherever a suitable hollow occurs a small marsh is formed, and in the cold weather streams and marshes are the haunts of woodcock and two or three species of snipe. The hillsides are generally very steep but a pleasant exception to this rule is the so-called "golf-course" on the neck about half a mile west of the station, where there is open grassland throwing off some delightful undulating downs.

The climate consists of three well-marked seasons. The rains, during which most of the snakes emerge, last from the middle of May to the middle of November, roughly speaking, but this year (1909) the previous Christmas rains having failed a very short hot season was experienced, the rainy season setting in early in April.

The greater part of the total rainfall is registered during the wet season, a few showers at Christmas and an occasional thunderstorm in March bringing the total to about 90 inches or probably more. It is in the rains that the frogs, toads and lizards on which perhaps the snakes chiefly feed make their appearance, together with leeches, bloodsuckers and a host of small insect life. At the end of the rains a cold season ensues and in January and February and even well into March a thick white frost covers the ground in the mornings. Ice is formed up to a quarter of an inch thick in midwinter, while in December 1908 heavy snow fell on all the higher mountains including Haka peak. The cold weather is followed by a hot dry season during which the atmosphere is rendered almost unendurable owing to the Chin habit of burning not only where they wish to cultivate but wherever there is grass or undergrowth to burn. Like many other Chin customs this is one which, in the opinion of the writer, cannot be too strongly condemned. In a few cases it is done for the purpose of procuring game, which is slaughtered as it flees in terror, but in the majority it is done from pure wantonness, for the Chins keep no cattle for which grazing has to be found. Indeed it is very questionable in the writer's opinion whether the burning, though it makes the green of the new grass more quickly obvious to the eye, does not destroy the more tender and succulent grasses and allow only the coarser kinds to flourish. The question has been well discussed in connection with its effect on teak forests, and there seems to be no doubt that a large amount of the valuable nitrogenous products of the vegetation is lost to the soil by the process. Innumerable young trees are either killed or their growth suddenly checked so that they become stunted and deformed.

After the burning, ferns, thistles and grasses appear and the ground is beautified with the colours of violets *(Viola patrinii)*, Primulas *(Primula denticulata)* and other flowers.

Such are the conditions prevailing where the collection was made, but it is not to be supposed that it is in any way representative even of the Haka Sub-division, still less of the Chin Hills as it was made within very narrow limits. Nearer the plains it is said that the pretty tree-snakes, *Dryophis*, etc., abound, while in the valleys

King Cobras are reported to be not uncommon. A King Cobra has since been obtained by the writer from near Haka.

As regards the collection itself Major F. Wall, I.M.S., has very kindly examined the writer's notes and some of the specimens as the writer did not feel qualified to offer his opinions without having them corroborated or, if necessary, corrected by some competent authority. Major Wall's remarks will be found incorporated in the text and followed by his initials so as to be easily recognisable, and the writer wishes to express his gratitude to him for his notes which naturally form the more interesting portion of the account, as well as for the instruction and encouragement given by him.

Vernacular names have not been given as the Chins recognise very few snakes and regard them all with horror. The mere display of some specimens in a bottle caused one Chin chief to leave the writer's house precipitately and return to his village. "Rul" (pronounced like the word "rule" but with a tendency not to sound the final "l") is the Chin for a snake in the Haka or Lai dialect. The most usually recognised snake of those collected was the green Pit-viper which was called "rul harr" (harr meaning difficult, sharp, rough). "Rul pi" (pi means big or female) was the name applied to the rat-snake (*Zamenis mucosus*), while "Sar vut saw," the meaning of which is not obvious, was applied indiscriminately to the snakes *Callophis macclellandi*, *Ablabes porphyraceus*, and *Simotes albocinctus*. "Ngan" is understood by most Chins for the Python or possibly for the Hamadryad, and "Tlua kan" for the Cobra.

Of snake bite no records exist, but a few cases came to the writer's notice. Three military police sepoys were bitten at different times, one in the thumb and two in the toe. In the case of the man bitten in the thumb he immediately put on a ligature and on his return to the lines had the wound cauterized and suffered no ill-effects. Of the other two one put on a ligature of sorts and suffered little, the other did nothing till his leg began to swell when he went to hospital and was treated. He had some fever, twenty-four hours' pain and a leg swollen up to the groin but nothing more. All these three men were bitten by *Lachesis gramineus* or perhaps *jerdoni* as far as could be judged from their descriptions coupled with the

fact that these species are about the commonest snakes found near here. Two cases were attended to by the American baptist missionary, a medical man. These were Chins who came in on the day after they were bitten in each case. They were treated to no less than five incisions one above the other from the thumb to the shoulder into which permanganate of potash was rubbed! One of these Chins was bitten by a *Lachesis monticola*, identified by the body, the head having been reduced to powder, cooked and applied to the wound by the victim! The other was also bitten by a Pit-viper to judge from the rather vague description given by the missionary.

A few odds and ends were thrown in with the snakes.

FAMILY—TYPHLOPIDÆ.

None represented in the collection but one was found in April 1907 on the road near Taungtek (altitude 4,500 ft.) on the Burma side of the Manipur river. The species was not identified and the specimen could not be preserved for lack of any kind of spirits.

FAMILY—COLUBRIDÆ.

Sub-family—COLUBRINÆ.

Blythia reticulata.

Seven specimens.

No. I.—Length 14 in. Tail 2 in. Ventrals 137. Subcaudals 27 pairs. Postoculars on the right one, on the left two.

No. II.—Length 16¼ in. Tail 1·7 in. Ventrals 141. Subcaudals 21 pairs. Postoculars as in No. 1, the lower one on the left very minute.

No. III.—Length 14½ in. Tail 1·85 in. Ventrals 138. Subcaudals 27 pairs, the 9th from the anal orifice being entire. Postoculars on the right two, on the left one.

No. IV.—Length 14 in. Tail 1·9 in. Ventrals 141. Subcaudals 28 pairs. Postoculars two on each side, the lower minute. This specimen appears to have a very minute præocular on either side between the præfrontal shield and the 3rd supralabial.

No. V.—Had to be thrown away, its characteristics were: length 11¾ in. Tail 1·4 in. Ventrals 140. Subcaudals 25 pairs.

No. VI.—Length 13 in. Tail 1·7 in. Ventrals 140. Subcaudals 27 pairs. Postoculars one on each side.

No. 18 of 1909.—Length 18 in. Tail 2½ in. Ventrals 140. Subcaudals 27 pairs.

These specimens were all obtained in Haka on the roads and towards dusk.

No. 3 of 1909.—Length 4⅜ in. Tails ⅝ in. Ventrals 155. Subcaudals 22

pairs, whitish beneath. This is an immature specimen of some snake which I placed here as I could not decide what else it might be. It was obtained at Fort White (7,500 ft.) in April 1909 by Mr. Angelo, Superintendent of Post Offices, who kindly brought and presented it to me. The anal shield was incorrectly noted by me, *vide* note.

[I examined one of these specimens, *viz.*, the one marked "No. 3 of 1909." It is without doubt a *Blythia reticulata*. The occurrence of this species in the Chin Hills extends its previously known habitat. It has hitherto never been recorded except from the Khasi Hills in Assam. The anal is reported entire, but I find it divided.—F. W.]

Ablabes porphyraceus.

Seven specimens.

	Length.	Tail.	Ventrals.	Subcaudals.
No. VII.	12½″	2″	215	75 pairs.
No. VIII.	39″	6½″	202	63 ,,
No. IX.	23¼″	4¼″	210	74 ,,
No. X.	20½″	3½″	214	66 ,,
No. XI.	36½″	5½″	210	60 ,,
No. XIA.	14¼″	2⅝″	204	65 ,,
No. 16 of 1909.	17½″	2¾″	213	66 ,,

The dorsal scales counted 19 anteriorly and at midbody, and 17 posteriorly in all the specimens, the reduction being due to the 4th and 5th rows above the ventrals coalescing.

In two specimens Nos. IX and XI the frontal touches eight shields being in contact with the præocular shields in addition to the normal ones.

In No. X the 26th, 27th, and 28th subcaudals counting from the vent are single.

The colour of the small (apparently immature) specimens, Nos. VII, X and XIA was a pale dove-colour (a kind of dirty white), while that of the large ones was a rich red exactly answering to Major Wall's description of "raw beef colour," but this colour rapidly disappears in spirit. No. 16 of 1909 was a yellowish colour, possibly an intermediate stage between the other two. The colour within the annulations was the same in all the specimens, *i.e.*, a deep mahogany red. The number of annulations varied little, but the marks themselves were often very irregular and sometimes were broken up into two or three small circles.

Coluber prasinus.

One specimen, No. XXXVII.

The head only was preserved much bleached by strong spirit, the rest of the specimen had to be thrown away.

Length 42 inches. Dorsal scales 19 anteriorly and at midbody, 15 posteriorly. Ventrals 202. Anal entire. Subcaudals 109 pairs. The hori-

zontal diameter of the eye slightly less than its distance from the nostril. Frontal shield not as long as its distance from the point of the snout; in contact with eight other shields. Supralabials 9, of which Nos. 4, 5 and 6 enter the orbit of the eye. Præocular one on either side. Loreal one. Postoculars two. Temporals two anterior ones on the right, one on the left. Infralabials 10, five of them touching the anterior and two the posterior sublinguals. The posterior sublinguals longer than the anterior. The specimen came from Nabwel village near Haka, altitude about 5,000 feet.

Coluber tæniurus.

A single specimen, No. 10 of 1909.

Length 5 ft. 6 ins. Tail 12½ ins. The dorsal scales numbered 23—21—17. Ventrals 250. Anal divided. Subcaudals 98 pairs doubtfully. It was caught in the military police lines and apparently taken for a King Cobra to judge from the way it was knocked about.

Simotes albocinctus.

[Var.—*typica*—F. W.]

Two specimens were obtained.

No. XII was killed by my wife about half a mile from Haka on the Haka-Falam road in September 1907, and is now much bleached. Length 20 ins. Tail 4 ins. Dorsal scales 19—19—15. Ventrals 181. Anal entire. Subcaudals 61 pairs. Supralabials on right side seven, of which 3rd and 4th enter the eye; on left eight, 4th and 5th entering the eye.

No. XIII was brought from Nerlon village just below Haka, altitude about 6,000 ft. or perhaps less. Length 29 ins. Tail 4½ in. Dorsals 19—19—15. Ventrals 191, Nos. 75 and 76 from the head having a small division near one side, possibly the result of an accident. Subcaudals 52 pairs. The suture between the internasal shields is greater than that between the præfrontal pair. The supralabials present the same abnormality as in No. XII. Colour mahogany red above, coral red below with large squarish black spots near the ends of the ventrals. There are 27 white dorsal cross bands about two scales wide, edged with black. On the nape the white cross band is distorted forwards to the parietal shields where it disappears, its black margin ending in a circular black spot on the parietals. A black or dark-brown mark curves across the head through the eyes to the labial margin. There are some small black lateral spots.

Oligodon dorsalis.

Four specimens all captured on roads in the station.

	Length.	Tail.	Ventrals.	Subcaudals.
No. XIV	20″	2¾″	179	35 pairs.
No. XV	16″	1½″	170	27 „
No. 9 of 1909 ..	17½″	2¾″	176	42 „
No. 11 of 1909 ..	7″	1″	179	38 „

The dorsals in all four specimens were 15—15—13, the step occurring at midbody. I have noted under No. XIV the remark "nasal undivided, *i.e.*, nostril pierced in centre of a single nasal shield" and under No. XV "nasal and nostril as in No. XIV." If these remarks are correct the characteristic, though of minor importance, is interesting in view of Major Wall's remarks on the affinities of this species on pages 327 and 328 of Vol. XVIII of the Society's Journal, where the shield is depicted in the illustration as undivided though in the "Fauna of British India" it is described as "divided." A light-coloured vertebral band with a series of black spots (XIV) or a black line (XV) on either side and the bright red colour beneath the tail as described by Major Wall in Vol. XVIII, page 328.

[This species has only once before been recorded from the Burmese Province, *viz.*, from Mansi, Katha District, this specimen being in our Society's collection. Its occurrence in the Chin Hills was to be expected, though never previously reported.—F. W.]

Zamenis mucosus.

One specimen, No. XVI, brought to me from below Nerlon village, altitude about 6,000 ft. or less. Length 6 ft. 6½ ins. Tail 18 ins. Greatest girth 5 ins. Ventrals 192. Anal entire. Subcaudals 92 pairs, the 16th from the tip of the tail being entire.—Dorsals. The disposition of these scales I made out to be as follows:—At two heads-lengths behind head 19, immediately behind this 17, at midbody 17, and at two heads-lengths from vent 10. The steps occurred as below:—

From 17 to 16.—Vertebral and adjacent row on the left unite, after two scales they separate again for one scale's length, then unite, divide again and unite again.

From 16 to 14.—The 2nd and 3rd rows on the left, and the 3rd and 4th rows on the right are absorbed.

From 14 to 13.—The vertebral and adjacent row on the right unite, the scales thus formed being doubly keeled for a considerable distance.

From 13 to 12.—The 2nd and 3rd rows on the left unite.

From 12 to 11.—The 2nd and 3rd rows on the right unite.

From 11 to 10.—The vertebral row unites with the adjoining row on the left and the following scales are again doubly keeled.

The distance "two heads-lengths from the vent" was only roughly taken in this instance. On the right the 7th supralabial is much produced upwards causing a distortion of the temporal shields on that side. There were three loreal shields on the left and four on the right arranged as follows:—anteriorly one large shield followed by three small ones. There was a small subocular, or it might be considered a lower præocular, on either side. The colour is uniform dark-brown.

Pseudoxenodon macrops.

Two specimens, Nos. 13 and 14 of 1909.

No. 13 of 1909 has a length of 30 ins. of which the tail is 6½ ins. Ventrals 173. Subcaudals 82 pairs.

No. 14 of 1909.—Length 42½ ins. Tail 9 ins. Ventrals 168. Subcaudals 81 pairs.

I should here remark that the identification of these two specimens as well as that of the following ones was worked out by Major Wall. The two *Pseudoxenodon* specimens were originally included by me in my remarks on the *Tropidonoti*, of which I wrote that I found the identification of the species from the literature at my disposal so difficult that I decided to leave it to others; but the return of my manuscript with Major Wall's remarks has enabled me to re-arrange the notes so as to accord with the identification of the specimens and to add the names to the numbers which were given alone before.

Genus *Tropidonotus.*

Two of the specimens I obtained, Nos. XXXV and XXXVI, I thought, at first, must be some new kind, but afterwards thought they might belong to the species *modestus* or the genus *Polyodontophis*. They appeared to me sufficiently interesting to describe at length, but as they have now been given specific rank and are described by Major Wall in a note which will appear in this Journal, it will only be necessary to give a few details here which are not mentioned by him, and to express my appreciation of the honour accorded me.

The two specimens were obtained from close to the station, and I have since obtained a third. No. XXXV was taken on the 8th October 1908 and No. XXXVI on the 26th September 1908.

There is no doubt that these two specimens (XXXV and XXXVI) constitute a species which has hitherto never been described, and I venture to name it after its discoverer. I think there can be no doubt that it should be classified as a *Tropidonotus*, its resemblance to the species of this genus being very striking except in one important particular, *viz.*, the costal rows, which number 17 and remain the same in the whole body length.

Only one other of the Indian *Tropidonoti* has 17 costal rows, *viz.*, *punctlatus* which is also a Burmese snake. In this (*punctlatus*) the rows fall to 15 posteriorly, agreeing with the fall from 19 to 17 which occurs in all other *Tropidonoti*. The subcaudal shields are more numerous in (*venningi*) than in any other Indian species, and in fact than in any other world species excepting two from Madagascar and one from America, still I think it should be considered *Tropidonotus* on the teeth.—F. W.]

The other *Tropidonoti* sent were eleven specimens besides two immature ones. These were supposed all to be either *himalayanus* or *subminiatus*, but

two of them turned out to be *Pseudoxenodon macrops* and have already been referred to. Major Wall's note, which I place here, gives the identity of the others.

[I have examined the eleven specimens referred to by Mr. Venning and find that his Nos. XVIII, XX, 2 of 1909, and 15 of 1909 are *himalayanus*, his XIX, XXI, 1, 4, and 8 of 1909 are *subminiatus*, and his 13 and 14 of 1909 are *Pseudoxenodon macrops*. The two immature ones referred to marked XL*a* and XL*b*, are *himalayanus*.

Some of the *Tropidonoti* are difficult to identify from one another, and this is specially the case when a specimen is abnormal. It frequently happens that the supralabials and the number of the anterior temporal shields are abnormal, and as these shields are of much assistance in distinguishing between some closely allied species the difficulty will be readily appreciated. No. XIX of Mr. Venning's list from the lepidosis might well be *stolatus*, but the colour negatived the idea. No buff stripes were to be seen, and no black chequering anteriorly, and no supralabials showed black at the sutures. It is in reality *subminiatus*, abnormal in having but one temporal, but the colour of the body did not assist the identification, the usual brilliant vermilion of the neck being totally absent.

The single broad subocular black blotch gave me the clue to its identity, and in comparing it carefully with other *subminiatus* specimens I was able to satisfy myself that it was one of this species.—F. W.]

The following table is reconstructed on the above notes:—

Tropidonotus himalayanus.

No.	Length.	Tail.	Ventrals.	Subcaudals.	Date of capture.
XVIII	.. 26″	7½″	160	92 pairs	2-7 -08.
XX	.. 27″	7¾″	165	89 „	10-10-08.
2 of 1909	.. 25″	7¼″	159	93 „	28- 4-09.
15 of 1909	.. 23¾″	2½″	161	24 „	Tail imperfect. 9- 7-09.

Tropidonotus subminiatus.

XIX	.. 23¼″	6½″	163	96 pairs	10- 8-08.
XXI	.. 30¼″	8¼″	174	91 „	14-10-08.
1 of 1909	.. 33½″	8″	167	85 „	11- 4-09.
4 of 1909	.. 18″	4½″	169	94 „	9- 5-09.
8 of 1909	.. 39″	9¼″	163	82 „	24- 5-09.

No. XVII, which I think must have been a *subminiatus*, had to be thrown away. It was taken on 11th June 1908 and contained about 9 eggs, and it had swallowed a frog. Its length was 29½ inches of which the imperfect tail accounted for 5 inches. It had 8 supralabials with 4th and 5th entering the eye. It had the vermilion tinge on its neck and the single black

triangular spot on the 6th and 7th labials. Its ventrals were 142, and subcaudals 47. In two cases frogs and in one case the remains of a lizard were found in the abdominal cavity. None of the specimens which were brought to me alive ever showed any temper nor could I induce them to bite. When teased they nearly invariably arched their necks slightly so as to depress their noses to the ground and remained in that position. In no specimen did I note a black nuchal spot although one or two had a distinct orange collar. No. 4 of 1909 has a dark spot in front of the orange collar.

Sub-family—DIPSADINÆ.

Dipsadomorphus hexagonotus.

Two specimens.

No. XXVI.—Length 26 ins. Tail 4⅜ ins. Dorsals 19—19—14. The steps take place as follows:—First the 3rd and 4th rows above the ventrals on the left unite making 18 rows, next the 3rd and 4th on both sides unite and the next row to the vertebral on the left is absorbed into the vertebral row making thus 15 rows. After this the vertebral and adjacent rows become very much mixed up and at last at two heads-lengths from the vent 14 rows are left. The ventrals are 242 and the subcaudals 86 (♀). The anal is entire.

No. XXVII.—Length 16⅜ ins. Tail 3¼ ins. Dorsals 19—19—13, the absorptions occurring in the vertebral rows chiefly. The ventrals are 222 (♀).

Psammodynastes pulverulentus.

One small specimen, No. XXVIII, was obtained. Dorsals 17—17—15. Ventrals 161. Anal entire. One anterior temporal. One præocular and two postoculars.

Sub-family ELAPINÆ.

Callophis macclellandi.

Var A.

Four specimens.

No.	Length.	Tail.	Ventrals.	Subcaudals.	Date of capture.
XXII ..	25″	2⅞″	195	33 pairs	10-9-08.
XXIII ..	25¼″	3″	192	34 „	15-9-08.
XXIV ..	25″	3″	197	35 „	17-9-08.
XXV ..	29¾″	3¼″	194	34 „	4-10-08.

No. XXIII had the 4th subcaudals from the vent entire, and No. XXV the 12th from the vent on the left very large and distorted. The black annulations numbered in No. XXII thirty-one, in No. XXIII twenty-nine, the 6th from the head being in two parts, in No. XXIV thirty-one and in No. XXV thirty-two with 4 on the tail in each case. All the specimens had the ivory cross bar on the head. I could never provoke any of them to bite or show any temper.

FAMILY—VIPERIDÆ.

Sub-family—CROTALINÆ.

Lachesis gramineus.

Two specimens.

No. XXIX.—Length 20 ins. Tail 3½ ins. Dorsals 21—21—15. Ventrals 166. Subcaudals 63. Colour grass green above with a series of white vertebral spots and a white line on the outer rows of scales with a red line below it, extending from the gape to half way along the tail. Tail reddish above. Beneath greenish white.

No. XXX.—Length 25 in. Tail 4 in. Dorsals 21—21—15. Ventrals 159. Subcaudals 55. Colour as in the last but without the vertebral spots. Taken on the 10th October 1908.

Lachesis monticola.

No. XXXI.—Length 19¾ ins. Tail 2¾ ins. Dorsals 25—23—21. Ventrals 151. Subcaudals 36. Three rows of scales between the eye and the labials. Postoculars two small ones. Supralabials 7 on the right, but 8 on the left.

No. XXXII.—Length 21½ ins. Tail 3½ ins. Dorsals 25—25—19. Ventrals 151. Subcaudals 47.

No. 17 of 1909.—An immature specimen, 10¼ ins. in length. Tail 1½ ins. Dorsals 25—23—? Ventrals 144. Subcaudals 40.

Two immature specimens, Nos. XXXIIa and XXXIIb were brought in with No. XXXI and said to be its young.

Lachesis jerdoni.

Five mature specimens.

No. XXXIII, a female kept in captivity by me, gave birth on the 12th September 1908 to four young ones two of which, Nos. XXXIIIa and XXXIIIb survived. The dorsals counted 21 anteriorly (except in one specimen, No. 6 of 1909 in which they numbered 23), 21 at midbody and 17 posteriorly. Three specimens were captured by me on the rifle range one morning, *viz.*, Nos. 5, 6 and 7 of 1909. No. 5 had subsequently to be thrown away. Nos. 6 and 7 of which 6 is a male and 7, I presume, a female, were caught "in copulâ", I think, as they were found together under a large fallen thistle on 15th May 1909.

A great many of the specimens collected had to be thrown away as will be seen from the following table of the numbers of commoner snakes received :—

Tropidonotus	.. ..	19 specimens (may include also *Pseudoxenodon*).
Oligodon dorsalis	.. ..	4 specimens.
Lachesis gramineus	.. ..	16 specimens.
„ *jerdoni*	.. ..	8 specimens.
„ *monticola*	.. ..	6 specimens.

It may be remarked that where "lengths" are given they include the tail length which is given under "tail", and that unless otherwise stated such measurements are in inches. In speaking of the number of rows of dorsal scales "anterior" means at two heads-lengths from the head, and "posterior" at two heads-lengths in front of the vent.

In addition to the ophidia, two specimens, out of about one dozen, *Ophisaurus gracilis* were sent. Also an embryo lizard, *Calotes jerdoni* extracted by me from an egg. The remaining eggs of the brood, ten in number, hatched out in a box of earth on 20th August 1908. This is a very common lizard in Haka.

The nomenclature followed is that given by Mr. Boulenger in the "*Fauna of British India, Reptilia and Batrachia*".

A NEW TROPIDONOTUS FROM THE CHIN HILLS.

BY

MAJOR F. WALL, I.M.S.

TROPIDONOTUS VENNINGI (spec. nov.).

Three specimens were received which from the maxillary dentition I place with the genus *Tropidonotus*. The maxillary teeth are 29, the last two or three gradually enlarging; with no gap separating the enlarged from the preceding teeth. The enlarged teeth are not twice as long as the median teeth. The dentition thus accords with the type of *Nerodia*.

No. 1.—Length 2 feet and 4½ inches, the tail 9 inches.

Rostral touches 6 shields, all the sutures being subequal. *Internasals.*—A pair; the suture between them ¾ that between the præfrontal fellows, ¾ the internaso-præfrontal. *Præfrontals.*—A pair; the suture between them equals the præfronto-frontal; touching the internasal, postnasal, loreal, upper præocular and supraocular. *Frontal.*—The supraocular sutures rather longer than the rest. *Supraoculars.*—Length rather less than frontal, breadth less than half frontal. *Nasals* divided, in contact with the 1st and 2nd supralabials. *Loreal.*—One. *Præoculars.*—Two. *Postoculars.*—Three. *Temporal.*—One. *Supralabials.*—9, the 5th and 6th touching the eye on the left side, 8 with the 4th and 5th touching the eye on the right side. *Infralabials.*—The 7th is the last of the series, and in contact with three scales behind. *Sublinguals.*—Two pairs, the posterior longer than the anterior, and in contact with the 5th, 6th and 7th infralabials. *Costals*, in 19 rows in the whole body length: rather faintly keeled except in the last 3 rows where keels are absent. *Ventrals* 167. *Anal* divided. *Subcaudals* 124 divided except the last four which are entire. *Colour.*—Dark blackish-brown with an indistinct chequering of black streaks. A pale collar incomplete mesially. Head marbled with black and grey, all the labial sutures blackish. Belly black beneath the tail, and hind body, becoming more and more mottled with greyish towards the throat which is mostly a dirty white.

The second specimen agrees except in the following particulars:—The costals are 16 posteriorly owing to a confluence of the 3rd and

4th rows on the right side. The supralabials are 9 on both sides, the 5th and 6th touching the eye. The ventrals and subcaudals are 172 and 135, the latter all divided. The length is 2 feet 3 inches and the tail 9 inches.

Habitat.—Haka Chin Hills. Type is in the British Museum (Natural History) and co.-type in the Bombay Natural History Society's Collection.

A third specimen has since been obtained in which the ventrals and sub-caudals are 165 + 119.

One juv. sent to the British Museum.

THE PALMS OF BRITISH INDIA AND CEYLON, INDIGENOUS AND INTRODUCED.

BY

E. BLATTER, S. J.

PART II.

(With Plates II, III, IV & V.)

(Continued from page 64 of this Volume.)

I.—CORYPHINÆ.

Spadix loosely branched, often a prolix panicle. Flowers diclinous, polygamous or hermaphrodite, single or in long rows flowering from above; carpels 3 *(Thrinax 1)*, free or loosely united, always separating after fertilisation and developing into 1—3 smooth berries. Fan or feather leaves; leaflets induplicate.

1. PHŒNICEÆ.

Spadix surrounded by a large complete spathe, remaining closed up to the time of pollination. Flowers diœcious, dimorphic. Ovary of 3 free carpels, one only ripening. Seed ventrally grooved; embryo usually dorsal. Leaves imparipinnate; leaflets with induplicate sides.

DISTRIBUTION.—The whole of Africa (except the palmless regions, the South-African floral region and the East-African islands); Arabia; Western Asia in the region of the Euphrates and Tigris, through India to the Sunda Islands and Cochin-China.

The only genus is:

PHŒNIX, L. GEN. NAT. 1224.

(From the Greek "Phoinix," which was originally the name for "purple colour;" later on the name was given to the Date Palm on account of the colour of the dates, which is somewhat between yellow and purple red.)

Mart. Hist. Nat. Palm. III. 257, 320, t. 120, 124, 136, 161.—Gaertn. Fruct. I. t. 9.—Lam. Ill. t. 893.—Roxb. Corom. Pl. I. t. 74; III. t.

Hook. Gen. Pl. III, II., 921, 80.—Trim. Journ. of Bot. 1885, XXIII, No. 273, p. 266.

Tall trees or low shrubs, the entire stem or the upper portion only closely covered by the more or less rhomboid bases of the petioles; stems occasionally branched. The first leaf of the seedling, and sometimes the first leaf of root-suckers is lanceolate, entire. Leaves pinnate; leaflets entire, linear, folded longitudinally and attached obliquely with their folded base to the common woody petiole, the lowest pinnæ usually transformed into spines; no midrib, but a slender nerve on either side of the fold; nerves longitudinal, parallel, stout and slender, the slender nerves often obscure; transverse veinlets present, but usually only visible under the microscope in thin sections, cut parallel with the surface of the leaf. In the majority of species the leaflets in the lower portion of the petiole stand in fascicles of 4 or 6, 2 or 3 on each side of the petiole, while the upper leaflets are usually alternate or opposite; common petiole semiterete or flat, often widening at the base into a sheath, which frequently expands into a mass of tough, reticulate fibres. Flowers dioecious, small, yellowish, coriaceous, sessile on the bends of long, glabrous, undulating spikelets, usually supported by 1 or 2 minute, subulate, or triangular bracts, the female flowers often approximate in pairs. The spikelets are inserted in horizontal or oblique lines on both sides of a flat, woody peduncle. Male flowers: Sepals 3, connate in a cupular 3-toothed calyx. Petals 3, obliquely ovate, valvate. Stamens 6; filaments short, subulate; anthers erect, dorsifixed; pistillode minute or absent. Female flowers: Sepals 3, connate in a globose, accrescent calyx. Petals 3, rounded, imbricate, staminodes 6, free or connate in a 6-toothed cup. Carpels 3, free; ovules erect; stigmas sessile, hooked. Peduncle often lengthening after flowering. Fruit a single, oblong, 1-seeded berry, with a terminal stigma, a fleshy pericarp, and a membranous endocarp; seed oblong, ventrally grooved; albumen uniform or subruminate; embryo small.

Species about 12.—Africa, Asia.

273.—Griff. Palms Brit. Ind. 136 t. 128A, 129A, B.—Jacq. Fragm. t. 24.—Kunth Enum. Pl. III. 254.—Miq. Fl. Ind. Bat. III. 62.—T. Anders. Journ. Lin. Soc. XI. 13.—Drude Bot. Zeitg. 1877, 638, t. vi. fig. 27-33.—Benth. &

Sir Joseph Hooker calls his attempt at diagnosing the Indian species of *Phœnix* tentative and says that it awaits much further knowledge of the living plants before it can be accepted as trustworthy. The same applies to the African species whose classification and distribution is still subject to discussion in spite of the investigations of Schweinfurth, Beccari, Engler, and Drude.[1]

CULTIVATION IN EUROPE.—All the species are stove or greenhouse palms; they are readily raised from imported seeds, sown in sandy soil, in a mild hotbed. When the seedlings have reached a sufficient size, they are potted off singly into small pots with the same kind of soil in which the seeds were sown. Later on, good turfy loam will be better. In the South of France, many of the species are largely grown in the open air, to supply the demand for well grown specimens for the decoration of apartments in Paris and other places. The method adopted is this: "The plants are taken up, the soil shaken from the roots, the palms packed in bundles, and forwarded to Paris, where each one is firmly placed in as small a pot as possible; they are then plunged in a mild hotbed in a warm house which is kept shaded and syringed until new roots have formed, when shading is gradually removed, and the plants hardened off. By these means, much better specimens are more rapidly and cheaply obtained than would be possible under a system of pot-culture from the seedling stage onwards." (Nich. Dict. of Gard.)

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[1] Those who wish to get an insight into the difficulties of the Phœnix-question are referred to the following authors:—

Martius, Historia Naturalis Palmarum, vol. III.

Jacquin, Fragmenta botanica 1809, p. 27.

Kirk, On the Palms of Eastern Tropical Africa, in the Journal of the Linn. Soc., London IX (1865).

Schweinfurth, Im Herzen von Africa.

Beccari, Mitteilungen über die Colonia Eritrea, in "Verhandl. Ges. für Erdkunde" (1892), p. 347.

Engler, Hochgebirgsflora des tropischen Africa in Berliner Akad., Physik. Abt. II. 153.

Beccarri, Malesia, vol. III. 345ff.

Drude, Die Palmenflora des tropischen Africa in Engler's Bot. Jahrb. vol. XXI (1895).

Drude, Palmæ (echte Palmen) in Nat. Pflanzenf. II. 3.

* Indigenous species.

PHŒNIX SYLVESTRIS, Roxb. Hort. Beng. 73; Fl. Ind. III. 787; Mart. Hist. Nat. Palm. III. 276 (excl. syn. Linn. et Kæmpf.) 326, t. 136. Kunth Enum. III. 255; Wall. Cat. 8602; Griff. in Calc. Journ. Nat. Hist. V. 350; Palms Brit. Ind. 141, t. 228, A; Brandis For. Fl. 554; Ind. Trees 645; Kurz For. Fl. II. 535; Becc. Males. III. 347, 364, t. 43, f. 3; Hook. Fl. Brit. Ind. VI. 425; Cooke, Fl. Bomb. Pres. II. 801.—*Elate sylvestris*, L. Spec. Pl. 1189 (partim).—*Katu Pindel*, Ham. in Trans. Linn. Soc. XV. 86.—Rheede Hort. Mal. III. t. 22, 25.

NAMES.—Wild Date Palm, Date-sugar Palm; Sendhi, Kejur, Khajur, Khaji, Salma, Thalma, Thakil, *(Hind.)*; Kajar, Kejur, *(Beng.)*; Khejuri, *(Uriya)*; Khajur, *(Kol.)*; Khijur, *(Santal)*; Sindi, *(Gond)*; Khajur, Khaji, *(Panj.)*; Seindi, *(Berar)*; Sendi, Khajura, Khajuri, *(Bomb.)*; Boichand, Sendri, Shindi *(Mar.)*; Kharak, *(Guz.)*; Sandole-ka-nar, *(Dec.)*; Itchumpannay, Periaitcham, Itcham-nar, Itham pannay, *(Tam.)*; Ita, Pedda-ita, Itanara, Ishan-chedi, *(Tel.)*; Ichal, Kullu, Ichalu mara, *(Kan.)*; Khurjjuri, Kharjura, Madhukshir, *(Sans.)*.

DESCRIPTION.—A very graceful palm, when not injured by extracting toddy, 30-50 feet high. Trunk rough from the persistent bases of the leaf-stalks. Crown hemispherical, very large and thick, leaves 10-15 feet long, greyish-green, quite glabrous, pinnate; petioles compressed only towards the apex, at the base bearing a few channelled triangular short spines reaching 4 inches. Pinnules very numerous, densely fascicled, 6-18 by ¼-1 inch long, glaucous, rigid, ensiform, conduplicate at the base, then canaliculate, subulately acuminated, almost spinous pointed, 2-4 farious, some intermediately spreading, others crossing these above and below in an ascending direction. Male flowers white, scented; spadix 2-3 feet long, erect; peduncle highly compressed. Spathes of about the same length, very coriaceous, almost woody, scurfy, separating into two boat-shaped valves. Spikes very numerous towards the apex of the peduncle, especially on its anterior face, generally in fascicles and simple, 4-6 inches long, slender, flexuose. Flowers ¼-⅓ inch long, very numerous, angular, oblique. Calyx cup-shaped, with 3 short rounded teeth. Petals three or four times longer than the sepals, concave, warty on the outside, on the inside

Phœnix sylvestris, Roxb.

deeply ridged and furrowed. Filaments scarcely any, or very short, free. Anthers linear, adnate, shorter than the petals. Female flowers: Spadix and spathe much the same as in the male. Spikes arranged in distinct groups, 1-1½ foot long, the lower 4—6 inches not bearing any flowers, flexuose. Flowers distant, roundish. Calyx cup-shaped, obsoletely 3-toothed. Petals 3, very broad, convolutely imbricate, having a small opening at the apex. Staminodes 3-4. Carpels 3, free, erect; ovules solitary; style recurved, inwardly papillose. Fruiting spadix 3 feet long, nodding at the apex from the weight of the fruit, much compressed, of a golden orange colour. Fruit scattered on long pendulous similarly coloured spikes, 1-1¼ inch long, oblong-ellipsoid, orange-yellow, with a terminal stigma, surrounded at the base by the perianth. Pericarp fleshy, yellow, moderate, very astringent, lined by irregular cellular white tissue, part of which adheres to the thin envelope that separates with the Seed. Seeds ⅝ inch long, rounded at the ends, deeply grooved along its whole length on one side, with a slight incomplete furrow on the other side, in the centre of which is a depression with a mammillate fundus, indicating the position of the embryo. Albumen on a transverse section horse-shoe-shaped.

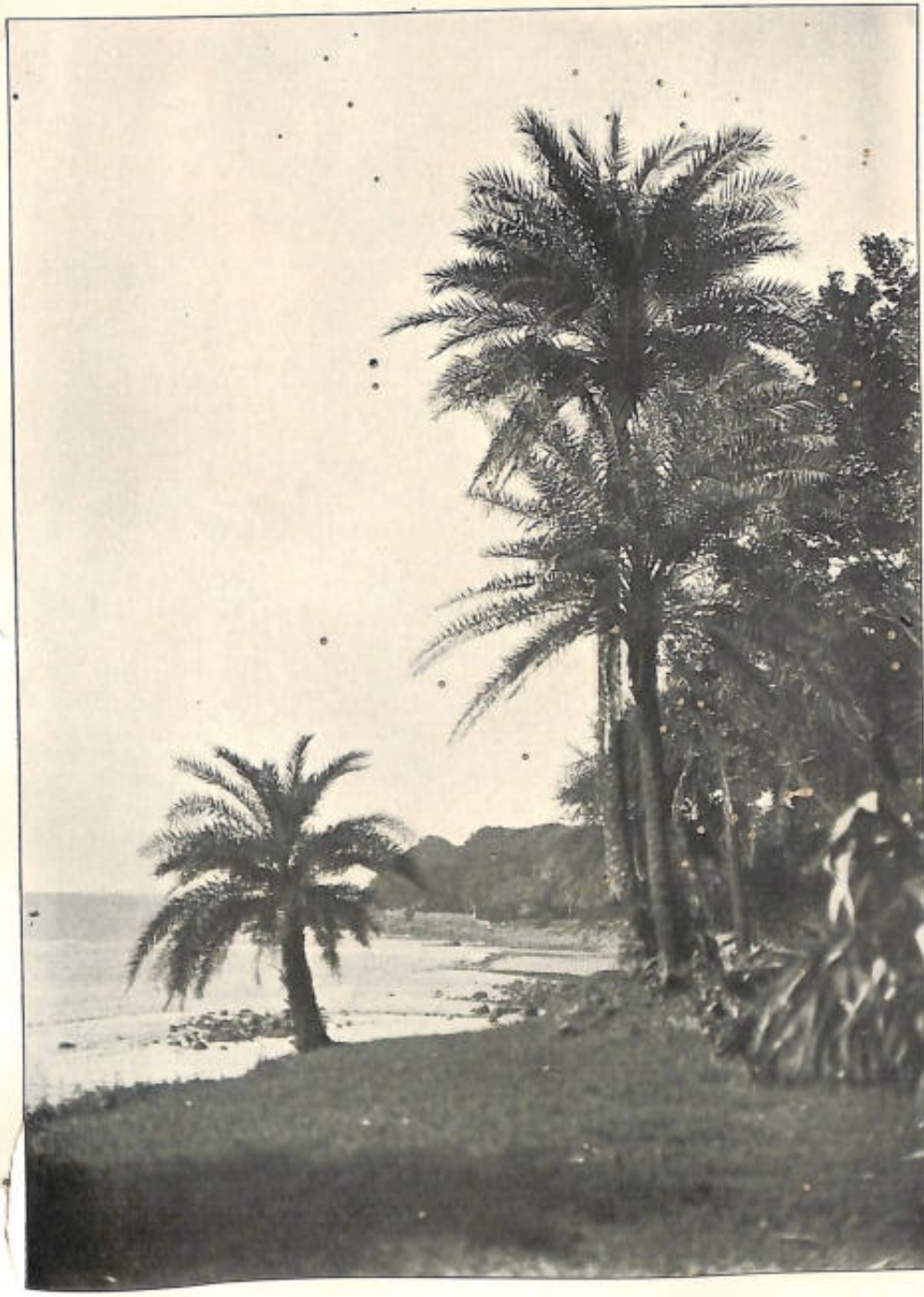
HABITAT.—Tolerably common throughout India, wild or more often cultivated. Forms extensive forests in Rohilkhand, on the low ground along the Ramganga river, and on the plateau of Mysore, between Shimoga and Tumkur, in moister stretches of low ground which intersect and drain the rocky undulating granite hills. Not uncommon in the Siwalik tract and the outer Himalaya, often associated with *Pinus longifolia*, reaching up to 5,000 feet in Kumaon, with stems 40—50 feet high. Ghiaunla in Gharwal at 3,500 feet. Banks of the Bias above Mandi. In the Jamu hills at 2,000 feet elevation. Salt range. Commonly planted and self-sown in most parts of India and Ceylon, except in Sind and South Punjab, where *P. dactylifera* takes its place. Most abundant in Bengal, Behar, on the Coromandel Coast, and in Guzerat. In the Bombay Presidency it is common in moist ground throughout the dry districts, usually along banks and in the beds of streams and watercourses.

FLOWERS at the beginning of the hot season. Fruit ripens in September and October.

USES.—In many localities, especially in Jessore and other districts of Bengal, this species is of considerable importance, owing to the extensive use of its sap in making sugar. According to Sir George Watt, there were in 1889, 168,262 acres of this palm under cultivation connected with the sugar supply. Sir James Westland has given a full account of the process of tapping the trees and of the manufacture of sugar from the crude sap in his "Report on the District of Jessore, 1874." When the tree is ripe the process of tapping begins, and it is continued each year thereafter. There are in the Date-palm two series or stories as it were, of leaves; the crown leaves, which rise straight out from the top of the trunk, being, so to speak, a continuation of it; and the lateral leaves, which spring out of the side of the top part of the trunk. When the rainy season has completely passed, and there is no more fear of rain, the cultivator cuts off the lateral leaves for one-half of the circumference, and thus leaves bare a surface measuring about 10 or 12 inches each way. This surface is at first a brilliant white, but becomes by exposure quite brown, and puts on the appearance of coarse matting. The surface thus laid bare is not the woody fibre of the tree, but is a bark formed of many thin layers, and it is these layers which thus change their colour and texture.

"After the tree has remained for a few days thus exposed, the tapping is performed by making a cut into this exposed surface, in the shape of a very broad V, about three inches across and a quarter or half inch deep. Then the surface inside the angle of the V is cut down, so that a triangular surface is cut into the tree. From this surface exudation of the sap takes place, and caught by the sides of the V, it runs down to the angle, where a bamboo of the size of a lead pencil is inserted in the tree to catch the dropping sap and carry it out as by a spout.

"The tapping is arranged, throughout the season, by periods of six days each. On the first evening a cut is made as just described, and the juice is allowed to run during the night. The juice so flowing is the strongest and best, and is called jiran juice. In the



GROUP OF WILD DATE PALMS (*Phœnix sylvestris*).

morning the juice collected in a pot hanging beneath the bamboo spout is removed, and the heat of the sun causes the exuding juice to ferment over and shut up the pores in the tree. So in the evening the new cut is made, not nearly so deep as the last, but rather a mere paring, and for the second night the juice is allowed to run. This juice is termed do-kat and is not quite so abundant or so good as the jiran. The third night no new cutting is made, but the exuding surface is merely made quite clean, and the juice which then runs is called jarra. It is still less abundant and less rich than the do-kat, and towards the end of the season, when it is getting hot, it is unfit even for sugar manufacture, the gur (molasses) made from it being sold simply as "droppings." These three nights are the periods of activity in the tree, and after these three it is allowed to remain for three nights at rest, when the same process again begins. Of course, every tree in the same grove does not run in the same cycle, some are at their first, some at their second night, and so on; and thus the owner is always busy.

"Since every sixth day a new cut is made over the previous one, it follows that the tree gets more and more hewed into as the season progresses, and towards the end of the season the exuding surface may be, and often is, as much as four inches below the surface above and below. The cuts are during the whole of one season made about the same place, but in alternate seasons alternate sides of the tree are used for the tapping; and as each season's cutting is thus above the previous season's and on the opposite side, the stem of the tree has a curious zigzag appearance. The age of a tree can of course be at once counted up by enumerating the notches and adding six or seven, the number of years passed before the first year's notch. I have counted more than forty notches on a tree, but one rarely sees them so old as that and when they are forty-six years old they are worth little as produce bearing trees. It is somewhat remarkable that the notches are almost always on the east and west sides of the tree and very rarely on the north and south sides; also, the first notch appears to be made in by far the majority of instances on the east side.

"As to the produce of one tree, one may expect from a good tree a regular average of five seers per night (excluding the quiescent nights). The colder and clearer the weather, the more copious and rich the produce. In the beginning of November tapping has begun. In December and January the juice flows best, beginning sometimes as early as 3 p.m., and dwindles away as the warm days of March come. If the cultivator begins too early, or carries on too late, he will lose in quality and quantity as much as he will gain by extending the tapping season.

"The next processs is the boiling, and this every rayat does for himself, and usually within the limits of the grove. Without boiling, the juice speedily ferments and becomes useless; but once boiled down into gur, it may be kept for very long periods. The juice which was at first brilliant and limpid, becomes now a dark brown, half-viscid, half-solid mass, and when it is still warm, it is easily poured from the boiling pan into the earthenware pots in which it is ordinarily kept. As it takes from seven to ten seers of juice to produce one seer of gur or molasses, we can calculate the amount of gur which one ordinarily good tree can produce in a season. We may count four and a half months for the tapping season, or about sixty-seven tapping nights. These, at five seers each, produce 335 seers of juice, which will give about forty seers, or one maund of gur, the value of which, at present rates, is from Rs. 2 to Rs. 2-4-0."

After the juice is boiled down into gur it is then sold to the sugar-refiners and by them is manufactured in various ways into different grades of sugar. The best known is called dhulva, a soft moist, powdery sugar, used largely in the manufacture of native sweetmeats. Another kind, termed pucka, is a purer, granular, and more expensive sugar. The waste molasses, collected during the preparation of sugar, is called chitiya gur, when boiled for a longer time, it becomes a black, sticky treacle, which is largely utilised for mixing with the tobacco for the Native hookah, and also for making cheap sweets. A small proportion of the juice is consumed as a drink either fermented or unfermented, under the name of taṛi, or is converted into vinegar.

Sir George Watt mentions that in recent years an endeavour

has been made to promote the manufacture of sugar in the Central Provinces; a company has already been formed under the name of the "Khandwa Sugar Manufacturing Company."

From the leaves bags, basket-work, brooms, fans, etc., are made. The footstalks, after being beaten, are converted into ropes for drawing water from wells. The fibres are plentiful, soft, bleach well, and are very well adapted for the use of paper-makers.

From the tree a gum is obtained, of which very little is known. The fruit is of an inferior kind and only eaten by the poorer classes, or used as medicine. Pounded and mixed with almonds, quince seeds, pistachio nuts, spices, and sugar it forms a restorative. A paste formed of the kernels and the root of *Achyranthes aspera*, is eaten with betel leaves as a remedy for ague.

CULTIVATION IN INDIA.—"The soil required for this palm is rich alluvial or black with moving water at about 10 feet from the surface or with irrigation and thorough under-ground drainage from a bed of gravel not less than 6 feet below the surface. The seeds should be sown when quite fresh, without removing the pulp, on a bed of rich loam dressed heavily with leaf-mould. When 6 inches high the little plants should be put out 18 inches apart in carefully prepared nursery beds, and grown carefully till 4 feet high, then transplanted to their permanent quarters, which may be in lines 30 feet apart, with 20 feet between each tree in the line. The ground should then be kept under irrigated crops for two years to get the young trees established." (Woodrow).

ILLUSTRATION.—Plate II. The photograph, supplied by Mr. Phipson, shows a fine specimen of *Phœnix sylvestris* growing on the Hanging Gardens, Malabar Hill, Bombay. The dense, almost spherical crown, with the gracefully bending leaves at once distinguishes this species from the real Date Palm (*P. dactylifera*). The lower part of the stem is covered with ferns and other vegetation. As the stem, however, is the same throughout, *i.e.*, covered by the persistent bases of the leaf-stalks, the imagination can easily supply the hidden part of the trunk.

Plate III. The photograph shows a small group of Wild Date Palms with their natural surroundings. It is a scene on the

Phœnix rupicola, T. Anders.

seashore on the East side of Malabar Hill, Bombay, characteristic of many parts of India.

PHŒNIX ZEYLANICA, Trimen in Journ. Bot. XXIII, 267 (1885): Hook. Fl. Brit. Ind. VI. 425; Trimen Fl. Ceylon IV. 326.—*Phœnix zeylanica*, Hort; Hook. f. in Kew Report, 1882. 63.—*Phœnix sylvestris*, Thw. Enum. 329 (non Roxb.).—*Elate sylvestris*, L. Sp. Pl. 1189 (for the most part).—*Phœnix pusilla*, Becc. Malesia, III. 408 (non Gaertn.).

NAME:—Ceylon Date Palm; Indi (in Ceylon).

DESCRIPTION:—Stem 8-20 feet high, rarely much shorter. Leaves rather short; leaflets very many, quadrifariously inserted, subequidistant, 7-10 inches long, linear-lanceolate, pungent, coriaceous, concave, spreading at right angles, bright green. Spathe 8-14 inches long, keel furfuraceous. Spadix 1 foot long or more, young scopiform; peduncle stout; rhachis flattened; branches of male 4-6 inches long, of female longer. Male flowers $\frac{1}{6}$ inch long; stamens 6; anthers subsessile, linear; female spadix long peduncled; peduncle 1 inch broad, flattened, branches 6-10 inches long, divergent in fruit. Female flowers scattered, globose; $\frac{1}{8}$ inch in diameter, calyx cup-shaped; petals orbicular. Fruit $\frac{1}{2}$ inch by $\frac{1}{4}$ inch in diameter, obovoid-oblong, apiculate, red, at length violet-blue; seed nearly as long, with the groove dilating into a canal of various forms.

HABITAT.—Ceylon, moist low country, especially on the Southern Coast, very common.

FLOWERS in February.

USES:—Mats and boxes are made of the leaves. The sweet pulp of the fruit is eaten.

ILLUSTRATION.—Plate IV. The photograph supplied by Mr. Macmillan, shows a specimen of *Phœnix zeylanica*. The leaves are comparatively short and do not exhibit the graceful curves of the Wild Date Palm. The stem is very rough being covered throughout with the bases of the fallen leaves.

PHŒNIX RUPICOLA, T. Anders. in Journ. Linn. Soc. XI. 13, 1869. Becc. Males. III. 348, 395.—*P. Andersoni*, Cat. Hort. Calc. n. 119 (1886—7.); Gard. Chron. 1877, II. 45, fig. 4. Hook f. Flora Brit. Ind. VI. 425.—*Phœnicoidea*, Griff. Journals, 46.

Phœnix zeylanica, Trimen.

Phœnix rupicola, T. Anders.

DESCRIPTION.—Trunk solitary, slender, naked, 15-20 feet high, 8 inches in diameter. Leaves 10 feet long; leaflets 1½ foot long, bifarious, not fascicled, flaccid, bright green; petiole compressed. Spadices elongated, much compressed; female spadix 3-4 feet long, peduncled, with a few fascicled spikes on the acute margins near the apex; spathe 1 foot long. Fruit oblong, ¾ inch long, shining, yellow. Seed ½-¾ inch long. This species can easily be distinguished by the numerous bright green decurved leaflets being all in one plane. This is the handsomest species in the genus.

HABITAT.—Sikkim Himalaya, from 400-1,400 feet; Assam; Mishmi Hills. Generally growing on rocks.

USES.—The interior of the stem is, according to Gamble, often eaten by the Lepchas.

ILLUSTRATION.—Plate V. The Photograph, supplied by Mr. Macmillan, shows a young specimen of *Phœnix rupicola*. The very short stem appears to be bulb-like on account of the rather long remains of the petioles covering up the real stem. The wide spreading, arching leaves with the narrow leaflets situated in one plane distinguish this species at once. Some beautiful examples of these Palms may be seen growing in the open in the Sibpur Botanic Gardens, Calcutta, and also at Gwalior, C. I., Agra and many other places in India, where they bear seed freely.

PHŒNIX ACAULIS, Buch. ex Roxb. Fl. Ind. III. 783; Hort.Beng. 73; Ham. in Trans. Linn. Soc. XV. 87; Kunth Enum. III. 257; Griff. in Calc. Journ. Nat. Hist. V. 345; Palms Brit. Ind. 137, var. *melonocarpa* ll. cc. 346, 138, t. 228; Mart. Hist. Nat. Palm. III. 274 321; Dalz. and Gibs. Bomb. Fl. 278; Brandis For. Fl. 555; Ind. Trees 645; Becc. Males. III. 348, 397, t. 44, IV f. 51-57; Wall. Cat. 8602 C; Cooke Fl. Bomb. Pres. II. 802.

NAMES.—Dwarf Date Palm; Khajuri, Pind Khajur, Jangly Khajur, (*Hind.*); Schap, (*Lepcha*); Chindi, Hindi, Jhari, Sindi, (*Gond.*); Juno, (*Kurku*); Pind Khajur (*Panj.*); Boichind (*Mar.*); Yita, (*Tel.*); Thin-boung (*Burm.*).

DESCRIPTION.—An almost stemless palm; stem bulbiferous, 6-10 inches in diameter; densely clothed with the sheaths and bases of the petioles, the ends of which are often bristly with the protrud-

ing hard fibro-vascular bundles. Leaves 2-6 feet long; leaflets nearly opposite, fasciculate, 10-20 by $\frac{1}{3}$-$\frac{2}{3}$ inch, stiff, the base thickened and decurrent; marginal nerve very strong; petioles one foot or more long, with spines 2-6 inches long. Spathes axillary, solitary, one-valved, about 6 inches long, with their bases rather below the surface of the ground, generally splitting into two portions down the middle on each side. Spadix 6-10 inches long, compressed, rather longer than the spathe, composed of many simple short erect flexuose branches; these are smooth and of a pale yellow. Male flowers $\frac{1}{4}$-$\frac{1}{3}$ inch long, alternate, solitary, sessile, pale yellow. Calyx cupular, 3-toothed; petals 3, obliquely lanceolate, acute, slightly united at the base; stamens 6, filaments very short, inserted into the base of the corolla; anthers linear, nearly as long as the petals; pistillode 0. Female flowers alternate, solitary, sessile, in bractiform notches on the sides of the branches of the spadix; calyx cup-shaped, truncate, with 3 obscure teeth on the margin; petals 3, sub-rotund, thick, fleshy, concave, smooth. Carpels 3, each 1-celled and 1-ovuled, ovule attached to the middle of the cell on the inside. Styles 3, small, short, recurved; stigma small. Fruiting peduncle short, usually concealed among the leaves; fruit $\frac{1}{2}$-$\frac{2}{3}$ inch long, oblong-ellipsoid, fleshy, smooth, mucronate, bright red to blue black; seed $\frac{1}{4}$-$\frac{1}{3}$ inch long, oblong, with a longitudinal groove on one side, embryo in the middle of the back, or convex side of the seed.

Habitat.—Northern India: from Kumaon eastwards to the Khasia Hills, elevated plains on the north side of the Ganges on a clayey soil; Burma: in plains between the valley of Hook-hoong and Mogam; Chota Nagpur; Ghats of the Sirsi taluka in Northern Kanara.

Flowers.—In the cold season; fruit ripens in April and May.

Uses.—According to Stewart, rope is made in certain localities from the beaten leaves. In the Central Provinces the leaves are used to thatch houses.

The fruit is eatable. In Chota Nagpur, a sort of sago is prepared from the pith; the stem is apparently not tapped for its juice.

Cultivation.—A very ornamental palm, valuable for decorative purposes.

PHŒNIX PUSILLA, Gaertn. Fruct. I. 24 (1788); Trim. in Journ. Linn. Soc. XXIII, 173; Fl. Ceylon IV, 327—*P. farinifera*, Roxb. Cor. Pl. I. 55., t. 74; Hort. Beng. 73; Fl. Ind. III, 785; Mart. Hist. Palm. III, 274; Griff. in Calc. Journ. Nat. Hist. V, 348; Palms Brit. Ind. 140 (excl. syn.); Brandis For. Flo. 556.

I have followed Trimen in considering this palm to be identical with *Phœnix farinifera*, Roxb. He says in Vol. IV, 327 of his Flora of Ceylon; "Beccari will not allow that Gaertner's *P. pusilla* could have been this plant (*P. farinifera*), as he thinks it does not grow in the parts of Ceylon in possession of the Dutch in Hermann's time; indeed, when I first recorded the plant, I had seen it only from Anuradhapura, and therefore Beccari has supposed it to be very rare in Ceylon; but now I find it to be universal in the sandy forests of the north, all the coast-towns of which were held by the Dutch at the end of the seventeenth century. As for the character, Beccari finds in Gaertner's figure of having deeper and larger arms to the bifid excavation in the endosperm, which thus more resembles *P. zeylanica*; this is too variable (as seen in Beccari's own figures) to be of much value. This never forms any stem whatever, and Gaertners' specific name is thus very characteristic."

NAMES.—Inchu (*Ceylon*); Eethie (*Tam.*); Chiruta-itu (*Tel.*); Eentha (*Mal.*)

DESCRIPTION.—Shrubby; stem very short, stoloniferous, entirely enveloped in the sheaths of the leaves that it is never seen; the whole appears like a large round bush. Leaves pinnate; petiole with one or more pairs of spines; leaflets subopposite, 1-farious, sword-shaped, much pointed, rigid, smooth, of a pale green. Spathes axillary, one-valved, concave on the inside, this concavity being bordered by two sharp edges, convex on the outside, there splitting longitudinally, leathery, smooth, withering. Spadix 8-12 inches long, erect, much branched; branches simple, spreading in all directions. Male flowers: calyx small, slightly 3-toothed; petals 3, oblong, rigid, white. Filaments six, very short, inserted into a fleshy globular receptacle. Anthers oblong, erect. Female flowers not on the same plant; calyx like the calyx of the male flower. Petals 3, orbicular, concave, equal, rigid, lasting. Ovaries 3, only one increasing in size, ovate, each having a short recurved style. Stigma simple. Ripe berry ½ inch long, of a dull purple black, of the size of a large French bean; pulp sweet and mealy. Seed cartilaginous, of the shape of the berry, grooved longitudinally, as in the Date, pretty smooth, brown outside, light greyish, white within, with a small elevation on the middle of the back, under which is an oblong pit containing the embryo.

HABITAT.—Coromandel Coast, not far from the sea; in the northern part of Ceylon in dry forests.

FLOWERS from January to April; fruit ripens in May.

USES.—The fruit contains a sweet pulp which is eaten by the natives. "The leaflets are wrought into mats for sleeping upon, etc. The common petioles are split into three or four and used to make common baskets of various kinds, but they are not so good for this purpose as the Bamboo, which is very elastic, much more durable, and splits easily. The small trunk when divested of its leaves and the strong brown fibrous web that surrounds it at their insertions, is generally about 15 or 18 inches long, and 6 in diameter at the thickest part; the exterior or woody part consists of white fibres matted together; these envelope a large quantity of farinaceous substance, which the natives use for food in times of scarcity. To procure this meal, the small trunk is split into 6 or 8 pieces, dried, and beaten in wooden mortars till the farinaceous part is detached from the fibres; it is then sifted to separate them, after which the meal is fit for use. The only further preparation it undergoes, is the boiling it into a thick gruel, or as it is called in India, *Kanji*; it seems to possess less nourishment than the common sago, and is less palatable, being considerably bitter when boiled." (Roxb.) Whenever rice is too dear or not to be had, many of the poor are forced to have recourse to this sort of food.

(To be continued.)

THE BUTTERFLIES OF KUMAUN.

BY

F. Hannyngton, I.C.S.

Part II.

(Continued from page 142 of this Volume.)

Family—PAPILIONIDÆ.

155. * **Papilio aeacus,** *Felder.*—Has been met with in horse-chestnut forests in May in the inner ranges at about 8,000 ft. I have not come across it.

156. **Papilio aristolochiæ,** *Fabr.*—Occurs sparingly in the Tarai in April, May, December and January.

157. **Papilio varuna astorion,** *Westwood.*—Rare at Naini Tal in May and September at 7,000 ft.

158. * **Papilio aidoneus,** *Doubleday.*—Rare in interior of Garhwal in May. I have not received specimens from further west than Sikhim.

159. **Papilio latreillii,** *Doyvan.*—Rare at 8,000 ft. in Pindari Valley in May and August.

160. **Papilio philoxenus,** *Gray.*—Common in May and again in August and September at 7,000 to 9,000 ft. flying round horse-chestnut flowers, and rhododendrons, Binsar, Naini Tal, etc.

161. **Papilio machaon sphyrus,** *Rothschild.*—Common from May-November, 3,000 to 9,000 ft.

162. **Papilio demoleus,** *Linn.*—Common. June to October, 1,500-3,000 ft.

163. **Papilio ravana,** *Moore.*—Not uncommon in May and September at from 6-10,000 ft.

164. **Papilio helenus,** *Linn.*—"Kali Valley, 2,000 ft., scarce." (Doherty). It is decidedly rare in W. Kumaun whence I have received no specimens. I have no doubt that it occurs along the foot of the outer ranges as it has been taken as far west as Dehra Dun (*vide* Vol. XI, p. 592 of the Society's Journal).

165. **Papilio protenor,** *Cramer.*—Not common, 2-5,000 ft., May to September.

166. **Papilio rhetenor,** *Westwood.*—Occurs sparingly in May and September up to 7,000 ft.

167. **Papilio janaka,** *Moore.*—Rare in May, 6,000 ft. near Loharkhet.

168. **Papilio polytes,** *Linn.*—Common up to 5,000 ft., May-November. I have not yet come across the *sakontala* form while the *romulus* form of the female seems to occur only in the Tarai.

169. **Papilio agestor govindra,** *Moore.*—Common at 7-9,000 ft., March to May; Naini Tal, Binsar, Dhakuri, etc.

170. **Papilio clytia dissimilis,** *Doubleday.*—Fairly common up to 6,000 ft.

March to October, especially in rains near Ranibagh. I have not yet come across the true *clytia* form in Kumaun.

171. **Papilio polyctor,** *Boisduval.*—Very common, 3,000 to 6,000 ft., June-October.

172. **Papilio paris,** *Linn.*—"Kali Valley, 2-3,000 ft." (Doherty). Not uncommon on the eastern border and westwards as far as Bhim Tal at any rate.

173. * **Papilio arcturus,** *Westwood.*—Recorded from Kumaon, but I have not yet come across it and it is evidently very rare within these limits.

174. **Papilio kashmirensis,** *Rothschild.*—Fairly common in April in the interior at 7,000 ft. The race *sikhimica* occurs on the eastern border along with forms which seem to merge into *P. glycerion*, Gray. The markings on the forewing are, however, those of *P. kashmirensis*.

175. **Papilio nomius,** *Esper.*—Haldwani and Ranibagh, up to 2,000 ft. in April and May.

Apparently common in some years and rare in others. Any Kumaun specimens that I have seen are nearer to *P. nomius*, as figured by Bingham than to the allied races.

176. **Papilio eurypylus axion,** *Felder.*—Rare on eastern border at 2 to 5,000 ft., July and August.

177. **Papilio agamemnon,** *Linn.*—Not common at Nalena at 4,000 ft. in August and in Gori and Kali valleys down to 2,500 ft.

178. **Papilio cloanthus,** *Westwood.*—Common in April and from August to October up to 7,000 ft. in river valleys.

179. **Papilio sarpedon,** *Linn.*—Very common from May to October. 1-5,000 ft.

180. * **Papilio xenocles,** *Doubleday.*—Rare in the Kali valley on eastern border in August.

GENUS.—PARNASSIUS.

181. **Parnassius jacquemontii,** *Boisduval.*—Scarce in Garhwal at 12,000 ft. in August and September.

182. **Parnassius hardwickei,** *Gray.*—Common at 8-11,000 ft., May and August-October in all the inner ranges. This species is subject to very marked seasonal variation.

183. * **Parnassius charltonius,** *Gray.*—Rare at 15,000 ft., August, in interior of Garhwal near the snow-line. I have not received any specimens.

PIERIDÆ.

184. **Leptosia xiphia,** *Fabr.*—Not uncommon up to 4,000 ft., April and May.

185. **Delias eucharis,** *Drury.*—Common up to 6,000 ft., January, May and October.

186. **Delias hierta,** *Hübner.*—Not uncommon in the Kali Valley and in the extreme east at 3,000 ft.

187. **Delias belladonna,** *Fabr.*—Rare, 4,000-8,000 ft. in May.

188. **Prioneris thestylis,** *Doubleday.*—Rare, Naini Tal, 7,500 ft. in May. I have not come across the wet-season form in Kumaun.

189. **Anaphæis mesentina,** *Cram.*—Common up to 6,000 ft. almost throughout the year.

190. **Aporia soracte,** *Moore.*—Very common. April and May, 6,000-8000 ft.

191. **Aporia agathon,** *Gray.*—The *caphusa* variety (?) is common in April and May at 6,000-8000 ft. I have not come across the *phryxe* variety (?) in Kumaun, though it should occur in Garhwal. Typical *agathon* I have not met with, though recorded from Kumaun.

192. ***Aporia nabellica,** *Boisduval.*—Recorded by Bingham from Naini Tal. I have never met with it, but it doubtless occurs in the interior of Garhwal near the snows.

193. ***Synchloe belia daphalis,** *Moore.* (= Euchloe daphalis, *Moore*).—According to Colonel Swinhoe, the type specimen was taken "at Kumaun" in April, presumably by Colonel Lang. It is evidently very rare and is such a short time on the wing that it has since escaped observation.

194. **Pieris canidia.**—Fairly common at 6,000-9,000 ft. May and October.

195. **Pieris brassicæ.**—Common up to 9,000 ft. April to November.

196. **Pieris napi,** *Melete.*—Not common at Naini Tal, but common in the Pindari Valley at 8,000 ft. in May and again in September.

197. **Pieris callidice,** *Esper.*—Fairly common at 12-14,000 ft. in June in the interior of Garhwal.

198. **Pieris chloridice,** *Hübner.*—Rare at the same elevation as the last named in August and September.

199. **Huphina nerissa.**—Common up to 4,000 ft. June to October.

200. **Ixias pyrene.**—Common in the Tarai in December and January, and up to 8,000 ft. in September and October. The large *Evippe* form is only found at high elevations.

201. **Ixias marianne.**—Common in Tarai. December to April, below 2,000 ft.

202. **Appias hippo.**—1 male from Ranibagh, 1,000 ft. in September.

203. **Appias lalage.**—Rare in Naini Tal at 7,000 ft. in May.

204. **Appias libythea.**—I have a single ♀ taken by a native collector near Naini Tal in July 1909 at about 7,000 ft.

205. **Catopsilia crocale,** *Cramer.*—Common, June to October, up to 3,000 ft. In deference to Bingham I have not separated *C. catilla* which occurs in swarms along with *C. crocale*. Breeding experiments would seem to point to the two forms being specifically distinct and the differences are constant.

206. **Catopsilia pyranthe,** *Linn.*—Common, June to October, up to 6,000 ft.

207. **Catopsilia florella,** *Fabr.*—Common, June to October, up to 6,000 ft.

208. **Gonepteryx rhamni,** *Linn.*—Common, May to October, 3,000 to 9,000 ft.

209. **Gonepteryx zaneka,** *Moore.*—Common in April and October, 6,000-10,000 ft.

210. **Colias hyale,** *Linn.*—Common. May to October, 6,000-12,000 ft. The *erate* dimorph (= lativitta, *Moore*) is rare in Kumaun.

211. **Colias croceus fieldi,** *Ménetries.*—Common. May to December, up to 14,000 ft.

212. **Terias venata,** *Moore.*—Common, from June to October, 2,000 to 7,000 ft.

213. **Terias libythea,** *Fabr.*—Common up to 4,000 ft. throughout the year, the *ombella* form in the dry season and the *selina* form in the rains.

214. **Terias læta,** *Boisduval.*—Common in April and again from July to October, up to 5,000 ft.

215. **Terias hecabe,** *Linn.*—Very common, up to 6,000 ft. almost throughout the year.

216. **Colotis (Teracolus) etrida,** *Boisduval.*—Local and rare. Haldwani, in September.

217. **Pareronia hippia,** *Fabr.*—Common, in April up to 1,500 ft. and throughout the cold weather in the Tarai.

FAMILY—LYCÆNIDÆ.

Sub-Family—GERYDINÆ.

218. **Allotinus multistrigatus,** *de Nicéville.*—"Two females at Askot" (on extreme eastern border) (Doherty). I have not seen it.

Sub-Family—LYCÆNINÆ.

219. **Spalgis epius,** *Westwood.*—Not common, Haldwani, December.

220. **Megisba malaya,** *Horsfield.*—Tailed variety only. Common, Ranibagh, in July.

221. **Lycæna astrarche,** *Bergsträsser* (= L. medon, *de Nicéville*).—Common at 5-8,000 ft. from April to July.

222. **Lycæna stolickana,** *Felder.* (= L. ariana, *Moore*).—Rare in the inner ranges at from 8-12,000 ft. in August and September.

223. **Lycæna galathea,** *Blanchard.*—Fairly common in August near the snow line at 10-15,000 ft.

224. **Chilades lajus,** *Cram.*—Not common up to 2,000 ft. in the cold weather from November to March.

225. **Chilades trochilus,** *Freyer.*—Common everywhere up to 7,000 ft., nearly all the year round.

226. **Cyaniris vardhana,** *Moore.*—Common on Cheena and Binsar, 7,000 ft., May, September and October; Dhakuri, 10,000 ft., May. Dr. Chapman has recently reviewed the whole of this genus on the basis of the male ancillary

appendages (*vide* P. Z. S., 1909, pp. 419 to 483). On this diagnosis, it will be necessary to place *C. vardhana* in the new genus *Notarthrinus*.

227. **Cyaniris marginata,** *de Nicéville.*—Not common, 4,000-10,000 ft., April, May and October.

228. **Cyaniris albocærulea,** *Moore.*—6,000-8,000 ft. Not common.

229. **Cyaniris dilecta,** *Moore.*—Fairly common in May and August at 6-8000 ft.

230. **Cyaniris celestina,** *Moore.*—Common from April to October, at 5-9,000 ft. This is the prevailing species at Naini Tal and is almost certainly protected. It is not only mimicked by *Chliaria* and some species of *Tajuria* (*vide* de Nicéville, Vol. III, p. 11), but also apparently by the females of *Lephyrus syla* and *L. bimapa*.

231. **Cyaniris puspa,** *Horsfield.*—Common, July to October, 2-8,000 ft.

232. **Cyaniris huegelii,** *Moore.*—Common from April to October from 5-10,000 ft.

233. **Zizera lysimon,** *Hübner.*—Common at Ranibagh, Bhim Tal, Bageshwar, etc., from 2-4,000 ft. in April and September.

234. **Zizera otis,** *Fabr.* (=sangra, *Moore*).—Common up to 4,000 ft. July to October.

235. **Zizera maha,** *Kollar.*—Common up to 9,000 ft. July to October.

236. **Zizera gaika,** *Trimen.*—Rare up to 4,000 ft. in April and August.

237. **Neopithecops lalmora,** *Butler.*—Jhulaghat, 2,000 ft. (Doherty). Scarce at Juili, 2,500 ft., July.

238. **Azanus ubaldus,** *Cramer.*—Ranibagh, Juili, Jhulaghat, etc., 1-3,000 ft. in May and June.

239. **Azanus jesous,** *Guerin.* (= A. gamra, *Ledorer*).—Not common at Haldwani in October and November. I have not come across it.

240. **Azanus uranus,** *Butler.*—Not common up to 2,000 ft. in July and August and again in February.

241. **Everes argiades,** *Pallas.*—Common. May to September, up to 5,000 ft.

242. **Nacaduba coelestis,** *de Nicéville.*—Recorded from Jhulaghat, 2,000 ft., by Doherty in August. I have not met with it.

243. **Nacaduba ardates,** *Moore.*—Common up to 4,000 ft., almost throughout the year.

244. **Nacaduba dana,** *de Nicéville.*—Rare up to 5,000 ft. in May and June and at lower elevations in October.

245. **Lampides bochus,** *Cramer.*—Rare in April at 4,000 and in October at 2,000 ft. Nalena, Juili, and Ranibagh.

246. **Lampides celeno,** *Cramer.* (=L. ælianus, *Fabr.*)—Common in suitable localities up to 5,000 ft. from April to October.

247. **Catochrysops strabo,** *Fabr.*—Common up to 8,000 ft. April to October.

248. **Catochrysops cnejus,** *Fabr.*—Common up to 8,000 ft. April to October.

249. **Catochrysops pandava,** *Horsfield.*—Common, June to October, 2-5,000 ft.

250. **Tarucus theophrastus,** *Fabr.*—Common in April and again July to September, 1-3,000 ft.

251. **Tarucus plinius,** *Fabr.* (=T. telicanus, *Lang*)—Common in April and again July to September, 1-3,000 ft.

252. **Tarucus venosus,** *Moore.*—Common, July and August. 1-3,000 ft. Probably only the wet season from of *Tarucus theophrastus*, but kept distinct in deference to Bingham.

253. **Castalius rosimon,** *Fabr.*—Common at Haldwani, 1,000 ft. in December and January.

254. **Polyommatus bœticus,** *Linn.*—2,000-7,000 ft. March to October. Very common everywhere.

Sub-Family—ARHOPALINÆ.

255. **Iraota timoleon,** *Stoll.*—Scarce, April to October. Bhim Tal and Nalena, 3-4,500 ft.

256. **Iraota mæcenas,** *Fabr.*—"1 Male, Jhulaghat" (Doherty). Regarded by de Nicéville as doubtfully distinct from the foregoing (Butt. Ind. III, p. 217).

257. **Surendra quercetorum,** *Moore.*—Not uncommon in October at 5-7,000 ft., but decidedly local.

258. **Arhopala centaurus,** *Fabr.*—1 Male taken at about 4,000 ft. in October, near Jeolikote; evidently a straggler from the eastern border.

259. **Arhopala amantes,** *Hewitson.*—Fairly common at 4,000 ft. in October throughout Kumaun.

260. **Arhopala atrax,** *Hewitson.*—Common in May and from July to October at 1-4,000 ft. throughout Kumaun.

261. **Arhopala ganesa.**—Common. 6-8,000 ft. May and June in oak forests along with *A. rama*.

262. **Arhopala dodonea,** *Moore.*—Not common at 6-8,000 ft. May and June, along with *A. rama*.

263. **Arhopala rama,** *Kollar.*—Common in oak and sál forests at 2-8,000 ft., especially at Ramgarh and in Sarju Valley from May to September.

264. **Acesina paraganesa,** *de Nicéville.*—Rare at Nalena, 4,500 ft., in May and June.

Sub-Family—PORITIINÆ.

265. **Poritia hewitsoni,** *Moore.*—"One male and one female in Kali Valley" (Doherty). I have not met with it.

Sub-Family—CURETINÆ.

266. **Curetis bulis,** *Doubleday.*—Common. May to October, 2-6,000 ft.

267. **Curetis angulata,** *Moore.*—Rare. May to October, 2-6,000 ft.

268. **Curetis dentata,** *Moore.*—Occurs sparingly along with *C. bulis* and

the preceding. Whether these two latter forms are entitled to specific rank is very doubtful.

Sub-Family—THECLINÆ.

269. **Zephyrus ataxus,** *Hewitson.*—Rare at Naini Tal and Binsar, July to September, at 6-8,000 ft.

270. **Zephyrus syla,** *Kollar.*—Common at Naini Tal, Muktesar, Binsar, Dhakuri, in April, September and October, at 6-9,000 ft.

271. **Zephyrus birupa,** *Moore.*—Not common. May, June and October. Nalena, Ramgarh, Binsar and Naini Tal, 4,500-8,000 ft.

272. **Zephyrus icana,** *Moore.*—"Rare at Dhakuri, 9,000 ft., Chaudans. N. E. Kumaun" (Doherty).

273. **Zephyrus triloka,** sp. n.

Female.—Upperside: ground-colour grey-blue of a duller shade than that of *L. liba*, Hewitson. *Forewing*, apex and outer margin fuscous brown, an irregular white patch at apex of cell more restricted in area than the similar patch in *L. syla* ♀; *Hindwing* dull brown with grey-blue irrorations in the interspaces.

Underside:—Silvery-greenish-white with discal and sub-marginal streaks arranged as in *L. syla* but of a much paler shade of brown, the two black anal and sub-anal spots reduced to mere dots and without any trace of orange margins.

Male—Unknown.

The three specimens before me were all brought in from the Pindari Valley in August by a native collector. I have named the form as above with some reluctance, remembering the case of *L. katura*. It is, however, abundantly distinct from the ♀ of either *L. syla* or *L. birupa*, its nearest allies, especially on the underside, nor is it very near *L. mandara*, Doherty, of which the ♀ has yet to be discovered.

The underside is also quite unlike that of the specimens of *L. liba* in the British Museum.

274. **Zephyrus dohertyi,** *de Nicéville.*—"N. W. Kumaun," (Doherty). He does not specify the exact locality. I have received a single male from the Pindari Valley in August.

275. **Zephyrus mandara,** *Doherty.*—"N. W. Kumaun," (Doherty).

These last four species are apparently confined to the inner ranges bordering on Tehri Garhwal and the snow-line.

276. **Euaspa milionia,** *Hewitson.*—Occurs sparingly at Binsar, 8,000 ft. in June. This is its first recorded locality in Kumaun, though it is apparently common in Mussoorie and Kulu.

277. **Chætoprocta odata,** *Hewitson.*—Fairly common in April and May and from July to October at 8-10,000 ft. in the neighbourhood of walnut trees on which its larva feeds.

278. **Chrysophanus phlæas,** *Linn.*—Common in the rains at 5-9,000 ft.

279. **Chrysophanus pavana,** *Kollar.*—Common in the rains at 5-9,000 ft. along with the last named.

280. **Ilerda sena,** *Kollar.*—Common. 3-9,000 ft. April to October.

281. **Ilerda epicles,** *Godart.*—Fairly common on the extreme east at 2-5,000 ft.

282. **Ilerda androcles,** *Doubleday* and *Hewitson.*—Not common at 8,000 ft. at Naini Tal, Binsar and Dhakuri in May and September.

283. **Ilerda moorei,** *Hewitson.*—Occurs rarely at the same times and places as the last named. The rich metallic blue of the upperside never turns green in some lights as in *I. androcles.*

284. **Ilerda viridipunctata,** *de Nicéville.*—Rare and local at Binsar and Naini Tal at 8,000 ft. in April and May. I have also one or two specimens from the Pindari Valley in August.

285. **Ilerda tamu,** *Kollar.*—Common at Naini Tal, April, May, July and September at 7,000 ft., also in the Pindari Valley at Dwali, 8,000 ft. in May.

286. **Ilerda brahma,** *Moore.*—Rare at Naini Tal, April and May, 7,000 ft. (Lang). Loharkhet, 5,000 ft. (Doherty). I found it fairly common but extremely local at the third mile on the road from Naini Tal to Ratighat at about 5,000 ft. in September 1909.

287. **Camena deva,** *Moore.*—Kapkot, 4,000 ft., August (Doherty). Not uncommon at Binsar and Naini Tal from July to September.

288. **Camena icetas,** *Hewitson.*—Fairly common at Naini Tal and Binsar in August and September, always at fairly high elevations above 6,000 ft.

289. **Camena cleobis,** *Godart.*—Rare at Naini Tal and Binsar in August and September, 6-8,000 ft.

290. **Camena ctesia,** *Hewitson.*—Not common, Naini Tal and Binsar at 7,000 ft. from July to September. The males when freshly caught have a beautiful metallic green gloss which soon disappears.

291. **Aphnæus vulcanus,** *Fabricius.*—Not common, Haldwani. October to December.

292. **Aphnæus lilacinus,** *Moore.*—Rare at Haldwani, December to March.

293. **Aphnæus lohita,** *Horsfield.*—Fairly common, Kapkot and Nalena, 3,500-4,500 ft.

294. **Aphnæus rukma,** *de Nicéville.*—Rare at Jiuli in March. 1 male, Loharkhet, May. 1 male from Jiuli, 2,500 ft. March, in Vanrenen's collection.

295. **Aphnæus elima,** *Moore* (= A. ictis, *Hewitson*).—Not common at Nalena and Jiuli, 2,000-4,500 ft. in March. Apparently the dry-season form of *A. ictis.*

296. **Aphnæus zaffra,** *de Nicéville.*—Naini Tal, 5,500 ft., May and at Binsar, 8,000 ft. in June. Sat Tal, 4,500 ft., May. Not common anywhere.

297. **Tajuria illurgis,** *Hewitson.*—Rare at Binsar and Naini Tal, 8,000 ft., in June.

298. **Tajuria illurgoides,** *de Nicéville.*—Naini Tal, 6,500 ft., July. (Lang). Three males in the Vanrenen's collection from Binsar, 8,000 ft., in September. I have not come across it and it is evidently very rare.

299. **Tajuria longinus,** *Fabricius.*—Not rare up to 3,000 ft. from May to September.

300. **Tajuria jehana,** *Moore.*—Not common at Haldwani in December.

301. **Tajuria yajna,** *Doherty.*—Eight specimens, including 1 female, taken at Nalena 4,500 ft., and Durgaon, 3,000 ft. in May 1909. The authenticity of this species has hitherto depended upon the capture of a single male by Doherty at Jhulaghat (2,000 ft.) in August. It was re-discovered in May 1909 by Mr. Peak's native catcher above the cart-road at Nalena, flying round high trees in the river-bed. The female, which has not been described before, is slightly larger than the male which it resembles in every respect on the upperside. On the underside it differs as follows:—

The ground-colour brighter, almost golden brown; the grey area on the hindwing more diffuse; the slender transverse line fulvous and white without any black.

302. **Chliaria othona,** *Hewitson.*—Rare, April and May, 4,500 ft., Nalena, Loharkhet.

303. **Chliaria kina.**—Fairly common in April and from July to October at 1-3,000 ft. usually in forest. It appears to be a shade-loving insect.

304. **Ticherra acte,** *Moore.*—"Askot, Baghrighat, 2,500-5,000 ft., Eastern Kumaun, scarce" (Doherty). I have not met with it.

305. **Horaga onyx,** *Moore.*—Rare in September and October at Khairna, 3,200 ft. and Jiuli, 2,000 ft.

306. **Horaga viola,** *Moore.*—Jiuli, 2,500 ft., Naini Tal, 7,000 ft., October, rare.

307. **Loxura atymnus,** *Cram.*—Common, July to October in lower hills up to 4,500 ft.

308. **Cheritra freja,** *Fabr.*—"Jhulaghat, Gori and Kali Valleys, 2-3,000 ft." (Doherty). I have not come across it.

309. **Deudorix epijarbas,** *Moore.*—Common, July to October, up to 6,000 ft. Its larvæ may be found in profusion in June and July infesting pomegranates—indeed in some years scarcely a pomegranate escapes their attacks.

310. **Hysudra selira,** *Moore.*—Common, Cheena and Binsar, 7,500 ft., in April and May, and to be met with rarely in September, flying round the wild indigo (*Indigofera purpurea*) on which its larva feeds.

311. **Rapala schistacea,** *Moore.*—Not uncommon on outer hills from July to November up to 6,000 ft.

312. **Rapala orseis,** *Hewitson* (= R. grisea, *Moore*).—Fairly common, September and October, 3-7,000 ft.

313. **Rapala nissa,** *Kollar.*—Common from July to October at 4,000-7,000 ft.

314. **Rapala tara,** *de Nicéville.*—Rare at Nalena and Naini Tal, 4,500-7,000 ft., in September. It is impossible to distinguish this species from *R. nissa* when on the wing.

315. **Rapala melampus,** *Cramer.*—Common, from July to November, at 3,000-7,000 ft.

316. **Virachola isocrates,** *Fabr.*—Fairly common at 4,000 ft. from July to September.

317. **Virachola perse,** *Hewitson.*—By no means common. Occurs sparingly from July to September at 4,000-6,000 ft. during breaks in the rains.

318. **Sinthusa nasaka,** *Horsfield.*—Local, but plentiful in certain localities in thick forest. Found very plentiful at Nalena, 4,500 ft., on the flowers of *Machilus odoratissima* in April and May 1909.

319. **Sinthusa chandrana,** *Moore.*—Scarce at the same altitude in May and in the Pindari Valley at 8,000 ft. in September.

FAMILY—HESPERIIDÆ.

320. **Badamia exclamationis,** *Fabr.*—Fairly common, 1,000 to 4,000 ft., August and September.

321. **Choaspes benjamini,** *Guerin.*—Common in May at 3,000-8,000 ft., especially near streams in forests.

322. **Ismene ataphus,** *Watson.*—August. Rare at 2,000 ft.

323. **Ismene jaina,** *Moore.*—Not common, May to August, 3,000 ft., Nalena.

324. **Ismene vasutana,** *Moore.*—Two specimens, a male and female, from Nalena, at 4,000 ft. in September.

325. **Bibasis sena,** *Moore.*—Fairly common, May to September, at 2,000 ft.

326. **Pirata chromus,** *Cramer.*—Rare at Ranibagh, 2,000 ft., in August.

327. **Chapra mathias,** *Fabr.*—Common, 3,000-7,000 ft., March to November.

328. **Chapra prominens,** *Moore* (=sinensis, *Mabille*).—Lower Ramganga, 2,500 ft. (Doherty). Not common at Bageshwar, 3,000 ft., in May.

329. **Chapra (Gegenes) karsana,** *Moore.*—Loharkhet, September, 6,000 ft. (Doherty).

330. **Parnara guttata,** *Bremer* and *Grey.*—Nalena, 4,000 ft., September, not common.

331. **Parnara bevani,** *Moore.*—Common, 3,000-7,000 ft., May to September.

332. **Parnara assamensis,** *Wood-Mason* and *de Nicéville.*—"Gori and Kali Valleys, 24,000 ft." (Doherty). Not common at Nalena and Naini Tal, 4,000-7,000 ft. in September.

333. **Parnara toona,** *Moore.*—"Lower Gori Valley, 2,500 ft." (Doherty). I have only come across it once in Kumaun, at Nalena, 4,000 ft., August.

334. **Parnara eltola,** *Hewitson.*—Common at from 3,000 to 6,000 ft. from April to September; on the whole, the most abundant species of this group.

335. **Suastus gremius,** *Fabr.*—Common, Ranibagh and Jiuli, 1-3,500 ft., June to October.

336. **Sarangesa purendra,** *Moore.*—Common, March to June, Ranibagh and Jiuli, 1-3,000 ft.

337. **Sarangesa dasahara,** *Moore.*—Common in same localities, July to September. Probably the wet-season form of the last-named. I find that Mr. Mackinnon has arrived independently at the same conclusion. The larvæ are indistinguishable.

338. **Telicota bambusæ,** *Moore.*—Rare at Nalena, 4,500 ft., in May and October.

339. **Telicota angiades (=brahma),** *Moore.*—Fairly common, 5,000 ft., May and June and again in September.

340. **Telicota (Padraona) dara,** *Kollar.*—Common at from 3,000 to 7,000 ft. in May, August and September.

341. **Taractrocera mævius,** *Fabr.*—Common at Naini Tal and Binsar at 7-8,000 ft., May and June.

342. **Taractrocera danna,** *Moore.*—Fairly common in May and June at about 7,000 ft.

343. **Æromachus stigmata,** *Moore.*—Fairly common at Bageshwar, 3,000 ft., in May.

344. **Ochus (Cyclopides) subvittatus,** *Moore.*—"Sarju Valley, 3-6,000 ft." (Doherty). Apparently occurs sparingly on the eastern border but I have not met with it.

345. **Halpe separata,** *Moore.*—Not uncommon in July and August at 4-6,000 ft.

346. **Halpe gupta,** *de Nicéville.*—Rare in May and June at about 7,000 ft.

347. **Halpe aina,** *de Nicéville.*—Not uncommon in May and June at 5-7,000 ft.

348. **Isoteinon masuriensis,** *Moore.*—Not uncommon, Cheena, 8,000 ft., in June.

349. **Isoteinon satwa,** *de Nicéville.*—"Scarce at Jhulaghat" (Doherty). I have not met with it.

350. **Satarupa sambara,** *Moore.*—Naini Tal, 7,000 ft., June, not common.

351. **Tagiades atticus,** *Fabr.*—Very common. 2-7,000 ft., April to October.

352. **Caprona suraya,** *Doherty.*—One male, Bageshwar, 3,500 ft., August (Doherty). I have not come across it.

353. **Caprona ransonnettii,** *Felder.*—Not uncommon at Ranibagh, 2,000 ft. in April and the darker form (= C. taylorii, *de Nicéville*) up to 5,000 ft. in June.

354. **Caprona,** *Felder.*—One male, Ranibagh, 2,000 ft., April.

355. **Odontoptilum sura,** *Moore.*—Rare in August at Jiuli, 2,500 ft.

356. **Erionota thrax,** *Linn.*—Not uncommon, Jiuli and Ranibagh, 2-3,000 ft., in October.

357. **Hyarotis adrastus,** *Cramer.*—Not common. 2,000-5,000 ft., Nalena and Takula.

358. **Coladenia fatih,** *Kollar* (=C. dan, *Fabr.*).—Common in April and May and again in October, at from 3-7,000 ft.

359. **Udaspes folus,** *Cramer.*—Common. April to September, at 3,000-7,000 ft.

360. **Notocrypta alysos,** *Moore.*—Rare at Nalena, 3,500 ft., in May. (Doherty).

361. **Notocrypta restricta,** *Moore.*—Fairly common, 3-5,000 ft., April to June.

362. **Celænorrhinus (Plesioneura) pulomaya,** *Moore.*—"Pindari Valley, 8,000 ft., August" (Doherty). Fairly common at Naini Tal at from 6-8,000 ft. in September.

363. **Celænorrhinus (Plesioneura) sumitra,** *Moore.*—"Pindari Valley, 7-9,000 ft." (Doherty). I have seen no specimens from further west than Sikkim. De Nicéville considered this indistinguishable from *C. pulomaya*, but the specimens in the British Museum (from Sikkim) are distinct enough.

364. **Celænorrhinus leucocera,** *Kollar.*—Very common. April to September, 3-8,000 ft., Nalena, Binsar, Naini Tal, etc.

365. **Celænorrhinus pero,** *de Nicéville.*—Not common at Naini Tal. 7,000 ft., August.

366. **Celænorrhinus munda,** *Moore.*—Fairly common at same times and places as *C. leucocera*.

367. **Celænorrhinus dhanada,** *Moore.*—"Kali Valley, 2-5,000 ft." (Doherty). I have not met with it.

368. **Kerana diocles,** *Moore.*—A single male in Mr. Peake's collection taken at Nalena, 4,500 ft., in September.

369. **Hesperia galba,** *Fabr.*—Common at 3-9,000 ft., April, May and October, especially in Sarju and Pindari Valleys in May.

370. **Lobocla casyapa,** *Moore.*—Not common at Dwali, 8,000 ft. in May, and at Naini Tal at the same elevation in June.

371. **Astictopterus olivasceus,** *Butler.*—A single male from Jiuli, 2,500 ft. in August.

ERRATA.

In Part I of this paper (No. 1, Vol. XX) the following *errata* occurred :—

Page 134, No. 21 for L. *ihsana* read L. *isana*.

Page 135, No. 31 for *coalpara* read *goalpara*.

Page 137, No. 70 for *arpisatis* read *parisatis*.

Page 137, No. 73 for '*Parhestina persimilis Zella's*' read '*P. persimilis Zella*.'

Page 140, No. 120, line 6, for 'October' read 'September.'

A FURTHER LIST OF BIRDS OF THE BHAMO DISTRICT, UPPER BURMA.

BY

MAJOR H. H. HARINGTON (92ND PUNJABIS).

(Continued from page 313, Vol. XIX.)

Herewith I send a few additions to my list of Bhamo Birds. Those marked with an asterisk* have been either compared with those in the Natural History Museum, South Kensington, or identified for me.

PARINÆ.

* (31) PARUS ATRICEPS, Horsf.—(Indian grey-Tit.)

Have seen a fine specimen shot by Major Delmè-Radcliffe near Bhamo.

PARADOXORNITHINÆ.

* (52) PARADOXORNIS GUTTATICOLLIS, A. David —(Austin's Crow-tit).

Two nests with parent birds were procured by Major O. K. Tancock, R. A., at Sinlum in April 1909.

CRATEROPODINÆ.

* (62) DRYONASTES RUFICOLLIS (Jard. & S.)—(Rufous-necked Laughing Thrush.)

Very common in the kine-grass jungle round Bhamo; and as it has been recorded from the Upper Chindwin, probably extends right across Northern Burma.

TIMELIINÆ.

* (134) TIMELIA JERDONI, Walden—(Jerdon's Red-capped Babbler.)

Very common in low-lying localities.

* (143) PELLORNEUM MINUS (Hume.)—(Sharpe's Spotted Babbler.)

Common; has a note very similar to *P. subochraceum*.

(165*a*.) *Alcippe Haringtoniæ*, Hartert.

B. B. O. C. No. cliv. p. 10.

"*Adult.* Most nearly allied to *A. phayrei*, Blyth, but differs in having a wide black stripe extending backwards from the eyes along the sides of the head and neck, and the outer webs of the primaries darker and less yellow.

It differs from *A. fratercula*, Rippon, in having a much larger and blacker bill, and much brighter outer webs to the primaries, which are yellowish-brown instead of olive-brown.

Culmen 16·5 mm. The wings of two males measure respectively 65 and 66 mm. of a female 69.

Hab.—Bhamo, Upper Burma.

Type in the Tring Museum: ♂ Bhamo 29, iii. 1909.

Collected by Major H. H. Harington.

Obs.—*A. nepalensis* (Hodgs.) has a white ring round the eye and a smaller and light coloured bill."

* (173 *b*) STACHYRHIDOPSIS BHAMOENSIS, Harington.—(Bhamo Red-headed Babbler.) One specimen procured near Bhamo in the plains.

LIOTRICHINÆ.

(255) MELANOCHLORA SULTANEA (Hodgs.)—(Sultan Bird.)

Recorded by Oates, Fauna, B. I.

BRACHYPODINÆ.

(290) OTOCOMPSA FLAVIVENTRIS (Tick.)—(Black-crested yellow Bulbul.)

Seen on several occasions along the China road.

CERTHIIDÆ.

(356) PNOEPYGA SQUAMATA (Gould).—(Scaly-breasted Wren.)

Recorded by Oates, Fauna, B. I.

SYLVIIDÆ.

* (367) ACROCEPHALUS AGRICOLA (Jerd).—(Paddyfield Reed-Warbler.)

One specimen.

* (379) CISTICOLA TYTLERI, Blyth.—(Yellow-headed Fantail-Warbler.)

One specimen.

* (410) PHYLLOSCOPUS FUSCATUS (Blyth.)—(Dusky Willow-Warbler.)

Very common in the cold weather in low-lying swampy localities. Some of my specimens have narrow white tips to their tail feathers; and Dr. Hartert, who kindly identified my Phylloscopi for me, writes as follows:—"This can only be *P. fuscatus* and the narrow white tips are of "very rare occurrence. I find them in two Chinese specimens, while others "do not show it, and one shows an indication only."

During the cold weather, I only got one specimen of *P. armandii* which is so plentiful at Sinlum during the hot weather.

* (417) P. SUPERCILIOSUS (Gm.)—(Crowned Willow-Warbler.)

* (426) P. LUGUBRIS (Blyth.)—(Dull-green Willow-Warbler.)

* (446) NEORNIS FLAVOLIVACENS, Hodgs.—(Aberrant-Warbler.)

* (446 *a*) N. FLAVOLIVACENS INTRICATUS, Hartert.

Both this bird and the last were procured near Bhamo during the cold weather.

The above were all kindly identified for me by Dr. Hartert.

(448) HORORNIS FORTIPES, Hodgs.—(Strong-footed Bush-Warbler.)

Recorded by Oates, Fauna, B. I.

(468) PRINIA INORNATA, Sykes.—(Indian Wren-Warbler.)?

All my specimens were winter ones, so it was impossible to decide whether they were the above or *blanfordi*.

LANIIDÆ.

*(488) TEPHRODORNIS PONDICERIANUS, (Gmel.)—(Common Wood-Shrike.)
Probably common round Bhamo.

MUSCICAPIDÆ.

(571) CYORNIS SAPPHIRA, (Tick.)—(Sapphire-headed Flycatcher.)
Recorded by Oates.

* (593) NILTAVA GRANDIS, (Blyth.)—(Large Niltava.)
Nest and parent bird obtained by Major Tancock, R. A., at Sinlum in May 1909.

SAXICOLINÆ.

(611) PRATINCOLA LEUCURA, Blyth.—(White-tailed Bush-Chat.)
Recorded by Colonel Rippon.

RUTICILLINÆ.

*(632) HENICURUS SCHISTACEUS Hodgs.—(Slaty Black-backed Forktail.)
Nest and parent bird procured at Sinlum on 28th April by Major Tancock, R. A.

* (647) CYANECULA SUECICA, (L).—(Red-spotted Bluethroat.)
Three specimens procured.

CINCLINÆ.

* (710) CINCLUS PALLASI, Temm.—(Pallas' Dipper.)
One specimen procured on 10th May 1908, in a stream below Sinlum; at the same time another was seen.
Irish brown, bill horny, legs bluish in front, black behind.

EMBERIZINÆ.

* (791) EMBERIZA PUSILLA, Pall.—(Dwarf Bunting.)
* (798) E. SPODOCEPHALA, Pall.—(Black-faced Bunting.)
Two specimens. I believe this is the first record of this bird from Burma.

MOTACILLIDÆ.

* (828) MOTACILLA OCULARIS, Swinh.—(Streak-eyed Wagtail.)
* (833) M. BOREALIS, Sundev.—(Grey-headed Wagtail.)
* (838) M. CITREOLOIDES, (Hodgs).—(Hodgson's Yellow-headed Wagtail.)
The above Wagtails were identified for me by Dr. Hartert. Of the last he writes:—"The seven or eight big yellow Wagtails appear to be all "*citreoloides*, as they are rather dark on the upper surface for *citreola*; "but these two are not easy to tell in winter."

DICÆIDÆ.

*(912) DICÆUM CRUENTATUM, (L.).—(Scarlet-backed Flowerpecker.)
Plentiful in the plains.
*(914) D. CHRYSORRHŒUM, Temm.—(Yellow-vented Flowerpecker.)
Procured near Bhamo.

(916) D. CONCOLOR, Jerd.—(Nilghiri Flowerpecker.)

Entered in my list as recorded by Colonel Rippon, was unfortunately included by mistake; this bird cannot be found in Burma.

(917) D. OLIVACEUM, Wald.—(Plain-coloured Flowerpecker.)

One specimen.

PITTIDÆ.

(927) PITTA NEPALENSIS, (Hodgs.)—(Blue-naped Pitta.)

One specimen.

PICIDÆ.

(975) IYNGIPICUS CANICAPILLUS, (Blyth.)—(Burmese Pigmy Woodpecker).

Dr. Hartert has identified my specimens as belonging to this species, so *I. pygmæus* should be omitted from my list.

PHŒNICOPHAINÆ.

(1122) RHOPODYTES VIRIDIROSTRIS, (Jerd.)—(Small Green-billed Malkoha.)

Included in my former list as recorded by Colonel Rippon, and was also entered in error.

STRIGES.

Sub-family ASIONINÆ.

1157. ASIO ACCIPITRINUS, (Pall.)—(Short-eared-owl).

Two put up by the regiment during field-firing at Mamauk.

ACCIPITRES.

(1189) PANDION HALIAETUS, (Linn.)—(Osprey.)

A cold weather visitor: a pair were very noisy in March 1909 in a swamp to the south of Bhamo, and, I think, must have bred there, but I found it impossible to get to the spot.

(1191) OTOGYPS CALVUS, (Scop).—(Black Vulture.)

(1196) PSEUDOGYPS BENGALENSIS, (Gm.)—(Indian White-backed Vulture.)

Both seen round Bhamo.

(1232) ELANUS CŒRULEUS, (Desf.)—(Black-winged Kite.)

One seen near Halone on 8th January 1909.

(1237) CIRCUS ÆRUGINOSUS, (Linn.)—(Marsh Harrier.)

One specimen.

(1243*a*.) ASTUR PLUMBARIUS KHAMENSIS, (Bianchi.)—(Bianchi's Goshawk.)

I shot a very fine specimen of the above on our range at Bhamo, it was identified by Dr. Hartert, who writes:—"I find the Goshawk is the "Tibetan race..... From Kham, S. E. Tibet. Described in the B. B. O. "C., XVI, p. 71, March 1906."

(1247) ACCIPITER NISUS, (Linn.)—(Sparrow Hawk.)

I got two sparrow-hawks; one described in my last list as *melanoschistus*; and a fine female on 29th January 1909. Dr. Hartert continues:—".....

The Sparrow Hawk (male) you now send is a very typical male of *A. nisus* "*melanoschistus*, while the female does not belong to this dark form, but is "rather a pale *nisus*." The former is probably a resident as it was procured in April, the latter a winter visitor from China.

(1265) TINNUNCULUS ALAUDARIUS, (Gmel).—(Kestrel.)

Seen on several occasions.

GALLINÆ.

PHASIANIDÆ.

*(1327) POLYPLECTRUM CHINQUIS (Müll).—(Grey Peacock-Pheasant).

Had a fine specimen brought in alive by a Kachin just before the Regiment left Bhamo; since sent to the Rangoon Zoological Garden.

(1340) GENNÆUS ANDERSONI (Elliott).—(Anderson's Silver Pheasant.)

Specimen got by Col. Rippon from Warar Bum, Military Police Post, 6,000 ft., and E. of Bhamo. (E. W. Oates. The Ibis, Jan. 1903.)

(1340) G. RIPPONI, Sharpe—(Rippon's Silver Pheasant.)

Specimen by Major Nisbett from Pansibum, 7,000 ft., and E. of Bhamo. Also been procured in Yunnan and at Keng Tung. (E. W. Oates. The Ibis, Jan. 1903.)

*(1340) GENNÆUS HARINGTONII, Oates.

Ann. and Mag. of Nat. History Ser. 8, Vol. V, February 1910.

Male and female shot by me at Nilum Kha, S. E. Bhamo, in March 1908.

(1340) G. DAVISONI. (Grant)—(Davison's Silver Pheasant.)

N. E. of Bhamo. Exact locality not known. (E. W. Oates. The Ibis, Jan. 1903.)

*(1340) G. BATEMANI, Oates—(Bateman's Silver Pheasant.)

Takes the place of *horsfieldi* in Burma. I procured three specimens at Sinkin. (E. W. Oates. B. N. H. S. J.) Vol. XVII, p. 10).

(1354) EXCALFACTORIA CHINENSIS. (Linn.)—(Blue-breasted Quail.)

Several shot at Lweje in December last; they must be very late breeders as many half-grown birds were put up.

(1355*a*.) COTURNIX JAPONICA. (Temm.)—(The Japanese Grey Quail.)

We shot half a dozen during a short trip to Lweje in December last.

HEMIPODIÆ.

*(1382) TURNIX PUGNAX (Temm.)—(Bustard-Quail).

Common round Bhamo.

*(1386) T. BLANFORDI, Blyth—(Burmese Button-Quail.)

Procured at Lweje.

RALLIDÆ.

(1399) AMAURORNIS BICOLOR (Wald.).—(Elwes' Crake.)

On 9th May 1909, Major Tancock, R.A., procured a nest with six eggs and parent bird at Lweje. I compared the latter with those in the N. H. Museum (S. K.) and found it typical. This, I believe, is the first record of

A. bicolor from Burma. On 29th May 1905, my spaniel put up a Bamboo Partridge out of a small swamp, and as it was so noisy, I thought there must be a nest, so I told a Kachin to look carefully, pointing out the exact spot, the bird having got up within a few feet of me. Sure enough, the Kachin found a nest at the very spot and, to my surprise, brought out a nest of four unmistakeable Rails' eggs. I had the swamp well hunted, but could put no other bird out. Whether the Bamboo Partridge had annexed the nest or not I cannot say, but it was very strange finding a nest at the exact spot. These four eggs agree both with Major Tancock's and with some which I have received from India.

(1402) GALLINULA CHLOROPUS (Linn.)—(Moorhen.)

(1403) GALLICREX CINEREA (Gm.)—(Watercock.)

(1404) PORPHYRIO POLIOCEPHALUS (Lath.)—(Purple Moorhen.)

(1405) FULICA ATRA, Linn.—(Coot.)

All the above seen when out duck-shooting.

LIMICOLÆ.

(1418) ŒDICNEMUS SCOLOPAX (S. G. Gmel.)—(Stone-Curlew.)

Several heard at night in the fields near Helon.

(1427) GLAREOLA LACTEA, Temm.—(Small Indian Swallow-Plover.)

(1436) VANELLUS VULGARIS, Bechst.—(Peewit.)

A pair was shot by Major W. G. Nisbett near the Fort, Bhamo. I have recorded this bird before from Thamanthi, Upper Chindwin.

(1451) HIMANTOPUS CANDIDUS, Bonn.—(Black-winged Stilt.)

(1465) TOTANUS FUSCUS, Linn.—(Spotted Redshank.)

(1474) TRINGA TEMMINCKI, Leisler.—(Temminck's Stint.)

(1482) SCOLOPAX RUSTICULA, Linn.—(The Woodcock.)

Fairly plentiful during the cold weather round Bhamo.

(1486) GALLINAGO SOLITARIA, Hodgs.—(Himalayan Solitary Snipe.)

On the 9th December last, when on the march between Sinlum and Lweje, Bhamo District, I shot a fine specimen of the above, as recorded by me in the *Rangoon Gazette* of the 27th December 1909.

(1487) GALLINAGO GALLINULA (Linn.)—(The Jack-snipe.)

One or two shot every season.

CICONIÆ.

(5159) HERODIAS ALBA (Linn.)—(Large Egret.)

(1568) NYCTICORAX GRISEUS (Linn.)—(Night Heron.)

(1574) BOTAURUS STELLARIS (Linn.)—(Bittern.)

I shot one in the swamp at the bottom of the polo ground.

ANSERES.

CYGNUS (?)

On 8th December 1908 while two of us were out snipe-shooting in the swamp to the South of the polo ground, we were completely taken by sur-

prise on putting up an unmistakeable swan. It was again seen by a visitor a few days later, who asked who kept swans at Bhámo as he had seen one alight on the river. After this it seems to have disappeared. The bill seemed particularly small and black in colour.

(1595) CHAULELASMUS STREPERUS (Linn.)—(Gadwall.)

(1606) NYROCA FERRUGINEA (Gm.)—(White-eyed Duck.)

(1609) N. FULIGULA (Linn.)—(Tufted Duck.)

The above were all procured during the last shooting season.

A LIST OF THE BUTTERFLIES OF THE PALNI HILLS WITH THE DESCRIPTIONS OF TWO NEW SPECIES.

BY

CAPT. W. H. EVANS, R. E.

WITH A NOTE ON MIGRATION BY MR. J. EVERSHED.

The Palni Hills may roughly be described as situated between the Nilgiris and Travancore and though excellent butterfly lists from the latter districts have been published, no such information, as far as I know, has ever been compiled for the Palnis.

I do not propose to give a long description of the district nor am I qualified to do so: intending visitors should obtain a "Guide to Kodaikanal" from Combridge. Under present arrangements the visitor to the Palnis leaves the S. I. R. at Kodaikanal Road station, proceeds for 33 miles by motor bus or bullock cart to the "Tope" bungalow at the foot of the hills (1,500 feet), and is then carried or rides up the Ghat road for another 12 miles to Kodaikanal (7,000 feet).

In Kodaikanal itself the blue gum and wattle has run riot and ousted most of the indigenous jungle with the result that butterfly life is not so prolific as it might be; a few good butterflies may, however, be picked up on the Downs and in Bombay Sholah. Most of the neighbouring valleys below the station contain "Sholahs" or patches of indigenous jungle in which butterflies may be obtained; the best of these is Tiger Sholah, situated at 5,000 feet, with Perumal and Neutral Saddle beyond. It is, however, in the jungles at the foot of the hills that butterflies really abound: the first 6 miles up from the Tope forms an excellent hunting ground, while the best place of all is the vicinity of the third mile-stone (2,000) where a small stream crosses the road.

My own experience was gained during a visit to Kodaikanal from the end of August to the beginning of October 1909. Mr. J. Evershed, of the Observatory, has sent me several useful notes as well as a note on migration, which I venture to think will prove of unusual interest. Dr. T. H. Campbell has given me the benefit of his experience gained during the months of May and June; he has also been through a collection belonging to Dr. Tracy. Dr. Henderson, of the Madras Museum, kindly let me go through the

Museum collection and showed me several butterflies he had caught himself during a recent visit to Kodaikanal. My thanks are also due to Father Gonpére of St. Xaviers College, Shembaganur, who kindly let me go through the College collection; I understood from him that periodically the better insects are removed to the College at Trichinopoly, which unfortunately I was unable to visit.

The list is, I am afraid, rather meagre; there are a number of common species not included, which are bound to occur and I think that an ardent resident collector would not take long to add another hundred species.

1. *Hestia malabarica.*—Dr. Campbell saw some specimens several years ago in the St. Xaviers College collection which he thinks must have come from somewhere in the Palnis.

2. *Danais plexippus.*
3. *Danais chrysippus.*
4. *Danais septentrionis.*

Common all the year at low elevations and often seen high up, especially during migrations in October and November.

5. *Danais limniace.*—Obtained by Mr. Evershed at 2,000 feet in June, also caught by Dr. Henderson.

6. *Danais aglea.*—Rare at low elevations, May, June, October.

7. *Danais nilgiriensis.*—Common above 2,000 feet all the year round, especially so in Tiger Sholah.

8. *Euploea coreta.*
9. *Euploea core.*
10. *Euploea kollari.*

All fly together at low elevations probably throughout the year; the species are difficult to differentiate between on the wing. I spent a morning near the Tope catching nothing but Eupleas which happened just then to be particularly abundant, and found that 80 per cent. proved to be *core*, 16 per cent. *coreta* and 4 per cent. *kollari*. *Core* is frequently seen at high elevations especially during migrations, while *coreta* may be caught in Tiger Sholah.

11. *Mycalesis perseus.*—Dr. Tracy has a pair from 3,000 feet.

12. *Mycalesis mineus.*—Two wet season males caught near the Tope in September.

13. *Mycalesis subdita.*—Wet season form common to 6,000 feet, May, June, August to October; the dry season form recorded by Mr. Evershed in November. My specimens differ from wet season *visala* from Sikkim precisely as described by Bingham with respect to the male brand, while all the ocelli on the underside are smaller and less prominent. The brand in dry season *visala* from Sikkim does not seem to pierce the discal band as it should do.

14. *Mycalesis oculus.*—Very common above 4,000 feet in forest, May, June, August to October, especially in Tiger Sholah. Dr. Campbell notes that a fresh brood appears at the end of May.

15. *Mycalesis malsara lepcha.*—Common all the year round up to 6,000 feet; dry season form in February.

16. *Mycalesis jungnia.*—Uncommon near the Tope in May, June and September.

17. *Orsotriæna meda mandata.*—Caught by Drs. Campbell and Tracy at the third mile-stone in July.

18. *Lethe drypetis.* } Common at all elevations in May, June
19. *Lethe rohria nilgiriensis.* } August to October, especially in Tiger Sholah.

20. *Ypthima baldus.*—Very common to 6,000 feet, April to June, August to October; I found both seasonal forms flying together in the Autumn.

21. *Ypthima chenui.*—I found this rare between 2,000 and 5,000 feet in August and September; Dr. Campbell found it common at these elevations in May and June near Neutral Saddle and on the road to the Tope.

22. *Ypthima ypthimoides.*—Extremely common above 5,000 feet more or less all the year round.

23. *Ypthima huebneri.* } Common to 4,000 feet in May, June,
24. *Ypthima huebneri ceylonica.* } August to October. I do not understand why Bingham in this and many other instances, notably the Symphædras, calls one butterfly a race of another when both fly together: would it not be simpler to consider *ceylonica* as a distinct species or as a dimorph of *huebneri* until breeding experiments settle the point.

25. *Melanitis ismene.*—I only secured one wet season specimen near the Tope in September; Dr. Campbell records it as common in Tiger Sholah and Kodaikanal in May and June; Mr. Evershed finds it common at high elevations in December, January.

28. *Melanitis bela varaha.*—Dr. Tracy obtained one in July.

27. *Elymnias caudata.*—Rare at 3,000 feet, May, September.

28. *Discophora lepida.*—One male at the third mile-stone in September.

29. *Charaxes psaphon imna.*—A male in the St. Xavier College collection.

30. *Charaxes fabius.*—Dr. Campbell obtained two specimens at the third mile-stone in May and June.

31. *Eulepis athamas.*—Common at low elevations, April to June, August to October.

32. *Apatura parisatis camiba.*—Common above 3,000 feet; May, June, August and September; females are less often met with than males as they frequent bushes not paths as the male does.

33. *Euripus consimilis.*—Dr. Campbell has found this insect not uncommon at the third mile-stone in May and June.

34. *Euthalia lepidea.*—Seen by Mr. Evershed near the Observatory.

35. *Euthalia garuda.*—One female in the St. Xavier College collection and a male caught by Dr. Tracy near Perumal in July.

36. *Euthalia nais.*—Common at low elevations: May, June, August and September.

37. *Moduza procris.*—Taken by Mr. Evershed in April and recorded by Dr. Campbell from Tiger Sholah.

38. *Pantoporia ranga.*—Rare, about 2,500 feet; August, September.

39. *Athyma perius.*—Common at 2,000 to 6,000 feet; in May, June, August to October.

40. *Neptis eurynome.*—Common at all elevations; April to June, August to October. Two forms occur, one with the underside golden and the other chocolate; in the latter the veins of the forewing are very heavily marked with black, a feature I have not observed in specimens from North India.

41. *Neptis columella.*—Rare at low elevations in September, and obtained by Dr. Henderson in May; my specimens are blue tinted as *jumbah*.

42. *Neptis jumbah.*—Common at low elevations; May, June and September.

43. *Neptis soma kallawa.*—Rather uncommon in Tiger Sholah; May, June and September. The *soma* group is very puzzling; my specimens differ a good deal from Bingham's description, they are larger with the markings more or less sullied and the underside deep chocolate; I have a specimen of *hampsoni* from the Nilgiris and a long series of *soma* from Sikkim and find that *kallawa* is a very distinct form.

44. *Rahinda hordonia.*—Common at a low elevations and occasionally seen in Tiger Sholah; in May, June, August to October. I have failed to find the differences pointed out by Mr. Bell, as regards the light and dark male mark, in either Sikkim or Palni Hill specimens.

45. *Cyrestis thyodamas.*—Not common at low elevations and sometimes seen at 7,500 feet; in May, June, September, October.

46. *Junonia iphita.*—Very common to 5,000 feet; May, June, August to October, and has been seen at 7,500 feet.

47. *Junonia lemonias.*—Found with *iphita*; Mr. Evershed records it as especially common in December and January.

48. *Junonia orithyia.* } Common at all elevations and seasons especially
49. *Junonia hierta.* } *hierta*.

50. *Junonia almana.*—Recorded as occurring rarely at all elevations. I did not come across it.

51. *Vanessa cardui.*—Common always and everywhere.

52. *Vanessa indica.*—Common above 3,000 feet; April to June, August to October. Mr. Evershed notes that the larva has precisely the same habits as the larva of *V. atalanta* and feeds on the leaves of stinging nettles, which it spins together.

53. *Vanessa canace.*—Common at 4,000 to 6,000 feet; May, June, August to October.

54. *Hypolimnas bolina.* } Common at low elevations; May, June, August to October and occasionally seen at high elevations especially during migrations.
55. *Hypolimnas misippus.* }

56. *Kallima horsfieldi.*—Always to be seen near the third mile-stone in May, June, August to October; difficult to catch as it always perches on branches just out of reach.

57. *Cynthia aseta saloma.*—Males in the St. Xavier College collection.

58. *Atella phalantha.*—Common everywhere probably all the year round.

59. *Cupha placida.*—Rare below 4,000 feet; September. Dr. Campbell found it common in Tiger Sholah and to 7,000 feet in May and June. Mr. Evershed records it from Tiger Sholah in October and has seen it in the Observatory compound, 7,500 feet.

60. *Argynnis hyperbius castetsi.*—Common all the year round at high elevations. Mr. Evershed notes that the larva is black with red spines and feeds on the long leaved violet: as one violet is not enough for one caterpillar and the plants are few and far between, the larva may frequently be observed wandering over the Downs in search of its foodplant.

61. *Cirrochroa thais.*—Not rare near the Tope in May and September.

62. *Byblia ilithyia.*—Obtained by Dr. Tracy at Periyakulam, in the plains five miles from the Tope.

63. *Ergolis ariadne.*—Common at low elevations; May, June, August to October; seen at high elevations during migrations.

64. *Ergolis merione taprobana.*—Common to 6,000 feet; May, June, August to October.

65. *Telchinia violæ.*—Rare, 5,000 to 7,000 feet; May, June.

66. *Libythea celtis lepitoides.*—One near the Tope; September.

67. *Libythea myrrha.*—Common to 5,000 feet; April to June, August to October; a few observed at 7,000 feet.

68. *Abisara echerius.*—Common to 6,000 feet; May, June, August to October; a fresh brood appears early in June.

69. *Papilio minos.*—Common to 7,000 feet; January, May, June, August to October; it sails along at a great height from the ground and is difficult to catch.

70. *Papilio hector.*
71. *Papilio aristolochiæ.*

Common at low elevations; May, June, August to October. *Hector* is often seen at the highest elevations.

72. *Papilio demoleus.*—Common everywhere and always.

73. *Papilio helenus daksha.*—Common above 2,000 feet; May, June, August to October. Mr. Evershed has observed the larva on Orange and Pomolo bushes.

74. *Papilio polytes.*—Common at low and often seen at high elevations probably all the year.

75. *Papilio polymnestor.*—Common to 5,000 feet and often seen higher still in May, June, August to October.

76. *Papilio crino.*—Not uncommon at low elevations; June, September and October.

77. *Papilio eurypylus jason.*—Common at low elevations in September and October.

78. *Papilio agamemnon.*—I saw one near the Tope in September. Dr. Campbell records it as fairly common to 7,000 feet in May and June; seen migrating by Mr. Evershed in November.

79. *Papilio sarpedon teredon.*—Common everywhere: April to June and August to October.

80. *Leptosia xiphia.*—Not rare at low elevations; May, June, August to October; seen by Mr. Evershed at the Observatory.

81. *Delias eucharis.*—Common to 5,000 feet; January, May, June, September; sometimes seen at high elevations.

82. *Anaphœis mesentina.*—Rather rare at low elevations; May, June and September.

83. *Pieris canidia.*—Common above 5,000 feet; April to June, August to October.

84. *Huphina nerissa phryne.*—Common at low and rare at high elevations; April to June and August to October.

85. *Ixias pyrene.* } Common at low elevations; April to June and
86. *Ixias marianne.* } August to October.

87. *Appias libythea.*—Males uncommon, females rare at low elevations in September and October.

88. *Appias albina.*—Not uncommon at low elevations; May, June, August to October. Mr. Evershed caught a pair migrating.

89. *Appias indra narendra.* Rare in Tiger Sholah; May, June.

90. *Catopsilia crocale.* }
91. *Catopsilia pyranthe.* } The first two common, the third rare, at all
92. *Catopsilia florella.* } elevations probably throughout the year.

93. *Colias hyale nilgiriensis.*—Common on the Downs at 7,000 feet all the year. Mr. Evershed has found the larva feeding on *Parochetus communis.*

94. *Terias libythea.* }
95. *Terias venata.* } Common at all elevations all through the year.
96. *Terias hecabe.* }

97. *Terias læta.*—Not caught by me; recorded as common all the year in the neighbourhood of Neutral Saddle.

98. *Terias silhetana.*—Fairly common at low elevations in August and September.

99. *Colotis amata.*—I did not see this. Dr. Campbell records it as common at low elevations in May and June and obtained a male at Neutral Saddle.

100. *Colotis fausta tripuncta.*—Male common, females rare in May, June, August to October. Dr. Campbell obtained a male at Neutral Saddle.

101. *Colotis etrida.*—Uncommon to 7,000 feet; May, June, August to October.

102. *Colotis eucharis.* } Common at low elevations; April to June,
103. *Colotis danæ.* } August to October.

104. *Hebomoia glaucippe.*—Common at low elevations and occasionally seen at high elevations; January, May, June, August to October; females are rare. My specimens resemble Sikkim specimens exactly.

105. *Pareronia hippia.*—Fairly common at low elevations in September and October.

106. *Pareronia celyanica.*—Rare at low elevations; June, August and September.

107. *Megisba malaya* (tailed). } Rare at low elevations in September.
108. *Spalgis epius.* }

109. *Cyaniris puspa.*—Common to 6,000 feet; August, September.

110. *Cyaniris lilacea.*—Three males at 2,000 feet in September. I differentiate it from *puspa* by the complete absence of white above and by the smaller, more sharply defined markings on the underside.

111. *Cyaniris albidisca.*—Common, April to June, August to October, above 5,000 feet especially in Bombay Sholah.

112. *Cyaniris akasa.*—Occurs with *albidisca* but is met with in more open country and extends lower down.

113. *Cyaniris huegeli singalensis.*—A few males obtained with *lilacea.*

114. *Cyaniris limbata.*—One male at 2,000 feet in September; only to be distinguished from the preceding by its darker colour.

115. *Chilades laius.*—Common at low elevations; May, June, August to October.

116. *Zizera maha.* } Common at all elevations probably throughout
117. *Zizera gaika.* } the year.
118. *Zizera otis.* }

119. *Zizera lysimon.*—Not observed by me; recorded by Dr. Campbell as not rare on the Tope road in May and June.

120. *Azanus ubaldus.*—One male near the Tope in September.

121. *Azanus jesous.*—Common at low elevations; May, June, August to October.

122. *Lycænesthes lycænina.* } Common to 5,000 feet; May, June, Sep-
123. *Everes argiades.* } tember and October.

124. *Talicada nyseus.*—Common at high and rare at low elevations in January, March to June, August to October. Dr. Campbell has found the pupæ in March on Stonecrop.

125. *Nacaduba macrophthalma.*—Rare to 6,000 feet, September; common to 3,000 feet, May and June. I obtained a male at 2,000 feet in September which I identify very doubtfully as this species; it is the size of *ardates*, the ground colour above is quite unlike *macrophthalma* being shining purple with broadish borders rather as in *Lycænesthes emolus* from Sikkim and exactly as in a specimen of *N. hampsonii* I have from Pachmarhi. On the underside it resembles *N. cælestis* with the ground colour much darker and of

course lacking the basal fascia; the discal fascia is displaced outwards between veins 4 and 5, a feature I have never noticed in *macropthalma*. There is an exactly similar specimen in the Society's Museum from the Palnis.

126. *Nacaduba ardates*.—Common at all elevations, April to June, August to October; the tailed and tailless forms occur together. Here as in Sikkim the tailed form is much lighter below with all the fasciæ straighter, narrower and more regular. It is a pity that no one has yet been able to prove by breeding that the two forms are identical; the tailed form has been bred in N. Kanara but unfortunately the tailless form does not appear to occur there.

127. *Nacaduba atrata*.—Common to 6,000 feet, August to October, but not recorded by Dr. Campbell. My specimens can easily be separated into two groups, viz., *atrata* and *prominens*; in the *atrata* group the fifth striga from the base is even and continuous while in the *prominens* group it is always broken at vein 2.

128. *Nacaduba kodi*, n. sp.—Two males and a female in poor condition, at 2,000 feet in September. Ground colour above and below as *N. dana* but rather darker, hindwing tailed, basal strigæ not to vein 1, discal strigæ to vein 1. As regards the markings below it is closely allied to *N. ancyra* and *hampsonii*; it differs from the former in the shape of the wings and from the latter in the shade of blue above as well as in having no tail. The female, a very poor specimen, has no blue above at all; below it is much lighter than the male.

129. *Lampides bochus*.—Dr. Campbell records this as rare in May and June; Mr. Evershed has caught it at 7,000 feet.

130. *Lampides celeno*.—Common everywhere, January, May, June, August to October.

131. *Lampides elpis*.—Rare at low elevations, May, June and September.

132. *Catochrysops strabo*.—Common at low elevations, May, June, August, September.

133. *Catochrysops cnejus*.—Common everywhere, August, September.

134. *Catochrysops pandava*.—In the Society's Museum from the Palnis.

135. *Tarucus plinius*.—At low elevations common in May, rare in September.

136. *Castalius ananda*.
137. *Castalius rosimon*.
138. *Castalius ethion*.
139. *Castalius decidia*.

More or less common to 5,000 feet, May, June, September, October. *Rosimon* has been caught in the Observatory compound.

140. *Polyommatus bæticus*.—Common everywhere and always.

141. *Curetis thetis*.—Rather rare to 2,000 feet, May, June, September and October.

142. *Amblypodia anita*.—Males common, females not seen, to 2,000 feet, June and September.

143. *Surendra quercetorum.*—Fairly common at low elevations, June, August to October.

144. *Aphnæus vulcanus.*—Rare at low elevations, September; Dr. Campbell caught a male at Neutral Saddle in June.

145. *Alphnæus lohita.*—Seen at the Tope in September; Dr. Tracy has a female from Neutral Saddle in June and Mr. Evershed a specimen from Perumal.

146. *Hypolycæna nilgirica.*—A female of this rare species in the St. Xavier College collection.

147. *Camena cleobis.*—A female at 4,000 feet in September.

148. *Catapœcilma elegans.*—Not uncommon in Tiger Sholah and at Perumal in May and June.

149. *Rathinda amor.*—Rare to 2,000 feet, September.

150. *Loxura atymnus.*—Common at low elevations, May, June, August to October.

151. *Rapala varuna.*—A female in the St. Xavier College collection.

152. *Virachola perse.*—Several specimens in the St. Xavier College collection.

153. *Celœnorrhinus ambareesa.*—Common at low elevation, May, June, August and September; Mr. Evershed has caught it at 6,000 feet.

154. *Celœnorrhinus leucocera.*—Common to 3,000 feet and a few caught in Tiger Sholah, May, June, August to October.

155. *Celœnorrhinus spilothyrus.*—Common in Tiger Sholah in September.

156. *Coladenia tissa.* } Occur more or less commonly to 3,000 feet,
157. *Coladenia dan.* } May, June, August to October.

158. *Tagiades obscurus.*—Rare at low elevations: May, June and September.

159. *Tagiades atticus.*—Seen near the Tope in September; one specimen in the St. Xavier College collection.

160. *Odontoplitum sura.* } Common at low elevations, May, June,
161. *Caprona ransonnettii.* } August to October.

162. *Caprona syricthus.*—Two near the Tope in September.

163. *Hesperia galba.*—Common at all elevations, May, June, August and September.

164. *Gomalia albofasciata.*—Not common at low elevations, in September.

165. *Baracus subditus.*—Common between 4,000 and 6,000 feet, especially so in Tiger Sholah, in May, June and September.

166. *Taractrocera ceramas.*—Fairly common at high elevations on the Downs in August and September.

167. *Iambrix salsala.*—Common at low elevations, May, June, August to October.

168. *Ampittia maro.*—Caught by Dr. Henderson and also in the Society's Museum from the Palnis.

169. *Aeromachus dubius.*—Fairly common above 5,000 feet in May, June, August to October.

170. *Hyarotis adrastus.*—Seen at 2,000 feet in September.

171. *Arnetta vindhiana.*—Rare from 2,000 to 5,000 feet in September.

172. *Notocrypta restricta.*—Rare in Tiger Sholah, May, June.

173. *Udaspes folus.*—Seen near the Lake in September.

174. *Cupitha purreea.*—One male near the Tope, September.

175. *Telicota bambusæ.*—Rare at low elevations, September.

176. *Telicota concinna.*—Rare in Tiger Sholah, September.

177. *Telicota gola.*—Two at 2,000 feet, September.

178. *Telicota dara.*—Fairly common to 6,000 feet, August to October. Very variable as usual. I follow Elwes and Edwards in considering *mæsa, mæsoides, pseudomæsa*, etc., as synonyms of *dara*.

179. *Halpe ceylonica.*—Two specimens at 2,000 feet in September; they agree exactly with specimens I caught in Kandy.

180. *Halpe honorei.*—One male at 2,000 feet in October.

181. *Halpe evershedi*, n. sp.—I obtained two specimens of a *Halpe* in Tiger Sholah in September and there is a specimen in Mr. Evershed's collection; as far as I can ascertain it is different to any species yet described and as Mr. Evershed was the first to capture it I name it after him. My specimens, both males, are closely allied to *Halpe sitala* from the Nilgiris only differing in the following particulars: upperside—no ochreous patch on the hindwing; underside—apex of forewing and disc of hindwing broadly ferrugineous ochreous, this area on the hindwing being crossed by two rows of ill-defined black spots; there are no traces of the white spots to be seen on the hindwing of *sitala* on the underside.

182. *Parnara sinensis.*—Males were fairly common in Tiger Sholah in September but I did not see a female; the local form differs from the North Indian form in having only one, or oftener no spot on the handwing above; on the hindwing below the spot at the end of the cell is always prominent but the discal row is reduced to two or rarely three spots.

183. *Parnara mathias.*—Common at all elevations in May, June, August to November.

184. *Parnara colaca.*—Common at low elevations, August to October.

185. *Parnara bevani.*—Rare, but seems to occur at all elevations in September.

186. *Parnara kumara.*—One female in Tiger Sholah, September.

187. *Hasora chabrona.*—Not rare at high elevations in September and October.

188. *Hasora chromus.*—Common at all elevations in September; Dr. Campbell found it rare in May and June and notes that it appears from 7 to 8 a.m. and from 5 p.m. to sunset.

189. *Hasora alexis.*—Common at high elevations, May, June and Sep-

tember. At the end of September I found a heliotrope bush swarming with these last three species.

190. *Badamia exclamationis.*—Common at low elevations; August to October.

191. *Rhopalocampta benjaminii.*—Rare at high elevations in September. Caught in Tiger Sholah by Mr. Evershed.

Note on Migrations.

By

Mr. J. Evershed.

The *Catopsilia* migrations are observed in spring and autumn over the Palnis. In the spring months,—March to June,—*C. crocale, C. pyranthe, C. catilla*, and occasionally *C. florella*, are seen flying north and north-east. The direction is quite independent of wind and can have no reference to the position of the sun, which may be at or near the zenith in April. They travel at about fifteen miles an hour, more or less, according to the direction of the wind, which may assist or retard their flight. It is remarkable how seldom the butterflies deviate from a constant direction or azimuth although following closely the contours of the ground: woods or small sholas are not avoided, but passed through near the ground if the undergrowth is not too thick, otherwise they prefer to fly over rather than around such obstacles. This habit seems to apply also to much larger obstacles, for the Palni Hills themselves could be avoided by travelling to the east in the plains, before reaching the hills; yet the butterflies may be seen ascending the precipices on the south side of the hills, and heading north immediately on reaching the summits.

These butterflies have not been seen by me in great swarms, as recorded occasionally in the plains but a single observer may count several hundred individuals passing per hour during about four hours in the middle of the day, and the flight may be maintained day after day for several weeks together, if the weather is sunny.

The autumn migrations are observed in October and November, the direction of flight being almost due south. In addition to *Catopsilias* many other species have been observed at this season, in particular *Papilio demoleus* (seen in great numbers in 1908), also *P. hector, P. agamemnon, Hypolimnas bolina, Danais chrysippus,*

D. plexippus, and *D. septentrionis*, *Junonia hierta*, *J. orithya*, *J. lemonias*, *Atella phalantha*, and a small skipper. Sometimes large numbers of dragonflies accompany the butterflies in the southward flight.

It has been noted that on reaching a bank of fog near the precipices on the south side of the Palnis a specimen of *P. hector* was turned back by it. The instinct impelling a southerly direction of flight was evidently operating even with a contrary wind and clouded sky, but the fog was baffling, and the butterfly had to retreat before it, returning however again and again right up to the edge of the wall of mist.

Towards the end of November 1908 two opposing streams of *Catopsilias*, with a few Danaids and Papilios were observed flying in almost opposite directions, one stream moving south and the other passing through it approximately in the direction north by east. It was noticeable that the butterflies showed not the slightest indecision or confusion at the crossing point, each individual maintaining its original direction of flight quite independently of the others. It is evident, therefore, that the instinct is not in any way dependent on numbers, but operates separately in each individual.

A feature of the autumn migration of 1909 was the very large number of the skipper *Parnara mathias* which accompanied the other species.

These migrations appear to occur over the whole of the grassy upland region of the Palnis, where very few of the species breed. Apparently the butterflies ascend from the plains on one side of the range, cross the hills, and descend again on the opposite side; but I have been unable to discover how far the flights are continued in the plains. *P. demoleus* has been observed migrating in large numbers a dozen miles or so to the south-east of the Palnis at the same time that the migration was in progress on the hills.

Co-operation by observers in other stations is much to be desired in order to trace out the whole course of a migration, and it is possible that systematic observation over extended areas might throw much new light on the origin of this mysterious instinct.

THE NATURAL HISTORY OF BOMBAY MALARIA

BY

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(With Plates I and II.)

Natural History can show no more fascinating story than that of the discovery of the Malaria Parasite, and the part played by the mosquito in its transmission from man to man. Laveran and Ross to whom we are indebted for this knowledge were medical men, but they were naturalists too; and the discoveries they made would have been impossible but for this fact. Not so very long ago a student of Natural History was looked upon as a crank who delighted in collecting all sorts of specimens and pursued a study which ordinary people considered largely a waste of time; now-a-days it is recognised that the whole science of Preventive Medicine, especially as it relates to the problems of Tropical Disease, is based upon the work of the one-time despised Naturalist. This being so, I need offer no apology for addressing this Society upon such a subject as The Natural History of Bombay Malaria, for Malaria is as much a matter of interest to the student of Natural History as to the medical man.

In 1880 Laveran found when examining the blood of persons suffering from malarial fever that small motile bodies could be seen in the red blood corpuscles of the patients. Some of the bodies were exceedingly minute and quite colourless but others were nearly as large as the blood corpuscles themselves and contained grains of blackish pigment in rapid motion. By a careful study of these bodies at all stages in an attack of fever Laveran was able to show that the occurrence of febrile paroxysms bore a direct relation to the development of the organism which he was observing. Thus just before the onset of an attack of ague, numerous large pigmented parasites were to be seen, but at the moment when the first symptoms of shivering occurred, examination of the blood showed that these large pigmented parasites were dividing up into minuter forms and their pigment was being set free in the blood. A little later in the attack the larger parasites

had mostly disappeared and small unpigmented parasites were present in many of the corpuscles of the patient. Laveran deduced from these observations that the organism he had been studying was the cause of malaria, and that the actual onset of an attack of fever took place when large mature parasites were reproducing themselves by a process of sub-division or shizogony.

Several different forms of malarial fever have long been recognised. The commonest is the so-called Tertian Ague, characterised by recurring attacks of ague and fever every third day. That is to say a man who had an attack on Monday might be quite free of fever on Tuesday, but would have a recurrence of symptoms on Wednesday and so on. Another form is Quartan Ague, in which the attack occurring on one day would be followed by two days of freedom from symptoms with a recurrence on the fourth day.

A third and more severe kind of Malaria takes the form either of a continued fever or a series of recurring paroxysms every third day. In the latter form each paroxysm usually lasts for from twenty-four to thirty-six or more hours, so that there is usually only a short interval between them. This kind of Malaria is called Malignant Tertian Fever.

Since Laveran's original discovery of the malarial organism it has been found that each of these types of Malaria is due to a different species of parasite, and it has been definitely proved that each phase of an attack of Malarial Fever is related to a corresponding stage in the life-cycle of the organism associated with it. For nearly twenty years after Laveran published his discovery nothing was known as to the manner in which the parasite gained entrance to the blood of man; and though the life history of each of its forms was carefully worked out by numerous observers, and it was found that they could exist and continue reproducing themselves for long periods in the blood of infected persons, no one was able to cultivate them or to keep them alive for more than a very short time outside the human body; neither had any one been able to trace the presence of the organism in the air, the soil or the water of malarious countries. But it had long been noticed that among the parasites present in the blood of sufferers from Malaria there were often large pigmented forms which were of a

very peculiar crescent shape in the case of Malignant Tertian Malaria; and circular or oval in shape in the case of Quartan and Tertian Ague. These forms of the parasite did not undergo subdivision in the blood; but some of them underwent a peculiar change known as flagellation in blood drawn from the body and kept under certain conditions for a short time.

As these peculiar forms did not appear to bear any definite relation to symptoms of fever some observers supposed that they were merely degenerating parasites, and some that they represented a resting stage of the organism, but others hazarded the opinion that they were connected with the transmission of the infection, though in what way they could not explain.

In 1898 Ross who had been experimenting with mosquitoes for a number of years at the suggestion of Sir Patrick Manson, made the momentous discovery that when mosquitoes of a certain species were allowed to bite sufferers from Malaria in whose blood these special forms of the parasite were present, the latter instead of being digested or disappearing, underwent a change and penetrating the stomach wall of the insect became encysted there. Continuing his observations Ross found that these encysted parasites which took the form of small tumours in the wall of the mosquitoes' stomachs, rapidly grew larger and larger until they were many times the size of the original parasite; and gradually as they increased in size the character of their contents changed also, until they appeared to be packed with thousands of little spindle-shaped bodies. Following them a stage further Ross discovered that after a time the cysts burst and discharged their contents into the body-cavity of the mosquito, and that finally many of the little spindle-shaped bodies were carried to the salivary or poison gland of the insects.

In this way one of the most remarkable zoological researches was brought to a successful conclusion. For Ross showed that the large pigmented parasites which did not undergo division in the human body but which when taken into the stomach of an anopheles mosquito commenced to develop there, were sexual forms of the malarial organism which required to enter a new type of host before they could combine and complete their cycle of

development, and produce the generation of sporozoits whereby the continuation of the species might be secured.

Besides solving a problem of the greatest interest to all naturalists, Ross' investigation supplied the answer to a riddle which had baffled medical men for hundreds of years; and what was still more important, placed in the hands of the sanitarian a new weapon by which he could attack the greatest scourge of human existence in tropical and sub-tropical countries, with some hope of success. For the discovery that anopheles mosquitoes became infected with malaria by sucking the blood of sufferers from the disease and that subsequently these infected mosquitoes became capable by their bite of transmitting the parasite to healthy persons, offered to all those who care to avail themselves of the knowledge, a certain method of escaping the disease by protecting themselves from mosquitoes, and at the same time suggested a protective measure of wider scope, the reduction or suppression of anopheles mosquitoes, by the adoption of which whole communities may benefit.

We may note that, malaria first became of interest to naturalists when Laveran, by his discovery of the malarial organism, showed that the disease was caused by the action of a minute animal parasite. Subsequently this interest was stimulated into activity by Ross' remarkable demonstration of the part played by mosquitoes in the transmission of this parasite from man to man and the result has been the foundation of modern Tropical Sanitation, which is largely based upon a knowledge of the natural history of insect pests and animal parasites.

In discussing the Natural History of Malaria the subject may be approached from several different points of view. We can study the malarial organism as a type of the minute animals called by zoologists Sporozoa, a sub-class of the unicellular animals known as Protozoa. Or we may take up another aspect of malaria and study the anopheles mosquito, the alternative host of the parasite, which is transmitted by its bite from man to man.

It is with this latter aspect of malaria, particularly as it affects Bombay, that I am concerned at present; but in a discussion of this subject I find myself considerably handicapped by having to

traverse almost the same ground as that covered by Captain Liston, I. M.S., in a paper read before this Society (Bombay Natural History Society in November 1908, *vide* Journal, Vol. XVIII, pp. 872-881. Those of you, who take an interest in the question of Bombay Malaria, would do well to read this paper, if you have not already done so, as it gives an exceedingly clear exposition of the more important points in the lifehistory of the malarial parasite in man and in the mosquito, and deals also in a very practical manner with the problem of malaria prevention. But there is another reason why I must direct your attention to Captain Liston's paper, because it contains the first announcement of a discovery regarding malaria of the greatest importance to the citizens of Bombay. This discovery relates to the species of mosquito concerned in the dissemination of malaria in the City. Briefly, Captain Liston, while investigating conditions in the Frere Road at a time when malaria had become epidemic there, found that only two species of anopheles mosquitoes were present in that locality. These two species were * *Nyssorhynchus stephensi* and *Myzomyia rossi*. Now, although it had been shown experimentally that both of these mosquitoes could be infected with malaria in the Laboratory, neither of them had been shown to transmit malaria in nature, and the careful examination of many hundreds of specimens of *M. rossi* in various parts of India had failed to show a single infected insect. And although *N. stephensi* had received less attention than *M. rossi*, it had likewise never been shown to be really concerned in the dissemination of malaria until 1908, when Captain Liston discovered that it was responsible for the spread of the disease in the Frere Road.

Since Captain Liston's original observation the examination of nearly a thousand mosquitoes caught in the Frere Road has fully confirmed his conclusions, *N. stephensi* being found infected with

* I have just been informed by Major S. P. James, I.M.S., that the mosquito formerly described under this name is now to be placed in the genus *Neocellia* and Mr. Theobald, the well known authority in mosquitoes, has agreed with him that this is the better classification.

In future, therefore, *N. stephensi* will stand for *Neocellia stephensi* rather than *Nyssorhynchus stephensi*.

malaria parasites and *M. rossi* quite free of infection. It has also been shown that the former anopheles is present not only in the Frere Road area but in lesser numbers in very many parts of the City, and wherever it occurs inquiry demonstrates the existence of malaria among the population. This being so, it becomes necessary to learn as much as possible about this particular species of mosquito, in order that measures may be taken for its control, in the hope that the spread of malaria in the City may be prevented.

But many people are sure to ask the question—"*how can we be certain that by taking steps to suppress or reduce the numbers of N. stephensi we may really influence malaria in Bombay?*" The answer to this question depends primarily upon the reply which may be given to certain other questions:—

(1) Whether or not malaria can be conveyed by any other agency than mosquitoes?

(2) Whether any kind of mosquito other than those belonging to the anopheles family can contract malaria and transit it again to man?

(3) Whether all species of anopheles mosquitoes are dangerous or whether only certain species can act as natural carriers of malaria?

In reply to question (1) we may point out that we have conclusive evidence that malaria parasites can be conveyed from an infected person to a healthy one by the agency of anopheles mosquitoes, and there is not one atom of evidence to show that malaria is contracted in any other way than by the bite of an infected anopheles. *Thus it is a question of demonstrated fact against pure speculation.*

In regard to question (2) it may be remarked that at present all the evidence is in favour of the conclusion that anopheles mosquitoes alone are responsible for the spread of human malaria, no one having as yet brought forward a single observation incriminating any other family of mosquitoes.

In regard to question (3) it may be pointed out that the balance of evidence is in favour of the conclusion that different species of anopheles mosquitoes are not equally dangerous; and that while some species carry malaria readily others do so with difficulty

or not at all. As a result of some thousands of observations upon one species, *M. rossi*, we are justified in concluding that it takes no part in the dissemination of malaria.

In view of these facts, it becomes necessary for us to learn as much as possible about the mosquitoes, particularly the anopheles mosquitoes, of Bombay; and the question as to whether or not malaria can be reduced or eradicated from the city can only be answered by those who have sufficient knowledge of the natural history of its mosquitoes.

Now a careful examination of a considerable portion of the island has shown that there are five species of anopheles mosquitoes present:—*N. stephensi*, *N. jamesi*, *M. barbirostris*, *M. culicifacies* and *M. rossi*.

The latter species of anopheles, which as I have mentioned previously, does not appear to be concerned in the dissemination of malaria in any part of India, may be found in large numbers in every part of the island. The other species are present in much smaller numbers and appear to be more or less restricted to certain localities. *N. stephensi* can be found with varying frequency in nearly every part of the southern portion of the city, but appears to be absent from the north of the island. *N. jamesi* occurs at Malabar Hill, the neighbourhood of the Gowalia Tank, the Mazagaon reservoirs, and in other places in the centre and north of the island. *M. barbirostris* may be found in scanty numbers in the south of the island, but is fairly common in the northern half. *M. culicifacies* has only been found in about a dozen places in the north of the island. In the majority of cases where *N. jamesi* and *M. barbirostris* have been found breeding in the south of the island, they have occurred in association with *N. stephensi*.

M. culicifacies has long been known as a dangerous carrier of malaria, and as I have already pointed out, we now know, thanks to Captain Liston, that, *N. stephensi* is also an active agent in the propagation of the disease. Both *M. barbirostris* and *N. jamesi*, though potential carriers, do not appear to be very dangerous ones, and fortunately they only occur in scanty numbers in the city proper. Practically, then, we are justified in assuming that over the greater part of Bombay we have only to deal with one dangerous

species of anopheles, *N. stephensi*, and if we can devise efficient measures for reducing the numbers of this mosquito, we shall in all probability greatly lessen the incidence of malaria among the population.

This fact is of great importance, for there are many different species of mosquitoes in Bombay, which swarms with *Culex* and *Stegomyia* and *Anopheles*: and it is only when we clearly realize that only one mosquito is really responsible for the spread of malaria in the greater part of the city that we can understand why it should happen that there is often very little of the disease in places where there are millions of mosquitoes. I wish to lay stress upon this point, because there are many people who fail to understand how mosquitoes can possibly be concerned in the spread of malaria when their own experience is that there is often little malaria where there are many mosquitoes and much malaria where there are few mosquitoes.

In Bombay the mosquitoes concerned in the spread of malaria represent only a fractional proportion of the total insects. This being so, those who wish to avoid malaria, or whose duties render it necessary to attempt the reduction of the disease, must be in a position to recognise the dangerous species.

Although it is very easy to distinguish between *Anopheles* and *Culex* or *Stegomyia* mosquitoes, it is by no means so easy to recognise the different species one from another or to separate the dangerous anopheles, *N. stephensi*, for instance, from the harmless anopheles, *M. rossi*.

As a matter of fact, it often happens that these two species are confused the one for the other. This would not matter so much, if it were possible with the funds usually allotted for the purpose to destroy or reduce the numbers of every kind of mosquito. Unfortunately the amount of money that a city like Bombay is prepared to spend upon this kind of work at present will not allow of this, so that it becomes a matter of importance that when anti-mosquito measures are undertaken for the avowed object of reducing malaria, money should be spent in such a way as to achieve its purpose, rather than in the mere destruction of a certain number of mosquitoes, many of which have nothing to do

with the spread of the disease. This makes it necessary that as many people as possible should learn to recognise a really dangerous anopheles mosquito when they see it.

With a very little practice, anyone who has learned to distinguish Anopheles mosquitoes from the ordinary Culex and Stegomyia can easily learn to tell the dangerous anopheles of Bombay from the harmless *M. rossi*. It is most important that people should know *N. stephensi* when they see it and the other species of anopheles are not difficult to recognise also.

The Recognition of Bombay Anophelines.

Every one should learn to clearly distinguish between Culicine and Anophelline mosquitoes. In Bombay the following points will help people to say whether a mosquito is an anopheles or not :—

Examine and note—

(1) *The attitude.*—Culex and Stegomyia mosquitoes, when resting, keep their body nearly parallel with the surface upon which they are sitting. Anophelines rest with their tails raised higher than their head.

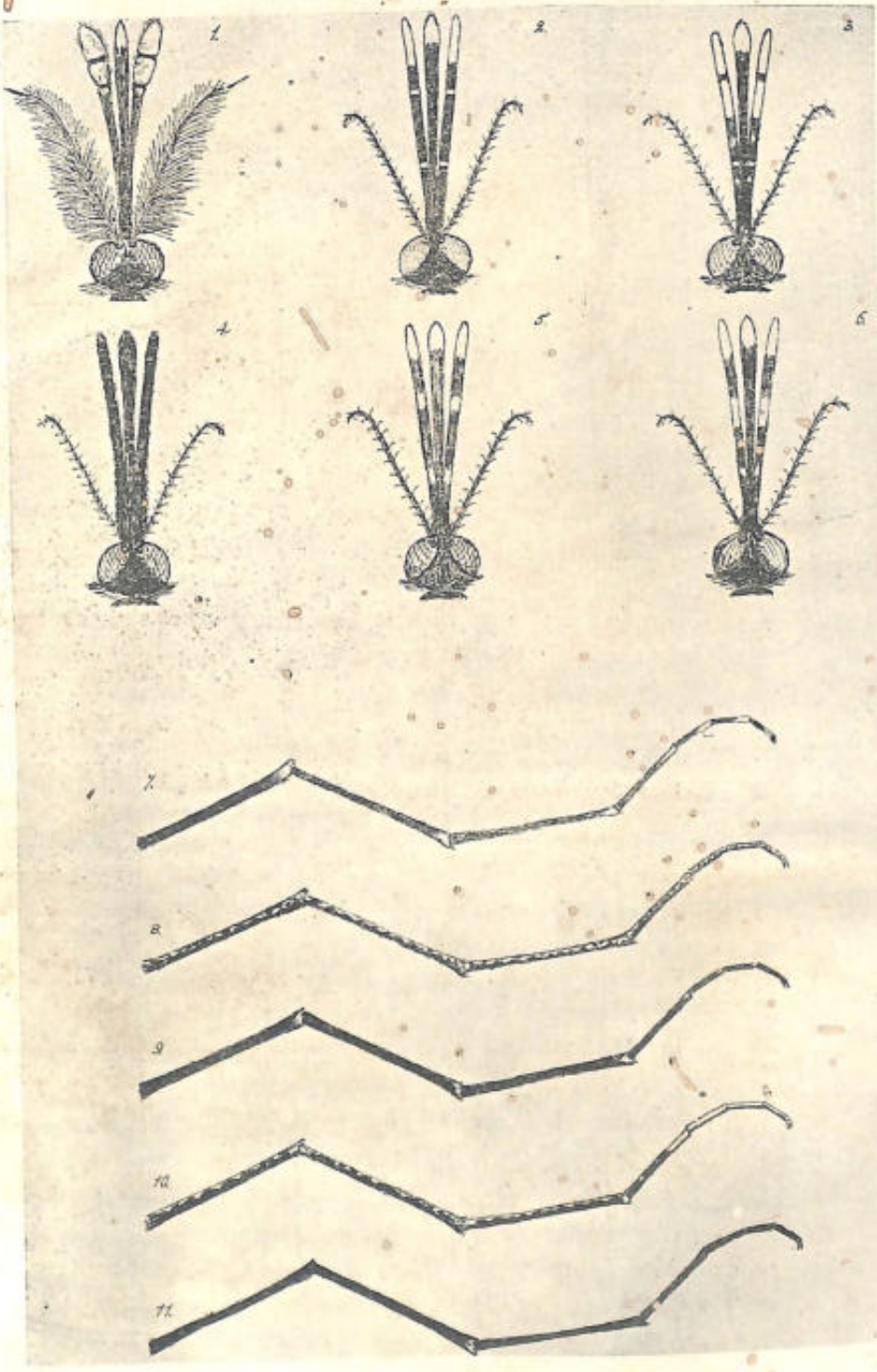
(2) *Shape.*—Culex and Stegomyia mosquitoes have a hump-backed appearance. Anophelines have straight backs and keep their bodies and their proboscis in a straight line.

(3) All Culex and Stegomyia mosquitoes in Bombay have clear looking wings. All the Bombay Anopheles have spotted wings.

Note.—There are some species of Culex in India that possess spotted wings but none of these have been found in Bombay. People must carefully distinguish between the black and white Stegomyia mosquito common in Bombay, which has white marks on its body and legs but clear looking wings. Many people mistake these mosquitoes for anopheles.

M. rossi.

The adults of this species of anopheles mosquito can be caught fairly easily almost anywhere in Bombay. They are fairly large in size and usually a light brown in colour with the wings covered with black spots. The female mosquito can easily be identified by the naked eye, but those who are not expert are recommended to



Heads and legs of Bombay Anopheles Mosquitoes.

make use of a small magnifying glass and to note the following points :—

Examine the palpi and note that they are covered with black scales except at three points, the tip, at which there is a broad band of white, and two other areas which show very narrow white bands. (*N. stephensi* has two broad white bands, one narrow one and a few scattered white scales on each palpi.)

Examine the legs and note that they are a uniform dark brown colour except at the joints where they are clearly banded with white. (*N. stephensi* has fine white speckles all over its legs).

N. stephensi.

The adults of this species resemble *M. rossi* very closely at first sight, and the males are not easy to distinguish except by the speckling of the legs. They are slightly greyer in colour than *M. rossi*. The female mosquito can be readily identified by the following points :—

Examine the palpi and note that they possess two broad white bands, one at the tip and another close to it. A third very narrow white band is present a little lower down, and there are often a few irregularly scattered white scales among the black scales of the palpi. Examine the legs and note that they are thickly speckled with white scales which give them a greyish appearance to the naked eye.

M. barbirostris.

This mosquito is quite unmistakable, as it is almost always a deep black in colour, and suggests at once a mosquito in mourning. There are a few whitish scales on the wings, but they are hardly noticeable except to close examination. The palpi and proboscis are very long and densely scaled, often appearing nearly as long and thick as the abdomen of the insect.

Examine the palpi and note the thick black scales and the absence of white bands. Sometimes there are a few white scales at the very tip but quite often they are absent.

Examine the legs and note that they are almost uniformly black, but that there are a very few white scales at the joints, too scanty to form bands of white such as may be seen on the legs of *M. rossi*.

N. jamesi.

This mosquito is usually of a dark grey or general blackish colour, and is smaller than either *M. rossi*, *N. stephensi* and *M. barbirostris*. It has a peculiar habit when sitting upon the wall of a tube or other object of gently waving its hind legs in the air. A most noticeable point is that the end of these hind legs is pure white in colour.

Examine the palpi and note that there are three white bands present, a broad one at the tips and two narrower ones lower down. The two latter are not however usually so fine as those present in *M. rossi*.

Examine the legs and note (1) that they are covered with very fine white speckles not quite so marked as those present in *N. stephensi*; (2) there are distinct white bands at the joints of the legs; and (3) *the last three joints of the hind legs are quite white.*

M. culicifacies.

This mosquito is much smaller than the other species of anopheles to be found in Bombay, and is usually rather a darkish grey in colour. It received its name from the fact that it does not assume quite so peculiar an attitude as most anopheles mosquitoes, and instead of raising its tail high in the air it keeps its body more nearly parallel to the object upon which it is sitting, resembling culex mosquitoes in this respect.

Examine its palpi and note that they have three fairly narrow white bands upon them, one at the tip and the others at intervals lower down.

Examine the legs and note that they are quite black or blackish brown in colour except for a very few white scales at the joints. There is no speckling of the legs as on *N. stephensi* and *N. jamesi*, neither is there any banding of the legs as in *M. rossi*.

Anopheles Larvæ.

It is also possible to distinguish between the larvæ of these different species of anopheles, and this is rather an important point, because we can usually find and capture mosquito larvæ more easily than adult insects, which are often rather difficult to catch. Of course, it is a very simple matter to breed out mosquitoes from any larvæ that we have obtained, but it is very useful to be able to recognise the species to which they belong without going to all this trouble.

Captain Liston in the paper to which I have already alluded, pointed out that a knowledge of the habits of mosquitoes soon teaches us that each species usually selects particular types of breeding places. This is quite true when we are dealing with natural breeding places, but we cannot absolutely depend upon such a rule in Bombay, where almost all the breeding places are of an artificial nature. Thus the five species of anopheles to be found in Bombay—all make use of wells for breeding places—and although it is possible to recognise the larvæ of *N. jamesi*, *M. culicifacies* and *M. barbirostris* with the naked eye, it is impossible to tell the larvæ of *N. stephensi* apart from those of *M. rossi*, except by the use of the microscope. We may lay down, however, certain general rules which will help us in many cases. Thus when we find anopheles larvæ in foul wells, puddles of dirty water or in liquid sewage, we may be almost certain that we have to do with *M. rossi* and not with the other and more dangerous species. If we find anopheles larvæ breeding in the weedy part of a tank, among the grass close to the edge, it is very probable that they will turn out to be *N. jamesi*, and we can be almost certain of this when they have a slightly brownish colour and present a rather hairy appearance. *M. barbirostris* larvæ may be found in the darker and deeper parts of such a pond especially where it is overshadowed by trees, and it is very common in some of the large open wells in the northern part of the island. The larvæ are generally very dark in colour often almost black, and they usually have two whitish marks across the back. They do not taper so much towards the tail as many of the other larvæ do, the smaller ones often appearing to be almost the same width from the thorax downwards. The larvæ of

M. culicifacies usually present a short stumpy appearance, the abdomen being only about twice as long as the breadth of the thorax. At first sight they almost look as though the last segment or so of their bodies had been cut off. The larvæ of *N. stephensi* and *M. rossi* are very much alike and vary a good deal in colour according to the tint of the water in which they are living. *M. rossi* especially presents some extraordinary variations in colour, sometimes being quite black, at other times bright green and in certain places quite a red colour. Usually, however, it is a dirty grey or earth colour. Frequently among a batch of larvæ some will be seen with an almost white or colourless head which gives them a peculiar appearance and causes people to imagine that they must belong to a different species.

But though experience will enable us to make a good guess at the species of larvæ which we may find we can only make quite certain either by breeding out some adult insects or else by very carefully examining the larvæ under the microscope with a $\frac{2}{3}$rd inch and $\frac{1}{6}$th inch objective. If we can do this the following points will enable us to say to what species of anopheles the larvæ belong:—

If we place an anopheles larvæ upon a slide in a drop of water covered with a cover glass and examine it with a low power ($\frac{2}{3}$rd inch objective) we shall note the roundish head with blackish markings which often form a sort of pattern. At each side of the head the antennæ project forward like horns and immediately in front of the head we can distinguish the feeding brushes. The head of the larva is attached to the thorax which is broad and solid looking and behind the thorax extends the abdomen formed of eight tapering segments. Both the thorax and the abdominal segments have a number of long spiny and branched hairs projecting from their surface, but if we look very closely we shall note that on a number of the abdominal segments there are small beautifully shaped fans which can be folded up or opened. It is by the characteristic shape of the palmate leaves which form these fans, together with certain peculiar hairs which are present on the forehead of the larvæ that we are enabled to identify the species of anopheles to which they belong.

Let us return for a moment to the head of the larvæ. If we examine it under the $\frac{2}{3}$rd inch objective we shall see that it possesses a sort of blunted cone-shaped forehead or clypeus, below the angles of which project the feeding brushes which have very much the appearance of shaving brushes. From the upper surface of the forehead or clypeus just between the feeding brushes we can note certain spines or hairs projecting. A pair of long hairs and a pair of shorter ones can usually be distinguished. Now these hairs differ in character in different species of anopheles larvæ and in examining such larvæ we should always take special note of them.

In order to differentiate larvæ in this way we must make use of a higher power objective than $\frac{2}{3}$rd inch. With a $\frac{1}{6}$th inch objective we can note the following differences in the leaflets of the palmate hairs on fans on the abdominal segments and the frontal or clypeal hairs respectively observable in the larvæ of species of anopheles mosquitoes to be found in Bombay.

M. rossi.

Place the larvæ in a drop of water on a slide, cover with a cover glass and examine with a $\frac{2}{3}$rd inch objective. Find the frontal hairs and then use a $\frac{1}{6}$th inch objective. Note two pairs of frontal hairs, a longer pair placed internally with a shorter hair on each side external to these. Focus very carefully and note that there is no lateral branching of these hairs.

Palmate hairs or fans.—Replace the 2-3rd inch objective and move the specimen until one of the palmate hairs or fans is in view, then focus with the 1-6th inch objective. Note that the fan is made up of a number of finely tapered leaflets joined at the base to a common arm which is attached to the upper surface of the abdominal segment. In *M. rossi* each separate leaflet is usually very finely tapered and extended into a long spine or filament which is as long as the broader body of the leaflet.

N. stephensi.

Examine the larvæ in the same way but note that:—

Frontal Hairs.—Though at first sight closely resem-

bling those of *M. rossi* possess very fine lateral branches.

Palmate Hairs.—Note that in these the body of the leaflet is at least twice as long as the spine or filament and that instead of being finely tapered off it frequently looks rather rough and broken. In old larvæ the upper portion of the leaflet is usually much darker in colour just at the point where the filament joins it.

M. barbirostris.

Examine the larvæ and note that the internal pair of frontal hairs are very long and often appear to cross one another at the tip. Sometimes they have one or more very fine branches. The external frontal hairs are possessed of numerous branches like the branches of a tree or bush. It is sometimes difficult to see them on account of the projection of the feeding brushes. If we examine the antennæ of a larvæ of *M. barbirostris* we shall also find a somewhat similar branched hair projecting from its inner surface about half-way up.

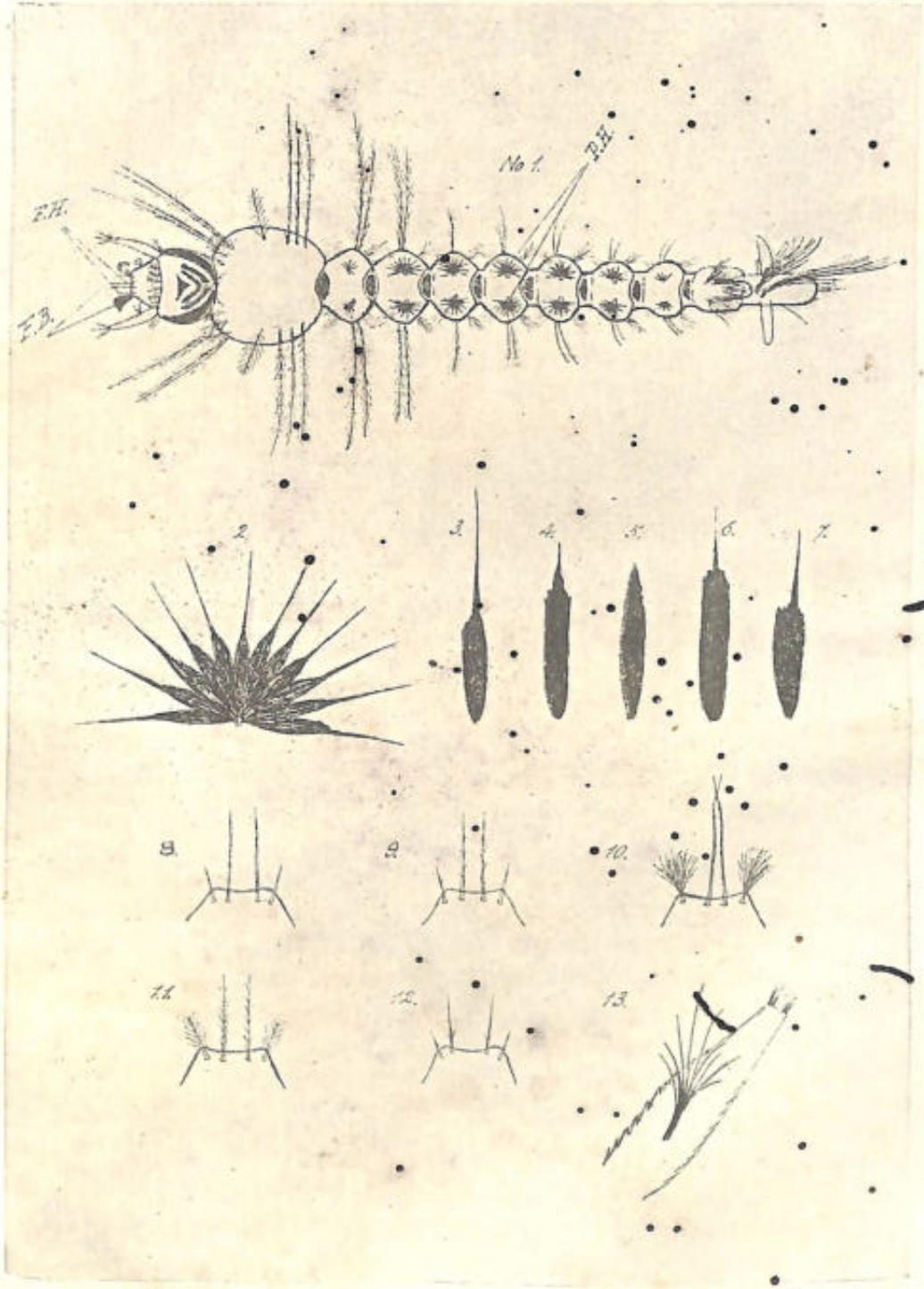
Examine the palmate hairs or fans which are present on each side of the abdominal segments. In larvæ of this species found in Bombay there is also a pair present on the thorax. The individual leaflets of the fans are rather large and coarsely tapered to a point and are not extended into any marked filament or spine as in the case of most other larvæ.

N. jamesi.

Examine the larvæ and note that the frontal hairs have a large number of fine lateral branches all the way up. These are to be seen on both internal and external frontal hairs. The palmate hairs or fans are very large and distinct, with rather wide broken-looking and slightly pigmented tops and a mediumly long spine or filament.

M. culicifacies.

Examine the larvæ and note that the internal frontal hairs are rather short and possess one or two fine lateral branches



Larvae of Bombay Anopheles Mosquitoes.

very like those seen in the larvæ of *N. stephensi* but usually a little clearer and longer. The external frontal hairs are also often slightly branched or frayed, but sometimes appear almost plain. Examine the fans or palmate hairs and note that they are large and prominent. A pair is present on the thorax. The ends of each leaflet is broad, broken-looking and slightly pigmented as in *N. jamesi* and the spine or filament is of medium length.

Breeding Places of N. stephensi.

As I have already pointed out the commonest dangerous anopheles in Bombay is *N. stephensi* and if we wish to reduce the number of this species and so lessen the chance of the spreading of malaria, we must know a good deal more about the habits of this mosquito and the places in which it breeds so that we can attack it with some hope of success.

Last year shortly after the commencement of the present enquiry, it became apparent that the breeding places usually selected by *N. stephensi* could be roughly divided into two classes :—

(1) Those that were permanent.

(2) Those that were temporary.

The permanent breeding places take the form of wells, tanks, iron cisterns, fountains and garden tubs. The temporary breeding places usually consist of surface pools of rain-water that collect in the monsoon, tin-pots, hollows in machinery, kutcha and pucca drains containing clean rain-water, &c. In regard to these two types of breeding places, it is possible to lay down certain definite rules :—

(1) Larvæ of *N. stephensi* are practically never found in really foul or dirty water.

(2) Temporary breeding places only appear to become infected with larvæ of *N. stephensi* when permanent breeding places exist in their vicinity.

The point regarding dirty water is of importance because a great many people imagine that dirty puddles in the streets, of foul water in gully and drain traps is a source of malaria. This is not the case, because, though some kinds of mosquitoes will breed in

places of this sort, the species concerned in the spread of malaria depend upon clean water for breeding purposes. One of the main reasons why the centre of towns and cities is often comparatively free of malaria is because the surface water speedily becomes too foul and dirty to allow of the breeding of dangerous anopheles; but if wells and cisterns and tanks of clean water are present malaria may occur and when it does so ignorant people ascribe it to bad smells, decaying organic matter and impure water.

In order to give you a clear idea of the kind of breeding places that are selected by *N. stephensi* I will mention some of the places in Bombay in which I have found the larvæ of this mosquito.

Permanent Breeding Places.

Among permanent collections of water I have found them most frequently in wells. Out of nearly 4,000 wells they have been present in about 1,200. In no case have they been found in wells containing foul stinking water.

Bombay possesses an exceedingly large number of wells, probably not less than 7,000. At one time these formed the sole water-supply of the island, but since the introduction of a pipe water-supply many of them have gone out of use and they now constitute a serious danger to the health of the inhabitants. Many of the wells in the older parts of the City are inside the houses. These are either placed in a dark basement, where one requires a lamp in order to examine them, or else below a central shaft running right up through the house and either open to the sky or lighted by a sky-light. Generally this central shaft is overlooked by landings on each floor or else windows or doors are so arranged that people can lean over and by letting down a vessel attached to a rope can draw water without descending to the well mouth. No doubt this arrangement was very convenient in the old days and saved people much trouble in drawing water for the upper floors of lofty houses, but it is difficult to conceive of a more ideal arrangement for the spread of malaria when anopheles mosquitoes, capable of transmitting the disease, are breeding in the wells and can find access to numbers of people living on each floor of the house, which is usually large and divided into a number of different tenements.

Some wells are not placed within the house but in a small yard at the back or in the compound, but many of them are so arranged as to be overlooked by windows specially made for the purpose of drawing water. In the northern portion of the island wells are usually in gardens or compounds and were once used largely for irrigation purposes, being surrounded by pucca tanks and water channels. Wells of this kind are generally very large and deep, some being as much as 25 ft. in diameter and from 50 to 100 ft. in depth.

N. stephensi has been found breeding in wells of every sort, but the darker wells inside the houses generally appear to be the most dangerous. They have been found in wells so shallow that it was quite possible to see the bottom and in others with a depth of from 20 to 30 ft. of water; they have also been found in wells where the water was far below the surface of the ground quite as often as in wells where the water was almost within reach of the curb; they often occur in wells containing much weed and floating matter but not infrequently they are present in wells in which the water appears absolutely clear. Wells in frequent use have often been found to contain them in spite of statements to the contrary.

Iron cisterns come next in importance to wells among permanent breeding places of *N. stephensi*, and altogether some hundreds of cisterns have been found to contain larvæ of this anopheles. Some of these cisterns are open ones but the majority are the usual covered cisterns found all over the city. Very few cisterns of this type are properly closed, and although they generally possess lids or man-hole doors, the lids rarely fit, and the man-hole doors are either left open or lost. During the monsoon I visited a very large number of modern houses with terrace roofs, and in many cases I found that nearly every cistern on the roof was breeding *N. stephensi*. This being so it is not surprising that residents in such houses should frequently suffer from malaria, because among the native servants who almost invariably live under the same roof, a certain proportion are sure to harbour malarial infection and with malaria-carrying mosquitoes breeding in the water-supply cisterns on the premises, there is every chance for the spread of malaria among the inmates.

In Bombay, public fountains also seem to be a favourite breeding place of *N. stephensi*, and the people who live in the neighbourhood of these fountains should remember this fact, for during the course of last year nearly every fountain in the street was found to be infected.

Neglected private fountains, garden tanks and mali tubs are also a source of danger, but it often happens that the people to whom they belong escape the consequences of their carelessness and their neighbours suffer instead. This fact was very forcibly brought to my notice on one occasion when I was visiting certain houses in the neighbourhood of Apollo Bunder. I had called at one house and obtained permission from the tenant of the top floor to examine the house cisterns. While talking to him he alluded to the fact that he had been suffering repeatedly from malaria for the past two years, the period during which he had lived in the house. Previously when staying in another part of Bombay he had kept quite free of fever for many years. On hearing this I asked permission to see his bedroom in order to look out of the windows. At the first glance I noticed a small round tank in a garden immediately below the windows. This garden belonged to another house. No mosquitoes were breeding on his premises so I visited the tank in the neighbouring garden and found it swarming with thousands of larvæ of *N. stephensi*. In another case the occupants of a house, anticipating my visit had caused their mali to fill in a small fountain with earth but a little of the water still remained round the edges and this contained many larvæ of *N. stephensi*, showing the condition that had existed previously.

Temporary breeding places.

Now every one knows that the temporary pools of water that collect during the monsoon become stocked with thousands of mosquito larvæ, and in past years it has often been the custom to attribute the presence of malaria in Bombay to the existence of numbers of pools of water of this kind. I have even heard it gravely stated that the whole of the malaria in the City was due to the collection of stagnant water on the Flats and the presence of the storm-water reservoir at Mahaluxmi. But it is an interesting

fact and one of considerable importance in relation to malaria prevention in Bombay, that temporary pools and collections of water only appear to become infected with the larvæ of the malaria-carrier *N. stephensi* when permanent breeding places of that mosquito exist in their immediate neighbourhood. Thus in the monsoon while numerous pools of fresh rain-water in the New Dock Works contained great numbers of larvæ of *N. stephensi*, it was impossible to find the insect breeding in the countless pools of rain-water to be found in Byculla and other areas in the centre of the island. The only explanation that I can offer for this condition of things is that, in Byculla and the centre of the island there are few wells and other permanent breeding places suitable for *N. stephensi*, which as a result is almost non-existent there: the scores of pools in that part of the island remaining uninfected because of the absence of permanent breeding places of this mosquito.

Whether or not this is the true explanation I cannot say, but the fact remains that the vast majority of pools in the north of the city do not appear to be a danger from the point of view of malaria. This is proved by the fact that not more than 1 per cent. of the people living in the neighbourhood of Gilder Street and Jacob Circle are infected with malaria whereas from 40 to 50 per cent. of the people residing in the neighbouring of Frere Road harbour the malarial parasite. In the neigbourhood of Frere Road there are wells, fountains, cisterns and tanks which have probably formed permanent breeding places for *N. stephensi* for many years, and when increased facilities for its breeding were afforded by the numerous pools of water which formed in the enclosure of the New Dock Works during the monsoon, it was enabled to take advantage of them with disastrous results to residents in that neighbourhood.

Minor temporary breeding places.

In giving a list of places in which *N. stephensi* could often be found breeding, I mentioned, tubs, tin-pots and other miscellaneous collections of fresh water. But what I have just told you about the temporary pools of water becoming dangerous only in the presence of permanent breeding places of *N. stephensi* holds good in regard

to these also. Wherever numerous wells, cisterns and tanks infected by this mosquito are found to exist, old tin-pots, collections of water on pieces of old machinery, disused mortar mills, stone troughs and everything that can hold a little fresh water for a few days, is very likely to be found to contain larvæ during the rainy season. Thus I have found them in pigeon troughs in the street, in tins and old cans in back-yards, in old paint pots, and in little collections of water in the hollows and crevices of both old and new machinery.

On several occasions I have found that paint pots and tins left on the roofs of houses in which painters had been working, had become most prolific breeding places. In one case twenty such tins were present on a roof, all breeding these mosquitoes, and the tenants of the top floor complained of having suffered considerably from fever, which they put down to "bad smells" and the existence of dirty puddles in the street. In another case I found that some one was keeping fowls on a terrace roof and tins and tubs of water were placed there for their use. The tubs and tins supplied the fowls with water and the household with malaria-carrying mosquitoes. Several times I have come across charming little terrace gardens nicely arranged on the roof of a house, and nearly always providing a selection of breeding places for *N. stephensi* in the shape of tins, tubs, and pots wherein water was allowed to remain. Two or three times large tin baths have been found upon terrace roof, forming excellent breeding places for *N. stephensi*, larvæ of which were present in large numbers. These observations show that terrace roofs may form a considerable source of danger in assisting the spread of malaria, when made use of as a sort of elevated back-yard or lumber store.

Special Breeding Places.

Besides the breeding places of which I have spoken Bombay possesses certain special ones of which every one should know. Among the more important of these are the two reservoirs which supply Bombay with water. At Mazagon the Bhandarwada reservoir is provided with a number of open sand filter beds each with its cushion well. Now these filter-beds seem to be just adapt-

ed for the breeding of *N. stephensi*. A few months ago when I examined these filters I found every one breeding thousands of these mosquitoes, and by using a muslin net which I drew along the edges of the filter beds I was able to collect a large number of them. At the time the larger reservoir which is underground, was undergoing repairs and was empty; but in a number of little pools of water on the floor I found many specimens of *N. stephensi*.

In Malabar Hill too I found the same mosquito breeding in the reservoirs and filters in spite of the fact that they are under cover. One of the filter beds which has been out of use for a long time on account of leakage, had its cushion well positively swarming with larvæ in spite of the presence of fish, evidently of a species which did not fancy a diet of mosquitoes. I may as well make it clear while speaking of the reservoirs and filter-beds, that the presence of mosquito larvæ in these places is no danger to the City in general but only to the unfortunate people, who have to live in the immediate neighbourhood. Both at Mazagon and Malabar Hill the vicinity of the waterworks has long been known to be malarious and this has usually been ascribed to leaking water. Probably this has been one cause, but there is no question that the reservoirs and filters themselves are a source of considerable danger to the areas immediately adjoining them.

Foreshore Pools.

Foreshore pools existing at Colaba and on the west of Nepean Sea Road at Malabar Hill are also a source of danger owing to the breeding of *Nyssorhynchus stephensi*. There are two places in Colaba, one on the east and one on the west coast, where I have found this mosquito breeding. One of these places is a small Bay just to the south of Sassoon Dock, and the other is a little Bay just at the back of the Colaba Post Office. In addition to these places it may be mentioned that *Culex* mosquitoes and *Myzomia rossi* can be found breeding all along the foreshore of Upper Colaba, but so far *N. stephensi* appears to be absent—probably because no permanent breeding places for the insect exist there, all the wells and cisterns being carefully covered. Along the foreshore of Nepean Sea Road there are a great number of rocky pools which usually

contain a mixture of fresh and sea water. Very many of these contain larvæ of *N. stephensi* during the monsoon when there is an extra amount of fresh water there.

Fresh water is not absolutely essential to mosquitoes, and it is probably the motion of the waves rather than the salt water which keeps many parts of the sea coast free of mosquito larvæ. Mosquitoes do not hesitate to lay their eggs upon sea-water, and the larvæ will hatch out and live in it; but larvæ, which have hatched out in fresh water, usually die when placed in a mixture containing 66 or 75 per cent. of sea water. Not long since I received from Colaba a sample of living mosquito larvæ taken from a shore pool. I estimated the amount of salt present in the water and found it 25 per cent. more than in ordinary sea water.

You will see from what I have been telling you that the distribution of *N. stephensi* is very wide, but is not by any means uniform, as may be shown by the fact that, over three hundred breeding places of this mosquito have been found in the North Fort Section and only two in Khara Talao. The existence of suitable breeding places has a great deal to do with this variation, but does not entirely determine it. It has been noticed that where favourable breeding places occur in close proximity to one another a larger proportion is infected than is the case where potential breeding places are more widely separated.

Originally, *N. stephensi* must have been largely restricted to breeding in wells, tanks and fountains, but the introduction of a pipe-water supply, on the intermittent system, and the adoption of the water-carriage system of sewage disposal, has led to the erection in every part of the city of large numbers of cisterns many of which serve as breeding places of mosquitoes. The negligence which has allowed the use of open and improperly closed cisterns is largely responsible for the wider distribution of dangerous anopheles.

Certain factors also appear to influence the distribution of *Nyssorhynchus stephensi*, tending on the one hand to favour its spread, and on the other to restrict it, and limit its numbers.

Among influences which tend to widen the distribution of this and other species of mosquitoes, vehicles appear to play a considerable part. During the monsoon a hundred vehicles, including

victorias, shigrams and broughams, were examined, in different stables in the city. In the course of this examination it was found that mosquitoes were invariably present in these vehicles, unless they had been recently disturbed. The greatest number of mosquitoes counted in one vehicle was 25. The greatest number of *N. stephensi* was 13. Watching the behaviour of mosquitoes occupying a vehicle that was being taken out from the stable, it was found that most of them remained clinging to the hood or inside the carriage until it had gone some distance; but gradually they became disturbed by the movements of the vehicle, and one by one escaped and flew away during the course of the drive.

These observations show the part played by covered vehicles in the diffusion of mosquitoes from one locality to another, and indicate one method by which *N. stephensi* tends to invade fresh areas, reaching by artificial means, places to which it would not ordinarily be carried, either by the wind or its unaided powers of flight.

Among factors which tend to limit the number and restrict the distribution of *N. stephensi* in Bombay, one of the most interesting and important is the existence of another mosquito belonging to the *Culicine* group. This mosquito, *Culex concolor*, appears to exert a directly antagonistic influence upon other mosquitoes, anopheles in particular, because its larvæ are specially adapted for preying upon those of other mosquitoes. It is frequently found breeding in the collections of water haunted by *N. stephensi* and destroys great numbers as the following observations show.

Four large larvæ of *Culex concolor* were placed in a bowl containing a number of larvæ of *N. stephensi* of different sizes. These they immediately began to seize and devour and in the course of two hours they had destroyed over 50. They will act in a similar manner under natural conditions as is shown by the fact that, breeding places which early in the season contained large numbers of larvæ of *N. stephensi*, later in the year contained larvæ of *Culex concolor* also; and subsequent examination has shown that *Culex concolor* alone remained.

The larvæ of *Culex concolor* does not seek its prey, but waits for its approach. It usually assumes an almost horizontal position just below the surface of the water, admirably suited for attack

upon larvæ of anopheles, which float on the surface. Occasionally it may be seen to turn its body in a half circle, when any moving object comes near it, evidently keeping a sharp look-out for the approach of its prey. It is exceedingly voracious and when hungry will seize any larva that ventures without striking distance, the movements of its head and neck being so rapid that the eye cannot follow them. Small larvae are swallowed whole, disappearing instantaneously; large larvæ are seized and held remorselessly in spite of their struggles, and are rapidly devoured while still alive.

In Bombay and possibly in other places *Culex concolor* plays a definite role in reducing the number of anophelines and is possibly one of the factors which assist in producing fluctuations in malaria from year to year. A number of aquatic insects and aquatic larvæ are known to prey upon mosquito larvæ. Among these may be mentioned dragon-fly larvæ, ephemera larvæ, the larvæ of chironomus and corethra, water boatmen and certain among the water-beetles. All these may be found breeding in Bombay in pools and tanks and wells. In addition I have recently discovered a minute almost microscopic water-bug which attacks and kills large numbers of anopheles larvæ. This little bug, which is only about 1-40th of an inch long, is present in considerable numbers in some of the wells in the north of the island. It is black in colour and runs readily about on the top of the water. It possesses a long suctorial proboscis tucked away on the underside of its body. Quite recently I was breeding out a number of anopheles mosquitoes from larvæ and was rather disappointed to find that all the larvæ were dying. On careful examination of the jar in which they had been placed I noticed two or three minute black bugs running rapidly about on the surface of the water. Out of curiosity I placed one in a small tube with some anopheles larvæ and very soon I saw the bug gently approach the larva at its tail end and then gradually move forward to the thorax. The larva did not appear to notice anything but by watching carefully with a magnifying glass it could be seen that the bug had inserted its proboscis into the thorax of the larva and was busy sucking out its juices. I placed one small bug in a bottle with a dozen anopheles larvæ and in twenty-four hours all but two were dead.

Tadpoles and frogs do not appear to be of the least value in keeping a place free from mosquito larvæ, and the latter are distinctly harmful, as they prey upon small fish which might otherwise serve this purpose. Turtle are useless for destroying mosquito larvæ and gold fish are not always efficient, numerous anopheles larvæ often being found in the same tank or fountain with them. A small fish, known locally as "Piku" is far more useful; but it must be present in sufficient numbers, and its efforts must not be hampered by floating weed or rubbish.

During the past few months this fish has been introduced experimentally into 15 wells which contained large numbers of larvæ of *N. stephensi*. All but two wells were rapidly cleared of mosquito larvæ and in the latter they had been reduced in number, but the presence of floating matter, leaves and flowers, afforded a safe cover for a few mosquito larvæ which thus escaped destruction.

The "Piku" fish which has been identified for me by Mr. Kinnear as *Haplochilus lineatus* were first, I believe, experimented with by the late Mr. E. H. Aitken who called them "Scooties" because of the way in which they darted about in the water. They are quite small fish rarely reaching 3 inches in length. When young they possess a brilliant white spot on the top of their heads just between the eyes. This spot is less noticeable in the older fish which become more striped about the body. Captain Liston showed me these fish when first I came to Bombay. They can be caught in considerable numbers in the stream which flows from the Vehar Reservoir past Marol and Kurla.

Since experimenting with "Piku" fish or "Scooties" I have come across two other species of fish which destroy mosquito larvæ. One of these fish can be obtained from ponds and tanks at Thana and is known locally as "Kazari" or "Kasara." Mr. Kinnear has indentified it for me as *Anabas scandens*.

The specimens of the fish which I have seen have been small, varying in size from 2½ to 6 inches, but I am told that it often reaches a length of 12 inches or more. Some of the fish are blackish in colour but many of them have a reddish tint on the back above the gills. They are rather thick-set in shape with big heads and

beautiful eyes which are large and bright yellow in colour. The "Kazari" is a most active fish and very voracious, destroying hundreds of mosquito larvæ in a very short time. It appears to be a surface feeder and quickly swallows anopheles larvæ and pupæ, and I have seen it jump several inches out of the water after a flying adult insect. Altogether the "Kazari" appears to be a most excellent fish to place in wells, in tanks and to keep in ornamental fountains. The third fish which Mr. Kinnear tells me is *Polyacanthus cupanus* was caught in the Gowalia tank. It is quite small, about 1½ to 2½ inches in length, with crimson underfins and a peculiar whisp on its tail. It is not a very quick feeder and has only a small mouth. It appears to eat mosquito pupæ readily but not nearly so quickly as the Kazari fish. The Chilwa *(Chilwa argentia)* which has sometimes been recommended for mosquito destruction does not appear to be nearly as efficient as either of the three fish I have just described. It is not a surface feeder and will leave anopheles larvæ untouched for long periods. The mud fish common in tanks and bheels do not appear to feed readily upon mosquito larvæ. I obtained two species of fish of this kind from the Gowalia tank but they would not eat either larvæ or pupæ. I do not know the names of these fish but in Assam similar fish are called "Singa" and "Mangur" respectively. "Jingas" or fresh-water prawns (called "Chingri" in Assam) will not touch mosquito larvæ.

The presence of water-weed in a tank, well or cistern is often a source of danger, forming as it does an excellent shelter for mosquito larvæ. Some water plants, notably duck-weed or *Lemna* and *Azolla* have been suggested as being useful in preventing the breeding of mosquitoes. These suggestions do not appear to have been based upon careful observation and experiment. In my experience these plants are of little or no value in preventing the presence of mosquito larvæ. But there is a weed which I have met with in Bombay and elsewhere which under certain circumstances appears to be a useful preventive of mosquito larvæ. This plant is the rootless duck-weed or *Wolffia arhiza*. It takes the form of small bright green round grains without stem, roots or leaves. These grains float on the surface of the water just like a scum of

bright green seeds. Where it is growing in large amount so as to form a continuous layer on the top of the water no mosquito larvæ can live and pools and tanks covered in this way will be found quite free of larvæ. Anopheles larvæ placed in a bowl of water covered with a layer of *Wolffia arhiza* immediately assume an almost vertical position, hanging head downwards in a manner quite unnatural to them. After a short interval they sink to the bottom dead. The larger the larvæ the more quickly they die, as young larvæ can pass their tails between the plant grains and so get access to the air. Culex larvæ and Stegomyia larvæ are also destroyed, but the latter live for several hours in the weed-covered water. Where the continuity of the layer of *Wolffia arhiza* is broken by the presence of grass or reeds or large leaved weeds, mosquito larvæ are enabled to exist without difficulty, and it would appear therefore that before this plant could be used with success as a protection for tanks, the latter would have to be cleared of other growths. The round tank at the Mint which is usually covered with a good growth of *Wolffia arhiza* is free of mosquito larvæ, and so is the Nakhoda tank and several pools near Parel.

In this paper I have endeavoured to deal with certain points in the Natural History of Bombay Malaria which I hope may prove of interest. I have said very little about malaria as it affects the population of Bombay, but I may mention before concluding that the infection may be found in every part of the city and island and that in certain areas it is so prevalent that over fifty per cent. of the population harbour one or other form of the parasite.

In the north of the island and round about the Flats and low-lying parts malaria is uncommon, contrary to what people have believed for many years; but in the older parts of the city, especially where there are many wells, malaria is present to an extraordinary extent. The New Dock Works have been responsible for an increase in malaria in the Frere Road area, but not so much on account of the excavation work there as because numerous pools have formed on the land around the excavations. But the New Docks did not bring malaria to Bombay, and there is evidence that it has been present in many localities for a very long time; and had there been no mosquito infected wells, cisterns and tanks in

the neighbourhood of Frere Road it is doubtful if we should have heard of much malaria in association with the New Docks. When the Prince's and Victoria Docks were under construction there does not appear to have been any marked occurrence of malaria in their neighbourhood, neither does there appear to have been any great increase along the line of the new Port Trust Railway, although a considerable amount of excavation work went on there. At Sewri too there is hardly any malaria even close to the new reclamation. All these facts bear out the contention that temporary pools of water only become dangerous when permanent breeding places of malaria carrying mosquitoes exist in their vicinity and the problem of malaria prevention for Bombay becomes chiefly a question of dealing with the permanent breeding places of *N. stephensi*. This can only be attained by controlling all permanent collections of water and rendering them mosquito proof, either by protecting them with some sort of cover or stocking them with large numbers of one or other of the species of fish that I have mentioned in this paper. Unfortunately we cannot depend upon this sort of thing being carried out by voluntary effort and it rests with the members of this Society in consort with all loyal citizens, who have the welfare of Bombay at heart, to do their best in urging upon the authorities the necessity for adopting a rational system of malaria prevention for the City and ensuring by proper bye-laws the necessary powers for putting it into operation.

Explanation of Plate I.

No. 1. Head of Male Anopheles showing proboscis, spatulate palpi and plumose antennæ. The banding of the palpi in the male anopheles is not characteristic and affords no help to recognition of the species.

Nos. 2-6. Heads and Appendages of Female Anopheles showing characteristic banding of palpi.

No. 2. *M. rossi.*

No. 3. *N. stephensi.*

No. 4. *M. barbirostris.*

No. 5. *N. jamesi.*

No. 6. *M. culicifacies.*

No. 7. Hind leg of *M. rossi* showing white bands at the joints.

No. 8. ,, ,, ,, *N. stephensi* showing speckling.

No. 9. ,, ,, ,, *M. barbirostris* unbanded almost completely black.

No. 10. ,, ,, ,, *N. jamesi* showing the white tips and the speckling.

No. 11. ,, ,, ,, *M. culicifacies* unbanded black or dark brown.

Explanation of Plate II.

Key to larvæ of Bombay Anopheles.

(1) Diagram of Anopheles larva showing frontal hairs *F. H.*, which must not be confused with feeding brushes *F. B.*, also palmate hairs or fans *P. H.* a pair of which is usually present on most of the abdominal segments.

(2) Complete palmate hair or fan from larva of *M. rossi.*

(3) Single leaflet from palmate hair or fan of *M. rossi.*

(4) ,, ,, ,, ,, ,, ,, ,, ,, *N. stephensi.*

(5) ,, ,, ,, ,, ,, ,, ,, ,, *M. barbirostris.*

(6) ,, ,, ,, ,, ,, ,, ,, ,, *N. jamesi.*

Note.—The palmate hairs on *N. jamesi* are very large and distinct, much more so than those on *M. rossi*, *N. stephensi* and *M. barbirostris.*

(7) Single leaflet of palmate hair or fan of *M. culicifacies*.

Note.—The palmate hair on *M. culicifacies* are very large and prominent like those of *N. jamesi*.

(8) Frontal or clypeal hairs of larva of *M. rossi*.

(9) ,, ,, ,, ,, ,, ,, ,, *N. stephensi*.

(10) ,, ,, ,, ,, ,, ,, ,, *M. barbirostris*.

(11) ,, ,, ,, ,, ,, ,, ,, *N. jamesi*.

(12) ,, ,, ,, ,, ,, ,, ,, *M. culicifacies*.

(13) Special branched hair on inner side of antennæ of *M. barbirostris*.

Note.—It is only possible to see the branching of the frontial hairs of *N. stephensi* and *M. culicifacies* by very careful focussing with 1/6th inch objective.

ADDITIONS AND CORRECTIONS TO CERTAIN LOCAL BUTTERFLY LISTS, WITH THE DESCRIPTION OF A NEW SPECIES.

BY

CAPT. W. H. EVANS, R. E.

The following additions and corrections to certain local lists of butterflies that have appeared from time to time in the Society's Journal may prove of interest. The additions are in nearly every instance the result of personal experience; in the corrections generic names have not been altered in cases where the specific name is correct.

"THE BUTTERFLIES OF CHITRAL." Vol. XIV., p. 666.

12. *Kanetisa sp.*—Is only a casual variation of the preceding species *Karanasa digna.*

15. *Karanasa cadesia.*—Has been placed as a synonym of the preceding species *Karanasa huebneri.* I am convinced that there are two closely allied though distinct species occurring together in Chitral though Col. Bingham to whom I sent a series did not agree. Mr. Doncaster, of Watkins and Doncaster, classed the specimens as all *leechi;* Moore, also placed as a synonym of *huebneri* by Bingham.

26. *Paralasa kalinda* = female of No. 25 *shallada.*

27. *Paralasa sp.* = *Erebia mani.*

29. *Melitæa robertsi* = *Melitæa didyma persea.*

30. *Melitæa persea* = *Melitæa didyma chitralensis,* an insect which is, I think, entitled to specific rank.

31. *Melitæa sp.*—Is probably a casual variety of No. 29: the specimen is now in the British Museum.

32. *Melitæa sp.* = *Melitæa saxatilis shandura,* Christoph.: this was identified by Bingham who intended to mention it in an appendix to his vol. 3.

55a. *Vanessa cyca interposita:* This is the insect mentioned under No. 55 as common in the spring.

56. *Libythea lepita* = *Libythea celtis.*

57. *Lycæna medon* = *Lycæna astrarche.*

58. *Lycæna sp.* = *Lycæna eumedon antiqua,* Staudinger.

59. *Lycæna sp.* is an aberrant female of No. 58.

61. *Lycæna sp.* = *Lycæna cytis,* Lang: not in Bingham.

62. *Lycæna persica* = *Lycæna icarus.*

63. *Lycæna ariana* = *Lycæna stoliczkana.*

65. *Lycæna sp.* = *Lycæna sarta:* the orange bordered females mentioned under No. 64 belong to this species.

66. *Lycæna sp.* = *Lycæna devanica.*

67. *Lycæna sp.* = *Lycæna pheretes lehana.*

68. *Lycæna metallica* = *Lycæna omphisa.*

72. *Lycæna sp.* = *Lycæna sebrus*, Boisduval: not in Bingham.

103. *Colias sp.* = *Colias alpherakii.*

104. *Colias sp.* = *Colias wiskotti.*

105a. *Goneptery.x rhamni chitralensis:* I did not recognise this until Bingham's book was published and then found that I had a solitary male amongst my specimens of *rhamni.*

110. *Pieris sp.* = *Pieris rapæ* as No. 108.

112 and 113. *Aporia sps.* = *Aporia nabellica.*

115a. *Pieris glauconome*: I found a male of this species amongst my specimens of *daplidice.*

123. *Parnassius stoliczanus* = *Parnassius delphius hunza.*

128. *Hesperia staudingeri* = *Carcharodus altheæ.*

129. and 130. *Hesperia sps.* = *Arnetta leslei*, Elwes: named after Major Leslie, joint author of the original paper.

138. *Parnassius sp.* = *Parnassius hardwickei.*

139. *Hesperia sp.* = *Actinor radians.*

"THE BUTTERFLIES OF LUCKNOW." Vol. XIV., p., 481 and XVI., p. 720.

89a. *Telicota augias*, found rarely with the very common *Telicota bambusæ* in the Dilkusha Gardens, September 1902.

96. *Parnara kumara.*—Is not this *colaca* or possibly *bevani*, which would be much more likely to occur in Lucknow than *kumara.*

"THE BUTTERFLIES OF MUSSOORIE." Vol. XI., p. 205.

214a. *Listeria dudgeoni*, De Nicèville: one specimen obtained in the Brewery Nallah in April 1906 and identified by Bingham: the only previous record is, I believe, the type from Bhutan.

277a. *Sarangesa sp*, caught at the Kimpti Falls in April 1906: the specimen was sent to Col. Bingham who intended to describe it as a new species in his vol. 3.

These two butterflies are now in Mr. Philip Mackinnon's fine collection of the Mussoorie butterflies.

"THE BUTTERFLIES OF THE CENTRAL PROVINCES." Vol. V., p. 19.

8a. *Mycalesis visala*: several specimens of the dry season form were caught by Major Stokes Roberts, R. E., in Pachmarhi in November 1905.

8b. *Mycalesis perseoides*: I caught several specimens of this insect in Pachmarhi in October 1906 and had put them amongst *mineus* until quite recently: there is no mistaking the small light coloured brand.

9. *Mycalesis malsara* = *Mycalesis malsara lepcha.*

14. *Yphima singala.*—In vol I., p. 231 of Marshall and De Nicèville's "Butterflies of India, etc." mention is made of a typical pair of *singala* obtained by Mr. Betham near Nagpur; I caught a typical male in September 1905 at Jabalpur: there are also several other records of *singala* from various parts of India. Bingham confines *singala* to Ceylon and gives it a

male mark: he records *striata* from the Nilgiris, which has nothing to do with the insect under consideration as it has the ocellus on the forewing above prominent apart from other differences. I think that *singala* may be taken as occurring in various parts of India: it differs from *avanta* in the absence of a male mark, usually only one ocellus on the hindwing above, indistinct bands on the forewing below, which are even in width and parallel to one another, and the obsolescence of the apical ocellus of the hindwing below.

16. *Ypthima philomela* = *baldus*: I do not think that *philomela* occurs in the C. P. *Baldus* is very common round Pachmarhi and specimens from there do not differ from specimens I have from Sikkim and the Palnis.

17. *Ypthima ariaspa* = *inica* included as No. 15.

May I venture to criticise Mr. Bell's treatment of the Ypthimas in the admirable series of articles on the *Common Butterflies of the Plains* now appearing in the Society's Journal. The species described are *philomela*, *asterope*, *hübneri* and *ceylonica*: but why should not *baldus* and *inica* have a place, especially as the highly localised *Melanitis bethami* has been accorded one? As regards *philomela*, Mr. Bell has taken word for word Bingham description and localities and has added "*Y. baldus* is given as a species extending from the Himalayas to Bengal, Central, Western and Southern India: Assam to Tenasserim. It is said to differ from Philomela in having the striæ coarser on the underside." Now Mr. Bell's figure of "*philomela*" shows an insect with distinct subbasal and discal bands on the underside, but there is no mention of these important features in his description: the figure is in fact what Bingham calls *baldus*. Of course until recently Bingham's *baldus* was known as *philomela* and Bingham's *philomela* as *tabebla*: the nomenclature of these two insects seemed however to have been finally cleared up by Watson in the Society's Journal Vol. X., p. 218. Can it be that Mr. Bell disagrees with Bingham on this point; if so I think this should be made clear and in any case the description and figure ought to agree with one another.

31. *Neptis nandina*.—Capt. Graham in October 1909 obtained some of the *yerburii, soma* group of *Neptis* in Pachmarhi. I did not have much time to examine them but noted that the markings were unsullied and the bands of the hindwing of even width: this being so they should be *soma hampsonii*.

59a. *Azanus ubaldus*.—Common at Jabalpur in the autumn and cold weather: the local form seems to be on its way to *Uranus*.

61a. *Nacaduba hampsoni*.—I obtained a male in Pachmarhi in October 1906: it agrees well with Bingham's description and Mr. Doncaster confirmed my diagnosis.

88. *Terias æsiope* = *libythea*.

89. *Terias rubella* = *venata*.

92. *Catopsilia catilla* = No. 93 *C. crocale* of which it is a dimorph.

95. *Catopsilia gnomia* = *C. florella*, which I have found common at Jabalpur.

98. *Catophaga paulina* = *Appias albina*.

98a. *Appias libythea*.—Col. Jermyn obtained a female in Saugor in the autumn of 1907.

99. *Nepheronia gea* = *Pareronia hippia*.

105. *Callosune sp.* = Dry season form of No. 104 *Colotis danae*.

106. *Callosune sp.* = *Colotis etrida*.

107. *Callosune sp.* = *Colotis vestalis*.

107a. *Colotis amata*. Recorded by Mr. Witt from Hoshangabad.

110. *Papilio dissimillis* and 111. *Papilio polydorus* = *P. clytia*.

112. *Papilio erithonius* = *P. demoleus*.

123a. *Parnara sinensis*.—Occurs during and after the rains rather rarely at Jabalpur. Mr. Betham did not number the Hesperiidæ. I have carried on the numbers for convenience.

125. *Parnara bevani* and 125a *Parnara colaca*.—A small skipper is very common in Jabalpur after the rains and, as I identify it, it is *P. colaca*; Col. Bingham to whom I sent a long series called it *bevani*, but I think he was wrong and I have not met with true *bevani* in the C. P. though it is not at all unlikely to occur. There are four small variable skippers very much alike, *viz.*, female *mathias*, *guttatus*, *colaca* and *bevani*: they have given me a good deal of trouble and perhaps a few notes on them may be useful to other collectors. Female *mathias* has on the forewing above always two spots in the cell and a spot in 1a, while the spot in 2 has its lower edge outwardly pointed; the hindwing above is usually devoid of spots but occasionally has as many as three; the hindwing below has a small spot at the end of the cell and a curved discal series of four to seven small spots. *Guttatus* usually has no spots in the cell of the forewing, though sometimes there are two, never a spot in 1a and the spot in 2 is quadrate; on both sides of the hindwing there is normally a straight decreasing row of 4 spots pointing to the apex of the wing in interspaces 2 to 5, sometimes the spot in 2 or 5 is out of line and there may be a spot at the end of the cell or one in 6. *Colaca* as regards the forewing resembles *mathias* except that there may be one or no spots in the cell; the hindwing above has nearly always a small prominent white spot in 4 but there may be two or none: the hindwing below has usually three largish spots in 2, 3 and 5 with occasionally a spot in 6, the row is curved, running parallel to the costa. *Bevani* is a smaller insect and differs from the others in having the termen evenly rounded instead of excavated just above the tornus: the forewing has all the spots reduced in size, usually one spot in the cell rarely a small spot in 1a, the spot in 2 is quadrate and there is often a spot in 6: the hindwing above is usually spotless but there may be as many as

three faint spots: on the hindwing below the spots are much as in *colaca* though smaller and there is often a spot in 1. The only other skipper that might be confused with the above is female *subochracea*, which I have never seen; the *kumara* and *conjuncta* groups run much larger over 1½ inches instead of about 1¼ inches.

127a. *Suastus robsonii*.—One specimen caught at Jabalpur in March 1906: it agrees well with De Nicéville's description, but I am not sure that *robsonii* will not eventually turn out to be merely a casual aberration of *gremius*.

128a. *Sarangesa dasahara*.—Common after the rains in Pachmarhi and I am surprised that Mr. Betham overlooked it.

I should like to take this opportunity to describe what I think is a new *Nacaduba* from Sikkim.

Nacaduba sivoka n. sp. In May 1906 I caught 3 specimens of a *Nacaduba* in some jungle at Sivoke in the Teesta Valley, Sikkim. They are allied to but distinct from *ardates*. Two are brown above with a few blue scales scattered on the disc: the third is brown with a large iridescent blue white patch on the disc of the forewing and some ill defined white patches on the hindwing, the discocellulars are defined with black on the forewing. Underneath the ground colour is pale golden yellow with light brown markings and fasciæ arranged as in *ardates* except that the basal fascia on the forewing does not extend to vein 1: the apical spot of the submarginal series on the hindwing is much enlarged being as large as the usual pre-anal spot. The termen of the forewing is very convex, much more so than in either sex of *ardates*: but for this last feature it seems to very closely resemble *N. noreia*. It seems to be very close indeed to what De Nicéville talks of as *N. lutea* in the Society's Journal Vol. X, p. 36. I could have obtained many more of the insect, but it never struck me at the time that it was anything unusual.

A PRELIMINARY LIST OF THE FISHES OF TIRHOOT, BENGAL.

BY

GORDON DALGLIESH.

Owing to the kindness of Mr. F. K. Rawlins, I have received a small collection of some 30 odd species of the commoner fishes of Tirhoot, Bengal. Like most of the Indian rivers, tanks, and jheels, Tirhoot abounds with a varied fish fauna which play no small part in the economy of the poorer native population, all fishes with a very few exceptions being extensively used as food. Netting to a large extent is carried on, while for the capture of very small species a form of wicker basket is employed, acting on the same principle as the lobster traps and eel baskets of home fishermen. Very large fish are killed by means of a form of spear made of bamboo and tipped with steel. Perhaps the commonest fishes occurring in the rivers are the *Siluridæ*, which on account of their forbidding and very often, loathsome appearance, are not relished as food by Europeans—though some are very fair eating—but are esteemed by most of the natives, especially the very poor classes. It is remarkable how many of the *Clupeidæ* (Herrings) and others, as a rule, essentially marine and esturine fishes find their way so far inland; for more than one species of herring is quite common in Tirhoot. In spite of the voluminous literature that has been written on Fishes in India, Day and other great ichthyologists have given us very little information regarding the life history of any species. The books on Indian fishes are purely of a technical character and really only of service to the systematic naturalist. On looking through those splendid volumes *Fishes of India* and "Fishes" in the *Fauna of British India* series one cannot but feel regret for the paucity of information on habits, etc. And the reason for this is not hard to discover. Most of us in India are too busy to pay much attention to the habits of the creatures around us, and nearly all our spare time is taken up in collecting the different objects we are specially interested in. Indeed, for this alone we have to depend largely on native collectors. And, again, climate and weather greatly retard those that would wish to study the life histories of the varied Indian fauna. Fishes and other lower vertebrates are extremely difficult nigh almost impossible to study in a state of nature. Much might be done and really valuable information gained by the erection of Biological stations for both Marine and fresh-water fauna in special charge of a trained scientific staff. But as things are now we must necessarily remain in ignorance regarding the ways of even our commonest fishes. It is true a lot *can* and *has* been learnt by keeping fishes in those heterogeneous receptacles designated "aquariums," and I would urge those sufficiently interested in fishes, to erect one for himself, however rough, and by dint of much careful labour and patience to learn as much as

possible the habits of the inmates, he may keep from time to time, noting down carefully anything and everything that he sees. Nor must the information gleaned from native sources be regarded lightly. Many natives are keen observers, and do not always wilfully mislead with an idea to please, and it does not do to scoff at what might at first hearing appear to be a "fairy tale." The true naturalist will always make notes of what he obtains by hearsay, endeavouring as far as possible to ascertain the truth for himself. For, however improbable a story might at first seem, it should be borne in mind that "there are more things in heaven or earth than are even dreamt of in man's philosophy." For instance, most of us in India know for a fact that, after a shower of rain many hitherto dry ditches and hollows are alive with small fish. Where do these come from? Are they carried in a vertex by the rain and deposited there? Highly improbable. Or have the fishes until now been hibernating in the mud? More than probable (see note under *Ophiocephalus*).

For the naming of most of the fishes listed here, I am indebted to Mr. Boulenger of the British Museum to whom my best thanks are due for much kindly help and information that he has always ungrudgingly at all times given to me. The nomenclature and numbers here employed are those of "Fishes" in the *Fauna of British India* Series.

The list contains two rare fishes and one, herring, hitherto only recorded from the coast.

Siluridæ

The *Siluridæ* or "cat fishes" are largely represented in India and fresh waters of other temperate and tropical regions, a few being found in salt waters. They all have carnivorous tendencies, some species being said to feed on carrion. In general appearance they are unattractive, a few having a most forbidding appearance. Their bodies have no scales, but in many genera there are long scutes.

Sometimes a stout long spine is present in front of the dorsal and pectoral fins, which are said to be poisonous. One to six pairs of barbels embrace the mouth very long and string-like in many species. It is from these barbels the group derive their popular name. These appendages having a fanciful resemblance to cat's "whiskers." Some *siluroids* have an accessory breathing organ which enable them to live out of water for a long time.

135. *Eutropiichthys vacha.*

Day gives the range of this fish from the Punjab and all large rivers of Sind, Bengal and Orissa. It is largely eaten by the natives of Behar.

143. *Ailia coila.*

Throughout the Bengal plains in large rivers and Assam. Greatly esteemed as a food fish.

151. *Pseudeutropius, garua.*

India generally.

156. *Macrones aor.*

Common throughout India, and is said to attain a length of 6 feet. In appearance it is perhaps one of the most repulsive looking of all the *siluroids.*

163. *Macrones cavasius.*

211. *Glyptosternum botium.*

Day records this fish from Delhi and the Northern rivers of Bengal. It never grows to any great size, and Mr. Boulenger informs me is rare. I have received one specimen which is now in the British Museum.

222. *Gagata cenia.*

Four specimens collected which were all quite small and are of the yellowish bronze colour with dark bands over the head and back as described by Day.

228. *Nangra viridescens.*

Four specimens obtained, Mr. Boulenger says it is a rare species.

Family *Cyprinidæ.*

The carps are well represented in the waters of Tirhoot and Bengal in general, many being especially valuable as food. Few members of this family are foul feeders and are said to prefer clean to dirty water. In their diet they are for the greater part herbivorous. It is noteworthy that though *Cyprinidæ* abound in the fresh waters of the old world and North America, they are but purely represented in Africa and are absent altogether from S. America and Australia. It is stated that natural hybrids occur among certain members of this family.

237. *Lepidocephalichthys guntea.*

Two specimens of this loach were obtained quite small ones, and according to Day it has a wide range in India evidently ascending the mountain streams to as high as Darjeeling. In their habits loaches are sluggish fish, and are not esteemed much as food except among the native population. They never attain any great size.

306. *Labeokontius.*

Hitherto this fish has not been recorded from Bengal. Day gives its range from the "base of the Nilgiris, and the Cauvery and Coleroon in all their branches down to the coast. Grows to two feet in length." Therefore, Tirhoot must stand as a new locality for this fish. I have received two specimens which were identified for me by Mr. Boulenger.

321. *Cirrhina mrigala.*

Several quite small examples. Attains 18 pounds in weight (Day).

322. *Cirrhina latia.*

In contrast to the last on the authority of Day this species is said to attain only 8 inches in length.

323. *Cirrhina reba.*

Several quite small examples. The intestines of this species are very dark, often showing through the somewhat pale skin.

341. *Barbus sarana.*

Probably ranges throughout India. Many species of barbels attaining a large size are frequently taken in the jheels and tanks of Behar, being a favourite food fish among Europeans and natives alike. One species which I have never yet been able to satisfacterily determine is known as the "*Rhoho,*" and judging from some large bony capsules of the head of this fish, which I have in my possession, must attain an enormous size.

389. *Barbus conchonius.*

Recorded from Behar by Day, and attaining probably no great size.

413. *Aspidoparia morar.*

A small fish not exceeding much more than seven inches in length.

417. *Rohtee cotio.*

In general appearance this fish has a great resemblance to the Bream (*Abramis brama*) of home waters.

436. *Danio devario.*

An exceedingly beautiful little fish which glistens in life with all the colours of the rainbow. I recollect obtaining many examples which I kept alive for some time taken from one of the large jheels in the district. Day says it attains a length of four inches.

449. *Chela gora.*

This fish is excellent eating and is the "white-bait" of Behar residents. To the natives it is known as *chulwa* in the Darbhanga district. It affords good sport with a light rod taking a small fly. I have killed several on a hook baited with a fragment of red wool. In general appearance it closely resembles the well-known "sprat," and in the evenings becomes very lively, and may be observed jumping no little distance out of the water. I think it is to a certain extent migratory, as in some seasons I could not obtain any. It is more common in the cold than in the hot weather, and as far as my own observations go, is essentially a river fish. It attains a length of 9 inches.

Clupeidæ.

The family of herrings are for the greater part marine and esturine fishes, few being found in fresh-water. It is superfluous here to say anything regarding their importance as a food supply. Though the majority are good eating, a few tropical species are said to be poisonous. The family is widely spread in temperate and tropical zones being well represented in India.

469. *Clupea chapra.*

Throughout the fresh waters of India in tanks and rivers. It is common in Tirhoot, and attains a length of 8 inches.

476. *Pellona elongata.*

It seems very little short of remarkable that this fish should have been obtained so far inland as Tirhoot. Day gives its range as "*Seas of India* (the italics are mine) to the Malay Archipelago, China and Japan." My specimens were identified by Mr. Boulenger. Herring's being chiefly migratory fishes, no doubt, at times travel great distances.

498. *Engraulis telara.*—Probably throughout Bengal.

501. *Engraulis purava.* One specimen received. Day records this species from "seas and estuaries of Sind and both sides of India, also the Malay Archipelago."

Notopteridæ.

The fishes of this family are essentially tropical, being found in fresh or brackish water. The scales are thin and cycloid extending over the head and gill covers. The pelvic fins are absent or reduced. Two species are Indian.

519.—*Notopterus kapirat.*—Two examples obtained.

Scombresocidæ.

The gar fishes are remarkable in having the jaws prolonged into a beak. They are for the greater part marine, a few being found in fresh waters.

536. *Belone cancila.*—This fish is, I think, fairly common in the rivers and I used to have several examples brought to me. It is said to attain a length of 12 inches or more.

Percidæ.

The large family of Perches is found in fresh and salt water alike. They are chiefly gregarious sometimes swimming in vast shoals, but are said when they grow old to lead a solitary existence. The famous Nair or "cock-up" (*Lates calcarifer*) may be cited as a familiar Indian example of this family. This fish has attained a weight of 200 pounds (Day).

628. *Ambassis nama.*—I received several specimens of this little perch.

827. *Nandus marmoratus.*—I received two specimens of this handsome little fish. Day says it is common in ditches and inundated fields where it preys on small *Cyprinidæ.*

868. *Sciæna coitor* (?).—I have marked this species with a query as I only have one immature example. Mr. Boulenger marked it "*Sciæna sp* ?" but I think it more than probable it can be referred to as *S. coitor.*

Gobiidæ.

The family of gobies is a small division of the suborder *Acanthopterygii* including the single family *Gobiidæ*, which though numerous, are fishes of small size, but interesting to the student on account of their strange breeding habits. The female fixes her eggs to the underside of stones, weeds, or shells, very often making a kind of nest. The male is more

brightly coloured than the female, and watches over the eggs until they are hatched remaining fixed to a stone or shell by means of a pelvic sucker. They are usually found in shallow water, fresh, brackish or salt. The Indian species constitute a large family.

1051. *Gobius giuris.*—I received two specimens of this little fish, which on first sight so closely resembled a familiar English species that I had my doubts at first as to its being Indian, and though I had taken every case to avoid the Indian consignment being mixed up with some British fish I had, I thought I must have done so, until Mr. Boulenger identified it for me as the above species.

Rhynchobdellidæ.

The curious fishes constituting this family are so eel-like in general appearance that they have been referred to as belonging to that family by some naturalists. On a closer inspection, however, they differ widely from the eels in many important respects. The important distinguishing feature are the long dorsal fins, the anterior portion of which consists of free spines, and the fleshy snout which is transversely striated beneath in *Rhynchobdella* and not striated in *Mastacembelus*. They are found in fresh and brackish waters of India, Ceylon and Burma, also Asia Minor and West Africa.

1155. *Rhynchobdella aculeata.*

Day says this species is found in brackish waters within tidal influence. My specimens, of course, were taken miles away from any tidal influence. I used to have several brought to me. The fish is said on good authority to drown if unable to reach the upper air. It lies concealed, as a rule, in mud.

Ophiocephalidæ.

The family of "snake-headed" fish are peculiar to the warmer regions of the old world, one species having been successfully introduced from China and naturalised in Western North America. These fishes are said to be able to withstand a severe drought, lying in a torpid condition in the mud until the rain, filling up the hollows where they lie hid, wakes them up to life again. It is these fishes that are often found in wayside puddles which the natives declare are brought down with the rain. To enable the *Ophiocephalidæ* to withstand drought, a hollow cavity is present in the head, an "accessory suprabranchial cavity for aërial respiration." These fishes, too, like the climbing Perch (*Anabas scandens*) can travel over wet ground progressing in a snake-like manner.

1205. *Ophiocephalus gachua.*

1206. *Ophiocephalus punctatus.*

Both these fishes are common in Tirhoot and are very good eating. They are called by the natives *Murrel.*

Labyrinthici.

The members of this family are freshwater and estuary fishes of Asia and South Africa. The family presents some remarkable Asiatic members, including the famous little "Fighting fish" of Siam *(Betta pugnax)*, the most beautiful little paradise fish *(Polyacanthus opercularis)* of China, and the climbing "perch" *(Anabus scandens)*. This last named fish probably occurs in Tirhoot, but hitherto I have not obtained it. The Gourami *(Osphromenus olfax)*, so much esteemed on account of its delicate flavour and naturalised in many parts of India, is also placed in this family.

1215. *Trichogaster lalius.*

I obtained one specimen of this beautiful little fish with Mr. Rawlin's consignment. It is quite common in Tirhoot, and I had at one time several living examples.

Tetrodon sp ?

I used to obtain many examples of a species of small "balloon fish," which are common in the rivers of Tirhoot but never satisfactorily determined the species. It is known to native fishermen as *Pokchar.*

DESCRIPTIONS OF INDIAN MICRO-LEPIDOPTERA.

BY

E. MEYRICK, B.A., F.R.S., F.Z.S.

XII.

(*Continued from page* 168 *of this Volume.*)

GELECHIADÆ

Narthecoceros logica, n. sp.

♂. 13-14 mm. Head and thorax ochreous-whitish. Palpi fuscous-whitish, more or less sprinkled with dark fuscous. Antennæ ochreous-whitish, with two blackish bands before apex. Abdomen grey. Forewings elongate, costa gently arched, apex round-pointed, termen hardly sinuate, oblique; fuscous-whitish, sometimes partially and variably sprinkled with dark fuscous; a suffused dark fuscous streak along costa from about ¼ to apex; two small cloudy dark fuscous spots transversely placed at end of cell: cilia ochreous-whitish, variably irrorated with fuscous and dark fuscous, especially about apex. Hindwings grey; cilia ochreous-whitish, more or less tinged or suffused with grey except towards base.

Maskeliya, Ceylon (Pole, Green, Alston); in November and December, four specimens.

Frisilia, Walk.

Head with appressed scales, side-tufts in ♂ more or less projecting over forehead; ocelli present; tongue developed. Antennæ over 1, in ♂ simple, more or less thickened and roughened towards base, basal joint moderate, without pecten. Labial palpi in ♂ with second joint short, with dense projecting tuft of scales beneath, terminal joint wholly clothed with dense rough scales, twisted or bent over so as to form another longer tuft lying above the former; in ♀ recurved with second joint expanded with rough scales above towards apex, beneath with more or less developed projecting tuft of rough scales, terminal joint longer than second, slender, acute. Maxillary palpi very short, filiform, appressed to tongue. Posterior tibiæ clothed with rough hairs above. Forewings in ♂ with subdorsal groove edged with dense scales from base to tornus; 2 and 3 stalked or 3 usually absent in ♂ and seldom in ♀, 4 out of 2 in ♂ and seldom in ♀, 7 to termen, 8 and 9 out of 7 or 8 absent, 11 from middle. Hindwings 1, trapezoidal, termen somewhat sinuate, cilia ⅔-½; 3 and 4 stalked, 5 somewhat approximated, 6 and 7 stalked.

This genus supersedes *Macrernis*, Meyr. It is a development of *Lecithocera* from which it is distinguished in both sexes by the tufted palpi, and further in the ♂ by the peculiarly modified terminal joint thereof, and the characteristic subdorsal furrow, which are found in all the species. Walker described

one species, *nesciatella*, (which I have from Maskeliya and Maturatta, Ceylon), and I have described two others, *heliapta* and *rostrata*; I now add six more, but have various others which require further material for elucidation. The species are rather closely allied and difficult; particular attention should be given to the neuration, the form of termen of forewings, and the character of the second discal stigma.

Frisilia senilis, n. sp.

♂ ♀. 12-13 mm. Head and thorax whitish-ochreous tinged with brownish, sides of crown whitish. Palpi in ♂ pale brownish-ochreous, apex suffused with dark fuscous, in ♀ ochreous-whitish, second joint pale ochreous sprinkled with fuscous except towards apex, anterior edge of terminal joint dark fuscous. Antennæ whitish more or less dotted with fuscous, suffused with ochreous towards base, with dark fuscous præapical band. Abdomen whitish-ochreous more or less tinged with grey. Forewings elongate, rather narrow, costa slightly arched, apex obtuse, termen almost straight, in ♂ somewhat oblique, in ♀ more oblique; 3 absent in both sexes, 2 and 4 in ♂ and sometimes in ♀ stalked, 8 and 9 out of 7; subdorsal groove in ♂ slightly sinuate anteriorly, bent down beneath second discal stigma; whitish-ochreous or pale ochreous, with some scattered dark fuscous specks, dorsal area in ♂ sometimes suffused with deep yellow-ochreous; discal stigmata black, dot-like, second in ♂ forming a somewhat oblique short transverse mark: cilia whitish-ochreous, sometimes suffused towards base with ochreous-yellowish. Hindwings light grey; cilia ochreous-whitish more or less tinged with grey.

N. Coorg, 3,500 feet (Newcome); in June, August and November, five specimens. The bent subdorsal groove of ♂ and absence of vein 3 in ♀ are peculiar characters.

Frisilia strepsiptila, n. sp.

♂ ♀. 18-20 mm. Head and thorax light brownish-ochreous, sides of crown pale ochreous. Palpi pale brownish-ochreous, in ♀ terminal joint whitish-ochreous, with anterior edge dark fuscous. Antennæ whitish-ochreous, with dark fuscous præapical band, in ♂ spotted with fuscous, basal joint clothed above with tuft of dense projecting scales, in ♀ somewhat infuscated towards base. Abdomen pale ochreous. Forewings elongate, posteriorly slightly dilated, costa anteriorly gently arched, apex obtuse, termen sinuate, little oblique; in ♂ 3 and 4 out of 2, in ♀ 2 and 3 stalked, 4 approximated, 8 absent, 9 out of 7; subdorsal groove in ♂ sinuate downwards on anterior half; brownish-ochreous, thinly sprinkled with dark fuscous specks; costal edge infuscated towards base; discal stigmata dark fuscous, first dot-like, second forming a crescentic dot, whence a rather oblique streak of fuscous or dark fuscous irroration runs towards dorsum; termen somewhat infuscated from apex to near tornus: cilia pale ochreous. Hindwings in ♂ with long pencil of whitish-

ochreous hairs lying along costa from base; whitish-ochreous tinged with fuscous, more infuscated posteriorly; cilia whitish-ochreous tinged with fuscous.

N. Coorg, 3,500 feet (Newcome); in November and December, four specimens. This and the next species differ from the rest in the absence of vein 8 of forewings; the basal tuft of antennæ and costal hair pencil of hindwings in ♂ are special points.

Frisilia homochlora, n. sp.

♀. 22 mm. Head and thorax pale ochreous. Palpi whitish-ochreous, second joint sprinkled with fuscous, anterior edge of terminal joint infuscated. Antennæ whitish-ochreous, very indistinctly spotted with fuscous, towards base infuscated, with dark fuscous præapical band. Abdomen whitish-ochreous. Forewings elongate, posteriorly rather dilated, costa gently arched, faintly sinuate in middle, apex obtuse, termen straight, rather oblique; 2 and 3 stalked, 4 approximated, 8 absent, 9 out of 7; pale ochreous; costal edge infuscated at base; discal stigmata cloudy, dark fuscous, first dot-like, second extending across transverse vein, subcrescentic; some slight infuscation along termen: cilia pale ochreous-yellow. Hindwings whitish-ochreous; cilia whitish-yellowish.

Palni Hills, 6,000 feet (Campbell); two specimens.

Frisilia sulcata, n. sp.

♂ ♀. 18-20 mm. Head and thorax deep yellow-ochreous. Palpi yellow-ochreous, in ♀ terminal joint whitish-ochreous, with anterior edge dark fuscous. Antennæ yellow-ochreous, with fuscous præapical band. Abdomen yellow-ochreous tinged with fuscous. Forewings elongate, costa anteriorly gently arched, apex round-pointed, termen in ♂ concave, in ♀ sinuate, somewhat oblique; in ♂ 3 absent, 2 and 4 long-stalked, in ♀ 2 and 3 short-stalked, 4 separate, 8 and 9 out of 7; subdorsal groove in ♂ somewhat sinuate anteriorly; deep yellow-ochreous, sprinkled with dark fuscous specks, in ♀ brownish-tinged; costal edge dark fuscous towards base; discal stigmata dot-like, black, conspicuous; a slender streak of dark fuscous suffusion along termen from apex to near tornus: cilia ochreous-yellow, in ♀ at apex with some dark fuscous suffusion. Hindwings pale grey; cilia pale ochreous.

Khasis, from April to July; Simla, in August; seven specimens.

Frisilia dipsia, n. sp.

♂. 19-20 mm. Head and thorax brown. Palpi brownish-ochreous. Antennæ pale ochreous, more or less spotted with fuscous, with dark fuscous præapical band. Abdomen pale ochreous, sides and segmental margins grey. Forewings elongate, costa gently arched, apex round-pointed, termen sinuate, rather oblique; 3 absent, 2 and 4 stalked, 8 and 9 out of 7; ochreous-brown, considerably sprinkled with dark fuscous; base of costa infuscated; discal stigmata dark fuscous, first forming a rather large dot,

second a roundish spot of irroration edged anteriorly by a transverse mark, lying below middle and touching groove; a streak of dark fuscous suffusion along termen: cilia pale ochreous, with a partially indicated fuscous line. Hindwings grey; cilia whitish-ochreous tinged with grey.

Maskeliya and Madulsima, Ceylon (Pole, Green, Alston); from December to March, and in June, nine specimens. The absorption of dorsal area in the groove is more considerable in this species than in any of the others.

Frisilia notifica, n. sp.

♂ ♀. 15-17 mm. Head and thorax brownish, sides of crown pale ochreous or sometimes whitish. Palpi in ♂ ochreous, in ♀ whitish, with second joint irrorated with fuscous, anterior edge of terminal joint dark fuscous. Antennæ whitish-ochreous, indistinctly spotted with fuscous, with dark fuscous præapical band. Abdomen grey, apex pale ochreous. Forewings elongate, slightly dilated posteriorly, costa gently arched, apex round-pointed, termen sinuate, rather oblique; in ♂ 3 absent, 2 and 4 stalked, in ♀ 2 and 3 stalked, 4 and 5 approximated, 8 and 9 out of 7; in ♂ ochreous-brownish, sprinkled with dark fuscous, suffused with deep yellow-ochreous along subdorsal groove, which is straight; in ♀ brown irrorated with dark fuscous; costa suffused with dark fuscous towards base; discal stigmata dark fuscous, rather cloudy, first forming a moderately large dot, second a transverse-oblong slightly oblique mark; termen more or less suffused with dark fuscous: cilia in ♂ pale ochreous, in ♀ brownish or pale brownish-ochreous, with two fuscous lines more or less indicated. Hindwings grey; cilia whitish-ochreous more or less wholly suffused with grey.

Maskeliya, Madulsima and Peradeniya, Ceylon (Vaughan, Pole, Green); from November to July, fourteen specimens.

Frisilia heliopta, Meyr.

Similar to *notifica*, but smaller (13-15 mm.), more ochreous in colouring, both discal stigmata dot-like, cilia yellower.

Kandy, Peradeniya, Maskeliya, Madulsima, and Dickoya, Ceylon; from December to June, twenty specimens.

Dolichotorna, n. g.

Head with appressed scales; ocelli present; tongue developed. Antennæ over 1, in ♂ simple, basal joint elongate, without pecten. Labial palpi very long, recurved, second joint thickened with scales, slightly rough towards apex beneath, terminal joint as long as second, in ♂ posteriorly with erect tuft of scales from base and short median protuberance of scales, in ♀ slender, acute. Maxillary palpi very short, filiform, appressed to tongue. Posterior tibiæ clothed with long hairs above. Forewings with 2 from towards angle, 7 absent, 11 from middle. Hindwings 1, very elongate-trapezoidal, apex obtuse, termen rounded, cilia $1\frac{2}{3}$; 3 and 4 out of 5; cell apparently open, 6 and 7 long-stalked.

A development of *Homaloxestis*.

Dolichotorna hotlias, n. sp.

♂ ♀. 13-14 mm. Head ochreous-whitish, crown in ♀ suffused with pale fuscous except on sides. Palpi whitish, second joint infuscated except towards apex. Antennæ whitish, indistinctly spotted with fuscous. Thorax ochreous-whitish, shoulders dark fuscous. Abdomen ochreous-whitish. Forewings elongate, narrow, costa gently arched, apex tolerably pointed, termen extremely obliquely rounded; brownish, somewhat mixed or in ♂ mostly suffused with ochreous-whitish, somewhat sprinkled with dark fuscous; very undefined markings formed by darker fuscous suffusion coarsely irrorated with blackish-fuscous, *viz.*, a streak along submedian fold, a cloudy patch in disc beyond middle, and a patch occupying apical fourth of wing: cilia in ♂ ochreous-whitish, in ♀ whitish-brownish, with two dark fuscous shades becoming obsolete towards tornus. Hindwings in ♂ pale whitish-ochreous, in ♀ whitish-grey; cilia pale whitish-ochreous.

Maskeliya, Ceylon (Pole); in January and February, three specimens.

Parelliptis, n. g.

Head with appressed scales; ocelli present; tongue developed. Antennæ 1, rather stout towards base, in ♂ simple, basal joint moderately elongate, without pecten. Labial palpi very long, recurved, second joint thickened with dense appressed scales, slightly rough beneath, terminal joint as long as second, slender, acute. Maxillary palpi very short, filiform, appressed to tongue. Posterior tibiæ rough-scaled above. Forewings with 2 from towards angle, 7 absent, 8 and 9 sometimes stalked, 11 from middle. Hindwings slightly over 1, elongate-trapezoidal, apex obtuse, termen slightly sinuate, oblique, cilia almost 1; 4 absent, 5 rather approximated to 3 at base, 6 and 7 stalked.

A development of *Homaloxestis*.

Parelliptis scytalias, n. sp.

♂. 14-15 mm. Head, antennæ, and thorax whitish-ochreous, shoulders narrowly dark fuscous, thorax and crown sometimes with a cloudy fuscous central line. Palpi whitish-ochreous, second joint dark fuscous except apex, anterior edge of terminal joint sometimes partially dark fuscous. Abdomen whitish-ochreous, suffused with dark fuscous beneath. Forewings elongate, rather narrow, costa gently arched, apex obtuse, termen very obliquely rounded; whitish-ochreous, with some scattered fuscous or dark fuscous specks; costal edge dark fuscous towards base; discal stigmata blackish; a rather dark fuscous streak along dorsum from $\frac{1}{4}$ to $\frac{3}{4}$, broad in middle and narrowed to extremities; posterior area from second discal stigma pale ochreous suffused with fuscous except towards costa, undefined anteriorly, darker fuscous towards termen, in one specimen whole wing suffused with rather dark fuscous except a rather broad costal streak and a line along submedian fold: cilia pale ochreous suffused with fuscous, at

apex with a bar of dark fuscous suffusion, on costa whitish-ochreous. Hindwings grey, paler anteriorly; cilia whitish-ochreous.

Maskeliya, Ceylon (Pole); in July and from October to February, ten specimens.

Eridachtha, n. g.

Head with appressed scales; ocelli present; tongue developed. Antennæ 1, rather stout towards base, basal joint moderate, without pecten. Labial palpi long, recurved, second joint thickened with appressed scales, terminal joint as long as second, slender, acute. Maxillary palpi very short, filiform, appressed to tongue. Posterior tibiæ clothed with hairs above. Forewings with 2 from near angle, 3 separate (in one wing of one specimen 2 and 3 very shortly stalked), 8 and 9 out of 7, 7 to termen, 11 from middle. Hindwings 1, elongate-trapezoidal, apex pointed, termen hardly sinuate, cilia almost 1; 3 and 4 stalked, 5 absent, 6 and 7 stalked.

A development of *Homaloestis*.

Eridachtha prolocha, n. sp.

♀. 15-16 mm. Head, palpi, and antennæ light ochreous-yellowish, second joint of palpi fuscous towards base. Thorax fuscous. Abdomen light fuscous. Forewings elongate, rather narrow, costa anteriorly gently arched, apex round-pointed, termen faintly sinuate, oblique; grey-brown: cilia brownish-grey. Hindwings grey; cilia light-grey.

Nilgiris, 3,500 feet (Andrewes); N. Coorg, 3,500 feet (Newcome); in April and August, three specimens.

Homaloxestis, n. g.

Head with appressed scales; ocelli present; tongue developed. Antennæ 1 or over 1, rather stout towards base, in ♂ simple, basal joint moderate, without pecten. Labial palpi very long, recurved, second joint thickened with appressed scales, terminal joint as long as second or somewhat longer, slender, acute. Maxillary palpi very short, filiform, appressed to tongue. Posterior tibiæ clothed with hairs above. Forewings with 2 from towards angle, 3 separate, 4 and 5 sometimes stalked, 7 and 8 stalked, 7 to apex or termen, 9 sometimes out of 7, 11 from middle. Hindwings 1, elongate-trapezoidal, apex more or less pointed, termen faintly sinuate or rounded, cilia ½-2; 3 and 4 connate or stalked, 5 rather approximated, 6 and 7 stalked.

Type *H. endocoma*. This is the genus hitherto termed by me *Lecithocera*.

Homaloxestis callitricha, n. sp.

♂ ♀. 20-21 mm. Head and thorax pale ochreous, sides of crown yellower. Palpi light ochreous-yellowish, scales of second joint somewhat expanded above and beneath. Antennæ whitish-ochreous. Abdomen ochreous-yellow. Forewings elongate, slightly dilated posteriorly, costa gently arched, apex obtuse, termen obliquely rounded; 4 and 5 stalked, 8 and 9

out of 7; light ochreous-yellowish, more or less sprinkled finely with fuscous discal stigmata blackish, well-marked: cilia light ochreous-yellowish. Hindwings whitish-ochreous, slightly greyish-tinged posteriorly; in ♂ with a large and very long expansible pencil of light ochreous-yellowish hairs lying along subdorsal fold from base; cilia pale yellowish.

Khasis, from July to September, three specimens.

Homaloxestis perizeucta, n. sp.

♂. 20-21 mm. Head and thorax pale brownish-ochreous. Palpi pale ochreous. Antennæ whitish-ochreous. Abdomen ochreous-yellowish, dorsally infuscated. Forewings elongate, slightly dilated posteriorly, costa gently arched towards base and apex, apex obtuse, termen hardly rounded, oblique; 4 and 5 stalked, 8 and 9 out of 7; pale ochreous more or less sprinkled with fuscous; discal stigmata indistinct, fuscous: cilia whitish-ochreous, sometimes tinged with brownish. Hindwings light grey, tinged with whitish-ochreous; cilia whitish-ochreous.

Khasis, in April; two specimens.

Homaloxestis endocoma, n. sp.

♂. 19 mm. Head and thorax rather dark fuscous, face and antennæ light ochreous-yellowish. Palpi ochreous-yellowish, anterior edge of terminal joint dark fuscous. Abdomen whitish-fuscous. Posterior tibiæ light ochreous-yellowish. Forewings elongate, posteriorly dilated, costa slightly arched, sinuate in middle, apex obtuse, termen slightly sinuate, rather oblique; 8 and 9 out of 7; rather dark glossy fuscous; on undersurface with anterior half clothed with light ochreous-yellowish hairs, limited by a large transverse patch of very long curled hairs beyond middle, anteriorly light yellowish, posteriorly fuscous, above which is a longitudinal brush of dense dark fuscous hairs from beneath costa: cilia fuscous. Hindwings fuscous, towards costa posteriorly with modified scales tinged with whitish-ochreous, on anterior half of costa with fringe of very long dense ochreous-yellow hairs projecting beneath forewings; on undersurface with a broad median fascia of ochreous-yellow suffusion clothed with appressed hairs except towards lower extremity; cilia whitish-ochreous, on upper half of termen tinged with fuscous.

Nilgiris, 3,500 feet, in April (Andrewes); one specimen.

Homaloxestis ochrosceles, n. sp.

♀. 15 mm. Head fuscous, face pale fuscous mixed with whitish. Palpi pale fuscous, terminal joint whitish, anterior edge dark fuscous. Antennæ white. Thorax fuscous. Abdomen grey, beneath whitish-ochreous. Posterior tibiæ light ochreous-yellowish. Forewings elongate, costa slightly arched, apex obtuse, termen hardly sinuate, oblique; 8 and 9 out of 7; fuscous: cilia whitish-fuscous. Hindwings grey; cilia whitish-grey.

Peradeniya, Ceylon (Green); in July, one specimen. Immediately distinguished from *cholopis* by the yellow posterior tibiæ.

Homaloxestis galeodes, n. sp.

♂ ♀. 10-12 mm. Head, palpi, antennæ, thorax, and abdomen glossy whitish-ochreous. Forewings elongate, narrow, costa slightly arched, apex tolerably pointed, termen extremely obliquely rounded; 9 separate; glossy whitish-ochreous, tinged with fuscous: cilia whitish-ochreous. Hindwings grey; cilia whitish-ochreous.

Khasis, in October; thirteen specimens.

Homaloxestis cribanota, n. sp.

♂ ♀. 13-16 mm. Head shining purple-fuscous, sides of crown ochreous-yellowish, face, palpi, and antennæ ochreous-whitish. Thorax fuscous, sometimes partially suffused with ochreous-yellowish. Abdomen in ♂ whitish-ochreous, hairy above, in ♀ fuscous. Forewings elongate, rather narrow, costa slightly arched, apex obtuse, termen extremely obliquely rounded; 9 separate; glossy fuscous: cilia whitish-fuscous. Hindwings grey; cilia whitish-ochreous more or less infuscated.

Khasis, in July and August; Gooty (Campbell); eighteen specimens.

Homaloxestis melicrata, n. sp.

♂. 14-15 mm. Head ochreous-yellow. Palpi pale ochreous-yellowish, lower half of second joint and anterior edge of terminal joint dark fuscous. Antennæ ochreous-yellow spotted with dark fuscous, with a dark fuscous band just below apex. Thorax ochreous-yellow more or less tinged with brownish. Abdomen pale ochreous. Forewings elongate, rather narrow, costa slightly arched, apex obtuse, termen very obliquely rounded; 9 separate; deep ochreous-yellow; markings light brownish irrorated with dark fuscous; a spot on base of costa, and costal edge more or less suffused with dark fuscous irroration from this to $\frac{1}{3}$; an undefined cloudy fascia from $\frac{1}{3}$ of costa to middle of dorsum; a cloudy spot representing second discal stigma; a triangular patch on costa at $\frac{2}{3}$, whence an irregular fascia runs to tornus; an undefined patch on upper $\frac{2}{3}$ of termen, edged by a dark fuscous terminal line: cilia ochreous-yellow. Hindwings whitish-ochreous tinged with grey; cilia whitish-ochreous.

Khasis, in August; three specimens.

Homaloxestis turbinata, n. sp.

♂. 13 mm. Head and thorax ochreous-yellowish. Palpi ochreous-yellowish, lower half of second joint dark fuscous. Antennæ yellowish spotted with dark fuscous. Abdomen grey, sides and anal tuft whitish-ochreous. Forewings elongate, costa anteriorly gently arched, apex obtuse, termen rounded, rather strongly oblique; 9 separate; ochreous-yellow, with some scattered dark fuscous scales; a small dark fuscous spot on base of costa; plical and first discal stigmata represented by small nearly adjacent dark fuscous spots, former slightly anterior; a triangular dark fuscous blotch on costa about $\frac{2}{3}$, its apex produced and reaching $\frac{3}{4}$ across wing; a cloudy dark fuscous streak along upper $\frac{3}{4}$ of termen: cilia

ochreous-yellow, above apex with a dark fuscous bar. Hindwings pale ochreous-yellowish; a dark grey streak along termen, on lower half more broadly suffused with lighter grey, and connected with an oblique dark grey linear mark on transverse vein; cilia pale yellowish.

Khasis, in June; two specimens.

Lecithocera, H. S.

Head with appressed scales; ocelli absent; tongue developed. Antennæ 1 or over 1, more or less thickened towards base, in ♂ simple, basal joint moderate, without pecten. Labial palpi long, recurved, second joint thickened with appressed scales, terminal joint as long as second or longer, slender, acute, or seldom in ♂ obtuse. Maxillary palpi very short, filiform, appressed to tongue. Posterior tibiæ clothed with hairs above. Forewings with 3 out of 2 or seldom absent, 4 seldom out of 2 or sometimes stalked with 5, 7 to apex or termen, 8 and usually 9 out of 7, or seldom 8 and 9 stalked, 7 absent, 11 from middle. Hindwings 1 or somewhat over 1, trapezoidal, termen hardly sinuate, cilia $\frac{2}{3}$—$\frac{1}{1}$; 3 and 4 connate or stalked or sometimes coincident, 5 rather approximated, 6 and 7 stalked.

Type *L. luticyrnella*, ♂ H. S. There has been much confusion about the specific identity of the type of this genus, but I now find the original description of Herrich-Schaeffer correct in every particular. The generic names *Tirizæ*, Walk., *Thubana*, Walk., *Tiva*, Walk., *Inapha*, Walk., *Patouissa* Walk., *Adelomorpha*, Snell., and *Macrotona*, Meyr. are synonyms of this.

Lecithocera hullulata, n. sp.

♂. 17 mm. Head ochreous-white. Palpi white, second joint infuscated on lower half. Antennæ whitish. Thorax whitish, posteriorly infuscated, marked with dark fuscous on anterior edge. Abdomen ochreous-whitish mixed with fuscous. Forewings elongate, costa gently arched, apex round-pointed, termen gently concave, oblique; 3 and 4 out of 2, 8 and 9 out of 7; ochreous-whitish, suffused with pale brownish except a triangular blotch on middle of costa reaching half across wing, and an undefined transverse patch before termen; a small costal mark of dark fuscous suffusion on each side of costal blotch, and a transverse-crescentic dark fuscous mark adjoining its apex posteriorly; a bar of fuscous suffusion near base, some fuscous irroration in disc and towards dorsum before middle, and a cloudy streak of fuscous suffusion along termen: cilia ochreous-whitish, with two fuscous shades. Hindwings rather dark fuscous, lighter and ochreous-tinged towards apex; a round dark fuscous spot in middle of disc, edged anteriorly by a white spot; some slight irregular whitish suffusion towards termen; cilia as in forewings, but shades less defined and tending to be interrupted.

Khasis, in November; one specimen.

Lecithocera cupatris, n. sp.

♀. 18-19 mm. Head white, back of crown tinged with ochreous. Palpi white, anterior edge of terminal joint dark fuscous. Antennæ

ochreous-whitish, indistinctly spotted with grey towards base. Thorax yellow-ochreous, suffusedly marked with white anteriorly. Abdomen pale ochreous mixed with grey. Forewings elongate, costa gently arched, apex obtuse, termen sinuate, oblique; 2 and 3 long-stalked, 8 and 9 out of 7; bright yellow-ochreous; an ill-defined transverse white line near base: a sinuate white transverse line somewhat before middle; space between these two lines occupied except towards costa by a suffused blackish blotch, more or less sprinkled posteriorly with blue-whitish; three white marks on posterior half of costa, sometimes confluent; a crescentic white mark in disc beyond middle; a blotch of dark fuscous suffusion extending over dorsal half of wing from antemedian line to near termen: cilia light ochreous-yellow. Hindwings light grey, becoming pale ochreous-yellowish towards apex; cilia whitish-yellowish.

Khasis, in September and October; two specimens.

Lecithocera sinuosa, n. sp.

♂ ♀. 9-10 mm. Head and thorax light glossy grey. Palpi whitish-ochreous. Antennæ light ochreous-yellowish spotted with dark grey. Abdomen whitish-grey, anal tuft ochreous-whitish. Forewings elongate, costa gently arched, apex obtuse, termen very obliquely rounded; 2 and 3 stalked, 8 and 9 out of 7; light glossy grey, with a slight purplish tinge; a narrow rather inwards-curved pale ochreous-yellowish fascia from ⅔ of costa to tornus: cilia light grey. Hindwings with 3 absent (coincident with 4); light grey; cilia pale grey.

Maskeliya and Matale, Ceylon (Pole); from February to August, six specimens.

Lecithocera oxycona, n. sp.

♂ ♀. 11 mm. Head whitish-ochreous, face and in ♀ centre of crown fuscous. Palpi whitish-ochreous, second joint and anterior edge of terminal joint dark fuscous. Antennæ ochreous-whitish, in ♂ much thickened towards base. Thorax rather dark fuscous, anteriorly and on patagia ochreous-whitish. Abdomen whitish-fuscous, anal tuft whitish-ochreous. Forewings elongate, costa gently arched, apex obtuse, termen rounded, rather strongly oblique; 2 and 3 stalked, 8 and 9 out of 7; rather dark fuscous, somewhat pale-sprinkled; a broad whitish-ochreous costal streak from base to about ⅔, attenuated to a point posteriorly; discal stigmata cloudy, dark fuscous: cilia grey, sprinkled with dark fuscous near base. Hindwings grey; cilia ochreous-whitish, tinged with grey towards base.

N. Coorg, 3,500 feet (Newcome); Gooty (Campbell); Konkan (Young); in June, three specimens.

Lecithocera itrinea, n. sp.

♂. 12-13 mm. Head purple-fuscous, sides yellow-ochreous. Palpi fuscous, more or less wholly suffused with yellow-ochreous. Antennæ yellowish, spotted with dark fuscous, thickened towards base. Thorax

fuscous. Abdomen light fuscous, anal tuft ochreous-yellowish. Forewings elongate, costa gently arched, apex obtuse, termen nearly straight, oblique; 2 and 3 stalked, 8 and 9 out of 7; brownish, irrorated with dark fuscous; stigmata very cloudy, dark fuscous, plical hardly marked, second discal sometimes forming a transverse mark: cilia light brownish, with two indistinct darker fuscous shades, base pale. Hindwings light fuscous; cilia whitish-fuscous.

N. Coorg, 3,500 feet (Newcome); Ceylon (without further record); from June to September, nine specimens.

Lecithocera semirupta, n. sp.

♀. 16 mm. Head and thorax dark fuscous. Palpi yellowish-fuscous. Antennæ yellowish spotted with dark fuscous, towards base thickened and suffused with dark fuscous. Abdomen fuscous. Forewings elongate, costa slightly arched, apex round-pointed, termen slightly sinuate, rather strongly oblique; 2 and 3 stalked, 8 and 9 out of 7; rather dark ashy-fuscous; stigmata dark fuscous, plical beneath first discal, second discal connected with dorsum by a dark fuscous bar: cilia rather dark fuscous. Hindwings grey; cilia light grey.

Khasis, in October; one specimen.

Lecithocera omphacias, n. sp.

♂. 12 mm. Head purplish-grey, sides of crown whitish-ochreous. Palpi whitish, second joint except apex, and anterior edge of terminal joint dark fuscous. Antennæ ochreous-whitish, indistinctly spotted with grey. Thorax and abdomen grey mixed with darker, anal tuft greyish-ochreous. Forewings elongate, costa slightly arched, apex obtuse, termen very obliquely rounded; 2 and 3 stalked, 8 and 9 out of 7; grey, irrorated with dark fuscous; second discal stigma represented by a cloudy dark fuscous transverse mark: cilia grey. Hindwings grey; cilia pale grey.

Madulsima, Ceylon, in May (Fletcher); one specimen.

Lecithocera mazina, n. sp.

♂. 14 mm. Head brownish-ochreous, sides of crown paler and yellowish-tinged. Palpi pale ochreous-yellowish, second joint tinged with fuscous anterior edge of terminal joint fuscous. Antennæ whitish-ochreous spotted with fuscous. Thorax fuscous. Abdomen light fuscous. Forewings elongate, somewhat dilated posteriorly, costa slightly arched, apex obtuse, termen somewhat rounded, oblique; 2 and 3 short-stalked, 7 absent, 8 and 9 stalked; light greyish-ochreous closely irrorated with fuscous: cilia light greyish-ochreous mixed with fuscous. Hindwings pale fuscous; cilia grey-whitish.

Simla, in July; one specimen.

Lecithocera ichorodes, n. sp.

♂. 15 mm. Head fuscous, sides of crown ochreous-yellow. Palpi dark fuscous, terminal joint ochreous-whitish except anterior edge. Antennæ

whitish-ochreous. Thorax fuscous mixed with darker. Abdomen grey-whitish, laterally suffused with blackish on posterior half. Forewings elongate, rather narrow, posteriorly somewhat dilated, costa slightly arched, apex obtuse, termen straight, oblique; 2 and 3 stalked, 8 and 9 out of 7; fuscous mixed with dark fuscous; all veins indicated by cloudy whitish-fuscous streaks; costal edge whitish-fuscous except towards base; discal stigmata cloudy, dark fuscous: cilia whitish-fuscous mixed with darker fuscous. Hindwings pale grey, darker towards apex; cilia ochreous-grey-whitish.

Nilgiris, 6,000 feet, in May (Andrewes); one specimen.

Lecithocera proclivis, n. sp.

♀. 16-17 mm. Head brownish, sides of crown ochreous. Palpi pale ochreous, terminal joint whitish-ochreous with dark fuscous anterior edge. Antennæ whitish-ochreous. Thorax brownish. Abdomen pale fuscous. Forewings elongate, rather narrow, costa slightly arched, apex obtuse, termen rounded, rather strongly oblique; 3 absent (coincident with 2), 8 and 9 out of 7; brown sprinkled with dark fuscous; discal stigmata dark fuscous, second connected with dorsum by a small patch of dark fuscous irroration: cilia pale brownish, with two indistinct fuscous lines. Hindwings grey; cilia ochreous-whitish, sometimes tinged with brownish.

Nilgiris, 6,000 feet, in May (Andrewes); two specimens.

Lecithocera autologa, n. sp.

♀. 14 mm. Head, palpi, antennæ, thorax, and abdomen fuscous; antennæ suffused above with dark fuscous towards base. Forewings elongate, costa anteriorly gently arched, apex obtuse, termen faintly sinuate, oblique; 2 and 3 stalked, 8 and 9 out of 7; fuscous, irrorated with dark fuscous; discal stigmata dark fuscous; cilia pale fuscous, with traces of darker shades. Hindwings grey; cilia pale fuscous.

Madulsima, Ceylon, in May (Vaughan); one specimen.

Lecithocera metavausta, n. sp.

♂ ♀. 13-15 mm. Head and thorax brownish with prismatic-violet reflections, sides of crown yellow-ochreous. Palpi ochreous-yellowish, anterior edge of terminal joint dark fuscous. Antennæ ochreous-yellowish spotted with fuscous, in ♀ roughened towards base. Abdomen pale ochreous, in ♀ sometimes infuscated. Forewings elongate, costa gently arched, apex obtuse, termen hardly sinuate, oblique; 2 and 3 stalked, 8 and 9 out of 7; yellow-ochreous, suffusedly sprinkled with brown or dark fuscous; base of costa more or less suffused with dark fuscous; discal stigmata dark fuscous; sometimes a transverse mark of dark fuscous suffusion between second discal and dorsum; a dark fuscous patch along termen from apex, more or less narrowed downwards and not reaching tornus: cilia fuscous mixed with dark fuscous, above apex ochreous-yellowish. Hindwings pale grey or in ♀ sometimes grey; cilia ochreous-whitish, more or less tinged with grey.

Khasis, from October to March; eight specimens.

Lecithocera aulias, n. sp.

♂ ♀. 12-14 mm. Head yellow-ochreous, crown in ♀ centrally tinged with purple-fuscous. Palpi yellow-ochreous, terminal joint whitish-ochreous with dark fuscous anterior edge. Antennæ ochreous-yellowish spotted with dark fuscous. Thorax ochreous, shoulders suffused with dark fuscous. Abdomen pale ochreous. Forewings elongate, costa gently arched, apex obtuse, termen straight, rather strongly oblique; 2 and 3 stalked, 7 and 8 stalked, 9 approximated or connate or out of 7 near base; in ♂ whitish-ochreous, thinly sprinkled with dark fuscous, costal edge ochreous-yellow, in ♀ ochreous-yellowish, more strongly sprinkled with fuscous and dark fuscous; costa suffused with dark fuscous towards base; discal stigmata black, second connected with dorsum by a transverse variable patch of dark fuscous suffusion: cilia ochreous-yellowish. Hindwings, with 3 absent (coincident with 4); light grey; cilia whitish-ochreous.

Khasis, in March and from July to October; four specimens.

Lecithocera hemichrysa, n. sp.

♂ ♀. 19-20 mm. Head dark shining purple-bronze, sides of crown ochreous-yellowish. Palpi in ♂ with second joint rather short, terminal joint twice as long, flatly dilated and somewhat hollowed internally on upper half, obtuse, fuscous, internally pale yellowish; in ♀ normal, yellowish-fuscous, terminal joint pale yellowish with anterior edge dark fuscous. Antennæ and thorax dark fuscous. Abdomen fuscous. Forewings elongate, somewhat dilated posteriorly, costa slightly arched, apex obtuse, termen hardly sinuate, rather oblique; 2 and 5 stalked, 7 and 8 stalked; pale ochreous-yellowish, irregularly irrorated with dark fuscous; costal edge suffused with dark fuscous from base to ⅔; discal stigmata represented by small dark fuscous spots, second lying on an oblique transverse line of dark fuscous suffusion forming triangular suffused spots on margins; beyond this all veins marked with strong dark fuscous lines; a strong black line round apex and termen: cilia deep ochreous-yellow, outer half metallic golden-bronze. Hindwings grey, tinged with pale yellowish towards apex, veins darker grey; cilia pale ochreous-yellowish, deeper, towards base.

Khasis, in April; two specimens. This distinct species has a superficial resemblance to some forms of *Timyra*, and the modification of the palpi in ♂ also suggests relationship; it is however a true *Lecithocera*, but may really indicate the genetic origin of *Timyra*.

Lecithocera crebrata, n. sp.

♂ ♀. 18 mm. Head glossy dark purple-fuscous, sides of crown ochreous-yellow, face more or less whitish-ochreous. Palpi whitish-ochreous, second joint sprinkled with blackish, anterior edge of terminal joint blackish. Antennæ dark fuscous, beneath pale ochreous-yellowish.

Thorax dark fuscous, in ♂ mixed with pale yellowish. Abdomen light ochreous-yellowish, on sides mixed with dark fuscous, in ♂ posteriorly with lateral tufts of scales on margins of segments. Posterior tibiæ light ochreous-yellowish. Forewings elongate, posteriorly slightly dilated, costa gently arched, apex obtuse, termen rather obliquely rounded; 2 and 3 stalked, 4 and 5 stalked, 8 and 9 out of 7; pale ochreous-yellowish, in ♂ irregularly irrorated with fuscous and blackish, in ♀ almost concealed with dense purple-blackish irroration; discal stigmata represented by cloudy round purple-blackish spots, their lower extremities connected in ♀ by a streak of pale ground colour: cilia light ochreous-yellowish, in ♂ slightly sprinkled, in ♀ mixed with dark fuscous. Hindwings in ♂ pale ochreous-yellowish, in ♀ rather dark fuscous; in ♂ with a downwards-directed fringe of dense ochreous-yellow hair-scales along lower margin of cell, longest in middle; cilia in ♂ pale yellowish, in ♀ fuscous.

N. Coorg, 3,500 feet, in May (Newcome); two specimens.

Lecithocera choritis, n. sp.

♀. 21-23 mm. Head pale yellow-ochreous. Palpi whitish-ochreous, second joint suffusedly irrorated with dark fuscous except at apex, anterior edge of terminal joint dark fuscous. Antennæ whitish-ochreous dotted with dark fuscous, towards base suffused above with dark fuscous. Thorax rather light purplish-fuscous. Abdomen pale yellow-ochreous. Forewings elongate, slightly dilated posteriorly, costa gently arched, apex obtuse, termen nearly straight, oblique; 2 and 3 stalked, 4 and 5 stalked, 8 and 9 out of 7; pale ochreous-yellowish, irregularly and variably irrorated with purplish-fuscous and dark fuscous; discal stigmata represented by round dark purplish-fuscous spots, connected by a central elongate patch of pale ground colour: cilia pale ochreous-yellowish, with traces of two fuscous shades. Hindwings grey: cilia whitish-ochreous, round apex with two faint fuscous lines.

Palni Hills, 6,000 feet (Campbell); Nilgiris, 6,000 feet (Andrewes); in May, three specimens.

Lecithocera epigompha, n. sp.

♂. 20 mm. Head and thorax brownish-ochreous. Palpi whitish-ochreous, second joint suffusedly irrorated with dark fuscous. Antennæ ochreous-fuscous. Abdomen pale ochreous. Forewings elongate, posteriorly dilated, costa slightly arched, apex obtuse, termen nearly straight, rather oblique; 2 and 3 stalked, 7 and 8 stalked; pale brownish-ochreous, suffusedly irrorated with fuscous except towards costa; base of costa suffused with fuscous; a blackish dot beneath costa near base; stigmata represented by rather large irregular subquadrate blackish spots, plical slightly before first discal and almost connected with it, second discal united with a similar spot beneath it to form a transverse spot; a pale somewhat curved subterminal line indicated by marginal bands of fuscous

suffusion: cilia whitish-ochreous with two light fuscous shades. Hindwings grey; cilia as in forewings.

Maskeliya, Ceylon, in April (Vaughan); one specimen. Allied to *trigonopis*, but broader-winged, and vein 9 of forewings separate.

Lecithocera homocentra, n. sp.

♂. 17-19 mm. Head and thorax whitish-ochreous. Palpi whitish-ochreous, second joint fuscous except apex, anterior edge of terminal joint dark fuscous. Antennæ whitish-ochreous, spotted with dark fuscous. Abdomen whitish-ochreous, more or less sprinkled with grey, anal tuft ochreous-yellowish. Forewings elongate, posteriorly dilated, costa gently arched, apex obtuse, termen almost straight, oblique; 2 and 3 stalked, 8 and 9 out of 7; pale brownish-ochreous, sometimes tinged with fuscous, especially towards base of dorsum, sometimes partially sprinkled with fuscous; discal stigmata rather large, blackish, plical sometimes indicated by some dark fuscous scales beneath first discal, often absent; a cloudy transverse mark of dark fuscous scales beneath second discal; a series of small dark fuscous dots round posterior part of costa and termen: cilia whitish-ochreous tinged with brownish. Hindwings and cilia whitish-ochreous.

Maskeliya, Ceylon, in July (Pole); six specimens.

Lecithocera ocalea, n. sp.

♂. 16 mm. Head pale ochreous, crown suffused with pale purplish-fuscous. Palpi pale ochreous, lower half of second joint dark fuscous. Antennæ whitish-ochreous. Thorax pale ochreous, shoulders narrowly blackish. Abdomen pale ochreous. Forewings elongate, rather narrow, posteriorly slightly dilated, costa slightly arched, apex obtuse, termen hardly sinuate, oblique; 2 and 3 stalked, 8 and 9 out of 7; brownish-ochreous; a small blackish spot on base of costa; a triangular dark fuscous blotch extending along anterior half of dorsum, its apical half black, apex formed by first discal stigma; second discal stigma represented by a transverse-oblong black spot; a nearly straight pale subterminal line indicated by strong blackish anterior margin, broadly suffused anteriorly with fuscous, which extends on lower half to dorsal blotch; some slight fuscous suffusion towards termen, and a rather dark fuscous cloudy terminal line: cilia light brownish-ochreous, with faint fuscous subbasal shade. Hindwings pale fuscous; cilia whitish-ochreous.

N. Coorg, 3,500 feet, in June (Newcome); one specimen.

Onebala, Walk.

Head with appressed scales; ocelli absent; tongue developed. Antennæ $\frac{1}{2}$—1, in ♂ minutely or sometimes moderately or strongly ciliated, basal joint elongate, without pecten. Labial palpi very long, recurved, second joint thickened with appressed scales, terminal joint usually longer than second or sometimes equal, slender, acute. Maxillary palpi very short,

filiform, appressed to tongue. Posterior tibiæ clothed with rough scales above. Forewings with 2 and 3 stalked or coincident, 4 and 5 separate or connate or stalked or coincident, 7 to apex, 8 and 9 out of 7 or seldom, 7 absent, 8 and 9 stalked, 11 from middle. Hindwings rather over 1, trapezoidal, termen slightly sinuate, cilia $\frac{1}{3}$—1; 3 absent, 4 and 5 connate or stalked or seldom coincident, 6 and 7 stalked.

Type *blandiella*, Walk., *Antiochtha*, Meyr., *Styloceros*, Meyr., and *Organitis*, Meyr., cannot be maintained as distinct, and must be merged in *Onebala*, of which the neuration varies considerably, as in the other allied genera. Four of Walker's species, *amicella*, *blandiella*, *cælatella*, and *agnatella* are referable here; I have described six others, *cremnaspis*, *tetradelta*, *stellulata*, *achnastis*, *balbidota*, and *characopa*, and now add twenty-three more.

Onebala scopulosa, n. sp.

♂ ♀. 14-15 mm. Head and thorax light greyish-ochreous, sides of crown white or sometimes head wholly whitish, shoulders narrowly dark fuscous. Palpi ochreous-grey, apex of second joint white, terminal joint longer than second, white with base and anterior edge blackish. Antennæ white, sharply ringed with dark fuscous, basal joint white lined with black. Abdomen greyish. Forewings elongate, narrow, costa slightly arched, faintly sinuate in middle, apex obtuse, termen faintly sinuate, oblique; 3 absent, 5 absent, 8 and 9 out of 7; ochreous-grey, sometimes much suffused with whitish, especially towards costa; a small blackish mark on base of costa; a rounded-triangular blackish blotch edged with whitish extending on dorsum from $\frac{1}{7}$ to beyond middle, and reaching $\frac{1}{2}$ across wing; an oblique black white-edged strigula from middle of costa; a rounded triangular dark fuscous blotch crossing wing posteriorly, its base formed by a whitish line from $\frac{5}{6}$ of costa to tornus, its lower side margined by a curved whitish line preceded by a blackish line, of which the extremity is somewhat enlarged to indicate second discal stigma, edged anteriorly with whitish on transverse vein; a black line on apical portion of costa: cilia on costa whitish-ochreous, on termen with successive fourths from base whitish-ochreous, brownish, whitish and light grey. Hindwings grey, darker posteriorly; cilia grey.

N. Coorg, 3,500 feet (Newcome); in July, October and November, four specimens.

Onebala clerodotis, n. sp.

♂ ♀. 13-14 mm. Head and thorax light bronzy-fuscous, with a whitish line above eyes. Palpi bronzy-fuscous, terminal joint longer than second, whitish posteriorly. Antennæ white lined throughout with black. Abdomen grey. Forewings elongate, rather narrow, costa gently arched, faintly sinuate in middle, apex obtuse, termen faintly sinuate, oblique; 3 absent, 4 and 5 stalked, 8 and 9 out of 7; fuscous, with a few dark fuscous scales

a small blackish spot on base of costa; a rounded-transverse blackish-fuscous blotch extending on dorsum from $\frac{1}{4}$ to $\frac{1}{2}$ and reaching $\frac{2}{3}$ across wing, partially whitish-edged; an oblique blackish mark on costa before middle, edged with ochreous-whitish; a curved-transverse blackish-fuscous mark on transverse vein, edged with ochreous-whitish; a moderate blackish-fuscous fascia adjacent to this posteriorly, edged posteriorly by an ochreous-whitish line from $\frac{2}{3}$ of costa to tornus; a black marginal line round apex: cilia whitish-fuscous, base before a broad fuscous shade whitish-ochreous. Hindwings rather dark grey; cilia grey.

Kandy and Maskeliya, Ceylon (Green, Alston); from July to October, four specimens.

Onebala causidica, n. sp.

♀. 20 mm. Head and thorax pale ochreous-bronzy, with a white line above eyes, shoulders fuscous. Palpi ochreous-fuscous, apex of second joint and base of terminal suffused with whitish, terminal joint longer than second, anterior edge dark fuscous. Antennæ white, basal $\frac{2}{3}$ lined or partially spotted with blackish, apical third wholly white. Abdomen fuscous, apex ochreous-yellowish. Middle tibiæ white with dark fuscous basal and supramedian rings, posterior tibiæ dark fuscous with white apical and subapical rings. Forewings elongate, rather narrow, costa slightly arched, faintly sinuate in middle, apex obtuse, tornen concave, rather oblique; 3 absent, 4 and 5 connate, 8 and 9 out of 7; fuscous sprinkled with whitish, basal and costal areas more or less wholly suffused with whitish-ochreous; a blackish-fuscous spot on base of costa; two large trapezoidal blackish-fuscous blotches edged with whitish, first extending on dorsum from $\frac{1}{6}$ to middle, one angle almost reaching costa at $\frac{1}{2}$, the other on submedian fold, second blotch with its anterior angles adjacent to a curved blackish-fuscous whitish-edged spot on transverse vein, posterior angles resting on costa at $\frac{2}{3}$ and dorsum before tornus: cilia whitish-ochreous, with a fuscous shade. Hindwings rather dark grey; cilia light greyish-ochreous, with grey subbasal shade.

Khasis, in April; two specimens.

Onebala ocreata, n. sp.

♀. 22 mm. Head and thorax light bronzy-fuscous, sides of crown whitish-ochreous, shoulders purplish-fuscous. Palpi fuscous, apex of second joint ochreous, terminal joint longer than second, dark fuscous, posteriorly ochreous-whitish. Antennæ white, spotted with dark fuscous, basal joint lined with dark fuscous. Abdomen fuscous, apex ochreous-yellow. Middle tibiæ ochreous-white, base dark fuscous, posterior tibiæ dark fuscous, apex ochreous-white. Forewings elongate, rather narrow, posteriorly slightly dilated, costa slightly arched, apex round-pointed, tornen concave, rather oblique; 2 and 3 long-stalked, 4 and 5 connate, 8 and 9 out of 7; fuscous sprinkled with whitish; costal edge whitish-ochreous, on basal

fourth dark fuscous, with a small blackish-fuscous basal spot; a very large blackish-fuscous triangular blotch edged with whitish extending on dorsum from near base to beyond middle, and nearly reaching costa at $\frac{2}{3}$; two connected small round dark fuscous spots on transverse vein, edged with whitish; a large rounded blackish-fuscous blotch immediately beyond this, connected by short bars with costa at $\frac{5}{6}$ and dorsum before tornus, edged with whitish; a blackish line round apex and termen: cilia whitish-ochreous, on termen with a fuscous shade, above apex with a fuscous patch. Hindwings fuscous; cilia light fuscous, base whitish-ochreous.

Palni Hills (Campbell); one specimen.

Onebala horistis, n. sp.

♂. 21 mm. Head bronzy-fuscous, with a white line above eyes. Palpi fuscous, second joint suffused with whitish-ochreous on apical half, apex white, terminal joint longer than second, dark fuscous, posteriorly whitish. Antennæ white lined with dark fuscous. Thorax blackish-fuscous, patagia whitish-ochreous except shoulders. Abdomen fuscous, anal tuft pale ochreous. Middle tibiæ dark fuscous with basal, median, and apical white spots, posterior tibiæ dark fuscous with apex whitish. Forewings elongate, rather narrow, posteriorly somewhat dilated, costa slightly arched, apex obtuse, termen sinuate, somewhat oblique; 2 and 3 long-stalked, 4 and 5 connate, 8 and 9 out of 7; blackish-fuscous; costal area above a line running from base of dorsum to $\frac{4}{5}$ of costa whitish-ochreous, within this basal third of costa suffused with dark fuscous, rest of costal edge ochreous-orange; a slender whitish-ochreous streak running from this pale costal area in middle of wing to dorsum near tornus; a slightly irregular white line from costa near apex to tornus; some cloudy white submarginal dots round apex and termen, and a black marginal line; cilia whitish-ochreous, towards base ochreous-yellow limited by a brownish shade, above apex with a fuscous patch. Hindwings fuscous, towards base paler and yellowish-tinged; cilia pale brownish, towards base ochreous-yellowish.

Khasis, in July; one specimen.

Onebala balanitis, n. sp.

♂ ♀. 26-27 mm. Head and thorax light fuscous, sides of crown pale greyish-ochreous. Palpi whitish-ochreous, second joint suffused with dark fuscous except towards apex. Antennæ whitish-ochreous. Abdomen pale ochreous. Forewings elongate, rather narrow, posteriorly slightly dilated, costa slightly arched, faintly sinuate towards middle, apex round-pointed, termen sinuate, rather oblique; 2 and 3 long-stalked, 4 and 5 connate, 8 and 9 out of 7; fuscous partially tinged with whitish-ochreous; a small blackish-fuscous spot on base of costa; a blackish-fuscous blotch extending along dorsum from $\frac{1}{3}$ to $\frac{5}{6}$, anteriorly rounded and reaching half across wing, narrowed to a point posteriorly, edged with ochreous-whitish; first discal stigma indicated by a small round blackish-fuscous spot resting

on this; two blackish-fuscous dots on tranverse vein, partially whitish-edged; a blackish-fuscous triangular blotch with apex touching these dots, base rather near and parallel to termen, edged posteriorly by a band of whitish-ochreous suffusion; a dark fuscous terminal line: cilia light greyish-ochreous suffused anteriorly with fuscous. Hindwings fuscous, anteriorly paler and tinged with whitish-ochreous; cilia light brownish.

Palni Hills (Campbell); two specimens.

Onebala straminicornis, n. sp.

♂ ♀. 18-20 mm. Head and thorax purplish-bronzy-fuscous, with an ochreous line above eyes. Palpi pale ochreous-yellowish, second joint suffused with fuscous except towards apex, terminal joint longer than second, dark fuscous anteriorly. Antennæ whitish-ochreous. Abdomen fuscous, apex ochreous-yellowish. Middle tibiæ ochreous-yellowish, with dark fuscous basal and median bands; posterior tibiæ dark fuscous, apex yellowish. Forewings elongate, rather narrow, slightly dilated posteriorly, costa slightly arched, faintly sinuate in middle, apex round-pointed, termen concave, rather oblique; 3 absent, 4 and 5 short-stalked, 8 and 9 out of 7; rather dark purple-fuscous, in ♂ somewhat mixed with pale ochreous suffusion towards costal area between $\frac{1}{4}$ and $\frac{3}{4}$; a triangular blackish-fuscous blotch obscurely edged with pale ochreous, extending on dorsum from $\frac{1}{4}$ to middle, and reaching $\frac{2}{3}$ across wing; an indistinct small oblique blackish-fuscous mark on middle of costa; a narrow transverse blackish-fuscous spot on transverse vein, obscurely pale-edged, upper end enlarged; an indistinct slender pale ochreous line from $\frac{2}{3}$ of costa to dorsum before tornus, preceded by an undefined fascia of blackish-fuscous suffusion dilated in disc so as to reach preceding spot: cilia light ochreous-yellowish, with a broad fuscous antemedian shade, with fuscous patches at apex and tornus. Hindwings fuscous; cilia pale fuscous, base whitish-ochreous.

Maskeliya, Ceylon (Alston, de Mowbray), in April and October; two specimens.

Onebala figurata, n. sp.

♂. 17-18 mm. Head and thorax light bronzy-fuscous or ochreous-bronze, with white line above eyes. Palpi fuscous, second joint whitish towards apex, terminal joint longer than second, whitish with dark fuscous anterior line. Antennæ white, ringed and lined with blackish. Abdomen whitish-ochreous. Middle tibiæ white with dark fuscous basal and median bands, posterior tibiæ fuscous with apex whitish and dark fuscous subapical ring. Forewings elongate, rather narrow, slightly dilated posteriorly, costa gently arched, apex obtuse, termen almost straight, oblique; 3 absent, 4 and 5 short-stalked, 8 and 9 out of 7; light fuscous, slightly purplish-tinged, more or less suffused with whitish-ochreous on costal half; a small spot of dark fuscous suffusion on base of costa; a fascia-form blackish-fuscous spot from dorsum before middle, reaching $\frac{2}{3}$ across wing; a short

dark fuscous oblique streak on costa before middle; a slender sometimes interrupted dark fuscous pale-edged mark on transverse vein; a somewhat incurved whitish-ochreous line from ¾ of costa to tornus, edged anteriorly by more or less dark fuscous suffusion; a dark fuscous interrupted line round apex and termen: cilia whitish-ochreous, becoming ochreous-yellow towards base, with a fuscous antemedian shade, at apex and tornus with patches of fuscous suffusion. Hindwings light fuscous tinged with ochreous; cilia whitish-ochreous, on upper part of termen with a light fuscous shade.

Maskeliya, Ceylon (Pole, Green); in June, July, December and January; five specimens.

Onebala caduca, n. sp.

♂♀. 14-15 mm. Head and thorax pale ochreous, with a whitish line above eyes. Palpi dark grey tinged with yellowish, apex of second joint whitish, terminal joint longer than second, whitish, anterior edge dark fuscous. Antennæ white ringed with black, near base lined with black. Abdomen grey, anal tuft pale ochreous. Middle tibiæ white with basal and median dark fuscous bands; posterior tibiæ dark fuscous with whitish apical and ante-apical rings. Forewings elongate, rather narrow, posteriorly slightly dilated, costa slightly arched, faintly sinuate in middle, apex obtuse, termen sinuate, oblique; 3 absent, 4 and 5 stalked, 8 and 9 out of 7; whitish-ochreous; a blackish-fuscous mark along costa at base; a very oblique trapezoidal blackish-fuscous blotch extending on dorsum from near base to ⅓, and reaching rather beyond fold, in ♂ reduced to an elongate spot above fold; a very oblique black strigula from costa before middle; a blackish-fuscous pale-edged mark on transverse vein, upper end enlarged, in ♀ surrounded with some undefined fuscous suffusion; a somewhat sinuate ochreous-whitish line from ⅔ of costa to tornus, edged anteriorly with dark fuscous suffusion enlarged in disc into a triangular patch almost reaching preceding mark; a blackish line round apex and termen: cilia whitish-ochreous, on basal third ochreous-yellowish. Hindwings light grey, tinged with yellowish; cilia as in forewings.

Khasis, in July; two specimens.

Onebala periastra, n. sp.

♂. 17-18 mm. Head ochreous-whitish, crown suffusedly mixed with dark fuscous. Palpi ochreous-whitish, second joint suffusedly irrorated with dark fuscous on lower ½, terminal joint with more or less indicated line of blackish scales on each side. Antennæ ochreous-whitish. Thorax rather dark purplish-fuscous, apex of patagia ochreous-whitish. Abdomen ochreous-whitish. Forewings elongate, rather narrow, posteriorly slightly dilated, costa slightly arched, apex obtuse, termen concave, oblique; 3 absent, 4 and 5 connate, 8 and 9 out of 7; dark purplish-fuscous, base of scales pale; stigmata represented by small round whitish spots plical slightly beyond

first discal; small whitish spots on costa at $\frac{2}{3}$ and before $\frac{3}{4}$; whitish dots on dorsum at $\frac{1}{4}$ and towards tornus, latter sometimes connected with second costal spot by a curved series of three or four small whitish dots: cilia dark purple-fuscous, with rows of whitish specks, on basal third slenderly barred with ochreous-whitish, extreme base ochreous-whitish. Hindwings ochreous-whitish tinged with grey: cilia ochreous-whitish, with a faint grey shade.

Maskeliya, Ceylon (Pole); in February, May, July, November and December, nine specimens. Distinguishable from *stellulata* by the round white second discal stigma, represented in that species by a minute dot with a second dot below it.

Onebala oxyzona, n. sp.

♂ ♀. 10-12 mm. Head and thorax rather dark purplish-fuscous, sides of crown ochreous-yellowish. Palpi whitish-yellowish, second joint irrorated with dark fuscous except towards apex, terminal joint longer than second, with incomplete blackish line on each side. Antennæ ochreous-whitish. Abdomen grey, anal tuft whitish-ochreous? Forewings elongate, narrow, costa slightly arched, apex obtuse, termen sinuate, oblique; 3 absent, 4 and 5 connate, 8 and 9 out of 7; purple-fuscous, sprinkled with blackish; costal edge more or less yellowish; markings deep ochreous-yellowish; some undefined suffusion towards costa and fold about $\frac{1}{4}$; two narrow cloudy transverse fasciæ, first before middle, sinuate, second at $\frac{2}{3}$, interrupted in disc; a cloudy ring representing second discal stigma; two dots on costa posteriorly, and a line along termen: cilia dark purple-fuscous sprinkled with whitish points, basal third slenderly barred with yellowish. Hindwings with 4 absent (as well as 3); grey; cilia grey, sprinkled with whitish points.

Maskeliya and Matale, Ceylon (Pole); from February to April, and in August, eleven specimens.

Onebala vigilax, n. sp.

♂. 21-24 mm. Head and thorax whitish-ochreous or pale ochreous tinged with brownish, shoulders dark fuscous. Palpi whitish-ochreous, second joint more or less irrorated with blackish except towards apex, terminal joint longer than second, with an incomplete blackish line on each side. Antennæ light ochreous-yellowish, ciliations 1. Abdomen whitish-ochreous. Forewings elongate, rather narrow, posteriorly dilated, costa slightly arched, faintly sinuate in middle, apex obtuse, termen sinuate, oblique; 2 and 3 stalked, 4 absent, 8 and 9 out of 7; pale yellow-ochreous, partially tinged with brownish, and thinly sprinkled with dark fuscous or black; an undefined basal fascia of dark fuscous irroration; two undefined transverse shades of dark fuscous or blackish irroration, first from $\frac{1}{4}$ of costa to $\frac{1}{2}$ of dorsum, angulated on fold, second from $\frac{3}{4}$ of costa to $\frac{3}{4}$ of dorsum, obtusely angulated in disc, followed by a paler shade with a few white scales;

stigmata blackish, plical obliquely beyond first discal, these two placed on first transverse shade, second discal transverse, edged with a few white scales; a dark fuscous terminal line: cilia dark fuscous sprinkled with whitish points, basal third barred with whitish-ochreous, base whitish-ochreous. Hindwings pale whitish-ochreous, more or less tinged with fuscous, especially posteriorly; cilia whitish-ochreous, with two more or less developed fuscous shades.

Maskeliya and Patipola, Ceylon (Alston); in February and April, two specimens.

Onebala pselaphistis, n. sp.

♂ ♀. 14-18 mm. Head and thorax pale brownish-ochreous, face and sides of crown whitish-ochreous. Palpi ochreous-whitish, second joint tinged with fuscous, terminal joint longer than second, anterior edge blackish. Antennæ ochreous-whitish, indistinctly spotted with dark fuscous. Abdomen whitish-ochreous. Forewings elongate, rather dilated posteriorly, costa slightly arched, apex round-pointed, termen concave, oblique; 2 and 3 stalked, 4 and 5 separate, 8 and 9 out of 7; light brownish-ochreous, more or less infuscated posteriorly; stigmata small, cloudy, fuscous, plical rather beyond first discal, an additional dot beneath second discal; a faint curved fine ochreous-whitish line from ⅔ of costa to dorsum before tornus, more strongly marked towards costa: cilia light greyish-ochreous with two fuscous shades, tips whitish on termen. Hindwings grey more or less tinged with whitish-ochreous; cilia whitish-ochreous, sometimes with two faint fuscous shades.

Khasis, in May, August, October and November; five specimens.

Onebala molybdias, n. sp.

♂ ♀. 13-15 mm. Head and thorax fuscous, with a white line above eyes, face paler. Palpi fuscous, terminal joint longer than second, white, with anterior edge black. Antennæ white, ringed and near base lined with blackish. Abdomen grey. Forewings elongate, narrow, costa slightly arched, apex obtuse, termen slightly indented beneath apex, obliquely rounded; 2 and 3 stalked, 4 and 5 separate, 8 and 9 out of 7; brownish, sprinkled with dark fuscous; a bright leaden-metallic spot lying along upper part of termen, preceded by a transverse series of five small white marks edged posteriorly with some black scales; a black dot in apex: cilia light brownish, outer half whitish-grey, at apex with a fuscous projecting hook edged beneath with whitish. Hindwings rather dark grey; cilia grey, basal third sometimes ochreous-tinged.

Maskeliya, Ceylon (Alston, Pole); in February, May, June and from October to December; six specimens.

Onebala propensa, n. sp.

♂. 20 mm. Head ochreous-whitish, tinged with grey on crown. Palpi grey, second joint ochreous-whitish towards apex, terminal joint whitish

with anterior edge dark fuscous. Antennæ ochreous-whitish. Thorax grey. Abdomen whitish-yellowish. Forewings elongate, rather narrow, posteriorly slightly dilated, costa slightly arched, apex obtuse, termen almost straight, rather oblique; 3 absent, 4 and 5 stalked, 8 and 9 out of 7; grey, slightly violet-tinged, somewhat sprinkled with whitish; costal edge ochreous-whitish from $\frac{1}{3}$-$\frac{2}{3}$; a small oblique dark fuscous mark on costa at $\frac{2}{5}$, and a transverse spot of fuscous suffusion from dorsum opposite reaching half across wing, both edged posteriorly with whitish; discal stigmata dark fuscous, slightly whitish-edged, an additional similar dot beneath and slightly beyond second discal; an almost straight slender white line from $\frac{1}{2}$ of costa to dorsum before tornus; a black line round apex and termen: cilia whitish-ochreous, towards base more yellowish-tinged, with a fuscous antemedian shade. Hindwings grey tinged with ochreous-yellowish; cilia as in forewings.

Patipola, Ceylon (Alston); in April, one specimen.

Onebala byssina, n. sp.

♂. 19 mm. Head fuscous-whitish. Palpi greyish-ochreous, second joint suffused with whitish towards apex, terminal joint longer than second, whitish, anterior edge dark fuscous. Antennæ fuscous-whitish, spotted and near base lined with dark fuscous. Thorax whitish-fuscous. Abdomen pale whitish-yellowish. Forewings elongate, rather narrow, posteriorly somewhat dilated, costa slightly arched, apex obtuse, termen sinuate, oblique; 3 absent, 4 and 5 short-stalked, 8 and 9 out of 7; pale fuscous, sprinkled with dark fuscous; a small dark fuscous spot on base of costa; costal edge ochreous-whitish from $\frac{1}{3}$ to $\frac{4}{5}$; a small oblique blackish mark on costa at $\frac{2}{3}$; a small dark fuscous spot on dorsum at $\frac{1}{3}$; stigmata small, dark fuscous, plical rather obliquely beyond first discal, an additional dot beneath and slightly beyond second discal; a faintly incurved slender ochreous-whitish line from $\frac{2}{3}$ of costa to dorsum before tornus, edged anteriorly with rather dark fuscous suffusion; several dark fuscous marginal marks round apex and termen: cilia whitish-ochreous with several suffused fuscous lines, towards base more yellowish-tinged. Hindwings whitish-yellowish, apex and upper part of termen suffused with fuscous; cilia whitish-yellowish.

Maskeliya, Ceylon (Pole); in June, one specimen.

Onebala acrophanes, n. sp.

♂ ♀. 16-20 mm. Head and thorax bronzy-fuscous, face paler. Palpi fuscous, second joint suffused with ochreous-whitish towards apex, terminal joint longer than second, ochreous-whitish, anterior edge dark fuscous. Antennæ ochreous-whitish spotted and near base lined with dark fuscous. Abdomen whitish-ochreous, sometimes suffused with grey. Posterior tibiæ fuscous, apex whitish, with a dark fuscous subapical ring. Forewings elongate, rather narrow, somewhat dilated posteriorly, costa slightly

arched, apex obtuse, termen hardly sinuate; oblique; 3 absent, 4 and 5 short-stalked, 8 and 9 out of 7; rather dark fuscous, with a slight purplish gloss; an inwardly oblique cloudy darker shade from dorsum before middle, reaching $\frac{2}{3}$ across wing, often obsolete; second discal stigma cloudy, dark fuscous, also often obsolete; a fine line of whitish scales from $\frac{2}{3}$ of costa to tornus very indistinct except at extremities; an interrupted black line round apex and termen: cilia whitish-ochreous, base more ochreous, with a broad subbasal fuscous shade, above apex and beneath tornus with rather dark fuscous patches. Hindwings fuscous, tinged anteriorly with pale ochreous; cilia whitish-ochreous, with fuscous subbasal shade becoming obsolete on lower part of termen.

Maskeliya and Patipola, Ceylon, throughout the year (Pole, Alston); twelve specimens.

Onebala butyropa, n. sp.

♂. 14-17 mm. Head light ochreous-yellowish. Palpi pale ochreous-yellowish, lower half of second joint suffused with fuscous, anterior edge of terminal joint dark fuscous. Antennæ pale yellowish, ciliations 2. Thorax dark purplish-fuscous. Abdomen whitish-yellowish, sometimes tinged with grey. Forewings elongate, narrow, costa slightly arched, apex obtuse, termen nearly straight, oblique; 2 and 3 short-stalked, 4 absent, 8 and 9 out of 7; rather dark purplish-fuscous; basal area darker purplish-fuscous, its margin formed by an irregular line from $\frac{2}{3}$ of costa to $\frac{2}{3}$ of dorsum; stigmata cloudy blackish, indistinct, first discal lying on edge of this patch and plical rather obliquely before it; a pale ochreous-yellowish dot on costa at $\frac{2}{3}$: cilia dark fuscous, beneath tornus and towards costal dot with patches of pale ochreous-yellowish suffusion. Hindwings pale grey; cilia whitish-ochreous, with two fuscous shades.

Maskeliya, Ceylon (Pole); in January, three specimens.

Onebala justa, n. sp.

♂ ♀. 11-12 mm. Head grey, face ochreous-whitish. Palpi ochreous-whitish, second joint grey except towards apex. Antennæ rather stout, whitish. Thorax grey irrorated with dark fuscous. Abdomen grey. Middle tibiæ white; posterior tibiæ dark fuscous, apical half white. Forewings elongate, rather narrow, costa slightly arched, apex obtuse, termen slightly rounded, oblique; 2 and 3 short-stalked, 4 and 5 connate, 8 and 9 out of 7; grey closely irrorated with dark fuscous; small ochreous-whitish dots on costa at $\frac{1}{3}$ and tornus: cilia dark grey with rows of whitish points. Hindwings grey; cilia light grey.

Hambantota, Ceylon (Fletcher); in November, two specimens.

Onebala ardua, n. sp.

♂ ♀. 19-21 mm. Head and thorax purplish-bronze, sides of crown ochreous. Palpi dark fuscous, second joint ochreous-whitish towards apex, terminal joint longer than second, whitish posteriorly. Antennæ ochreous-

whitish. Abdomen greyish-ochreous. Middle tibiæ dark fuscous, extreme apex whitish; posterior tibiæ dark fuscous, hairs above whitish-ochreous or pale ochreous. Forewings elongate, somewhat dilated posteriorly, costa slightly arched, apex obtuse, termen sinuate, somewhat oblique; 3 absent, 4 and 5 separate, 8 and 9 out of 7; brown sprinkled with dark fuscous; stigmata cloudy, dark fuscous, plical beneath first discal, an additional dot beneath second discal; a small spot of dark fuscous suffusion on dorsum beneath plical stigma, and a dot beneath costa beyond first discal; a pale ochreous line from $\frac{2}{3}$ of costa to dorsum before tornus, indented at $\frac{1}{2}$; a series of blackish dots along posterior part of costa and termen: cilia light brown, on tornus with a fuscous subbasal shade. Hindwings and cilia grey.

Khasis, in May, July and September; four specimens.

Onebala elaphopis, n. sp.

♂ ♀. 18-20 mm. Head and thorax dark fuscous, sides of crown pale ochreous. Palpi dark fuscous, terminal joint as long as second, more or less whitish-ochreous posteriorly. Antennæ pale greyish-ochreous, ciliations in ♂ 2½. Abdomen grey, anal tuft greyish-ochreous. Forewings elongate, somewhat dilated posteriorly, costa gently arched, apex rounded-obtuse, termen almost straight, somewhat oblique; 2 and 3 stalked, 4 absent, 7 absent, 8 and 9 stalked; in ♂ an expansible pencil of hairs from base on undersurface covered by costa of hindwings; dark shining bronzy-brown; discal stigmata large, cloudy, dark purple-fuscous: cilia bronzy-brown. Hindwings rather dark grey; cilia brownish.

Khasis, from May to September; eight specimens.

Onebala myadelpha, n. sp.

♂ ♀. 15-19 mm. Head and thorax brownish or rather dark fuscous, sides of crown pale ochreous. Palpi fuscous or rather dark fuscous, terminal joint nearly as long as second, posteriorly ochreous-whitish. Antennæ ochreous-whitish, ciliations in ♂ 1. Abdomen grey, anal tuft pale greyish-ochreous. Forewings elongate, somewhat dilated posteriorly, costa gently arched, apex rounded-obtuse, termen almost straight, somewhat oblique; 2 and 3 stalked, 4 absent, 7 absent, 8 and 9 stalked; in ♂ an expansible pencil of hairs from base on undersurface covered by costa of hindwings: light shining bronzy-brown: stigmata large, cloudy, rather dark purple-fuscous, plical somewhat before first discal: cilia pale bronzy-ochreous or bronzy-brownish. Hindwings grey; cilia pale bronzy-ochreous, sometimes greyish-tinged.

N. Coorg, 3,500 feet (Newcome); Nilgiris, 3,500-6,000 feet (Andrewes); Khasis: from March to May, in August and December; ten specimens. Extremely similar to the preceding species, but distinct by the much shorter antennal ciliations of ♂; also lighter-coloured, plical stigma indicated antennæ paler.

Onebala lubrica, n. sp.

♂. 13 mm. Head and thorax glossy bronzy-brownish, sides of crown whitish-ochreous. Palpi grey, second joint ochreous-whitish towards apex, terminal joint as long as second, ochreous-whitish, anteriorly grey. Antennæ pale whitish-ochreous, ciliations fasciculated (1). Abdomen grey, anal tuft pale greyish-ochreous. Forewings elongate, costa gently arched, apex rounded-obtuse, termen slightly rounded, somewhat oblique; 2 and 3 short-stalked, 4 absent, 8 and 9 out of 7; glossy bronzy-brownish; second discal stigma large, cloudy, fuscous, very indistinct: cilia light bronzy-ochreous. Hindwings grey; cilia pale ochreous.

Pûsa, in July (Lefroy); one specimen. Also very similar to the two preceding, but distinguished by the smaller size, different antennal ciliations, absence of the hair pencil of forewings and of first discal stigma.

Harmatitis, n. g.

Head with appressed scales; ocelli absent; tongue developed. Antennæ $\frac{4}{5}$, in ♂ strongly ciliated ($2\frac{1}{2}$), basal joint moderately elongate, without pecten. Labial palpi very long, recurved, second joint thickened with dense scales, terminal joint longer than second, slender, acute. Maxillary palpi very short, filiform, appressed to tongue. Posterior tibiæ with appressed scales. Forewings with 3 absent (coincident with 2), 8 and 9 out of 7, 7 to apex, 11 from middle. Hindwings somewhat over 1, trapezoidal, apex obtuse, termen faintly sinuate, oblique, cilia $\frac{1}{3}$; 3 absent (coincident with 4), 5 rather approximated, 6 and 7 stalked.

A development of *Brachmia*.

Harmatitis sphecopa, n. sp.

♂. 17-18 mm. Head dark fuscous, face ochreous, sides of crown orange. Palpi pale ochreous-orange, second joint mixed with black towards base, anterior edge of terminal joint black. Antennæ ochreous-yellow. Thorax dark purple-fuscous. Abdomen dark fuscous, apex orange. Forewings elongate, rather narrow, costa slightly arched, apex obtuse, termen sinuate, rather oblique; dark purple-fuscous; costal edge ochreous-orange from about $\frac{1}{5}$ to $\frac{4}{5}$; an irregular transverse ochreous-orange spot on costa before middle, reaching half across wing; a narrow ochreous-orange spot along costa about $\frac{3}{4}$; a group of a few pale ochreous scales above tornus: cilia dark purple-fuscous. Hindwings and cilia dark fuscous, with golden-bronze and purplish reflections.

Peradeniya, Ceylon, in March (Green); two specimens.

Timyra mendicella, Walk.

(*Decuaria mendicella*, Walk., Cat. XXIX, 797; *Timyra torentis*, Meyr., Journ., Bombay Nat. Hist. Soc. XVIII, 449.)

By an unfortunate confusion between this and the following species, which I had wrongly supposed to be *mendicella*, I have re-described the true *mendicella* as *torentis*, thus leaving the other unnamed; I now correct this error.

Timyra præceptrix, n. sp.

♂ ♀. 21-25 mm. Head bronzy-fuscous, sides of crown yellowish, face whitish-ochreous. Palpi in both sexes sickle-shaped, pale yellowish, lined with blackish, in ♂ with second joint clothed with loose hairs above. Antennæ in ♂ with strong basal tuft of blackish and yellowish scales. Thorax dark bronzy-fuscous, variably mixed with yellow, with a whitish line on each side of back. Abdomen fuscous more or less wholly suffused with pale ochreous-yellowish. Posterior tibiæ with large median tuft of long curved purplish-fuscous and ochreous-yellow scales tipped with black. Forewings elongate, narrow, costa slightly arched, apex obtuse, termen slightly rounded, rather oblique; 7 to apex, 9 out of 7 or separate; dark purplish-fuscous; basal, median, and terminal areas marked with suffused longitudinal orange streaks which are very variable in development, but discontinuous between the areas, most largely developed in ♂; in ♂ a cloudy transverse ochreous-whitish or pale orange transverse line before middle; two short white streaks on veins 8 and 9 towards costa; a whitish line along termen; cilia whitish-fuscous, with three blackish-fuscous lines. Hindwings rather dark fuscous in ♂ more or less suffusedly mixed with ochreous-yellowish along a broad longitudinal median area; in ♂ a subdorsal groove enclosing an expansible pencil of very long whitish-ochreous hairs; cilia fuscous suffused with yellowish on upper half of termen, with two fuscous shades.

Maskeliya, Pundaluoya, Bogawantalawa, Dickoya, and Maturatta, Ceylon (Pole, Green, de Mowbray); from February to April, and August to October; twelve specimens. Larger than *megdicella*, without the white basal lines of forewings, and further distinguished in ♂ by the hairs of second joint of palpi and yellowish suffusion of hindwings.

Epimimastis glaucodes, n. sp.

♂. 16-17 mm. Head and thorax light grey; lower part of face darker grey. Palpi grey, anterior edge darker. Abdomen light grey. Forewings elongate, rather narrow, costa moderately arched, apex obtuse, termen rounded, rather oblique; grey; a black dot near base above middle; an oval blackish blotch in disc before middle, edged with white; second discal stigma black edged with white; apex and termen somewhat suffused with darker, with a blackish marginal line; cilia light grey. Hindwings light grey; cilia pale whitish-ochreous tinged with grey.

Maskeliya, Ceylon, in June and September (Pole); three specimens.

Dactylethra globulata, n. sp.

♂. 11-12 mm. Head and thorax ochreous-whitish, shoulders sometimes sprinkled with fuscous. Palpi brown mixed with blackish, second joint white anteriorly, terminal joint white with two fine rings of blackish irroration. Abdomen ochreous-whitish. Forewings elongate, rather narrow, costa slightly arched, apex obtuse, termen very obliquely rounded;

whitish, tinged with brownish and sprinkled with dark fuscous; three moderately large roundish fuscous spots in disc at $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$, sprinkled with darker, first smaller and less marked; a suffused similar patch extending along termen: cilia fuscous-whitish, irregularly sprinkled with dark fuscous. Hindwings grey; cilia whitish.

Puttalam, Ceylon, in September and October (Pole); two specimens.

ŒCOPHORIDÆ.

Syllochitis, n. g.

Head with appressed scales; ocelli absent; tongue developed. Antennæ $\frac{4}{5}$, in ♂ serrate, minutely ciliated, basal joint moderate, with pecten of scales. Labial palpi long, recurved, second joint much thickened with dense scales, slightly rough beneath, terminal joint shorter than second, with dense posterior scale-projection on lower half, acute. Maxillary palpi very short, filiform, appressed to tongue. Thorax with double posterior crest. Posterior tibiæ rough-scaled above. Forewings with rough scales on surface, 2 and 3 stalked, 7 and 8 stalked, 7 to apex (indefinite), 11 from middle. Hindwings 1, trapezoidal-ovate, cilia $\frac{3}{4}$; 3 and 4 connate, 5 somewhat approximated to 4, 6 and 7 nearly parallel.

A development of *Depressaria*, with relationship to *Izatha*.

Syllochitis petræa, n. sp.

♂ ♀. 17-22 mm. Head and thorax dark fuscous, often sprinkled with pale ochreous points, face irrorated or suffused with whitish-ochreous. Palpi purple-fuscous, variably mixed with blackish and sometimes with whitish-ochreous. Abdomen fuscous. Forewings elongate, costa slightly arched, apex rounded-obtuse, termen rounded, somewhat oblique; dark purple-fuscous, with scattered rough black scales; more or less pale ochreous irroration towards costa anteriorly; first discal stigma represented by two very obliquely placed small tufts of black and whitish-ochreous scales second by a larger mostly black transverse tuft; a curved patch of undefined brownish suffusion in disc posteriorly; an undefined black terminal line interrupted with whitish-ochreous: cilia brown tinged with purplish, with rows of whitish-ochreous points. Hindwings thinly scaled, bronzy-fuscous, veins darker; cilia concolorous.

Maskeliya, Madulsima, Matale, Wellawaya, Kegalle, and Puttalam Ceylon (Green, Pole, Alston); from November to February, twelve specimens.

(*To be continued.*)

NOTES RELATING TO THE DISTRIBUTION, HABITS, AND NIDIFICATION OF *CERTHIA HIMALAYANA*, VIGORS, (THE HIMALAYAN TREE-CREEPER), IN AND AROUND SIMLA, AND THE ADJACENT RANGES.

BY

P. T. L. Dodsworth, F.Z.S.

This is the only species of Tree-Creeper to be found about these North-West Himalayan ranges, and extends from the foot of the hills to elevations of nearly 12,000 feet.

They are common birds, and are generally to be seen moving about in pairs, although both, while keeping in close proximity to each other, will not, as a rule, be found on the same tree. They are by no means shy, and visit the compounds and gardens here freely. I have often managed to get quite close to one by walking up quietly to the opposite side of the trunk of the tree on which it was ascending, and then standing quite still. The bird soon comes round, and gives one a very good opportunity of observing, at close quarters, its mode of progression. The large claws and feet undoubtedly play the most important part in this—the stiff tail feathers merely acting as auxiliaries.

These birds are not strictly arboreal in their habits, as I have occasionally noticed them feeding on low retaining walls, and once I saw one working along the ground, among some *doób* grass, on a steep hill.

I have never seen them frequenting the thin branches of trees, and the reason for this, perhaps, is that as their barks are generally smooth, they afford no lodgment for insects. If this is so, the birds seem to be well aware of it, for as soon as they have attained a fairly good height in their ascent, and are nearing the smaller branches, they immediately fly off to another tree, and begin to work upwards as usual.

Though strictly passerine, the resemblance of this bird to the woodpecker, in its mode of progression, is very marked. It has often struck me as curious, why these Creepers invariably climb upwards in a *spiral* manner. Does this method of ascent give them a better chance of obtaining food? Observers are silent on this point, and whatever may be the correct reason, one cannot help being struck with the insatiable appetites of these tiny creatures. They never appear to be satisfied, and are perpetually on the move from early in the mornings to late in the evenings. In addition to insects of various kinds, small black ants, and especially their larvæ, appear to constitute their chief nutriment.

These birds are to be seen at all seasons of the year, but generally become more abundant during the early spring and autumn months. The large numbers observed at these periods is doubtless due to their upward and downward seasonal movement along these ranges.

Its note is a low squeak, but the cock bird has a loud and sweet song during the breeding season.

This Creeper is apparently the true representative of *Certhia familiaris* of Europe.

After an examination of a large number of specimens shot at various times of the year, I have arrived at the same conclusion as Oates that these birds have only an autumn moult.

In nestlings the upper plumage is not so dark as in old birds; the rump and upper tail-coverts show only faint traces of ferruginous; and the fulvous band on the quills is much lighter. The whole of the lower plumage, from the cheek to the vent, is cross-barred with dusky, and the under tail-coverts and flanks are fluffy, and slightly tinged with fulvous. The length of the bill is, of course, much smaller.

The information on record about the nidification of this Creeper is not only very meagre, but, it seems to me, somewhat erroneous and misleading. I am unable to understand how the nests of these birds escaped the observations of so acute an ornithologist as Hume.

In the neighbourhood of Simla and adjacent ranges, courting and building operations commence about the middle, or third week of March. The birds are then very active, and are to be seen constantly flitting from tree to tree, and examining, with great minuteness, all nooks and crannies for likely spots. It is at this period that the cock's song is frequently heard.

They lay from about the last week in March to the first week in May, but most eggs are to be taken during the early part of April. The earliest date on which I have found eggs is the 27th March, and the latest, the 3rd May. Most of the nests examined towards the latter end of April generally contained young.

They have only one brood annually.

Four is the normal number of eggs, but on three occasions I have taken five; and in one instance, I found a nest containing only three young ones, half fledged.

The nests were invariably situated on trees, and were placed sometimes in holes, belonging to other birds, but usually in chinks and crevices formed by thick branches shooting upwards from the main trunks. I have never found their nests on oaks, but have no doubt whatever that they build on these. Their favourite trees here are Himalayan Cedars (*Cedrus deodara*) and Rhododendrons (*Rhododendron arboreum*). The same sites appear frequently to be used year after year, but whether by the same birds or not, it is impossible to say. When the eggs are once removed, the nest is deserted for that year. In one instance only, I succeeded in obtaining an egg from a nest that I had robbed, a few days previously, of four eggs.

The heights of the nests found during the last two or three years varied

from 2½ feet to 20 feet, but the majority that came under notice were less than 4½ feet from the ground. One nest was placed in a crevice formed by the thick upper roots of a *Cedrus deodara*, which had got exposed, and was actually below the level of the ground.

The eggs were not laid on the bare wood, but the crevices or holes were lined with thick masses of small feathers, in which a few pieces of dry grass and straw were occasionally intermingled. In some cases the nests were mere pads of feathers on which the eggs reposed; in others, the pads were more substantial, and the egg-cavities somewhat deeper.

The nests were shapeless—exactly like those of the ordinary sparrow—and could not stand removal.

The nests take roughly about a week or a fortnight to complete, and both the birds help, not only in carrying materials, but also in the building operations. They seem to become very bold at this time, and I have frequently, from within a few feet of the nest, watched them going in and out of a hole with feathers. As the sexes are alike, it is difficult to make accurate observations, but so far as my experience goes, the hen bird alone appears to perform the labours of incubation. She then becomes fearless, and sits very close. I have frequently caught her on the nest. She generally begins to brood after the first or second egg is laid, and the cock feeds her on the nest. The eggs appear to be laid one daily, (I have only been able to put one nest under observation as regards this point), and take from 13 to 14 days to hatch. Both the old birds help in feeding the young, which leave their home in about three weeks, and follow their parents about for some time, and are fed by them.

The following are some extracts from my daily journal relating to the nidification of this bird:—

(*a*) *27th-30th March.*—Four fresh eggs. Nest consisting of small feathers, straw, etc., and placed in old hole belonging to Woodpecker in small Rhododendron tree; height from ground 9 feet; elevation 6,900 feet. The old bird was caught in the nest, and released after identification.

(*b*) *3rd April.*—(i) Four eggs, slightly incubated. Nest a shallow pad of feathers placed in crevice formed by two thick branches of a Himalayan Cedar (*Cedrus deodara*), shooting upwards from main trunk. Height from ground 2½ feet. Elevation 6,200 feet.

(ii.) Another nest to-day containing five fresh eggs placed in crevice of upper roots of *Cedrus deodara*, which had got exposed, either through the action of the rain, or by the hill on one side having given way. The nest was a pad of feathers, and was actually below the level of the ground. Elevation 6,800 feet.

(*c*) *6th April.*—Another fresh egg from nest (*a*).

(*d*) 16*th April*.—Four young, just hatched. Nest in small natural crevice of *Cedrus deodara*; height from ground 4 feet. Elevation 6,000 feet.

(*e*) 20*th April*.—Three young, partially fledged; nest in hole of small tree; elevation 6,500 feet.

(*f*) 22*nd April*.—Nest containing five hard set eggs placed in crevice of Rhododendron tree and composed of feathers; height from ground 29 feet. Elevation 7,000 feet.

(*g*) 27*th April*.—Two nests to-day each containing four young; heights of nests from ground 4-4½ feet. Elevation 6,500 feet.

(*h*) 29*th April*.—Nest containing four, hard set eggs placed in hole of *Cedrus deodara*: height from ground 4 feet. Elevation about 6,800 feet. The hole was lined with feathers, and the eggs were on the point of being hatched. The hen allowed herself to be caught in the nest. When approaching the tree my foot slipped, and I made a good deal of noise, but in spite of this, the bird did not fly off.

(*i*) 3*rd May*.—Two eggs slightly incubated this year (1910) from nest (*b*). While the eggs were being removed, both birds became greatly agitated, and would frequently creep down the trunk, have a peep at what was going on, and then fly off again. As soon as the eggs were removed, one of the birds disappeared into the hole, and did not come out of it as long as we were there—quite half an hour or so.

(*j*) 9*th May*.—Nest in small Rhododendron containing four young, partially fledged. Height from ground 4 feet. Elevation 6,800 feet.

In shape the eggs are somewhat lengthened ovals, slightly compressed towards the small end. The texture of the shell is fine, and the eggs are glossless.

The ground colour of the majority of the eggs is white; of a few, pale pinkish-white; and they are all heavily spotted and speckled, with brownish-red, chiefly towards the large end, where they become confluent, and from irregular caps or zones. In two eggs these caps or zones are towards the small ends. The amount of markings varies in different specimens. In three eggs, belonging to the same clutch, they are so thick that the ground colour is scarcely visible.

In length the eggs vary from ·65 ins. to ·71 ins., and in breadth from ·47 ins. to ·5 ins.; but the average of 18 eggs measured was ·67 ins. × ·48 ins.

Hume's measurements of 2 eggs = ·69 ins. × ·5 ins., and ·68 ins. × ·5 ins.

Oates' measurements of eggs (number not stated) = ·6 ins. × ·45 ins.

The weights of four *fresh* eggs were :—

2 at 21 grains each.
2 at 20 " "

Average weight of the four eggs = 20½ grains.

The weights of three semi-incubated eggs were :—

2 at 18 grains each.
1 at 19⅓ grains.

Average weight of the three eggs = 18⅓ grains.

PLANTS OF THE PUNJAB.

A BRIEF DESCRIPTIVE KEY TO THE FLORA OF THE PUNJAB NORTH-WEST FRONTIER PROVINCE AND KASHMIR.

BY

Colonel C. J. Bamber, F.L.S.,

Indian Medical Service.

Part VI.

(Continued from page 975 of Volume XIX.)

Herbs, erect, with Opposite Exstipulate Simple Leaves.

Leaf Margins Entire.

Petals Ununited.

Dianthus Caryophyllus, Carnation, Clove Pink,
Caryophyllaceæ.
F. B. I. i. 214.
N.-W. F. Province.
Attock (Falconer).

medium size, perennial, smooth, greyish green, branched and leafy below, jointed and thickened at the joints; leaves 4-6 by $\frac{1}{8}$ in., linear grooved, pointed, flowers pink, 1-1½ in. diam., fragrant in loosely branched clusters, bracts 4 broad with an abrupt point, much shorter than the calyx, calyx 1-1¼ in. long, tubular, 5-toothed, petals 5, stalked, smooth, toothed, stamens 10, inserted with the petals on a long process, styles 2; capsule ovoid, 4-toothed, seeds discoid, with a central groove.

Dianthus crinitus,
Caryophyllaceæ.
F. B. I. i. 215.
Salt Range.
N.-W. F. Province,
Peshawar.
Baluchistan (Lace.)

like the last species, but the bracts 4-8 are lanceolate and long pointed, branches rigid, clusters few-flowered, petals white, scented, fringed nearly to the base.

Tunica stricta,
Caryophyllaceæ.
F. B. I. i. 215.
Kashmir.

medium size, annual, slender, smooth, branched from the base, leaves radical ¼-½ in. long, numerous, linear with the tip broad and narrowing to the base, stem leaves linear; flowers ⅛ in. long, white, in

HERBS, ERECT, WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

LEAF MARGINS ENTIRE.

PETALS UNUNITED.

clusters of very few flowers without bracts on straight slender stalks, calyx 5-toothed and ribbed, top shaped, petals 5, stalked, linear, oblong, margin even, stamens 10, ovary, 1 celled, styles 2; capsule oblong, opening by 4 teeth, seeds many, boat-shaped, wrinkled on the edges and keel.

Acanthophyllum macrodon,
CARYOPHYLLACEÆ.
F. B. I. i. 216.
N.-W. F. Province.
Waziri Hills (Stewart).

small, perennial, tufted, spinous, minutely velvety; leaves ½-¾ in. long, pale green, stiff with a hard sharp pointed tip, horizontal, flat above, convex below, $\frac{1}{16}$-$\frac{1}{10}$ in. diam. at the base, flowers pink, ¾ in. long, terminal, solitary, bracts 4 linear with thin papery margins, rough with projecting processes, recurved, calyx cylindric, 5-toothed, teeth spiny with very narrow thin, papery margins, petals 5, narrow, long stalked, stamens 10, styles 2, ovary 1-celled: capsule ovoid or oblong, 1-2-seeded, seeds almost kidney-shaped, laterally flattened, margin notched.

Saponaria vaccaria,
Musna.
CARYOPHYLLACEÆ.
F. B. I. i. 217.
The Plains to 10,000 ft.
Simla in Cornfields (Collett).
Murree (Douie).
Hazara (Barrett).
Baluchistan (Lace).

medium size, annual, smooth, a weed of cultivation, robust, branches none or only a few; leaves 1-3 by ½-¾ in. radical leaves oblong, short-pointed, stem leaves sessile, base rounded or heart-shaped, linear oblong; flowers pink in terminal many-flowered forked clusters, calyx ½ in. long, cylindric, ovoid in fruit, 5-toothed, with 5 broad, green nerves, petals 5, stalked, short, irregularly toothed, broad at the tip, stamens 10, styles 2; capsule included in the calyx, broadly ovoid, opening at the top by 5 teeth, seeds many, round, large, black. This plant is used as a substitute for soap.

HERBS, ERECT, WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

LEAF MARGINS ENTIRE.

PETALS UNUNITED.

Silene conoidea,
CARYOPHYLLACEÆ.
F. B. I. i. 218.
The Plains to 8,000 ft.
Simla in Cornfields (Collett).
Gujrat District.
Sargodha (Doule).
Hazara (Barrett).
Rawalpindi.
Baluchistan (Lace).

medium size, sticky from velvety glands, annual, branches forking; leaves 2-4 in. long, radical leaves broad at the tip narrowing to the stalk, stem leaves oblong or lanceolate, sometimes very narrow, sessile, short-pointed; flowers pink, few, erect in terminal branching racemes, calyx 1 in. long, base thrust in, 5-toothed, teeth long, sharp-pointed, ½ the length of the calyx, swollen out in fruit, petals 5, broad at the tip, small, margin even or toothed, stalk has a projection ear-like, 2 scales, stamens 10, 5 joined to the petals, styles 3, ovary stalked; capsule ovoid, shining, pointed, hard enclosed in the inflated calyx, seeds many, shaped like a spiral shell with 5 dorsal and 5 lateral rows of tubercles.

Silene Moorcroftiana,
CARYOPHYLLACEÆ.
F. B. I. i. 219.
Himalaya, 10-13,000 ft.

medium size, perennial, stems many, stock woody, densely tufted, flowering branches erect, slender dividing or not at the top, velvety; leaves radical, broad at the tip, narrowing to the base, stem leaves shorter, linear, long or short-pointed or blunt; flowers white or reddish in terminal or nearly terminal clusters of one to three flowers, calyx 1-1½ in. long, tubular, sticky, base projecting inwards, slender below the middle, nerves 10, dark, teeth short blunt with thin pepery margins, petals divided into 2, the segments strap-shaped, protruding from the calyx, stalk with a long tooth on both sides, also 2 long scales, stamens 10, 5 joined to the petals, styles 3 on a stalk longer than the capsule; capsule ovoid, seeds flattened, not grooved, with 5 rows of latteral and dorsal tubercles.

Silene arenosa,
CARYOPHYLLACEÆ.
F. B. I. i. 219.
N.-W. F. Province, Peshawar.
The Plains.
Attock.
Baluchistan (Harsukh.)

small, annual, slender, bluish green, sticky, much-branched from the root, velvety, flowers open at night: leaves ⅜-1½ in. long, stiff, narrow, long-pointed, margins rolled up; flowers ⅜ in. long in few flowered widely dividing clusters, stalks ½-1 in. long, thread-like, calyx ½-⅝ in. long, club-shaped, slender, 10-ribbed, base pushed inwards, teeth with

HERBS, ERECT WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

LEAF MARGINS ENTIRE.

PETALS UNUNITED.

thin papery margins, petals with the blade divided, lobes linear, stalk with a tooth on each side, scales 2, small, lanceolate; capsule oblong, the style stalk equal to the capsule; for other characters, see the last species.

Silene tenuis,
CARYOPHYLLACEÆ.
F. B. I. i. 219.
Himalaya, 8-12,000 ft.

small, perennial, smooth or sticky with glands, many stems from the root, slender unbranched; leaves 1-3 in., short or long-pointed, narrow, linear or lanceolate, often with scattered hairs, flat, radical leaves slightly broadened upwards, flowers ½in. long, dirty yellow or brown, often in a circle in short racemes, stalks ½-1 in., bracts short, in a circle, awl shaped, calyx bell-shaped ½-½ in., thin, base rounded or abrupt, 10-nerved, teeth blunt, spreading, petals divided, stalk with two teeth, hairy, scales short oblong; capsule oblong, seeds with 5 dorsal and lateral rows of tubercles; other characters like the last species.

Silene Griffithii,
CARYOPHYLLACEÆ.
F. B. I. i. 220.
Himalaya, 7-11,000 ft.

medium size, perennial, stout, velvety or hairy, stems divided or not; leaves 2½-4 by ¾-1¼ in., radical leaves lanceolate with a broad tip ending in a broad stalk, stem leaves oblong, sessile, velvety on both surfaces; flowers white in opposite axillary irregularly 3-flowered clusters, shortly stalked, calyx ½-1 in. long, cylindric, barely dilated above except in fruit, teeth short-pointed, not bordered with white, nerves 10, green, base rounded or abrupt, petals deeply 2-lobed, lobes divided into 3-6 parts, no scales, no teeth on stalks of petals; capsule oblong, ovary shortly stalked, seeds minute, sides flat or convex, back grooved; other characters like the last species. This plant is used in Lahoul with an alkali as a substitute for soap.

HERBS, ERECT WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

LEAF MARGINS ENTIRE.

PETALS UNUNITED.

Silene Webbiana,
CARYOPHYLLACEÆ.
F. B. I. i. 220.
Himalaya, Sirmur.

medium size, slender, very like Silene viridiflora Linn., leaves 1½ in. broad, stem leaves ovate stem-clasping, long-pointed, 5-9-nerved; flowers greenish white, drooping in loose opposite long-stalked clusters, calyx ¾ in., very slender, 10 nerved swollen in fruit, teeth with thin edges, petals long, blade divided, lobes strap-shaped, scales 2, styles 3; capsule cylindric, oblong; other characters like the last species.

Cucubalus baccifer,
CARYOPHYLLACEÆ.
F. B. I. i. 221.
Himalaya, 5-8,000 ft.

medium size, rambling, velvety with curly white hairs; leaves 1-2 by ¾-1 in., ovate lanceolate, short-pointed, thin with scattered hairs, narrowed into the stalk, upper leaves sessile; flowers greenish white, nodding in 1-3 flowered loose leafy clusters or solitary in the forks of the branches, calyx ½ in., 5-toothed, broadly bell-shaped, 10-nerved, base-rounded, teeth large, broad, nearly short-pointed, petals 5, 2 lobed, stalk narrow toothed at the top, blade of petal with 2 scales at the base, stamens 10, styles, 3; capsule round, black, the size of a pea, tip crowned with a projection, shining, dry or fleshy, becoming thin, seeds minute, many, kidney-shaped with a lateral depression.

Lychnis coronaria,
CARYOPHYLLACEÆ.
F. B. I. i. 222.
Kashmir, Valley in groves and fields (Jacquemont).

medium size, perennial, covered with white wool, sparingly branched; leaves 3-5 in., lanceolate with a broad tip narrowed to the stalk, stem leaves oblong; flowers red purple, on long stalks, calyx ¾-1 in., top-shaped, 10-nerved, teeth 5, twisted to the left, petals 5, 1 in. or more in length, with 2-toothed stiff scales at the stalk, heart-shaped with a notch at the margin, broad, stamens 10, styles 5; capsule nearly sessile, within the calyx, 5-valved, valves with an even margin, seeds many, doubly convex.

HERBS, ERECT WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

LEAF MARGINS ENTIRE.

PETALS UNCUNITED.

Lychnis Cachemeriana, CARYOPHYLLACEÆ. F. B. I. i. 224. Kashmir (Royle).

medium size, straight, stout, unbranched, with grey hairs, leaves 2-3 by ½-⅔ in., narrow, ovate to linear-lanceolate, slightly rough; flowers white, large, erect or nodding in nearly terminal contracted clusters, calyx ¾-1 in. long, green, oblong, teeth 5, short or long pointed, nerves many, branching, petals 5, blade ½ in. long, stalk woolly, blade 2-fid, lobes divided, stamens 10, styles 5; capsule ovoid, 5-fid, on a woolly stalk, seeds many, kidney-shaped, granulate.

Lychnis Stewartii, CARYOPHYLLACEÆ. F. B. I. i. 224. Himalaya, Upper Chenab and Chamba River, 8-11,000 ft. (Stewart).

small, stiff slender, upper part sticky and woolly, leafy; leaves 2 by $\frac{1}{10}$-$\frac{1}{12}$ in., very narrow, linear, spreading, 1-nerved, keeled by the stout mid-rib, margins turned in; flowers white, ⅔ in. long, solitary or in opposite pairs with 2 linear bracts above the middle, in the upper leaf axils, nodding, calyx ⅓ in. long, oblong, velvety, nerves green faint, free or united, teeth 5, rounded, edges thin with long curled hairs, petals 5, heart-shaped with a notched margin, blade very short, scales 2, notched, divided into two, curved back, stalk very broad with a tooth on each side, petals projecting beyond the calyx, stamens 10, styles 3, very short; capsule ovoid, projecting out of the calyx, 10-fid, stalk woolly.

Lychnis indica, CARYOPHYLLACEÆ. F. B. I. i. 225. Himalaya, 5-10,000 ft. Simla (Collett). Changlagalli (Doule).

medium size, leafy, branches dividing into forked pairs, very slightly velvety; leaves 1-3 by ½-2½ in., ovate lanceolate to orbicular, lower leaves stalked; flowers creamy white inside and purplish outside, erect or nodding in open or close many-flowered branching sticky hairy clusters, stalks without bracts, calyx ½-¾ in. long, velvety, bell-shaped, nerves 10-15, simple or branched, teeth 5, broad, blunt, rarely short-pointed, petals 5, much longer than the calyx, blade 2-fid or divided into several processes, 2 erect crisped scales at the base of the

HERBS, ERECT WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

LEAF MARGINS ENTIRE.

PETALS UNUNITED.

blade, forming with other petal scales a crown over which the anthers project, stamens 10, styles 5, twisted, silvery; capsule ovoid, teeth 5, simple or bifid, stalk short, velvety, seeds many, minute, very dark, kidney shape, granulate.

Lychnis hutans,
CARYOPHYLLACEÆ.
F. B. I. i. 225.
Himalaya, 9-12,000 ft.
Murree, Hattu (Collett).

very like the last species, but smaller, calyx more rounded and shorter, petals purple and limb shorter and less divided.

Lychnis pilosa,
CARYOPHYLLACEÆ.
F. B. I. i. 226.
Himalaya, 9-12,000 ft.

very like the last species, but covered with long hairs and the seeds with longer projections.

Cerastium dahuricum,
CARYOPHYLLACEÆ.
F. B. I. i. 227.
Himalaya, 10-11,000 ft.
Murree (Stewart).
Matiana, Hattu (Collett).

large, perennial, stems stout, ascending among shrubs to 12 ft. or straggling over grass, smooth; leaves 1½-2 in., large, oblong, sessile or eared, united, blunt or short pointed, margin projecting; flowers white, ¾ in. diam., long stalked without bracts in much forking clusters, sepals 5, unevenly, oblong, short-pointed, shining with thin margins, ⅜ in., ovate-lanceolate; petals 5, 2-lobed, heart-shaped, twice the lengh of the sepals, stalks bearded, stamens 10, styles 5; capsule straight, twice the length of the calyx, many-nerved, teeth recurved, seeds flattened, many.

Cerastium vulgatum,
Mouse-ear chickweed,
CARYOPHYLLACEÆ.
F. B. I. i. 228.
The Plains to 15,000 ft.
Simla (Collett).

small, annual, velvety, more or less sticky, a weed of cultivation, stems many, simple or branched, stout or slender; leaves ½-1 in., lower broad at the tip narrowing to the stalk, upper oblong or ovate, blunt or short-pointed; flowers ⅛-¼ in. diam., in clusters few or many flowered, open or crowded, or in umbels or heads, sepals 5, lanceolate about ¼ in. long, margins broad, petals 5, rarely none,

HERBS, ERECT WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

LEAF MARGINS ENTIRE.

PETALS UNUNITED.

equal to the sepals in length, shortly lobed, stamens 10, sometimes 5 or less, styles 5; capsule cylindric, much longer than the calyx, often curved, like a horn (cerastos), whence the name is derived, teeth straight, seeds many, flattened.

Cerastium Thomsoni,
CARYOPHYLLACEÆ.
F. B. I. i. 228.
Himalaya, at Kishtwar and Lahoul, 10-12,000ft.

small, hairy, very glandular, branched only at the base; leaves ¾-1½ in. long, linear-oblong, nearly short-pointed, straight; flowers ½-¾ in. diam., white in few flowered nearly umbel-like clusters, bracts with narrow thin margins, stalks slender, sepals 5, oblong-lanceolate nearly short-pointed, coloured below the thin tips, much smaller than the petals, petals 5, broad, capsule cylindric, twice the calyx, teeth 10, seeds many, flattened.

Stellaria crispata,
CARYOPHYLLACEÆ.
F. B. I. i. 229.
Himalaya, 6-10,000 ft.
The Glen.
Simla in shady places (Collett).
Baluchistan (Lace).

large, smooth, slightly velvety above, stems quadrangular, shining with a line of fine hairs, joints often hairy; leaves 3-8 in. long, lanceolate or oblong, rather leathery, tips slender, margin more or less crisped, sessile, long pointed; flowers white, small in much branched clusters, terminal, sepals ¼ in. 5, oblong-lanceolate, long-pointed, margin narrowly thin and dry, often sticky, petals 5, 2-fid, as long as or twice as long as the sepals, stamens 10, styles 3; capsule short, 3-celled, seeds one or two granulated.

Stellaria paniculata,
CARYOPHYLLACEÆ.
F. B. I. i. 229.
Himalaya, 7-9,000 ft.
Fagu, Narkunda (Collett).

medium size, very like the last species but the stem is reclining and the leaves are not crisped; flowers are smaller, petals notched, shorter than the sepals, capsule equal to the calyx, seeds wrinkled.

HERBS, ERECT WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

LEAF MARGINS ENTIRE.

PETALS UNUNITED.

Stellaria bulbosa,
CARYOPHYLLACEÆ.
F. B. I. i. 231.
Himalaya, 6-9,000 ft.
Jamu to Murree, (Jacquemont).
Hazara (Barrett.)

small, smooth, root stock creeping, bearing small round underground branches with buds or eyes, stem slender, erect, unbranched with a line of hairs; leaves 2-6 pairs, 1-1½ ins. long, ovate with a broad tip or unequally lanceolate, hardly short pointed, rather fleshy, sessile or narrowed into a stalk, margins rarely hairy; flowers of two kinds, the lower on the plant from slender stalks being minute without petals bearing ripe seeds, the nearly large flowers, ½ in. diam., rarely producing seed, sepals 4 or 5, green, oblong-lanceolate or lanceolate, ⅓-⅔ in., shorter than the petals, petals 4 or 5, white, ovate oblong, shortly 2-lobed; stamens 10, with purple anthers, styles 2, thread-like; capsule 8-angled, valves 4 divided to the base, seeds few, large, furnished with excrescences on the surface.

Stellaria glauca,
CARYOPHYLLACEÆ.
F. B. I. i. 233.
Himalaya, Lahoul, (Jaeschke).

medium size, perennial, slender, quite smooth, stem squadrangular; leaves 1-2 ins. long, sessile, oblong or linear-lanceolate, long-pointed, base rounded, margins thickened; flowers ¼-¾ in. diam., white on nearly solitary terminal rather stout straight stalks, bracts thin, sepals 4 or 5, more or less united at the base, linear-oblong, long or short-pointed, green, petals 4 or 5, broad, 2-lobed, twice as long as the sepals, stamens 10, slender, styles 3, rarely 4; capsule broadly ovoid, 4-6 valved, valves undivided, equal in length to the sepals, seeds many, very granulate.

Arenaria Meyeri,
CARYOPHYLLACEÆ.
F. B. I. i. 236.
N.-W. F. Province, Peshawur, (Stewart).
Baluchistan.

small, annual, covered with spreading glandular hairs, stem cylindric, branches in parallel clusters; leaves ¼-½ in., linear, awl-shaped, recurved; flowers ¼ in. diam., white in clusters, sepals 5, ⅛ in. long, green, erect, rigid, sharp, margins white, petals 5, very short, ovate-oblong, not divided, stamens 5-7,

HERBS ERECT WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

LEAF MARGINS ENTIRE.

PETALS UNUNITED.

styles 3; capsule oblong, much shorter than the sepals, 3-valved; seeds many, red-brown, round, notched, flattened.

Arenaria foliosa,
CARYOPHYLLACEÆ.
F. B. I. i. 236.
Himalaya, 9-13,000 ft.

small, perennial, quite smooth, branched from the base, slender, leafy; leaves ½-⅔ by $\frac{1}{17}$ in., spreading, never stiff or sharp, very narrow, linear, bright green; flowers white, ¼ in. diam. on long-stalked, almost umbelled, clusters bracts and bracteoles leathery, concave, short-pointed, calyx rounded and not thickened at the base, sepals 5, ⅛ in., leathery, sharp; petals 5, longer than the sepals; stamens 5, styles 3, capsules ovoid, larger than the sepals; valves 3, recurved; seeds many, small pale brown, kidney-shaped, granulate on the back.

Arenaria kashmirica,
CARYOPHYLLACEÆ.
F. B. I. i. 236.
Himalaya, 6-7,000 ft.
Lahoul (Jaeschke).

very like the last species, but glandular, velvety, leaves stiffer and sharper, flowers smaller with longer petals.

Arenaria holosteoides,
Kakua, gaudial.
CARYOPHYLLACEÆ.
F. B. I. i. 241.
Himalaya, 7-12,000 ft.
Murree (Douie).
Baluchistan (Boissier).

large, slender, pliable, smooth or velvety, much-branched, leaves 1-3 ins., linear or linear-oblong, sessile, base broad, short or long-pointed; flowers ¼-½ in. diam., white, nodding in few-flowered clusters, flower stalks slender widely separated, no bracts, calyx not thickened at the base; sepals 5, blunt, linear-lanceolate to broadly ovate-oblong, green with thin edges, smooth or very hairy and glandular at the back; petals 5, equal to or longer than the sepals, tip with a shallow notch, broad; stamens 5, styles 2-3, thread-like, long; capsule nearly round, shorter than the calyx, very thin, 2-6-valved to the base; seeds ⅛, red-brown or blackish, with rows of sharp tubercles.

HERBS ERECT WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

LEAF MARGINS ENTIRE.

PETALS UNUNITED.

Hypericum perforatum, Common St. John's Wort,
Bassant, dendlu.
HYPERICACEÆ.
F. B. I. i. 255.
Himalaya, 3-8,000 ft.
Simla in shady forest, (Collett).

medium size, perennial, stem 2-angled, lowest branches rooting; leaves ½ in. long, oblong or ovate, blunt, dotted with translucent glands, pale below with black dots, sessile; flowers 1 in. diam., yellow in terminal or axillary short-stalked clusters; sepals 5, ¼ in. long, united at the base, linear, short-pointed; petals 5, persistent, with black glandular edges; stamens many in 3 bundles; anthers black-dotted; styles 3, as long as the stamens; ovary 3-celled; capsule ½ in. long, ovoid, seeds many, small.

Hypericum elodecides,
HYPERICACEÆ.
F. B. I. i. 225.
Himalaya, 6-12,000 ft.
Simla, Narkanda in shady forest, (Collett).

medium size, perennial, stems round, lowest branches rooting; leaves 1-1½ ins. long, ovate, blunt or lanceolate, short-pointed, base stem-clasping margins black-dotted; flowers ¾ in. diam., in clusters of branching racemes; sepals 5, ¼ in. long, narrowly lanceolate, black-dotted and streaked, margins with gland-tipped teeth; petals 5, persistent, black-dotted and streaked; in other characters like the last species.

Vahlia viscosa,
SAXIFRAGACEÆ.
F. B. I. ii. 399.
The Plains.

small, annual or biennial, velvety with sticky glands; leaves ½-1 in. long, nearly sessile, oblong, narrowed at both ends, short-pointed; flowers ¼ in. long, white, nearly sessile, in pairs or solitary in nearly all the axils of the upper leaves, calyx tube united to ovary and above it; lobes 5, ovate and short-pointed, persistent in fruit; petals 5, ¼ in. long, ovate with a broad tip united to the ovary; stamens 5 and styles 2; both ¼ in. long; capsule ¼ in. diam., one-celled, nearly round, splitting at the top between the styles; seeds minute, many, smooth.

HERBS, ERECT, WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

LEAF MARGINS ENTIRE.

PETALS UNUNITED.

Ammania pentandra, LYTHRACEÆ. F. B. I. ii. 568. Hot Plains in moist places. Ashobi. Narkand.

small, annual, many opposite branches, covered with flowers; leaves 1 in. long, sessile, unevenly oblong, floral leaves bract-like, oblong broad-based; flowers very small, solitary sessile axillary, bracteoles awl-like, as long as the calyx, calyx enclosing the ovary, teeth 10, petals 5, narrow or none, stamens 5, on the calyx tube, style one, thread-like or short, stigma round; capsule round or depressed, 3-celled, 3-valved, seeds black, round. The different species of Ammania are used in native medicine to raise blisters.

Galium RUBI

Ammania baccifera, see Herbs, Erect, Opposite, Exstipulate, Simple, Petals none.

Ammania salicifolia, see Herbs, Erect, Opposite Exstipulate Simple, Petals none.

Ammania senegalensis, see Herbs, Erect, Opposite, Exstipulate, Simple, Petals none.

Ammania multiflora, see Herbs, Erect, Opposite, Exstipulate, Simple, Petals none.

Epilobium angustifolium, ONAGRACEÆ. F. B. I. ii. 582. Himalaya, 8-12,000 ft.

medium size, smooth, leaves 3-6 by $\frac{3}{4}$ in., nearly sessile, short-pointed, margins even or minutely toothed; flowers $\frac{3}{4}$ in., rose purple in spikes at the ends of branches, bracts narrow, soon falling off, calyx tube scarcely produced above the ovary, covered with close white wool, linear, teeth 4, lanceolate, long-pointed, purplish, almost petal-like, petals 4, $\frac{1}{2}$-$\frac{3}{4}$ in., ovate with a broad tip, stalked, stamens 8, on the ovary, bent on one side, 4 shorter, style cylindric, hairy above the base, stigmas 4, distinct, spreading; capsule linear, 4-celled, splitting from the apex, 2$\frac{1}{2}$-3$\frac{1}{2}$ ins., velvety, valves 4, recurved, seeds many, narrowly ovoid, smooth, crowned with a tuft (coma) of dirty yellow silky hairs.

HERBS, ERECT; WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

LEAF MARGINS ENTIRE.

PETALS UNUNITED.

Epilobium latifolium,
ONAGRACEÆ.
F. B. I. ii. 583.
Himalaya, 11-14,000 ft.
Kashmir.

small, smooth; leaves 1½-3 by ½-¾ in., oblong, narrowed to both ends, margin even or minutely toothed, blunt or short-pointed; flowers on stalks in the axils of distant leaves, no bracts; in other characters like the last species.

Epilobium origanifolium,

see Herbs, Erect, Alternate, Exstipulate, Entire.

PETALS UNITED.

Rubia tibetica,
RUBIACEÆ.
F. B. I. iii. 204.
Himalaya, 10-14,000 ft.
Kulu (Hay).

small, rough, perennial, root thick woody, bundles of stamens each ¼ in. thick, stout, with glistening white bark, erect, annual shoots clustered together, simple or branching, nodes of the stems covered with thin bases of old leaves; leaves ½-1 by ¼-½ in., sessile, broadly ovate, round or lanceolate, often in a circle of four leaves, leathery, margins and midrib rough; flowers ⅛ in. diam., in axillary or terminal clusters, shorter than the leaves, or solitary on long axillary stalks, calyx tube ovoid or round, no teeth, corolla bell-shaped, lobes 4-5, lanceolate, short-pointed, stamens 4-5, anthers round, style 2-branched, ovary 2-celled; fruit ⅛ in. diam., smooth, round or almost 2-lobed, seeds 2, small.

Galium boreale,
RUBIACEÆ.
F. B. I. iii. 205.
Himalaya, 5-11,000 ft.
Kashmir, Lahoul.

medium size, perennial, smooth or velvety, branches square; leaves 1-2 by ¼-½ in., 4 in a circle, lanceolate, blunt, stiff, margins rough, sessile, 3-nerved, from the base; flowers minute, white in nearly erect axillary and terminal many-flowered clusters with ovate bracts, calyx tube ovoid or round, teeth none, corolla wheel-shaped, lobes 4, nearly pointed, stamens 4 in the corolla tube, anthers 2-lobed, style short, 2-branched, ovary 2-celled; fruit 1/12 in. diam., 2-lobed, dry, covered with hooked hairs, seeds 2, small, flat on one side, convex on the other.

HERBS, ERECT, WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

LEAF MARGINS ENTIRE.

PETALS UNITED.

Asperula triflorum, RUBIACEÆ. F. B. I. iii. 205. Himalaya, 6-10,000 ft. Mashobra, Mahasu, Narkanda (Collett).

small, perennial, smooth, stems sometimes straggling; leaves, long and short, 1½-2½ by ¼-½ in. and ⅜-1 by ¼-½ in., the long sessile, the short stalked, 6-8 in a circle or the short 4 in a circle, lanceolate, not 3-nerved from the base; flowers whitish yellow, minute in axillary or terminal few-flowered clusters; otherwise like the last species.

Galium tricorne, RUBIACEÆ. F. B. I. iii. 207. The Plains, Waziri[illegible] Attock Hills, Kashmir, to 13,000 feet.

medium size, annual, very rough, stem stout, branches square; leaves 1-1½ by ⅛-⅜ in., linear, stiff, 6-8 in a circle, point rigid tapering; flowers white, minute on long or short stout axillary, 1-3-flowered stalks, corolla lobes ovate short-pointed; fruit smooth, ⅛ in. diam.; otherwise like the last species.

Galium verum, RUBIACEÆ. F. B. I. iii. 208. Himalaya, 5-10,000 ft. Kashmir, Lahoul.

small, perennial, smooth, stem velvety upwards; leaves ½-1 by ⅛-⅜ in., 8-10 in a circle, linear, point rigid tapering, sessile, margins turned in; flowers bright yellow, minute in very many short many-flowered clusters; fruit ⅛ in. diam., smooth; otherwise like the last species.

Galium tenuissimum, RUBIACEÆ. F. B. I. iii. 208. The Plains at Rawalpindi, Kashmir, 5-6,500 ft.

small, annual, very slender, the plant appears broad above and narrow below, the stem dividing into two, the branches into two or three, rough with the roughness directed downwards, leafy at the forks only; leaves ½-⅞ by 1/16 in., 6 in a circle, linear, rough with scattered bristles, margins turned in; flowers white or yellowish, minute in large loose-flowered clusters on long slender stalks, corolla lobes sharp, stiff pointed, fruit ⅛ in. diam.; otherwise like the last species.

Galium setaceum, RUBIACEÆ. F. B. I. iii. 208. The Plains, Hissar (Aitchison).

small, annual, stems round, minutely rough or smooth; leaves ½-⅞ by 1/16 in., upper filiform, short pointed, bristly, margins turned in, lower shorter, broader at the tip not bristly; flowers most minute, yellow in terminal and lateral few-flowered clusters

HERBS, ERECT, WITH OPPOSITE EXSTIPULATE, SIMPLE LEAVES:

LEAF MARGINS ENTIRE.

PETALS UNITED.

on slender stalks equal to or longer than the leaves: fruit $\frac{1}{10}$ in., smooth or with a few hooked hairs: otherwise like the last species.

Galium ceratophylloides, RUBIACEÆ. F. B. I. iii. 209. Kashmir, 8,500 ft. Pusiana, (Clarke).

small, stems hardly branching, short, 4-angled, very slender, quite smooth: leaves $\frac{1}{3}$ in., in close set circles of six, rather weak, finely long-pointed with bristles, minutely rough towards the tip; flowers very minute, yellowish in axillary 3-flowered clusters on erect stalks shorter than the leaves with two awl-like bracts at the tip, corolla segments lanceolate, long-pointed; otherwise like the last species.

Galium vernum, see Herbs, Prostrate, Opposite, Exstipulate, Simple.

Asperula cynanchica, RUBIACEÆ. F. B. I. iii. 209. Himalaya, Kashmir, 8,000 ft.

small, perennial, smooth, rarely just velvety, stock woody, stems many, slender, round, branches square: leaves $\frac{1}{4}$-$\frac{3}{4}$ by $\frac{1}{12}$-$\frac{1}{8}$ in., small, linear oblong, blunt, lower in circles of 4, upper in pairs; flowers $\frac{1}{10}$ in. long, pink or white in slender clusters or heads at the naked tips of branches with 2 small linear oblong bracts, corolla fennel-shaped, lobes 4, triangular shorter than the tube, fruit $\frac{1}{12}$ in. diam.: otherwise like Galium.

Asperula brachyantha, RUBIACEÆ. F. B. I. iii. 209 Himalaya, Kashmir, 7-12,000 ft.

very like the last species, but with shorter leaves in pairs, shorter blunter bracts, and woolly longer corolla: flowers more in heads.

Scabiosa Olivieri, see Herbs, Erect, Opposite, Exstipulate, Lobed.

Scabiosa speciosa, see Herbs, Erect, Opposite, Exstipulate, Lobed.

Spilanthes Acmella see Herbs, Erect, Opposite, Exstipulate, Simple, Toothed.