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Hatch, Surg.-Major W. K. ... ...Bombay.
Hatherell, Capt. W. G. ... ...Bombay.
Haughton, Samuel (I.C.S.) ... ...*Europe.*
Hauxwell, T. A. ... ...Maulmain.
Heath, R. H. ... ...Beawar.
Heeckerenez, LeBaron Von(Hon. Corrpg. Member).Java.
Henderson, Surg.-Capt. R. S. F. ... ...Deesa.
Henderson, Surg.-Major W. G. H. ... ...Hyderabad (Sind).
Herbert, Surg.-Capt. H. ... ...Bombay.
Hibbert, Capt. E. ... ...Mount Abu.
Hibbert, Col. J. ... ...*Europe.*

Hickman, R. St. J.... ... ...Cachar.
Hight, Mrs. ... ...Nasik.
Hill, F. J. A. ... ...Karwar.
Hill, H. Charles ... ...Naini Tal.
Hodgson, C. M. ... ...Belgaum.
Hoghton, Major D. de ... ...Khandalla.
Hole, H. A. ... ...Silchar.
Holland, W. J. ... ...Khandeish.
Hore, Lt.-Col. W. S. ... ...*Europe.*
Hornidge, S. (C.E.) ... ...Ahmednagar.
Howlett, Col. A. (I.S.C.) ... ...Mandalay.
Howse, G. E. ... ...Bombay.
Hudson, C. W. M. (I.C.S.) ... ...Bandora.
Hunter, H. C. V. ... ...*Europe.*
Hunter, Lt.-Col. J. M. ... ...Rajkote.
Hunter, Capt. W. H. ... ...Nagpur.
Hurkisondas Nurrotamdas ... ...Bombay.
Hussey, Col. C. E. ... ...*Europe.*
Hutchinson, Lieut. C. R. M. ... ...Bakloh.
Hutchinson, F. T. ... ...Bombay.
Hyam, Judah (Life Member) ... ...Poona.

Indore, H. H. the Maharaja Holkar of ... ...Indore.
Inglis, Chas. M. ... ...Cachar.
Inverarity, J. D. (Life Member) ... ...Bombay.
Israel, Shalom Bapujee ... ...Murud, Janjira.

Jackson, Col. F. H.... ... ...Palanpur.
Jacob, G. (I.C.S.) ... ...Belgaum.
Jacob, H. S. ... ...Munmar.
James, H. E. M. (I.C.S.) ... ...Calcutta.
Jamieson, A. ... ...Ootacamund.
Jardine, A. J. A. ... ...Burma.
Jardine, James ... ...*Europe.*
Jardine, Mrs. John... ... ...*Europe.*
Jayakar, Surg.-Lt.-Col. A. S. G. ... ...Muscat.
Jeejeebhoy, Sir Jamsetjee (Bart.) ... ...Bombay.
Jenkins, J. L. (I.C.S.) ... ...Bombay.
Jenkins, R. A. ... ...Bombay.
Jennings, Capt. A.... ... ...*Europe.*
John, H. E. ... ...Bombay.
Johnson, J. R. Kirby ... ...*Europe.*
Johnson, S. M. ... ...Cawnpore.
Johnston, Andrew ... ...Coorg.
Jones, Surg.-Capt. F. W. C.... ... ...Mhow, C. I.
Jones, Lieut. M. D. Goring ... ...Mhow.
Jugmohundas V. Bhaisett ... . Bombay

Kaliandas Keshavdas .. ..Bombay.
Kané, Dr. Sadashive W. ... ...Bombay.
Kantak, Dr. Shantaram V. ... ...Bombay.
Kay, Dr. W. ... ...Bombay.
Kazi Sahabudin, Khan Bahadur (C.I.E.) .. Poona.
Keatinge, G. (I.C.S.) ... ...Dharwar.
Kearns, A. S. ... ...Madras.
Keary, Major H. D. ... ...Burma.
Kemball, H. V. (C.E.) ... ...Sukkur.
Kennedy, Major W. P. ... ...Nandod.
Kennedy, H. E. Rear-Admiral W. R. ... ...*Europe.*
Kennedy, R. ... ... *Europe.*
Kenyon, James ... ...Karachi.
Ker, L. B. ... ...Bombay.
Kerkhoven, E. J. (Hon. Correspg. Member) ...Java.
Keys, H. W. ... ...Dhulia.
Khan, Muncherji Framji ... ...Bombay.
Khareghat, M. P. (I.C.S.) ... ...Broach.
Kilkelly, Surg.-Lt. P. P. ... ...Bombay.
King, Alfred ... ...Bombay.
Kinloch, A. M. ... ...Rangoon.
Kinsman, F. ... ...Mandalay.
Kirtikar, Surg.-Major K. R.... ... ...Thana.
Knight, D. ... ...Tuticorin.
Kolhapur, H. H. the Maharaja of (Life Member) ...Kolhapur.
Kunwar Kushal Pal Sinh ... ...Narki.

Lamb, R. A. (I.C.S.) (Life Member) ... ...Alibag.
Lancaster, A. ... ...Raipur, C. P.
Landon, H. J. (I.C.S.) ... ...Poona.
Lang, F. ... ...*Europe.*
Lang, Walter ... ...Bombay.
Langley, Brig.-Surg. E. H. ... ...*Europe.*
Latham, Hon'ble Mr. F. L. ... ...*Europe.*
Lathi, H. H. the Thakore Sahib of ... ...Lathi.
La Touche, Major-General ... ...*Europe.*
La Touche, C. B. ... ...Rutlam.
Lawder, Dr. E. J. ... ...Hyderabad.
Lawley, Major the Hon'ble R. T. ... ...Madras.
Leask, J.... ... ...Bombay.
Lee, Lieut. A. W. H. ... ...Bellary.
Lee, P. Henry K. ... ...Mysore.
Lees, John ... ...Cachar.
Lees, R. C. ... ...Bombay.
Lee-Warner, W. (I.C.S., C.S.I.) ... ...Bangalore.
Lely, F. S. P. (I.C.S.) ... ...Europe.
Leslie, A. K. ... ...Bombay.
Lester, Lt. C. D. ... ...Cutch.
Leville, Rev. H. ... ...*Europe.*

Lewis, Lt. E. H. ... ...Trimulgherry.
Lewis, Rev. Goldwyer ... ...Bombay.
Light, Capt. R. H. ... ...Bhuj, Cutch.
Lindesay, Major E. ... ...Jabalpur.
Lingard, Dr. Alfred... ... ...*Europe.*
Lisboa, Dr. J. C. ... ...Bombay.
Litchfield, E. ... ...Dehra Dun.
Little, F. A. ... ...Bombay.
Little, Hon'ble Mr. T. D. (C.E.) ... ...Bombay.
Littledale, Professor H. ... ...Baroda.
Loam, Mathew ... ...Ganjam, Madras.
Loch, Col. W. W. ... ...Bhurtpur.
Logan, R. (I.C.S.) ... ... *Europe.*
Long, A. M. ... ...*Europe.*
Long, G. R. (Life Member) ... ...Maulmain.
Lord, J. P. ... ...Surat.
Lovell, E. C. T. ... ...Colombo.
Low, C. E. (I.C.S.) ... ...Khandwa.
Lowdell, Surg.-Major C. G. W. ... ...Nasik.
Lowndes, G. R. ... ...Bombay.
Lowrie, A. E. ... ...Chunda, C. P.
Luard, E. S. ... ...Bombay.
Lucknow, The Curator & Sec., Provincial Museum..Lucknow.
Luxumonrao Juggonnath, Dewan Bahadur ...Sion.
Lye, Rev. S. L. ... ...Bombay.
Lynch, C. B. ... .Bombay.
Lynn, G. R. (C.E.) ... ...Baroda.

Macaulay, Capt. K.... ... ...Bombay.
Macaulay, R. H. ... ...Bombay.
Macaulay, W. M. ... ...Bombay.
MacCartie, Surg.-Major F. ... ...Bombay.
MacDonald, Dr. D.... ... ...Bombay.
MacDonald, J. ... ...Bombay.
Macfarlane, J. ... ...Mangalore.
Mackenzie, J. Muir (I.C.S.) ... ...*Europe.*
Mackenzie, Col. K.... ... ...Hyderabad, Deccan.
Mackenzie, M. D. ... ...*Europe.*
Mackenzie, Hon'ble Mr. T. D. (I.C.S.) ... ...*Europe.*
Mackinnon, P. W. (F.E.S.) ... ...Mussoorie.
Maclean, Jas. ... ...Bombay.
Macleod, N. C. ... ...Bombay.
Macnaghten, Chester ... ...Rajkote.
Maconachie, Brig.-Surg.-Lt.-Col. G. A. ...*Europe.*
Macpherson, Major T. R. M. ... ...*Europe.*
Mactaggart, H. B. ... ...*Europe.*
Madden, Lieut. T. E. ... ...Agra.
Madras, The Supt., Govt. Central Museum ...Madras.
Mahaluxmiwalla, K. D. ... ...Bombay.

Mainwaring, H. ... ...Bijapur.
Mair, A. ... ...Bombay.
Mallins, Surg.-Major C. ... ...Madras.
Maneckshaw, Doctor D. ... ...Bombay.
Manser, Surg.-Major R. ... ...*Europe.*
Mant, R. N. ... ...*Europe.*
Maries, Chas. (Hon. Correspg. Member)... ...Gwalior.
Marston, G. D. (C.E.) .. ..Sholapur.
Marten, James ... .Raipur, C. P.
Martin, Surg.-Lt.-Col. D. N. ... ...Saugor, C. P.
Martin, Lieut.-Col. Gerald (Life Member) ...*Europe.*
Mason, Geo. E. ... ...*Europe.*
Masson, D. P. ... ...Lahore.
McCabe, R. B. (I.C.S.) ... ...Kamrup, Assam.
McCann, W. H. ... ...Bombay.
McClelland, W. S. (M.I.C.E.) ... ...*Europe.*
McCorkell, G. (I.C.S.) ... ...Ahmedabad.
McIntosh, H. J. (I.C.S.) ... ...*Europe.*
McKenzie, Alex. ... ...Bombay.
McLaren, Mrs. G. ... ...Bombay.
McMullen, Dr. G. C. ... ...Kotri.
McNeil, J. (I.C.S.) ... .N. Canara.
Mead, Capt. H. R. ... ...Ahmedabad.
Mead, P. J. ... ...Ahmedabad.
Meade, Major M. J. ... ...*Europe.*
Mehta, P. R. ... ...Surat.
Mercer, Frank ... ...Mandalay.
Meredith, Richard ... ...*Europe.*
Messent, P. G. ... ...Bombay.
Meyer, Surg.-Capt. C. H. L. ... ...Bombay.
Meyer, O. ... ...Bombay.
Middleton, T. H. ... ...Baroda.
Millard, W. S. ... ...*Europe.*
Miller, E. ... ...*Europe.*
Millett, G. P. ... ...Thana.
Mills, Vet.-Major Jas. ... ...Bombay.
Minniken, G. G. ... ...Kilba, *viâ* Simla.
Modi, Bomanji Edulji ... ...Kaira.
Modi, Jivanji Jamsetji ... ...Bombay.
Monie, H. ... ...Bombay.
Monk, Capt. P. R. ... ...*Europe.*
Monks, Surg.-Major C. ... ...Mahableshwar.
Monod, E. C. ... ...*Europe.*
Monro, A. V. ... ...Lahore.
Monté, Dr. A. de ... ...Bandora.
Monté, Rev. Dr. B. de ... ...Bombay.
Moos, Dr. Framroz A. ... ...Thana.
Morgan, Vet.-Capt. J. W. ... ...Ahmednagar.

Morris, A. W. (F.Z.S.) ... ...Yercaud.
Morris, D. ... ...Bombay.
Morris, Lieut. D. O. ... ...Buldana.
Morton, Surg.-Lieut. J. P. ... ...Madras.
Moscardi, E. H. (I.C.S.) ... ...Karwar.
Moulani Sheikh Habibud Din (C.S.) ... ...Hyderabad.
Moultrie, J. E. ... ...Ngathainggyaung, Lower Burma.
Moulvi Syed Ali Belgrami ... ...Hyderabad.
Muir, Frank ... ...Jhansi.
Muller, Professor O. V. ... ...Bombay.
Murray, Andrew ... ...Bombay.
Murray, W. ... ...Bombay.
Mure, J. S. ... ...Lahore.

Nagpur, The Curator, Central Museum... ...Nagpur.
Nairne, Rev. A. K. (Hon. Correspg. Member) ...Poona.
Naranji Dwarkadas (Life Member) ... ...Bombay.
Navanagar, H. H. Maharaja Jam Saheb of ...Rajkote.
Nawab Mahomed Salamullakhan, Khan Bahadur...Buldana, Berars.
Newborn, C. ... ...Bombay.
Newman, Surg.-Col. J. H. ... ...Pachmarhi.
Newnham, Capt. A. (F.Z.S.) ... ...Satara.
Nicéville, L. de (Hon. Correspg. Member) ...Calcutta.
Nicholls, G. Jasper (I.C.S.) ... ...Moradabad.
Nicholson, E. F. ... ...Bombay.
Nicholson, Capt. J. S. ... ...Natal
Nurse, Lieut. H. H. ... ...*Europe.*
Nutt, Col. H. L. ... ...Sawantwady.

Oates, E. W. (Hon. Correspg. Member) ...Mandalay.
O'Brien, Hon'ble W. T. ... ...Karachi.
O'Callaghan, I. ... ...Bombay.
O'Connell, J. ... ...Bombay.
O'Conor, J. E. (C.I.E.) ... ...Calcutta.
Oldham, F. T. ... ...Kamptee, C. P.
Olivier, Lt.-Col. H. D. (R.E.) (Life Member) ...Bombay.
Ollivant, Sir E. C. K. ... ...Karachi.
Ommanney, D. G. ... ...Ahmednagar.
Ommanney, H. T. (I.C.S.) ... ...*Europe.*
Ommanney, J. L. ... ...Shwegyin, Burma.
Opiumwalla, Dorab E. ... ...Bombay.
Ormiston, Geo. E. (C.E.) ... ...*Europe.*
Orr, J. P. ... ...Poona.
O'Shea, F. Bernard... ... ...Calcutta.
Osman, C. W. ... ...*Europe.*
Osmaston, B. ... ...Chakrata.

Osmaston, L. S. ... ...Poona.
Owen, R. R. ... ...*Europe.*
Owen, W. S. ... ...*Europe.*
Ozanne, E. C. (I.C.S.) ... ...Poona.

Palliser, H. G. (C.E.) ... ...Belgaum.
Pandurang Gopal, Dr. ... ...Bombay.
Parker, Surg.-Major J. ... ...Bombay.
Parmenides, John ... ... *Europe.*
Parry, Capt. L. H. (R.A.) ... ...*Europe.*
Parsons, Hon. Mr. Justice ... ...Bombay.
Pawalla, Jamsetji C. ... ...Bombay.
Pearse, Surg.-Capt. A. ... ...Darjiling.
Pearson, Mrs. H. C. ... ...Bhaynder.
Pease, H. T. ... ...*Europe.*
Pechey-Phipson, Mrs. (M.D.) ... ...Bombay.
Peddie, M. G. ... ...Nowgong.
Peet, A. W. ... ...Vizagapatam.
Peile, Lieut. A. J. (R.A.) ... ...Bombay.
Pemberton, E. S. ... ...Marmagao.
Penny, L. ... ...Bombay.
Pentland, Major R. C. ... ...Quetta.
Penton, John E. ... ...*Europe.*
Pestonji Jivanji ... ...Hyderabad.
Peters, Surg.-Lt.-Col. C. T. ... ...Bijapur.
Petit, Bomanji Dinshaw (Life Member) ... ...Bombay.
Phillips, Mrs. ... ...Assam.
Philpott, C. C. ... ...*Europe.*
Phipson, H. M. (C.M.Z.S.) (Life Member)... ...Bombay.
Pilcher, Lieut. A. J. (R.E.) ... ...Poona.
Pinhey, Capt. A. F. ... ...Ulwar.
Plinston, G. C. ... ...Bombay.
Pollen, Dr. John (I.C.S.) ... ...Godhra.
Poncins, Baron Edmond de (Life Member) ...*Europe.*
Poore, Capt. R. M. ... ...Natal.
Porebunder, H. H. Prince Kumar Shri Bhao Singjee of ... ...Porebunder.
Prain, Surg.-Capt. D. ... ...Calcutta.
Prall, Surg.-Capt. S. E. ... ...Karwar.
Pratt, E. M. (I.C.S.)... ... ...Bandra.
Preston, F. J. ... ...Sholapur.
Prior, Capt. H. M. ... ...Calcutta.
Prior, Capt. W. ... ...Lucknow.
Proctor, H. E. ... ...Bombay.
Pyrke, Capt. R. D...* ... ...*Europe.*

Quicke, Surg.-Major W. H. ... ...*Europe.*
Quin, H. O. (I.C.S.) ... ...Ahmedabad.

Rahimtoola Khairaz	...Bombay.
Raikes, E. B.	...Bombay.
Raja Murli Manohur, Bahadoor ...	...Hyderabad.
Rajpipla State, The Administrator of the	...Nandod.
Rand, W. C. (I.C.S.)	...Satara.
Rattry, Lieut. H. C.	...Jhansi.
Rayment, Vet.-Major G. J.	...Rawal Pindi.
Readymoney, N. J.	...Bombay.
Reddie, F. A.	...Bombay.
Reeve, R.	...Bombay.
Reid, G. B. (I.C.S.)	...Ahmedabad.
Renton, Lieut. C. C.	...Julna.
Reynolds, P. (C.E.)	...*Europe*.
Richardson, Cecil	...Bombay.
Richardson, Major W. St. John ...	...Calcutta.
Rippon, Capt. G.	...Meiktila.
Ritchie, A. M.	...*Europe*.
Rivett-Carnac, J.	...Cachar.
Rivett-Carnac, L.	...Bombay.
Robb, Surg.-Major John (M.D.) ...	...*Europe*.
Roberts, R.	...Secunderabad.
Roberts, T. L.	...Bombay.
Robertson, B. (I.C.S.)	...Khandwa.
Robertson, Col. D.	...Gwalior.
Robinson, Mrs.	...*Europe*.
Robinson, Lieut. G. T.	...Rawal Pindi.
Rodon, Major G. S.	...Belgaum.
Rogers, C. G.	...Dehra Dun.
Rogers, Henry (M.R.C.V.S.)	...Bombay.
Rogers, Thos.	...Bombay.
Roorkee, The Principal, Thomason College	...Rurki.
Rose, F.	...Jubbulpur.
Russell, L. P.	...Bombay.
Rustomjee, H. J.	...Karachi.
Rutherford, D.	...*Europe*.
Ryland, E. C.	...Calcutta.
Ryrie, J. M.	...Bombay.
Sada, Monsieur A.	...Pondicherry.
Sage, Lieut.-Col. C. A. R.	...Dharamsala.
Sandhurst, H. E. Lord	...Poona.
Sansom, F. E.	...Hongkong.
Saone, G. Prier De...	...Bombay.
Sassoon, Mrs. S. D....	...Bombay.
Savile, P. B.	...Bombay.
Scindia, H. H. the Maharaja (Life Member)	...Gwalior.
Scott, Lieut. E. W. W.	...Secunderabad.
Scott, M. H. (I.C.S.)	...*Europe*.

Seal, Dr. C. E. ... ...Haliganj.
Selby, Col. H. O (R.E.) ... ...Bombay.
Servai, Cursetji N. ... ...Bombay.
Servai, Rustom F. ... ...Bombay.
Sewell, R. A. D. ... ...*Europe.*
Sharp, Professor W. H. ... ...Bombay.
Sharpe, Major-Genl. C. F. ... ...Coonoor.
Shelley, Lt. Bertram A. G. (R. E.) ... ...Bombay.
Sheppard, W. D. (I.C.S.) ... ...Sirsi, Kanara.
Shipp, W. (C.E.) ... ...Jubbulpur.
Shipp, W. E. ... ...Bombay.
Shopland, Capt. E. R. ... ...Karachi.
Shuttleworth, A. E. ... ...Cachar.
Silcock, H. F. (I.C.S.) ... ...Poona.
Simkins, A. R. M. ... ...*Europe.*
Simpson, A. F. ... ...Bombay.
Sims, E. Proctor ... ...Bhownagar.
Sims, R. Proctor ... ...Bhownagar.
Sinclair, W. F. (I.C.S.) (Life Member) ... ...*Europe.*
Sladen, J. (I.C.S.) ... ... Shewan, Karachi.
Slater, D. McLauchlan ... ...Bombay.
Slater, E. M. ... ...*Europe.*
Slater, J. Sanders ... ...Bombay.
Sly, F. G. (I.C.S.) ... ...Hoshungabad.
Smales, Chas. B. ... ...Magwe, Burma.
Smetham, E. R. ... ...Bombay.
Smith, Capt. S. C. ... ...Bombay.
Smith, Capt. Stanley ... ...*Europe.*
Smith, Mrs. Yorke ... ...*Europe.*
Smyth, R. Bateman... ... ...*Europe.*
Smythies, Arthur ... ...Dehra Dun.
Snuggs, J. F. ... ...Harda, C.P.
Spalding, C. S. ... ...Bhownagar.
Spence, L. H. ... ...Kaira.
Spencer, F. A. ... ...*Europe.*
Spurrell, Capt. R. J. ... ...Nagpur.
Squire, W. W. (C.E.) ... ...Bombay.
Squires, Mrs. R. A. ... ...*Europe.*
Stanton, W. C. ... ...Rangoon.
Starling, The Hon'ble Mr. Justice M. H. ...Bombay.
Stewart, R. B. (I.C.S.) ... ...Malegaon.
Stiven, J. ... ...Bombay.
Storey, Thos. H. ... ...Oodeypur.
Street, Surg.-Major A. W. F. ... ...*Europe.*
Sturrock, G. C. (R.A.) ... ...Roorkee.
Summers, Thos. ... ...Hyderabad.
Sutherland, W. ... ...Nagpur, C. P.
Swan, H. H. ... ...Bombay.

Swinhoe, Col. C. ... ...*Europe.*
Syers, Capt. H. C. ... ...*Europe.*
Sykes, C. M. ... ...Mandvi, Cutch.
Symington, J. H. ... ...Bombay.
Symons, H. S. ... ...Bombay.
Symons, J. L. ... ...Bombay.
Symons, N. S. (Life Member) ... ...Bombay.

Talyarkhan, Maneckshaw J. ... ...Bombay.
Tanner, Lieut. C. O. O. ... ...Hyderabad (Sind.)
Tata, Dorabji J. (Life Member) ... ...Bombay.
Tata, Jamsetji N. (J.P.) ... ...Bombay.
Taylor, James H. ... ...Khorda, Orissa.
Taylor, W. C. ... ...Khorda, Orissa.
Tejpal, Goverdhundas Goculdas (Life Member) ...Bombay.
Temulji B. Nariman, Dr. ... ...Bombay.
Tenasserim Agri-Horticultural Society, The Hon. Secretary of the ... ...Maulmain.
Terry, G. W. ... ...*Europe.*
Thacker, W. ... ...Bombay.
Thatcher, Capt. J. F. C. ... ...Nusseerabad.
Thomas, R. E. S. ... ...Calcutta.
Thomason, R. M. ... ...Rutlam.
Thompson, H. N. (F.Z.S.) ... .Monywa, Burma.
Thompson, P. ... ...*Europe.*
Thompson, R. H. E. ... ...Jubbulpur.
Thomson, Mrs. H. I. P. ... ...Bombay.
Thomson, Capt. D. B. ... ...Poona.
Thurburn, H. B. ... ...*Europe.*
Tod, Alex. M. ... ...Bombay.
Tod, F. H. ... ...Poona.
Tomlinson, S. (C.E.)... ... ...Bombay.
Tooth, E. ... ...Bombay.
Topham, F. D. ... ...Bijapur.
Tottenhan, W. F. L. ... ...Pegu.
Townsend, G. H. ... ...Bombay.
Traill, John ... ...*Europe.*
Traill, W. H. ... ...Jhansi, C. P.
Trapmann, A. G. (C.E.) ... ...Rangoon.
Travers, C. H. ... ...Ganjam.
Tribhuvandas Motichund Shah, Dr. ... ...Junagad.
Trevithick, R. L. (A.M.I.C.E.) ... ...Bombay.
Trevor, Hon'ble Mr. A. C. ... ...Poona.
Trewby, Miss Lilian (M.D.) ... ...Amraoti.
Trivandrum, Hon. Sec., Government Museum and Public Gardens ... ...Trivandrum.
Trood, W. ... ...Sirispur.
Troup, N. F. T. ... ...Kumaon.

Tudball, Chas. (C.E.) ... ...Shillong.
Tudball, W. (I.C.S.)... ... ...Bareilly, N.-W. P.
Tufnell, Capt. H. R. ... ...*Europe.*
Turner, Mrs. A. F. ... ...Bombay.
Turner, A. W. ... ...*Europe.*
Turner, M. C. ... ...Calcutta.
Twopenny, C. D. ... ...Shrinagar, Kashmir.

Uloth, H. W. ... ...Bombay.
Ulwar, H. H. Maharaja Jey Singh of (Life Member) Ulwar.
Unwalla, J. N. (Life Member)... ... ...Bhownagar.

Vaidya, Dr. Poput Prabhuram ... ...Bombay.
Vaidya, Vishwanath Prabhuram ... ...Bombay.
Vanderzee, J. H. ... ...Ellichpur.
Vandravandas Purshotumdas ... ...Bombay.
Vaughan, Surg.-Capt. J. C. S. ... ...Lahore.
Vidal, Hon'ble Mr. G. W. (I.C.S.) ... ...Poona.
Viccaji, Framji R. (Life Member) ... ...Bombay.
Vincent, Lieut. F. L. ... ...*Europe.*
Virji Jhina Raval, Dr. ... ...Bombay.

Wade-Brown, Surg.-Capt. F. J. ... ...Bombay.
Wadia, Hon'ble Mr. Nowroji N. (C.I.E.) ...Bombay.
Waddington, C. W. ... ...Rajkote.
Walker, A. C. ... ...Bombay.
Wallace, John (C.E.) ... ...Bombay.
Wallace, F. B. ... ...Bombay.
Wallace, L. A. ... ...*Europe.*
Wallinger, W. A. ... ...Surat.
Wapshare, H. ... ...Ootacamund.
Ward, Lieut. C. H. ... ...*Europe.*
Ward, T. J. ... ...Bombay.
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Yule, Col. J. H.	...Peshawar.

BOMBAY NATURAL HISTORY SOCIETY.

STATEMENT of ACCOUNT from 1st January, 1894, to 31st December, 1894.

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Balance in Bank on 1st January, 1894 ...	2,136	12	4	Rent from 1st December, 1893, to 30th Nov. 1894, at Rs. 100 per month	1,200	0	0
Cash with the Hon. Secretary on 1st January, 1894 ... ... Rs. 25 0 0				Establishment from 1st December, 1893, to 30th November, 1894	1,395	0	0
Petty Cash balance on 1st January, 1894... ... ... „ 21 2 11				Furniture Account	214	2	0
	46	2	11	Library Account	79	2	0
Subscriptions for 1893 (in arrears)	285	0	0	Printing and Stationery	231	9	6
Do. for 1894	8,262	0	0	Messrs. E. Wimbridge & Co., proceeds of 15 Camp Beds sold by the Society for Mr. J. Wallace	290	11	3
Do. for 1895 (in advance)	270	8	0	Cost of printing Journals and coloured plates from England	8,663	12	0
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Do. for Journal from Members residing out of India	190	0	0	Balance in Bank on 31st December, 1894....	1,344	12	2
Entrance Fee	1,030	0	0	Petty Cash balance on 31st December, 1894.	25	13	4
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Audited and found correct.

N. C. MACLEOD,
Hon. Auditor.

E. M. SLATER,
Hon. Treasurer.

BOMBAY, 1st *January*, 1895.

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H. C. S. Baker del. Hanhart Bros. Chromo. lith. London.

PRINIA SOCIALIS.
The Ashy Wren-Warbler.

ZOOL. Kolkata ALIPORE

JOURNAL

OF THE

BOMBAY

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Vol. IX.] BOMBAY. [No. 1.

THE BIRDS OF NORTH CACHAR.

PART II.

By E. C. Stuart Baker.

(*With Plate B.*)

(*Continued from Vol. VIII, page* 211.)

Family *Sittidæ*.

(122) Sitta himalayensis.—The White-tailed Nuthatch.

Oates, No. 315; *Hume, No.* 248.

Only to be found, as a rule, on the highest peaks, but I once had a nest of this bird brought to me at Gunjong itself, which was taken at an elevation of little over 2,300 feet. At the time I could not identify it, but I afterwards took another nest containing four young and an addled egg, and by the help of this I was able to ascertain the identity of the others. These eggs differ from those of any other nuthatch's I know of in that, instead of being a glossy pure white as one would have expected, they have a faint, very faint, creamy tinge about them. In my eggs the spots, which consist of small, irregular, pale reddish blotches, are almost confined to the larger end.

The five eggs average ·74″ × ·60″.

(123) SITTA CINNAMOMEOVENTRIS.—The Cinnamon-bellied Nuthatch.

Oates, No. 316 ; *Hume, No.* 251.

This is the most common type of Nuthatch in the North Cachar Hills, but so little seems to be known of its nidification that I reproduce the few notes I have collected on the subject.

The first nest I ever took of this bird was found in April, 1888, on some date between the 15th and 20th. It consisted merely of a few skeleton leaves and one or two feathers, being just sufficient to fill up the bottom of the hole in which it was placed. This was a natural hollow in a branch of a tree at a height of about twenty feet from the ground, and the entrance to it, which had been originally about four inches by three, had been reduced to a neat circular hole of rather less than two inches diameter by means of earthwork built all round the edge by the birds. The material seemed to be stiff clay and some semi-transparent stuff that looked like tree-gum. The nest contained five young. Another nest, which was found on the 3rd May, was quite different ; the hole in which it was placed had been formerly the property of a barbet and was small enough as it was, so there was no earthwork at the entrance ; the nest itself was composed of moss and feathers and was rather compact and deep. It contained four eggs, which were all broken by the boy who was sent up to take them.

In 1889 I only found one nest, in which were four eggs, rather hard set. The nest was made entirely of dead leaves, and was placed at the bottom of a deep crevice in the trunk of a small dead tree ; the long natural orifice had been completely filled up for some 18 inches, only leaving a hole at the top just big enough for the bird to squeeze through.

In 1891 I found two nests—one empty and one with two eggs ; both were made of leaves and a little moss. In the empty one no earthwork had been made about the entrance, though the nest seemed to be completed ; in the other the rim of the hole, which was naturally small, was neatly smoothed and finished off with clay. The situation of the tree in which the nest is placed is usually one standing in thin forest, but one nest was taken from a dead stump by the road-side, and another was found in a tree, in a clearance, which had been killed by ringing. The usual complement of eggs

appears to be four. In shape they are a rather long oval, but slightly pointed. The texture is close and hard, and the surface smooth and highly glossed. The most common type seems to be a pure white egg with rather numerous, small spots of dull, dark red. In some eggs these spots are merely tiny specks, in others they are almost large enough to be called blotches, and in the last mentioned nest the eggs were quite boldly marked with rather light reddish.

The average of the only six eggs I have measured is ·70″×·56″, and they differ from one another very little in either size or shape.

(124) S. NAGAENSIS.—Austen's Nuthatch.

Oates, No. 318 ; *Hume, No.* 248 *Ter.*

I got a male of this species in May, 1891, at Hungrum. I also had a shot at the female, but, most unfortunately, I missed and, though I followed it up a long way, failed to get another shot, and so missed getting a female, as yet undescribed.

(125) S. FORMOSA.—The Beautiful Nuthatch.

Oates, No. 324 ; *Hume, No.* 252.

Oates records this as having been killed at *Asalu in the Khasia Hills.* I have made careful enquiries, but can find no trace of any place of this name in the Khasia and Jaintea Hills district, and I think the place referred to may be *Asalu, the old head-quarters* of the *North Cachar Hills.*

(126) S. FRONTALIS.—The Velvet-fronted Blue Nuthatch.

Oates, No. 325 ; *Hume, No.* 253.

Common up to about 4,000 feet. This species does not appear ever to lessen the size of the entrance to its nest hole with clay. On the other hand I have known them enlarge portions of cracks in order to effect an entrance into a desirable hollow.

Family *Dicruridæ.*

(127) DICRURUS ANNECTENS.—The Crow-billed Drongo.

Oates, No. 326; *Hume, No.* 279.

In April and May, 1891, I found this bird breeding very freely in these hills. The nest is much like that of *D. ater*, but is smaller and even more flimsy, yet neater, than that bird's. Half a dozen nests average under 4″ in internal diameter, and out of 20 nests I don't think I have seen any over 4·5″. The materials are chiefly very fine elastic twigs

and coarse grasses bound together with cobwebs and almost completely covered outwardly with scraps of rough brown moss and lichen. I only found them breeding at places over 4,000 feet. The eggs are typical Drongo's eggs, and cannot be distinguished from many specimens of *D. ater* or *D. longicaudatus*. None of my eggs have a white ground, and the majority are rather a warm salmon or creamy pink. One or two clutches are marked almost entirely with dark reddish-brown, these blotches forming a very well-defined ring about the larger end and scanty elsewhere. A few marks of pale lavender and neutral tint are also to be seen if the eggs are closely examined. In most eggs these latter marks predominate over the darker ones, but the majority of eggs are but thinly marked with either. Twenty-five eggs average ·94″×·74″, and they vary between ·88″ and 1·02″ in length and between ·7″ and ·81″ in breadth.

Three appear to be the usual number of eggs laid, but I have taken two eggs only more than once which showed signs of incubation.

(128) D. ATER.—The Black Drongo.

Oates, No. 327; *Hume, No.* 278.

Common everywhere, more especially below 2,500 feet.

(129) D. LONGICAUDATUS.—The Indian Ashy Drongo.

Oates, No. 328; *Hume, No.* 280.

(130) D. CINERACEOUS.—The Grey Drongo.

Oates No. 333.

Length 11·3″; wing 5·6″; tail 6·4″; bill at front ·8″ and from gape 1·2″; tarsus ·7″.

The above measurements represent the average bird of these parts; some few are slightly larger, others smaller.

NIDIFICATION.—The nest is not, I think, to be distinguished by general appearance from that of *D. ater* or *D. longicaudatus*. Two nests now before me are both made of fine but strong grass-stems internally, and outside these are wound stems of plants, coarser grasses and a few slender and soft twigs. These are almost completely covered with lichen and cobwebs except at the bottom. Taking into consideration the dozen or so nests that I have seen, I should say they are less tidy than those made by the other members of this genus, the inner part—it cannot be called lining—often protruding over and beyond the lichen and cobwebs.

The nests average in size about 4·6″ × 1·8″ externally, and about 3·8″ × 1·2″ or less internally.

They are generally, but not always, placed at a considerable height from the ground, and the site selected by the birds is usually a fork, either upright or horizontal, towards the summit or outermost branches of the tree. It seems always to be very strongly attached to the supporting twigs, these often being entirely covered in with the materials or, at other times, very firmly wound round and about with the tenacious yellow webs of the large black and yellow spider.

The eggs, as far as I have as yet been able to ascertain, are of two types—firstly, pinkish in ground-colour with rather numerous spots and blotches of red and reddish-brown. These spots are nearly always confined principally to the larger end, where they sometimes form a ring or undefined cap. In the second type the ground-colour varies from white to extremely pale cream, and the markings consist of blotches of deep purply-brown and others of the same colour, but much paler, looking as if they had been half washed out. In all my eggs of this type the blotches form a scattered ring about the larger half.

The full number of eggs appears to be three. I have only taken two nests with four eggs, and in several of these, which contained three only, there were distinct signs of incubation having commenced. Twenty-six eggs vary in length from ·93″ to ·98″ and in breadth from ·7″ to ·74″, the average being ·96″ by ·72″. All my nests containing eggs have been taken between the 12th April and 30th May. I have only found it breeding between three and five thousand five hundred feet, but it is common in the cold weather at much lower elevations and extends into the plains of Cachar, etc. I know nothing in its habits different from those of the common drongos. Its note is extremely soft and sweet, and its song the same.

(131) CHAPTIA AENEA.—The Bronzed Drongo.

Oates, No. 334 ; *Hume, No.* 282.

The nest is a small, very neat cup; outwardly the principal materials are short, broad pieces of grass, bamboo leaves, and shreds of tan-coloured bark; these are bound together with a strip of the same bark and secured with masses of cobweb and lichen ; the interior is generally made of the ends of fine flowering grasses from which the seeds have

been stripped. One nest I have is, with the exception of the interior, entirely composed of tiny scraps of shavings, these having been collected from near my bungalow, where some sawyers had been at work cutting posts. The nest is quite white, except where covered with grey cobwebs; the inner part is much as usual. There is never any lining to the nest, but invariably the finest pieces of grass are placed innermost.

Most nests are placed in a semi-pendant position between the bifurcating branches of some small fork; at other times they are placed in an upright position, but these latter only number about one in five. Most of those I have taken were found on slender branches at some height, between 15 and 20 feet, from the ground, but I have seen a nest not 5 feet from it, and others again over 40 feet up and quite inaccessible.

The dimensions of one nest are: external breadth, 4·2″, depth 1·8″; internal breadth 2·8″, depth 1·6.″ Generally speaking, they are very strongly and compactly made, but a few nests are rather flimsy in appearance, and the base can almost be seen through.

The eggs are either three or four in number. I have never seen more than four eggs or young, and have never taken less than three eggs which showed any signs of incubation. In coloration they remind one at once of the eggs of *Terpsiphone paradiseus*; indeed, but for their greater size, I have seen many that could not be distinguished from those of that bird or of *T. affinis*. In ground-colour they are a pale fawn or cream, and they are marked at the larger end with indistinct spots of a darker shade of the same colour. In some specimens there are also underlying spots of grey or faint neutral tint and a few of a rather darker purplish; these are either distributed over the larger half of the egg or tend to form a zone or cap at that end. They differ as a rule very considerably from the eggs of the other members of this sub-family both in coloration and shape, but I have one clutch of eggs which are exact miniatures of the paler type of egg of *D. ater*. As regards shape, they are typically a fairly long oval, but little pointed. The shell is smooth and fragile, exhibits no gloss, and is very porous. The average size of all my eggs is ·78″ × ·59″. The greatest length is ·80″ and the greatest breadth ·60″; the least both ways is respectively ·73″ and ·56″; the next smallest egg to that is ·77″ × ·57″. The earliest

date at which I have taken a nest with eggs was the 3rd of April, 1892, and they breed generally during that month and May, and sometimes in early June. This little drongo is exceedingly common everywhere, perhaps even more so than *Dicrurus ater* and *D. longicaudatus*. It descends to the plains over a great part of India and may be found up to 5,000 feet. During the cold season great numbers are always to be seen together, though one can hardly say that they keep in flocks, as each bird appears to act quite independently of the rest. They are very bold birds and seem to fear neither hawk, owl, nor crow, tackling any such which may make their appearance, driving them away from where they wish to feed.

(132) CHIBBIA HOTTENTOTA.—The Hair-crested Drongo.

Oates, No. 335; *Hume, No.* 286.

A most remarkable ooligical occurrence once came under my experience in connection with one of these birds. In the latter end of April, 1891, I discovered a nest of this bird in a small sapling, and by getting on a bank above the nullah in which the tree grew I could see into the nest, in which there were two eggs. Wishing to get the bird, a man who was with me set a noose of fine thread over the nest and we came away. The next morning I sent the native to the nest, but as the bird was not caught, he reset the noose and returned, and at about noon again went to inspect it, this time returning with the bird, and the nest; the latter contained, to my astonishment, four eggs, but I concluded that one must have been laid directly after we left the nest and the other just before the man visited it in the morning. On examining the bird I found yet another egg quite ready to be deposited, and it would certainly have been laid within six hours. Thus altogether three eggs would have been laid between 10 A.M. one day and about 6 P.M. the next. The fourth egg must have been laid at about 5 A.M. in the morning. The five eggs were all quite perfect, and there was nothing abnormal either in their appearance or their contents.

The eggs vary in ground-colour from an extremely faint to a rather warm creamy-pink; it is never quite white, and never, I think, as dark as the darkest eggs of *D. ater* or *D. longicaudatus*. In some eggs the colour is rather a livid pink. The markings consist of small irregular

(137) ELACHURA HAPLONOTA.—The Plain Brown Wren.

A separate article on this bird, with a plate, appeared in the third number of the Journal for 1892; so it is needless to add anything here.

(138) UROCICHLA LONGICAUDATA.—The Long-tailed Wren.

Oates, No. 354 ; *Hume, No.* 332.

I had a specimen of this bird brought to me by a Naga in 1888, which he had caught in a snare. This was at a place called Guilong and at an elevation of about 4,000 feet.

(139) PNOEPYGA SQUAMATA.—The Scaly-breasted Wren.

Oates, No. 356 ; *Hume, No.* 329.

A rare bird here, the next species being the common type.

(140) PNOEPYGA PUSILLA.—The Brown Wren.

Oates, No. 357 ; *Hume, No.* 330.

This is the commonest type of wren in the North Cachar Hills, but it is extremely locally distributed. A few birds may be met with at Guilong, and it is found thence along all the higher hills for some 12 miles in a direct line south-east, after which it is no longer met with. In its habits it differs in no way from *P. squamata*, being the same restless, energetic little bird, equally shy and skulking and equally loth to leave the piece of jungle in which it is hiding. The favourite haunts are masses of brambles, raspberry bushes and scrub, interspersed with moss-covered trees, and if there are a few fallen trees about, so much the better.

The first nest I found of this bird was a lovely little ball of bright green moss wedged in amongst a mass of brilliant yellow orchids which were growing on a large, mossy tree. It was placed just above a broken branch about 5 feet from the ground almost level with my eyes, yet so beautifully was it concealed that, standing as I was within a yard of it, I could not see it until nearly all the over-hanging orchids had been cut away. Another nest was placed against a fallen tree in amongst the luxuriant moss which hung from it in long festoons. Altogether I have taken about ten nests, and these have all been either built against the trunks of living trees or against fallen logs. Where these were covered with moss, the nest was always made of that particular kind of moss and well hidden amongst the same, where there was no moss, and this was the exception, they were usually placed in, or under, a clump of orchids, tree-fern, or other plant.

The nests, which are rather small for the size of the bird, average some $4\frac{1}{2}''$ in diameter, being almost perfect spheres; the entrances are about an inch across and generally rather more vertically. All the nests I have seen have had no other materials than moss used in their construction, the roots alone forming the lining and, as a rule, the brightest and freshest moss being outside. The earliest date on which I have taken a nest was the 4th of May, but they must commence breeding in the middle of April, as in early May I got some half-fledged young ones. They continue to breed until about the middle of June.

The eggs differ in no way from the *P. squamata*. They are pure white, and in shape broad regular ovals. The surface is fine and smooth, but quite glossless, and the shell is very fragile.

Twenty-one eggs average ·72″ × ·55″, and they vary in length between ·70″ and ·75″, and in breadth between ·52″ and ·58″.

Four is, I think, the full complement of eggs, but I have seen three, and once two, eggs showing signs of incubation.

Family *Sylviæ*.

(141) LOCUSTELLA CERTHEA.—Pallas's Grasshopper Warbler.

Oates, No. 360; *Hume No.* 421.

I observed this bird, and shot two specimens, in July, 1891, about the rice-fields and swampy patches of grass and ekra on the Umrung Plateau at about 1,200 to 1,500 feet. An examination of the birds proved that they were breeding, but a most careful search produced no nests.

(142) ACROCEPHALUS STERTOREUS.—The Indian Reed Warbler.

Oates, No. 363; *Hume, No.* 515.

Not uncommon in the grass lands at the foot of the hills.

(143) A. DUMETORUM.—Blyth's Reed Warbler.

Oates, No. 366; *Hume, No.* 516.

Mr. H. A. Hole found these birds fairly common along the foot of the hills, haunting ekra and sun-grass.

(144) TRIBURA LUTCIVENTRIS.—The Brown Bush-Warbler.

Oates, No. 372; *Hume, No.* 522.

I got a single specimen of this bird in May, 1890, shooting it whilst it was flitting about in a patch of ekra on the Umrung plain.

(145) ORTHOTOMUS SUTORIUS.—The Indian Tailor-bird.

Oates, No. 374 ; *Hume, No.* 530.

Common up to 3,500 feet, not above.

(146) O. ATRIGULARIS.—The Black-necked Tailor-bird.

Oates, No. 375 ; *Hume, No.* 530 *Bis.*

I have seen about a dozen specimens of this bird, the majority females trapped on the nest. It does not appear to ascend above 2,500 feet, and nearly all my birds were obtained in the Jatinga valley, nowhere over 1,500 or 1,600 feet.

The female, when the feathers of the neck become abraded, shows a certain amount of black on the throat, and the black bases of the feathers can always be seen if turned back with the finger. All the eggs I have seen have been like the pale reddish blotched type of eggs of *O. sutorius*, but they average smaller, ·67″ × ·44″ barely, and they seem to be decidedly more fragile. Dimensions of male in summer : length 5·3″ ; tail 2·4″ ; wing 1·8″; tarsus ·8″ ; bill from gape ·65″.

(147) CISTICOLA TYTLERI.—The Yellow-headed Fan-tailed Warbler.

Oates, No. 379 ; *Hume, No.* 541.

This little bird is common all over the grass plateau and grass-covered hills to the north and north-west, the only place I have not found it in being a large open plain close to the hot springs, where I found the next bird alone. Two kinds of nests are built by this warbler ; that most commonly to be met with is a small purse about 3½″ long by about 2½″, or rather more across. It is of the most flimsy construction, and is made of the flowering ends of fine grasses, the tips generally inwards. The commonest situation is a tuft of coarse grass, to the stems of one or more of which it is attached, the blades being brought down and incorporated with the nest. The opening is either quite close to, or at the very top of, the nest. The second form of nest is built against a broad leaf of some sort growing quite close to the ground, the leaf of a very common species of ground orchid being the one generally chosen. The leaf is not sewn together in any way, but the nest is merely fastened to it like a watch-pocket, and so shallow and flimsy is it that it seems as if it were impossible it could support a brood of young.

They appear to be early breeders, April and May being the chief breeding months, though I have taken eggs as late as the 4th July in 1891. The eggs are very beautiful, pale bright blue, blotched boldly with light brown or reddish-brown, or sometimes with deep purply-black; in the former case the markings are rather large irregular blotches; in the latter, generally, small spots and specks only. The surface is very mooth, close and glossy, and the shell is stout for so small an egg. Eighteen eggs average ·57″ × ·46″, and range between ·55″ and ·6″ in length and between ·45″ and ·48″ in breadth.

This little bird has a most remarkable cry compounded of two distinct sounds. The first is a prolonged plaintive note sounding like chee-e-e-ah, and the second, uttered after a distinct interval, is a beautiful bell-like note. A peculiar thing, too, is the fact that, whereas it is always easy to fix the locality of the first sound, it is next to impossible to locate the second even approximately correctly. I was for a long time under the impression that the notes, though both uttered by this species, were made by different birds, but a male bird caught on the nest was brought to me in a small wicker cage and whilst in my hut repeatedly uttered both sounds, and I noticed then that the bell-like note seemed sometimes to come from under my table, where the bird was lying, and sometimes from right away outside the hut.

The female seems seldom to utter the second note. This genus is, I think, stronger on the wing than any other warbler I know. Their flight is very quick and very level as well, and, when disturbed, they will fly a long way at a time. I do not think this bird sits on its eggs at all during the day unless it is raining. I spent several days in 1891 hunting for nests, and all which I obtained when the day was fine were found by accident, for the birds were never noticed on the nests, not one being found through the bird being disturbed from it. On one day, when it was raining, however, the only two nests I obtained were both found by noticing the bird fly away. She did not leave the grass from close to the nest, but crept out of it through the grass for a couple of yards before taking wing, and then, when once she did fly, she went right away out of sight, instead of keeping close by and showing any anxiety as to the fate of her property.

(148) CISTICOLA VOLITANS—The Golden-headed Fan-tailed Warbler.

Oates, No. 380.

I came across a number of warblers, which were most undoubtedly of this species, in a broad open plain south of the hot springs. I have got specimens of this bird every year, since 1888, from this place, but have met with them nowhere else. I have been able to distinguish no difference in their note between this and the last species.

(149) CISTICOLA CURSITANS.—The Rufous Fan-tailed Warbler.

Oates, No. 381; *Hume, No.* 531.

I have found this bird breeding on the grassy summit of a hill over 4,000 feet high.

(150) FRANKLINIA GRACILIS.—Franklin's Wren-Warbler.

Oates, No. 382; *Hume, No.* 536—8—536 *Ter.*

Common everywhere up to nearly 5,000 feet, but above this I have not met with it. I mention here merely the different types of eggs I have met with, as its nidification generally is far too well known to call for remark: 1, plain white; 2, white, densely covered everywhere with minute specks of red; 3, do. with brownish, the marks forming a very distinct ring; 4, plain blue; 5, do. profusely *speckled* with reddish all over; 6, do. with numerous very faint tan marks, making the egg look like a miniature of those of *Ochromela nigrorufa*, the Black and Orange Fly-catcher; 7, blue, boldly speckled with black; 8, blue, *blotched*, with reddish all over. Besides there is every intermediate form, and an endless series can be made of these eggs.

I have noticed that at the beginning of the season plain white or plain blue eggs are far more numerous in proportion to the others than they are later on, as may be shown by the following table kept during 1891. April was the first month in which an account was kept, and it was continued until September, after which I temporarily left the sub-division.

	Plain blue.	Plain white.	Others.
April	14	4	27
May	32	6	67
June	14	2	84
July	6	...	98
August	3	2	92
September	...	...	76

It is also a curious fact that the plain-coloured eggs average much larger than the others. Thus fifty plain blue eggs average ·65″ × ·44″; 12 white average ·63″×·43″ and 200 spotted eggs average ·59″×·41″. They breed practically all the year round, but I have never taken a nest either in December or January. On the 14th February, 1892, I was given a nest containing four eggs almost ready to hatch, and during the middle of November, 1891, I came across a nest containing a single fresh egg.

(151) F. RUFESCENS.—Beavan's Wren-Warbler.

Oates, No. 383 ; *Hume, Nos.* 535 *Bis*, 536 *Bis*, 538 *Bis.*

Very common indeed up to about 3,500 feet, not, I think, ascending much above that.

The nest is undistinguishable from that of the last bird and the eggs also are much the same, but I have never taken any resembling either of the two commonest types of *F. gracilis*—that is to say, either white or blue with innumerable freckles of reddish all over. The markings in this bird's egg are also less numerous, and in nine cases out of ten form a distinct ring towards the larger end. I have rarely taken unspotted blue eggs and only once a clutch of pure white ones.

(152) F. CINEREICAPILLA.—Hodgson's Wren-Warbler.

Oates, No. 385 ; *Hume, No.* 537.

Very rare indeed. I have taken five nests which were quite undistinguishable from those of *F. gracilis* and the eggs were all a pure skim-milk blue, rather lighter in shade than those of *F. gracilis* and also less glossy. In shape they are rather broad, regular ovals, one or two being rather lengthened. My last specimen was taken in July 1890, and since then I have seen no others. Ten eggs average ·59″×·42″.

(153) GRAMINICOLA BENGALENSIS.—The Large Grass-Warbler.

Oates, No. 388 ; *Hume, No.* 542.

Recorded from Cachar, but I have not yet obtained a specimen.

(154) MEGALURUS PALUSTRIS.—The Striated Marsh-Warbler.

Oates, No. 389 ; *Hume, No.* 440.

Not uncommon in the grass lands running along the foot of the hills.

(155) ACANTHOPTILA NEPALENSIS.—The Spiny Warbler.

Oates, No. 391 ; *Hume, No.* 431.

I found this bird frequenting the okra and sun-grass growing along the banks of the Kopili, where it enters the Assam Valley.

(156) CHÆTORNIS LOCUSTELLOIDES.—The Bristled Grass-Warbler.

Oates, No. 392 ; *Hume, No.* 441.

A single specimen, a female, was brought to me with a nest and three smashed eggs in June, 1891, at the hot springs. This is the only bird of the species I have ever obtained, though the Mikir (who brought the nest) assured me that they were fairly common.

(157) ARUNDINAX ACDON.—The Thick-billed Warbler.

Oates, No. 393 ; *Hume, No.* 518.

Recorded from Cachar. I have never met with it.

(158) PHYLLOSCOPUS AFFINIS.—Tickell's Willow-Warbler.

Oates, No. 405 ; *Hume, No.* 561.

One of the most common willow-warblers to be found during the cold weather in North Cachar.

(159) P. TRISTIS.—The Brown Willow-Warbler.

Oates, No. 407 ; *Hume, No.* 554.

Most commonly found from December to the end of March, but never anything but rare.

(160) P. INDICUS.—The Olivaceus Willow-Warbler.

Oates, No. 408 ; *Hume, No.* 562.

A very rare visitor. I have met with but one specimen.

(161) P. FUSCATUS.—The Dusky Willow-Warbler.

Oates, No. 410 ; *Hume, No.* 555.

A rare bird. Some years I have not noticed it at all.

(162) P. PULCHER.—The Orange-barred Willow-Warbler.

Oates, No. 414 ; *Hume, No.* 568.

(163) P. PROREGULUS.—Pallas's Willow-Warbler.

Oates, No. 415 ; *Hume, No.* 560.

This bird is very common during the cold weather, and some few birds remain in these hills all the year round, for, in 1888, I took a nest containing three eggs. The nest is exactly like those described by Captain Cock (in Hume's "Nests and Eggs," vol. I, pp. 260-1), namely, globular shaped, made of moss and very thickly lined with

soft small feathers. The nest I took was placed next the trunk of a tree and just between two large branches which grew above and below it. There was no lichen on this nest, but there were a few scraps of pine bark fastened here and there by means of cobwebs. The eggs were a dull white marked with reddish-brown, in two eggs the markings consisting of fairly numerous spots, in the third of nothing but very large blotches, one or two being nearly ·2″ across.

(164) P. SUPERCILIOSUS.—The Crowned Willow-Warbler.

Oates, No. 417 ; *Hume, No.* 565.

A common winter visitant.

(165) P. MANDELLII.—Mandelli's Willow-Warbler.

Oates, No. 419.

In 1889 I had a nest of this bird brought to me, which at the time I believed to belong to *P. superciliosus*, as I mistook the parent birds, which were caught on the nest, for that species. The nest was an oval ball, composed entirely of moss and lined with a little grass and very fine roots. The diameter lengthways was about 6·5″ by about 5·5″ across. It was said to have been wedged in between some stones on a steep mossy bank. It contained three fresh eggs, white with rather numerous freckles and small spots of rather bright reddish scattered all over the surface, and in one egg forming a distinct ring at the larger extremity. The shell is close and fine and the surface shows a slight gloss. They measure ·61″×·43″ ; ·6″×·42″ ; ·6″×·43″. This nest was taken on a peak above Hungrum and in scrub forest. I unfortunately did not note down the date on which it was taken, but I remember it was during the last few days of March.

(166) ACANTHOPNEUSTE NITIDUS.—The Green Willow-Warbler.

Oates, No. 421 ; *Hume, No.* 559.

An occasional winter visitant.

(167) A. VIRIDANUS.—The Greenish Willow-Warbler.

Oates, No. 42; *Hume, No.* 560.

On the same peak as that on which the nest of *P. mandellii* was taken I myself found a nest of *A. viridanus*. The upper part of the road running over this peak is extremely stony and the bank is often merely a mass of stones with large hollows here and there between them. Whilst on the march, in July, 1891, I observed a small bird fly out of one of these hollows, and on looking into it found a large loose globular nest made of moss and dead leaves, and lined with white goat's

hair. It was of very irregular construction, but roughly speaking it was about 8″ in height by about 5·5″ in breadth. It contained three pure white eggs with very fragile shells, which were glossless and of rather a chalky texture. I shot the male bird which returned to the nest within about ten minutes after I found it, so that there was no mistake as to their identity ; they measure ·58″×·44″, ·57″×·42″, and ·58″×·41″. In shape they are broad, rather regular ovals.

This is the only occasion on which I have seen the bird except in the cold season, when it is fairly common.

(168) A. LUGUBRIS.—The Dull Green Willow-Warbler.

Oates, No. 426 ; *Hume, No.* 558.

A common winter visitant.

(169) A. CORONATUS.—Temminck's Crowned Willow-Warbler.

Oates, No. 427 ; *Hume, No.* 563 *Bis.*

I saw one specimen, a female, of this bird in January, 1891.

(170) A. OCCIPITALIS.—The Large Crowned Willow-Warbler.

Oates, No. 428 ; *Hume, No.* 563.

Oates mentions this bird as having been found in North Cachar, but I have not yet met with it.

(171) A. TROCHILOIDES.—Blyth's Crowned Willow-Warbler.

Oates, No. 429 ; *Hume, Nos.* 564 and 564 *Bis.*

I have seen this bird once or twice in North Cachar, and once had a nest brought to me which was said to belong to this bird, but I rather doubt if it was. In shape the nest was a roughly-formed globular affair, made of moss, and it was said to have been taken from amongst the roots of a tree. It contained three eggs ; white, rather sparsely speckled with dull reddish, rather more numerous towards the larger end. The surface is slightly glossy and is stouter than in most eggs of the birds of this genus. They measure ·59″×·45″, ·58″×·45″, and ·60″×·45″.

(172) CRYPTOLOPHA AFFINIS.—The Allied Fly-catcher Warbler.

Oates, No. 431 ; *Hume, No.* 576.

A rare bird here, but probably less so really than appears to be the case, as it keeps much to the interior of evergreen forest and thus escapes observation.

(173) C. BURKII.—The Black Crowned Fly-catcher Warbler.

Oates, No. 433 ; *Hume, No.* 569.

This bird is not uncommon here during the cold weather, but on the commencement of the rains most of the birds seem to remove elsewhere, as I have very seldom met with it after April.

(174) C. XANTHOSCHISTA.—Hodgson's Grey-headed Fly-catcher Warbler.

Oates, No. 434 ; *Hume, No.* 569.

It is somewhat doubtful if the form found here is the true *xanthoschista*, as it averages far smaller than the Western form. My birds seldom reach 4″ in total length and average only some 3·3″. The tail averages about 1·6″, *and the wing 2·05″*. Besides this the colouring differs in one or two minor details.

I have on several occasions taken the nest, and have found it always to be made of moss and lined with exquisitely soft vegetable down. With one exception, all my nests were globular in shape, and they were placed either on steep banks or else against the trunk of a tree. The exception referred to was a lovely little cup-shaped nest, wedged into a stout fork of a dead branch lying on the ground. The fork was covered with white lichen, but none of this had been used in the construction of the nest, though, as this was lined with the usual white down, it was by no means at all conspicuous.

I have only observed this bird in the hot weather and rains well to the east of the district, but in the cold weather it wanders over most of the hills down to as low as some 2,000 feet.

Twenty-four eggs average ·56″×·46″ and vary hardly at all in size. They are all in shape broad ovals, somewhat compressed and pointed towards the small end.

(175) C. JERDONI.—Brook's Grey-headed Fly-catcher Warbler.

Oates, No. 435 ; *Hume, No.* 572.

The commonest form here is that which I have already noted as *C. xanthoschista*, but I have seen a few birds whose very dark heads were quite sufficient to separate them at once from that species. It haunts the same places, and has exactly the same habits, as that bird. I have not taken its nest.

(176) C. POLIOGENYS.—The Grey-checked Fly-catcher Warbler.

Oates, No. 436 ; *Hume, No.* 575.

I have seen but one pair of these birds, both of which I shot as they were hopping about near their nest. This was a most beautiful little affair exactly like that described by Gammie as belonging to *Pnoepyga albiventris*. The moss on the tree was very long, hanging down in lengthy festoons and tangles, and this moss, as it grew, was

worked into a small nest in which was placed a lining of moss roots. Outside the moss hung down over it, perfectly screening it from view, and there was no opening but merely the natural one between the moss-fronds and the tree-trunk. Had not the bird flown out, when I was only a few feet away from the tree, I do not think I could have ever found it.

It contained three eggs, white like all eggs of the genus *Cryptolopha*, but more glossy than the eggs of any other species that I have seen. In shape they are like those of *C. xanthoschista*, and they measure ·62″×·49″, ·63″×·5″, and ·59″×·49″.

(177) C. CASTANEICEPS.—The Chestnut-headed Fly-catcher Warbler.

Oates, No. 437 ; *Hume, No.* 578.

This little bird is not by any means rare to the east of the district, though it seems to be confined to a very small area. In the Laisung Valley I took several nests, all of just the same description as those of *C. xanthoschista*. In texture and shape, the eggs are also precisely similar, but are, of course, much smaller, measuring only ·53″ × ·4″.

It has a wonderfully pretty little song, which it constantly utters during the breeding season and generally in close proximity to the nest.

(178) C. CONTATOR.—Tickell's Fly-catcher Warbler.

Oates, No. 438 ; *Hume, No.* 576 *Bis.*

I have seen a specimen of this bird said to have been got in North Cachar ; personally I have never met with it.

(177) ABRORNIS SUPERCILIARIS.—The Yellow-bellied Fly-catcher Warbler.

Oates, No. 440 ; *Hume, No.* 574, *No.* 577 *Bis.*

This is by far the commonest fly-catcher warbler to be found in these hills, and is fairly common from the level of the plains up to the highest peaks.

The song is short, but very sweet and clear, and the bird is very fond of uttering it. This, more than any other species of *Abrornis* or *Cryptolopha*, takes its prey on the wing just like the fly-catchers, and I have often watched it for some half hour or so, alternately fluttering into the air and capturing some insect and then sitting on a twig and singing his cheerful little song.

All the eggs I have seen were blotched with reddish, thickly scattered everywhere and forming a deep-coloured cap at the larger end.

Fifteen eggs measure ·57″ × ·43″. In shape they resemble the eggs of the last species, occasionally being somewhat longer in proportion.

(180) A. ALBIGULARIS.—The White-throated Fly-catcher Warbler.

Oates, No. 442; *Hume, No.* 577.

Fairly common in the valleys towards the east, but rather rare elsewhere.

I have been very unlucky in not being able to get good clutches of the eggs of this species, though I have repeatedly obtained nests, either empty or containing young. The few eggs I have are of two distinct types. The first has a pinkish ground-colour, in some rather a deep pink, freckled all over with bright dark red, in a few cases the freckles being rather larger and giving a mottled appearance to the egg. These eggs are in coloration just like those of *Tesia cyaniventris*. The second type has the ground-colour pale yellowish, and the freckles are of yellowish-brown only.

Mandelli's nest was made of bamboo leaves and grass; all mine were made principally of moss and moss-roots, though one or two had a few bamboo leaves intermixed. The bamboos in which they were built were usually small ones, not much over 2″ in diameter, and seldom, if ever, over 3″. My eggs, eleven in number, average ·53″×·43″. None are as long as Mandelli's four eggs. The song is similar to that of the last bird, but is weaker and less often used.

(181) NEORNIS FLAVOLIVASCENS.—The Aberrant Warbler.

Oates, No. 446; *Hume, No.* 552.

A very rare bird here. I have come across it only three times.

(182) HORORNIS FORTIPES.—The Strong-footed Bush-Warbler.

Oates, No. 448; *Hume, Nos.* 526 *and* 552 *Bis.*

Fairly common on the higher ranges, not descending much below 2,800 feet in the breeding season and most often found over 4,000 feet.

(183) H. PALLIDUS.—The Pale Bush-Warbler.

Oates, No. 450; *Hume, No.* 527 *Bis.*

I obtained a bird which I believed to belong to this species in 1887, but I did not preserve it, and I am now rather doubtful as to its identity.

(184) H. PALLIDIPES.—Blanford's Bush-Warbler.

Oates, No. 451; *Hume, No.* 527 *Quat.*

This species seems to be confined entirely to the highest peaks to the north-east of the district, but on these it is not very rare.

The nests, of which I have taken three, are exactly like those of *H. fortipes*—that is to say, it is shaped like an egg with the small end cut off. It differs from the nest of that bird, however, in not having nearly so many feathers in the lining and also in being rather bulkier. The eggs are the same in shape as those of *H. fortipes*, but in colour I think they are somewhat deeper and they are also a purer chocolate, none of my eggs having the reddish tinge which is generally present in eggs of that species. The eggs, of which I have five, average ·71″×·51″.

(185) H. MAJOR.—The Large Bush-Warbler.

Oates, No. 452; *Hume, No.* 529.

Bill pale yellowish-brown, the culmen and tip darker, irides brown, legs reddish-fleshy. This bird is very rare here and, as far as I know at present, entirely confined to the highest peaks about Hungrum. The only three birds I have seen were all trapped on their nests. These (the nests) are very deep cups made of fine grasses and a few bamboo leaves and the inner part entirely of shreds of fine grass; in two nests there was a thick lining of feathers just as in the nests of *H. fortipes*, but in the third there were not half a dozen feathers altogether. One nest contained three eggs, of which one was unfortunately broken, and the remaining two contained two each. Five eggs are like those described as belonging to *H. pallidipes*, but are even darker; the third clutch, on the other hand, is quite as bright as most eggs of *H. fortipes*, and probably a full series of each species of this genus would show that they all range equally from the lightest to the darkest shades.

All eggs of this genus become mildewed very easily, being in this respect much like the red eggs of some of the *Prinias*.

(186) H. CANTURIENS.—The Large Bush-Warbler.

Oates, No. 453.

A single specimen recorded by Hume from Lakhipur in Cachar.

(187) PHYLLERGATES CORONATUS.—The Golden-headed Warbler.

Oates, No. 454; *Hume, No.* 531.

Irides tan-brown. I obtained several specimens of this bird in 1887 and 1888, but since then I do not think I have seen three.

The nests which I have had brought to me, on which the parent birds were said to have been trapped, were a sort of link between the nests

of *Orthotomus* and *Franklinia* on the one hand and of *Cisticola* on the other, for, though they are not completely enclosed in one or more leaves as is the case with the former, they are yet firmer and more bulky than are the latter. As a rule, the leaf, which is usually the semi-pendant one of a khydia, or kindred plant, about half encloses the nest forming the back-wall and also a partial support to the side-walls. It differs also from all allied nests that I know of in having a distinct lining of vegetable down.

I have seen very little of this bird in a state of nature, but this little certainly leads me to the same conclusion as Oates has arrived at, namely, that the bird is more nearly allied to *Cryptolopha* than to *Orthotomus*. Its eggs, however, show a nearer affinity to the latter genus. They are much like very pale, scantily-marked specimens of the eggs of *O. sutorius*, and I have one or two clutches of this bird which match them very well. They average ·56″ × ·45″, and in shape are broad, very regular ovals.

(188) SUYA CRINIGERA.—The Brown Hill-Warbler.

Oates, No. 458 ; *Hume, Nos.* 547, 548, *and* 549 *Quat.*

Common everywhere in suitable localities.

S. ATROGULARIS.—The Black-throated Hill-Warbler.

Oates, No. 459 ; *Hume, No.* 549.

I am somewhat doubtful about this species, as I have no skins to refer to, nor have I ever been able to compare the bird with an authenticated skin. The birds which I imagined to have been of this species were both darker and duller on the upper plumage than the next species ; in many the supercilium is quite absent, and in the others most indistinct. On the other hand the black of the breast does not descend as low as it should do in a typical S. atrogularis.

(189) S. KHASIANA.—Austen's Hill-Warbler.

Oates, No. 460 ; *Hume, No.* 549 *Bis.*

The species is very common on all the higher ranges, but I have not found it below about 3,000 feet. The eggs are of three distinct types. In one the ground-colour is pure white, and in another a pale bluish or greenish. In both these types the markings consist of strongly defined spots and specks of brownish-red, which in nine cases out of ten form a ring or cap towards the larger end and are sparsely scattered elsewhere ; but in a few eggs the markings are very dense every-

where, and they are then generally rather paler and more blotchy than in the other eggs. The third type is similar to the commonest type of egg of *S. crinigera*—that is to say, it has a pale yellowish flesh-coloured ground, and the markings, which are of a pale reddish, are freckles and blotches rather than well defined spots.

One hundred eggs average ·63″ × ·47″ and range between ·57″×·66″ and in breadth between ·45″ × ·51″. In shape they are broad, regular ovals, and abnormal shaped eggs are very rare. The texture is fine and close, and some eggs show a slight gloss.

(190) PRINIA FLAVIVENTRIS.—The Yellow-bellied Wren-Warbler.

Oates, No. 463 ; *Hume, No.* 522.

The following details as to plumage are not noted by Oates :—

Lores dark greyish-ashy.

The tail is always barred in summer, the final bar being broader and more strongly developed. Irides reddish-tan or pure tan.

In the female the lower mandible seems to be always paler in colour.

I can find nothing to show that the white eyebrow is a seasonal ornament. Some birds possessing this were shot in the height of the breeding season, and others which were obtained in December and January had it just as distinctly marked.

I have found this bird up to 4,000 feet, and have taken its nest at this elevation.

(191) P. SOCIALIS.—The Ashy Wren-Warbler.

Oates, No. 464 ; *Hume, Nos.* 534, 535, *and* 535 *Bis.*

Common here up to 3,000 feet, above which I have not met with it. Irides tan-coloured. Tail obsoletely barred. I have never yet met with a nest of this bird built in a leaf like that of *Orthotomus.*

(192) P. INORNATA.—The Indian Wren-Warbler.

Oates, No. 466 ; *Hume, Nos.* 543, 543 *Bis, and* 544.

Common up to about 3,000 feet.

(193) P. BLANFORDI.—The Burmese Wren-Warbler.

Oates, No. 468 ; *Hume, No.* 543 *ter. and* 544 *quat.*

A few wren-warblers occur here which are nearer this species than the last, but they appear to run into one another very much and will, I expect, be eventually both placed under the same name. As regards the bill remaining brown in summer, females of the last species do not attain the black bill.

MAN-EATING PANTHERS.

By J. D. Inverarity.

(*Read before the Bombay Natural History Society on* 10*th July*, 1894.)

In the hot weather of 1894, I was shooting in the northern part of the Hyderabad country, and spent a great deal of my time in trying to secure a man-eating panther that I was informed had already killed 21 people. From what afterwards occurred I believe there must have been two panthers addicted to man-eating, but at first I thought there was only one. I arrived at a village called Tutra on April 25th. Here several persons had been killed, and I was told that the panther was in the habit of sneaking into the villages at night and seizing some one asleep by the throat. There were several villages he had killed in, occupying, roughly speaking, a diameter of seven miles. I had not long to wait for a kill, as on the morning of April 27th news was brought of a man killed in the village of Karwa, two miles off, the previous night. I rode there at once, and found the corpse of a fine big man, with the holes made by the panther's teeth in his throat and claw-marks on the chest and legs. This village consisted of about a dozen huts. The man had been lying asleep on a cot, his wife on another cot by his side, in the small open space in front of his hut enclosed by a thorn fence. The hut was the centre one of the village. I found the tracks of the panther; he had crossed the fields, gone up the village pathway, entered by the gate which had not been properly closed, and sprung on the man as he lay asleep. He had been frightened off by the shouts of the villagers. He bolted back up the path he had come and made across the fields to the jungles where I lost his tracks. The general character of the jungle, in the neighbourhood of the villages frequented by the panther, was flat, intersected at long distances by shallow nullahs. A great portion of the jungle was bare, other portions had grass about waist-high—a most unpromising place to find a panther in, as he might be in any of the grass patches over an area of miles. On this occasion I tried a couple of beats in the nullahs near the village without success. Subsequently I used to walk the grass patches, but it was like looking for a needle in a bundle of hay. The panther tracks were not found by me in the nullahs. I believe it must have usually lain up in the flat jungle somewhere in the grass.

That night, *i.e.*, of the 27th April, he was wandering close to my tents most of the night, and was seen by several of my people. On the night of the 28th April he killed a man at a village called Chandur about two miles from my camp. I did not see this body. He was frightened off the man and visited my camp later in the night and came close up to the tents, but before I could get round to the spot he had moved off and I did not see him. Shortly afterwards I heard shouting in the village and learnt he had caught a dog and carried it off. I then moved camp to Chandur. The next I heard of the brute was that, on the night of the 30th April, he had killed a boy aged 7 years (the son of the Bania who was supplying my camp) at the village of Nanda about four miles off. The boy was sleeping on the same cot as a man, in the open space in front of a hut, which was the outside one of the village. The head of the cot was against the otla of the hut and the boy was the furthest from the road. The panther came on to the otla, passed the man and seized the boy and went clear off with him. The body was not found and must have been entirely eaten. Nothing was heard of the panther till the night of May 4th, when he appeared close to my tent at Chandur. I had a lamp put out in the field, twenty yards off, and sat on a camp-stool hoping he would come between me and the light, for, as there was no moon, I could not see. He, however, went to the village and killed a calf. On the night of May 6th he killed a woman at the village of Nimni seven miles away. I moved camp on the 7th to Nanda, where he was expected to turn up soon, and he did not disappoint expectations, as, at 11 p.m. on the night of May 9th, I heard an uproar at a house in the village 80 yards from my tent. As I always had my rifle and lamp ready, I was at the spot in a couple of minutes and saw the track left by a body being dragged down the village road. Followed by a number of villagers all shouting at the top of their voices I ran along the trail, and in 50 yards came to a large patch of blood where the panther had evidently dropped the body; he had taken it on again; a few yards more the road cleared the houses and took a sharp turn to the left into a field, and, soon after turning the corner, we ran on to the body. The panther could only just have left, as there was no blood when I first arrived and in a few minutes a large pool formed. I at first thought it was a gray-haired woman, but

it turned out to be a girl of about 16 years ; the hair being full of dust looked gray by the lamp-light. She was dead ; the body lay on the back, the legs straight out, the head resting on the right cheek, the right arm, adorned with two iron bangles, was bent as if it had been thrown up towards the neck, the left arm lay along the side. There was a cut, an inch long, on the chin, and the fatal teeth-marks in the throat. As we looked, the blood poured from a hole in the neck just behind the lobe of the right ear and made a large pool of black blood on the ground ; the jugular vein had been opened. If we had gone quietly there would have been a good chance of a shot, as the panther was evidently very reluctant to leave its victim. But, of course, one cannot prevent the shouting, as the panther might be frightened away by the noise before he had killed, though I believe that death must be immediate. I noticed the expression of the face was quite calm and ordinary in this instance, as well as in the case of the man killed at Karwa. I tracked the panther for some distance further by lamp-light down the road and across the fields, and in this direction it was at least half a mile to the jungle, though there were patches of jungle scattered in the fields. He had gone at a walk when leaving the girl and was walking as far as I tracked. I then suggested that the relatives should retire home and leave the body where it lay, for me to sit near it in case the panther returned, which I think he would have done, but they declined to accede to this sensible proposition and insisted on sitting round the corpse, with a number of sympathizing friends making a great noise. The tracks were those of a large male panther. He had dragged the body 100 yards. The girl, I think, must have been at least seven stone weight. When the teeth are in the wounds no blood flows, as I found none on the trail, except the large patch where he had dropped it. Any blood that flows is probably drunk. This girl was lying with seven other people all close together on the ground, in the open space in front of the hut. She was nearest the road. The panther entered by a gap between the corner of the hut and the thorn fence and then had the girl's throat within his reach. The girl was buried in the morning, and in the evening I sat, close to the place where we found her, for five hours till the moon set, staring at the road in case the panther should come up it. I also had two

policemen stationed at two other sides of the village with guns on the look out, but the panther did not return. Six days then passed and nothing happened except that on two nights the panther was said to have been seen, but as I could not find any tracks in the morning I do not think he was there. On the afternoon of May 15th, I moved my camp back to Chandur, and that evening, at 8 p.m., a large male panther was caught in a pit-fall at the entrance to the village of Nanda, close to the spot where he had dropped the girl on the 9th. The bait was a goat. He was shot in the trap by a police sepoy.

The man-eater was now supposed to be finished, but at 4 a.m. that very night, at the same village (Nanda), a panther seized a sleeping police sepoy. He was lying on his right side with his left arm over his head, so the panther did not get a good grip at his neck and it was frightened off. The police sepoy walked to my camp and was there by daylight. I found he had a shallow wound on the jaw, another, not more than half an inch deep, on the neck below the left ear, and a good sized hole, more than an inch deep, in the back of the arm close to the armpit, and a slight scratch on the back. He seemed all right. I washed the wounds out with a weak solution of carbolic acid, and as I had a probe, I have no doubt I got to the bottom of the wounds. That day he kept well, though a lot of thin watery blood oozed from the wounds. The next morning his cheek and neck were very much swollen ; the hole in the arm looked all right. I dressed his wounds again and had them well fomented with hot water. At night he breathed with difficulty and died at midnight—44 hours after being wounded—I presume of blood poisoning. That night, at 9 p.m.,a panther appeared close to my tents and was fired at, but missed by a police sepoy, and the panther again came on the night of May 18th near my tent. While I was sitting in front of my tent at 2 a.m. looking out for it, four cheetul crossed the field and stood within 60 yards of me. The male panther killed was 6 ft. 6 in. long, and I at first thought we had got an innocent panther, but as no further kill took place after that night, I believe he was the right one, and that the one that seized the police sepoy was a female that accompanied him. I, however, never noticed more than one track at the scene of a kill. At any rate, between the 26th April and 9th May, there were five kills—then the male panther was killed on May 15th, and afterwards, on same night, a man seized by

a panther at the same village, and after that no more kills. I think the solution of the puzzle must be that the male usually, if not always, did the killing. I cannot be certain that the second one was a female, but judging from the size of the holes in the police sepoy, I think it is likely. The two being at the same place the same night looks as if they had been a pair. In the 26 cases previous to that of the police sepoy, all were killed at once. The police sepoy was the only one seized in a clumsy way. I stopped in that part of the country for eleven more days and nothing more happened, and it was reported to me also that down to 6th June there had been no further disaster. In none of the cases, except that of the Bania boy, did the panther get away with the body, so that there was very little eating done. Besides the occasions I have mentioned that the panther came to my camp, there were several nights he was alleged to have been seen, but I do not count any night when his tracks could not be found in the morning. The panther fired at by the police sepoy on May 17th was certainly missed. The place was a field several hundred yards from jungle, and if it had been hit, blood must have been found. Moreover, it came again on the night of May 18th. I allude to this so as to exclude the possibility of it being thought that the second panther might have been hit, and died. I am afraid it is still at large. The slain panther had a perfect set of teeth and skin in good order and no reason is apparent why it should have taken to evil habits. All the kills were at night, of persons asleep and there had been no case, as far as I could ascertain, of a person up and about being attacked either by day or night.

ON A SPECIMEN OF *HEMIDACTYLUS GLEADOVII*, MURRAY, WITH A BIFID RENEWED TAIL.

By H. H. Brindley, M.A., St. John's College, Cambridge.

(*With two Plates.*)

(*Read before the Bombay Natural History Society on 10th July*, 1894.)

The subject of this communication is the abnormal condition of the tail of a specimen of the house gecko, *Hemidactylus gleadovii*. The animal was sent to me by Mr. H. M. Phipson with a request that I would write a note on it for the *Journal of the Bombay Natural History Society*. For its identification I am indebted to Mr. G. A. Boulenger of the British Museum.

The general appearance of the animal is shewn in the drawings of the ventral surface, Plate A, figs. 1 and 2. The tail becomes bifid a short distance behind the cloaca, and terminates in a short branch, which is straight and lies almost in the long axis of the body, and in a longer branch, which commences as an outgrowth on the right-hand side, and gradually bends round towards the middle line. Whether this bent condition was permanent during life is uncertain, as the animal had been in spirit some time before I received it, and I do not know its previous history.

The chief dimensions are—

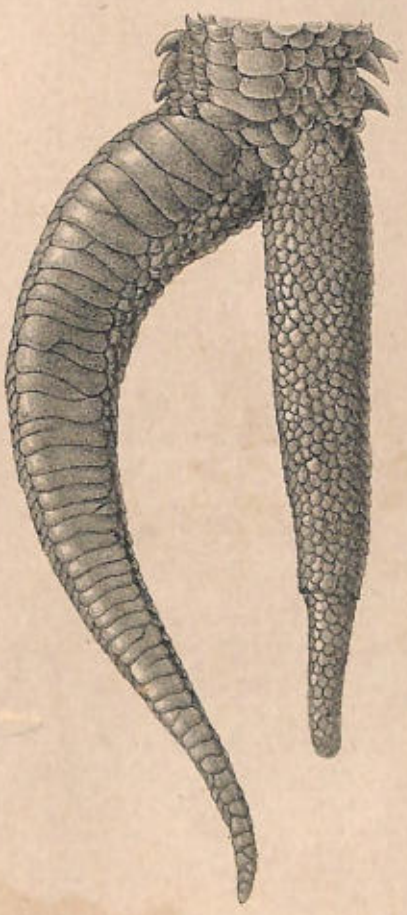
Length, snout to cloaca	... ...	5·5 cm.
„ cloaca to fork of bifurcation	... ...	·45 „
„ fork to tip of long branch of tail	... ...	3·1 „
„ „ „ „ short „ „	... ...	1·9 „
Width, long branch ...	... ...	·5 tapering to ·07 „
„ short „ ...	... ...	·3 „ „ ·1 „

The short branch narrows suddenly at 1·4 cm. from the fork, after which it tapers regularly. The other external features of the three parts of the tail are as follows :—

	Section.	Scaling.	
		Dorsal and lateral.	Ventral.
Undivided proximal part.	Rounded, depressed.	Small smooth scales. Several longitudinal series of large pointed keeled tubercles.	A median series of transversely dilated scutes.
Long branch (tapering).	Oval, flattened ventrally.	Small smooth scales; no tubercles.	Transversely dilated scutes.
Short branch (relatively blunt).	Rounded, flattened ventrally.	Small smooth scales; no tubercles.	Small smooth scales.



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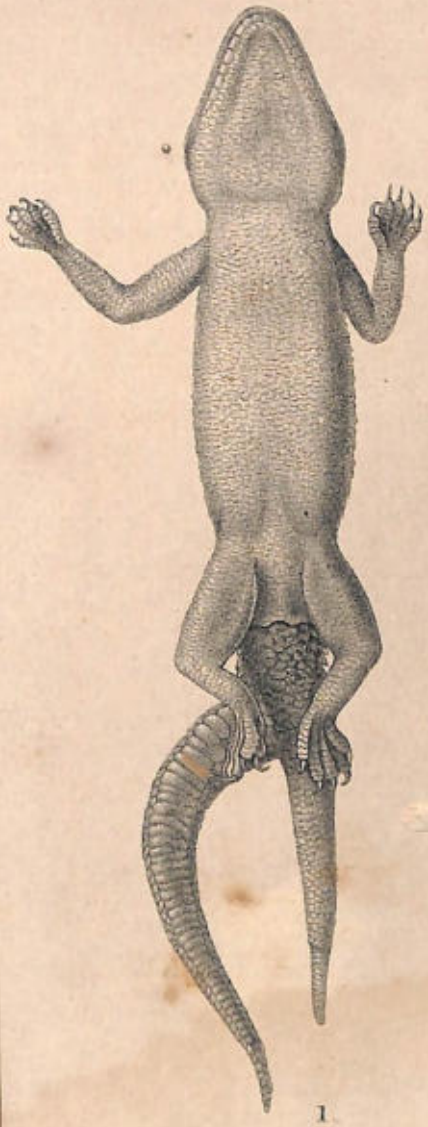
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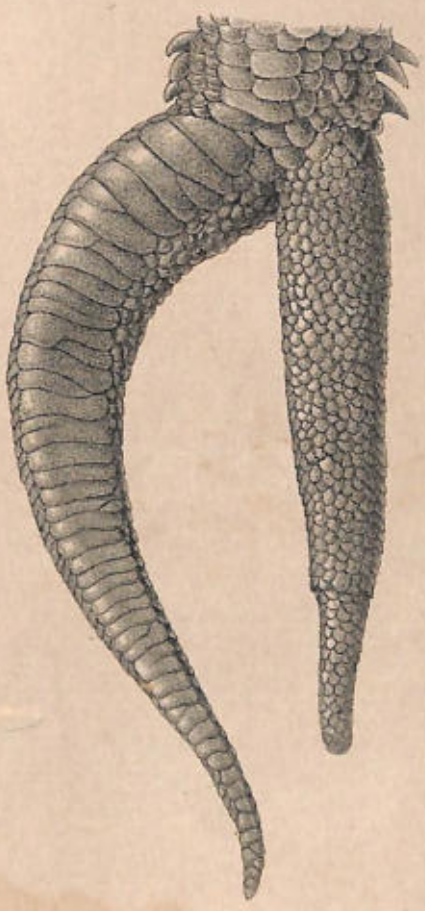
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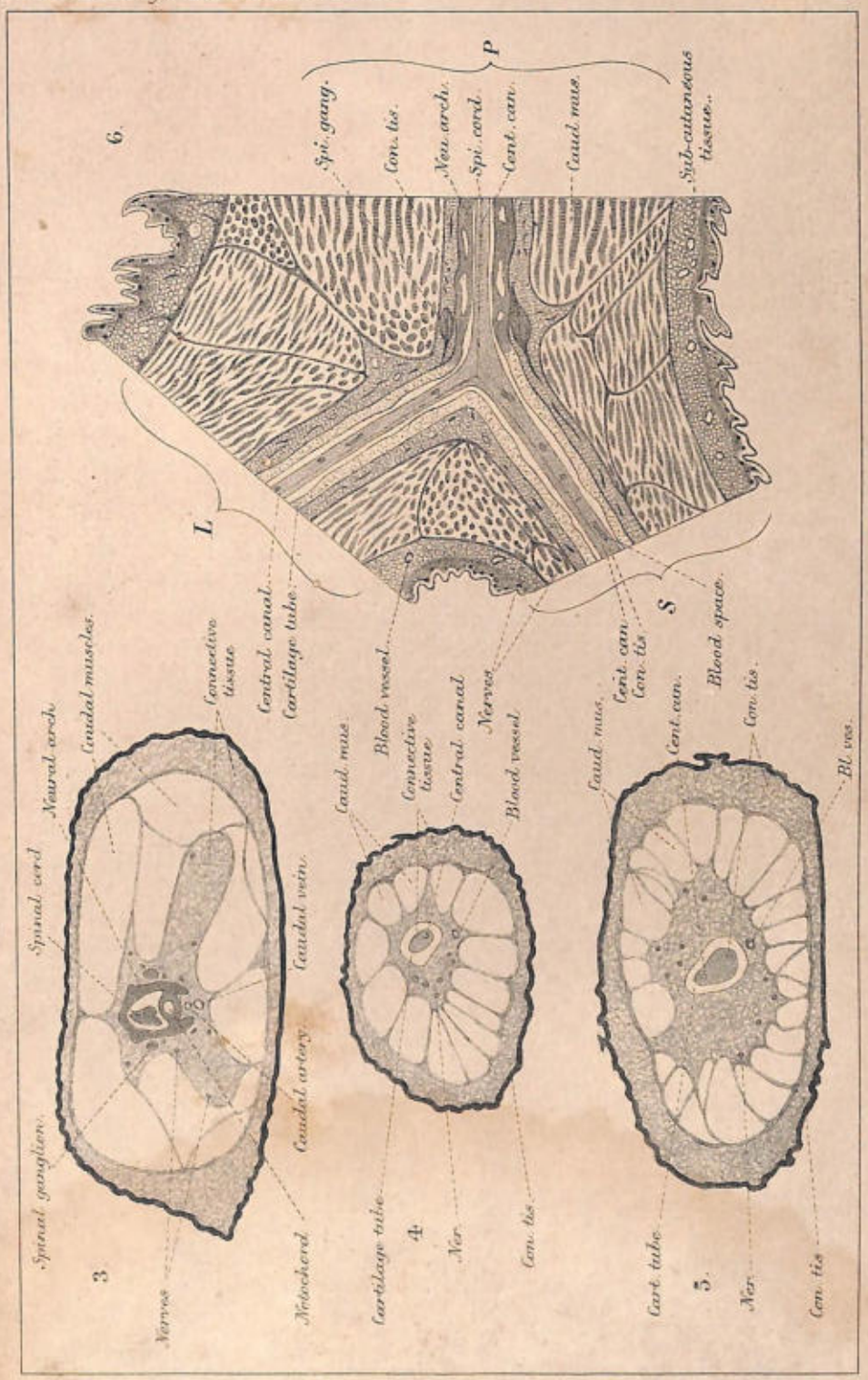
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M.P.Parker del.

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6.
Spi. gang.
Con. tis.
Neu. arch.
Spi. cord.
Cent. can.
Caud. mus.
Sub-cutaneous tissue.
P
L
S
Connective tissue
Central canal
Cartilage tube
Caudal muscles.
Neural arch.
Spinal cord
Caudal vein.
Caudal artery.
Notochord
Spinal ganglion.
Nerves
3
Caud. mus.
Blood vessel
Connective tissue
Central canal
Nerves
Blood vessel
Cartilage tube
Ner.
Con. tis
4
Caud. mus.
Cent. can.
Con. tis
Cent. can.
Blood space.
Con. tis.
Bl. ves.
Cart. tube
Ner.
Con. tis
5.

The scaling of the undivided proximal part, which for brevity will henceforward be spoken of as the stump, is normal to this species of *Hemidactylus*[1]; while that of the ventral surface of the short branch and of the dorsal surface and sides of both branches of the new growth differs from the normal scaling. Now it is known that in the case of certain lizards which have the power of renewing the tail after accidental loss, the scaling of the new growth differs from the normal.[2]

The probability that the bifid portion of the tail in the present case is a new growth was, therefore, suggested by the characters of the scaling, and an examination of the internal structure left no doubt on the point. It has long been known that the structure of the renewed tail of a lizard differs remarkably from that of the congenital tail,[3] and the subject has been recently exhaustively investigated by Fraisse,[4] whose work includes an account of the renewed tail of *Hemidactylus frenatus*. The chief structural peculiarities of the renewed tail were constant in the several genera he examined and may be epitomised as follows :—

(*a*) The vertebral column is not renewed as such, but from the point of fracture an unsegmented, imperforate, and usually somewhat irregular cartilaginous tube grows out in direct continuation of the neural arches. This tube tapers with the tail, and its lumen ends blindly near the tip.

(*b*) The spinal cord is not renewed, but the lumen of the cartilage tube contains a core of connective tissue with large blood vessels, which is continuous with the spinal cord of the stump. In reality this core is a tube with thick walls, as it contains a central lumen lined by a single layer of columnar epithelial cells. This lumen is continuous with that of the central canal of the spinal cord.

(*c*) The innervation of the renewed portion is effected by infiltration of the spinal nerve roots from above the point of fracture.

(*d*) The caudal artery and vein of the stump grow into the renewed portion and give off branches within it.

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[1] Boulenger, G. A. Fauna of British India. Reptilia and Batrachia, 1890, p. 87.

[2] Boulenger, G. A. On the scaling of the reproduced tail of Lizards, Proc. Zool. Soc., 1888, p. 351.

[3] Dugès, A. Mémoire sur les espèces indigenes du genre *Lacerta*, Ann. des Sciences Naturelles, 1829, vol. XVI, p. 337.

[4] Fraisse, P. Die Regeneration von Geweben und Organen beiden Wirbelthieren, besonders Amphibien und Reptilien. Cassel, 1885.

In the present case the internal structure of the tail was examined by means of serial transverse sections cut through the stump, and both branches of the new growth, and longitudinal sections through the region of the bifurcation. The features thus revealed are illustrated on Plate B, figs. 3 to 6. It will be seen that the structure of the stump is that of a normal tail, while each branch presents all the characters of a renewed tail as described by Fraisse. It is, therefore, unnecessary to give a detailed account of the histology. The considerable degree of irregularity of structure and the excentric positions of the cartilage tube and of the central canal within it are more probably results of the disturbing factor of the whole new growth being double than of its elaboration under the changing circumstances of the active life of the animal; for it would appear from Fraisse's figures and from several cases of renewed tails in other genera which I have examined that the new growth is usually a symmetrical structure. It should be observed, however, that in the present case there is a considerable degree of asymmetry in the stump, a condition which, if it existed before the tail was broken, may possibly have exercised some determining influence on the form taken by the new growth; though, on the other hand, it is possible that the unusual nature of the latter brought about disturbances in the nutrition of the stump.

Many instances of caudal duplicity in lizards have been recorded, and it has often been suggested that an explanation of this condition is to be found in a second tail having grown out from an injured place. It is quite possible that some cases have originated in this way, and in the Cambridge University Museum there is an example of *Trogonophis wiegmanni* (*Amphisbænidæ*) possessing what is apparently the stump of a second tail growing out laterally near the tip of the normal tail. In the present case, however, as shown in Fig. 6, the cartilage tube is bifid from its commencement from the neural arches of the stump, leaving no doubt that the whole of the new growth was elaborated at one time. It is at present not possible to offer an explanation of this kind of duplicity, especially in the absence of experimental evidence.

In conclusion a word may be said as to the difference between the scaling of the two branches of the tail. It appears that, so far as the epidermis is concerned, the median ventral line of the stump did not divide with the tail, but continued along the long branch only, while the short branch, though situated actually in the long axis of the body, was treated as a lateral part and received the small scales normal to the sides of a congenital tail. Strictly, therefore, the duplicity has not involved the epidermis. A case which has possibly some

bearing on the above is furnished by a specimen of *Lygosoma telfairii* (*Scincidæ*) in the Cambridge Museum, in which the tail is bifid in its distal portion. Though it has not been dissected, there is little doubt that the bifid portion is a new growth. Seen from the dorsal surface, the longer (left) branch of the tail is continued in the long axis of the body, and bears the short (right) branch as a lateral outgrowth. The normal tail of this species is covered ventrally by broad transverse scutes, and elsewhere by small scales. In this abnormal example the row of ventral scutes leaves the median ventral line of the tail and passes gradually on to the right side and consequently towards the short branch of the extremity. At the bifurcation the broad scutes cease, the whole of the bifid portion being covered by small and quite regular scales. The dorsal scales of the stump, on the other hand, become lateral on the left-hand side as they approach the bifurcation, and there become continuous with the rows of scales on the left side of the long (left) branch of the extremity. Hence, so far as the epidermis is concerned, the left side of the longer branch of the new growth represents the dorsal surface of the animal; while the right side of the shorter branch represents the ventral surface. It is noteworthy that in this instance, as in that of *Hemidactylus*, there is a departure from the normal condition in the undivided portion of the tail, which is not a renewed structure.

It is probable that duplicity of the renewed tail is not very uncommon among certain genera of lizards, and I have lately received a specimen of *Anolis grahami* (*Iguanidæ*) with a renewed tail which bears two symmetrically developed dwarf tails on its sides, so that the new growth has a trifid appearance. It is desirable that all such cases should receive careful examination, as the matter has a direct bearing on the problem of symmetrical growth.

List of Figures.

Plate A, Fig. 1.—*Hemidactylus gleadovii*, ventral surface, nat. size $\times 1\frac{1}{2}$.
" " " 2.— Do. do. do. of tail, nat. size $\times 3$.
" B " 3.—Transverse section through proximal portion of tail.
" " " 4.— Do. do. short branch of tail.
" " " 5.— Do. do. long branch of tail.
" " " 6.—Longitudinal section through bifurcation of tail. Nat. size $\times 10$.

P. Proximal portion. L. Long branch. S. Short branch.

N.B.—Figures 3 to 6 are somewhat diagrammatic. The shrunken condition of the spinal cord and connective tissue cores is no doubt a result of the preparation for section cutting. In life they would fill the lumens of the neural canal and cartilage tubes respectively.

SOME INDIAN STALKING AND SHOOTING.

By A. M. Markham, I.C.S., F.Z.S.
"ROHILLA."

(*With a Plate.*)

(*Read before the Bombay Natural History Society on* 10*th July*, 1894.)

I am emboldened by reading the pleasant and sportsmanlike paper of my friend (by correspondence) Mr. Inverarity, as true as it is graphic, on sambar shooting, to send for the *Journal of the Bombay Natural History Society* a few notes of my own.

I have had a good deal of sambar, spotted deer, and other stalking in different submontane forests in the N.-W. P., in the Himalayas of outer Kumaon, in the spurs of the Kaimur and Vindhya ranges, and in the Sivalik hills east of the Ganges.

I think that the best stalk I ever had was in a small tract of preserved forest in the Native State of Chirkhári on the left bank of the Ken river. I was given a day's shooting therein, with permission to shoot three stags, through the kindness of the then Political Officer of Bundelkhand, who is now the Earl of Lauderdale. My camp was on the right bank of the Ken in the Banda District, of which I was then the Collector. Under the guidance of a local *shikari*, who proved of no great use, I crossed the river before sunrise on a lovely morning in February. I well remember that, just as Mr. Inverarity describes, I had my heart sent bounding, and my rifle thrown quickly into position, by a row in the bushes on the bank and the pyrotechnic exit therefrom of a gorgeous peacock as I arrived. The forest came close down to the lovely stream, which was rushing in a great hurry, and with prodigious fuss, through a narrow boulder-strewn channel, about 60 yards wide, which took some crossing. I was younger in those days, and did not mind the wade through the clear cold water to commence my day on, a proceeding which was not without the danger of being carried off my legs by the swift, and in places deep, current. The jungle in the preserve was of a diversified contour. There were numerous more or less lofty little hills, some separate, and some in connected groups; all covered with forest, growing amid jumbled blocks of trap (?) rock of every size and shape. Lying between these hills were open glades of grass with scattered groups of trees; and there were many deep and craggy ravines, bush-and-tree

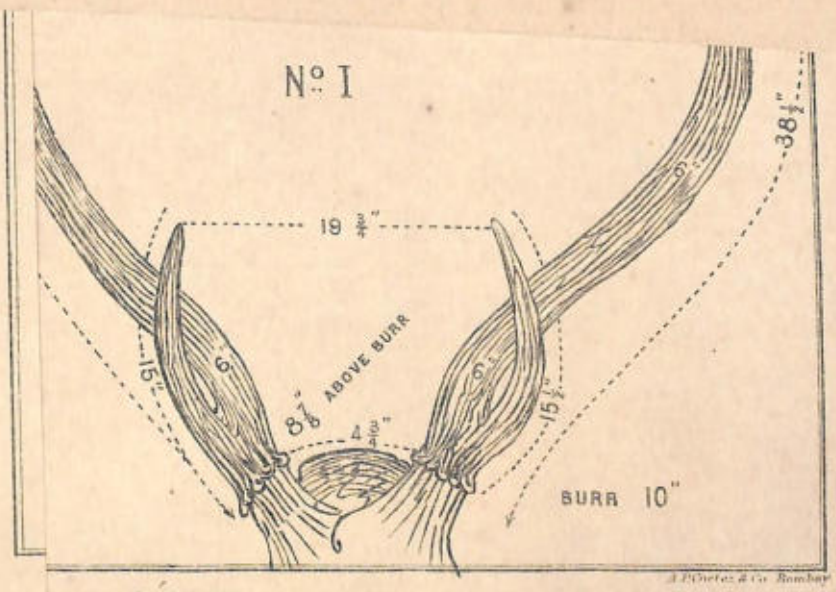


ERRATA.

(Plate of "*Typical Horns of the Sámbar.*")

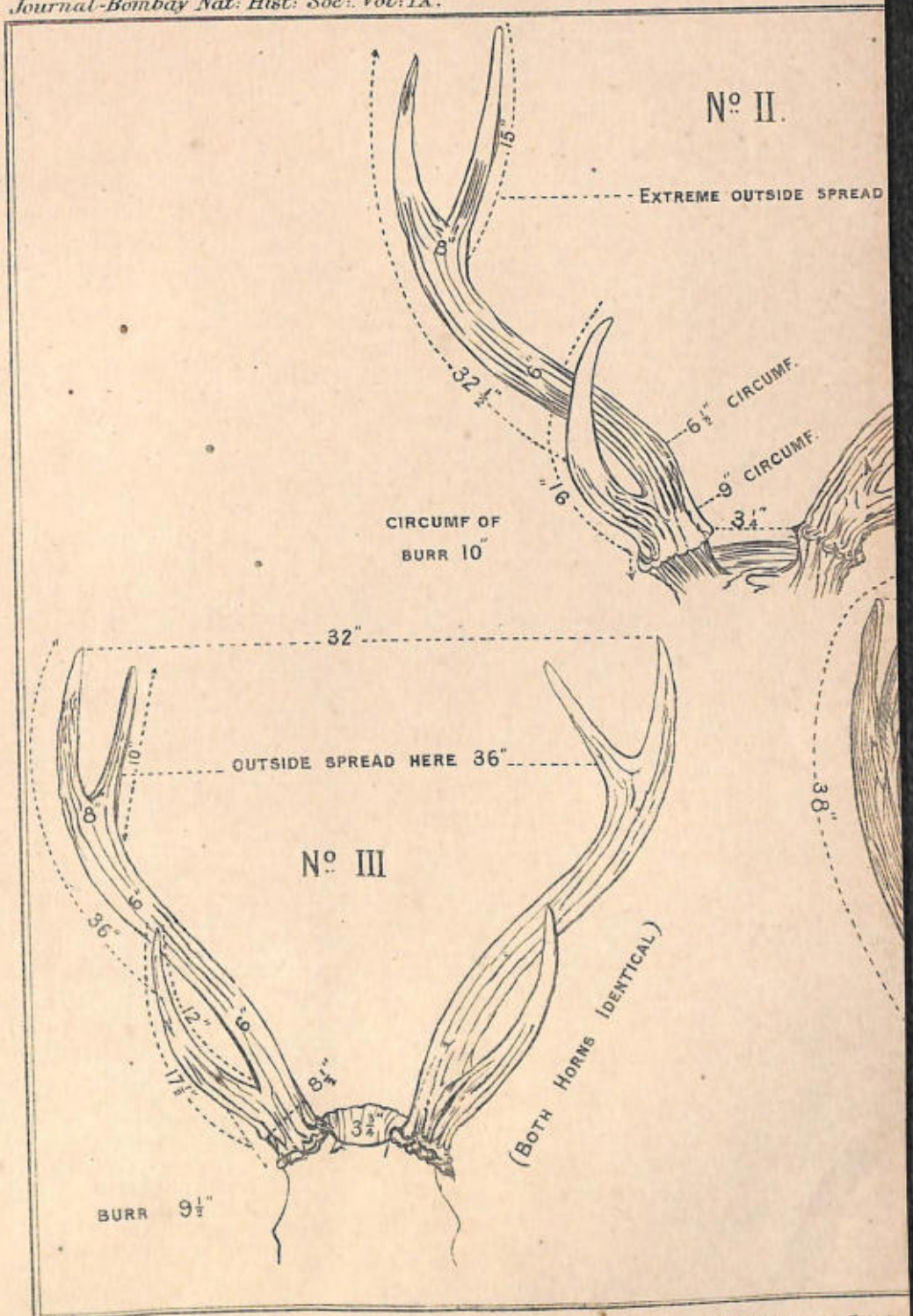
(1) For *Chikhari*, read *Chirkhári.*
(2) „ *Bignor*, read *Bijnor.*

ED.



F THE SÁMBAR.

the "SAMBAR".
"MÁHA".
the "JARAO."



TYPICAL HORNS

Nº I From Chikhari, known
" II From Bijnor known as th
" III From Raimgarh, known

clad from bottom to brink, running down to the river. It was a lovely little bit of sporting country. On the sand on the edge of the river were the fresh tracks of a leopard and a hyæna and innumerable spoor of deer. As I went forward among the low bush near the bank I put up numbers of peafowl and the painted spur-fowl (*Gallo-perdix lunalatus*), which were allowed to go their ways, though they offered tempting shots. (I poached a morning soon after, wishing to get some of the latter birds, but I did not see one!) I had not gone a quarter of a mile, and the sun had not yet risen, before I spied a splendid old sambar silhouetted against the sky on a rocky point of one of the nearer hills. I waited while he and his harem of three hinds moved round the point, and then ran round below, hoping to get a shot. I soon sighted him again and fired at him as he stood against a background of black rock. I had over-estimated the distance I suppose, for I saw the splash of the bullet on the rock just above the withers of the stag. I was afraid that my precipitancy had lost him, but he seemed so grand a quarry that I determined to follow him. It was a most arduous stalk; the hills were very steep, and the rocks, sharp ledges, creepers, and undergrowth made advance very difficult and slow. Twice again that forenoon I sighted the stag, but he, or rather his hinds, and a young stag who had joined the family party, were very wary, and I did not get a shot. Soon after noon I called a halt, in a secluded nook under a big rock, and attacked my tiffin basket. The pop of a soda-water cork (it was long before the days of Codd) resulted in a thunderous rush below me to the right, not fifty yards off. Before I got hold of my rifle it was too late, and I was only in time to see my noble friend disappearing into some dense jungle with his splendid horns laid nearly flat on his back. I ought to have examined the little grassy dell, in which the deer had evidently lain up, before taking my ease. The *shikari* counselled giving him up, and insisted that that stag would not let himself be approached again. However I was not going to throw up the sponge yet, and after a longish siesta, started on the trail again. Twice that afternoon did I spot that stag, but he gave me no chance. I sent the *shikari* to a coign of vantage to watch, and went on alone. The sun was within an hour of setting when, cautiously rounding a rocky point near the top of one of the hills, my eyes were delighted by seeing

him once more, standing uneasily at gaze, about 80 yards off down hill. The raising of the rifle caught his eye, and he was off. I put in practice a dodge which I have often found efficacious. I chose a well-marked opening between two rocks ahead, on the other side of which I calculated from his direction that he must soon pass, and I covered that opening carefully. As his form appeared, I pulled and heard the welcome and unmistakable *thud*. He kept on, now quite out of sight, but very soon a crash and a sound of struggling and of flying stones told me he was mine. Joyously I scrambled down to find him dying with the little ·450 Henry bullet in the centre of his shoulder. Another through the heart put him out of pain. When the *shikari* arrived we *cached* the stag, to be recovered next day. The head proved not so fine as it had appeared in life (they hardly ever do I think), but it is considerably over the average for these parts. The horns are nearly symmetrical—left 38½", right 38"; the spread between the points of the outer (shorter) tines is 34", and that from outside to outside of the beam, at the point of widest spread, is 37¾". The brow antlers are 15½"; the circumference of the beam, from above the brow antlers all the way up to the spring of the tines, is 6", and at the latter point it is 8". Below the brow antlers the circumference is 8⅞", and that of the burr is 10".

The *shikari* said that from his point of vantage he had viewed a fair stag into a ravine hard by. I sent the *shikari* to walk up the bed of the ravine from the river and took up my post to command the upper end and flanks of the cover. Two stags raced out, and I had a good clear shot, and dropped the finer of the two like a shot hare. His impetus turned him over twice, and unfortunately the right horn, catching on a ledge of protruding rock, was smashed to bits. The head was so much poorer than the one I had just got that I was easily consoled. While standing over him I heard loud cries from the *shikari*, which brought me to the bank of the ravine above him, to find him treed by a huge boar, who was furiously ripping at the trunk of the rather small tree in which the man had taken refuge. I speedily released the *shikari* from his precarious perch by slaying the boar. It was said to be a well-known brute, who had been a terror to the frequenters of the forest and had killed a man not long before, and *it was reported had eaten him*. By this time the short February day was deepening into

dusk, and I returned well pleased to my camp. Both stags were brought in next morning.

On the slopes of the Riwa plateau to the N. and N.-W. of the Allahabad District and in the Kirwi sub-division of the Banda District are numerous sambar. I have never stalked them there with any success. It is impossible to move without sound on bamboo and other leaves, over loose stones, at an angle of 45° and steeper. I have in such country, on the few occasions on which I had the chance, had the animals driven. The hill-side invariably ends above in a perpendicular escarpment of trap rock, inaccessible except by rifts which occur at differing intervals. This is locally known as the *arri*. The slope is driven parallel to this *arri*, and everything on it makes sooner or later for a pathway which the animals of countless ages have worn along the base of the escarpment. The guns are ambushed in a line on the slope at right angles to the *arri*, their posts being determined by lot. That commanding the pathway under the escarpment is of course the best, and is usually posted so as to command also one of the practicable rifts leading up to safety in the forest on the plateau above. The other posts are as a rule likely to shew sport only in proportion as they are nearest to the uppermost one. One never knows what animal may turn up in these beats. Tiger, panther, bear, sambar, pig, blue bull, or spotted deer (the latter more rarely)—all are represented there. If a tiger is known or suspected to be in the jungle, the posts, or at least the upper ones, are in carefully-made *machans* in trees, cunningly hidden at the last moment with green boughs. The uppermost post is not invariably the best as far at least as tiger is concerned; and the unerring, but to all appearance unreasonable, selection of another post for their line of advance by successive tigers, is one of those jungle incidents which no fellow can understand. In a certain now well-known beat, which I may say that I discovered, a tiger or two are killed every year; and the beast *invariably* comes to one particular post, the third from the top, with nothing whatever to indicate the reason of his preference for that line. For sambar in this jungle the very greatest caution is necessary. It is perfectly marvellous with what complete silence so heavy a beast, with his spreading head, will make his way, in front of the line of beaters, through dense cover and over broken rocks. The sportsman may have sat for an hour, with exemplary patience, silent, motionless and noiseless at his post. A big sambar may have come up close without the gun having had the faintest inkling of it, and may have been standing, suspiciously

sniffing the air, and listening with his huge ears, making up his mind for a further advance when the beaters should approach too near. Should the sportsman, under such circumstances, seeing the beaters close up, and imagining that all is over, move even an eyelid, the wary beast is off with a plunge and a crash, either back through the line of beaters, or down hill to turn their flank, sometimes giving the occupants of the less-sought-for posts below a chance of a shot. Another moment or two of motionless silence, and the occupant of the post at the *arri* would have had an easy shot at the huge deer as he walked delicately, like Agag, along the well-known path, or quietly scrambled up the rocky defile to the top. All the other animals come along with much less concern or concealment ; only the sambar stag is thus cautious. In such a beat the pea-fowl, spur-fowl and such like always lead the way ; next come the wild sow and her litter, and perhaps a rattling porcupine; a shuffling bear may give you a chance if you are for him ; a blue bull, or a rare spotted deer, may come next ; but the wily sportsman will do well to let the line come right up to his post before he dares to breath aloud, if his aim be the lordly sambar.

The bears of these parts are the common Indian sloth bear (*U. labiatus*), and their coats are so open and coarse that they yield but poor trophies. They do such a lot of damage, however, and are so dangerous to the people who have to frequent these forests, that as a rule it is right never to spare one. In my experience the people fear a bear here much more than a tiger.

In the outer Himalayas the stalking is much easier than in the Vindhyas or Kaimurs. The undergrowth is more manageable and less diffused, and the pine needles make a noiseless carpet. The sambar is here locally known as *Jarao*. The head is of a different shape and make from that of the Central India sambar ; more rugose, heavier and more massive in proportion to the length ; but the antlers are not so long nor so graceful. They sometimes shew 'sports' on top. It is many years since I had any sambar stalking in the interior of these hills, but my recollection is that the *Jarao* are not nearly so wary there as their congeners are in the Kaimur and Vindhya hills. In the foot-hills of the Himalayas the *Jarao* are very numerous, and I have stalked and shot four stags before breakfast, within five or six miles of my camp at the outer foot of the mountains. I once shot a *Sarâo* (*Nemorhædus bubalinus*) in the same hills—a rare beast. In the *sál* and other forests lying in the submontane plains below the N.-W. P. Himalayas the sambar is locally known as *Mâha*, *i.e.*, big, great.

Stalking is here practically unworkable. The grass is high and rank; where there is undergrowth it is dense, and the large dry leaves of the *sál* and other *Latifolia* and the myriad dry twigs among them make a noiseless approach quite impossible. I have usually shot these forests from a howdah; but I have occasionally, in a suitable tract, got down and successfully stalked both *chital* and sambar. They are fairly numerous, the former particularly, and not very wild. The closing of the forests to all deer shooting after the end of February has materially increased their numbers, while it has made them less wary. The heads of the submontane forest sambar differ both from those of the Central Indian and the Himalayan varieties. They are shorter in the horn, but spread much more, and are more massive than even a *Jarao* head of the same size. On the whole the *Máha* yields the handsomest trophy of the three, taking one thing with another. The accompanying rough sketches were made from three somewhat typical heads of the varieties of sambar of which I have written. The *Máha* head, with all its points polished like ivory for some six inches from the tips, is a handsome trophy. *That* head had certainly been for more than one year carried proudly through the forest. I agree with Mr. Inverarity in holding that the sambar, and I think the *chital* also, does not, at any rate after he attains full growth, shed his antlers annually. If they did so, with such numbers of them in the forest, one would pick up cast horns more frequently. The process of shedding is very irregular in all deer up here. I have seen *chital*, sambar and *para* (hogdeer) in hard horn and in every stage of velvet during one and the same shoot. You will see more velvet at Christmas than you will in May; but you will see hard horn at Christmas and velvet in May.

Cuon rutilans is as great a foe to the deer—and to the sportsman—here as he is on the Taptee. If a pack takes up its quarters in a jungle, everything leaves it, except the pig. *Sus scropha* has a fine contempt for every other animal! That reminds me of a funny thing I once saw. We were beating across some *sál* forest with a line of elephants and emerged upon a small circular opening, in the centre of which was a muddy depression, with some water still remaining in the middle. A large sounder of pig had been wallowing in the mud and had, on our appearance, retreated into the forest on the opposite side. One small half-grown boar remained in the open.

He faced the line of elephants, and began to go through the most laughable antics, by way of challenge. He stamped and champed his tushes ; he danced and pranced and curvetted in our faces for all the world as if he were an Irishman at Donnybrook fair with a coat to be trod on. The Mahauts urged us to shoot him, saying that he was mad, and that he would injure an elephant ; but we refused to slay the little champion at a disadvantage. Finally, seeing that we had no fight in us, he slowly and gravely trotted after the rest.

I once had a sambar hind driven through my camp near Kirwi by a pack of wild dogs at dawn. My people turned the dogs and saved the deer. By the time I was awake and alive to the conditions, it was too late to slay any of the pack. They had gone. I never spare them when the rare chance offers. I once got a right and left with No. 4 into a pack, as it crossed a jungle road in Indian file, and bagged a dog and a bitch. They were in fine coat as it was in the cold weather ; red as an English fox, with a dark stripe down the back, and a fine brush, which was black, except towards the root, where it was of the body-colour. The jungle natives are full of stories as to the deadly pertinacity of their attack. They say that a pack will kill a tiger in a few days by never letting him rest or eat or drink, and by timing their simultaneous onslaught when the royal beast is worn out. One jungle story which I have heard gravely told is quoted by Jerdon (Mammals, p. 147) from Brian Hodgson. It is to the effect that the pack will sprinkle their peculiarly acrid urine upon the low leaves and stalks of under-growth, and then, by combined action, drive a tiger into this cover. The urine temporarily blinds their victim, and they set upon him with impunity. They are the scourge of any jungle they enter.

I had the other day the pleasure of perusing the Game Book of that good all-round sportsman, the Maharaja of Kuch Bihar. It contains the measurements of 133 tigers. They are distinguished into male and female, but I think it is evident that some females have been erroneously entered in the column for males. It is certain that there are several cubs included in the latter. The average length of 99 tigers in the male column is $9'\ 4\frac{3}{4}''$. Deducting nine animals from this list which were evidently females or cubs, the average length of 90 male tigers is $9'\ 5\frac{5}{8}''$. The largest are two of $10'\ 2\frac{1}{2}''$, noted in Rowland Ward's "Measurements of Great Game." The largest I

have myself shot, or seen shot, out of over 200, was 10′ 2″. The average of the Maharaja's 34 tigresses is 8′ 7″. The largest was 9′ 3½″. My largest tigress was 9′ 2″. Some other measurements are given in the Kuch Bihar Game Book. The average girth of 34 big males was 50⅕″, the average biceps of 32 was 26″, the average fore-arm of 32 was 18¾″; and the average weight of 14 was 469 lbs. The following are the measurements of one of the heaviest (though not the longest—he was 9′ 9½″) tigers I ever shot :—

Height at shoulder	40½	ins.
Length of body	6 ft. 11½	,,
,, of tail	2 ,, 10	,,
Girth behind shoulders	49¾	,,
,, of fore-arm below elbow ...	21	,,
,, of head round cheeks ...	36	,,
Length of cleaned skull between perpendiculars	14	,,
Breadth of cleaned skull between perpendiculars	10 9/16	,,
Girth round the zygomatic arches ...	27¾	,,

I wish I had kept the measurements of my big 10′ 2″ tiger. *Eheu fugaces*! It is a long time ago.

Since jotting down the above notes, I have had the luck to kill my longest tiger, and I think also the heaviest I have ever shot or seen. The following are his measurements :—

Length of body...	7′ 1½″
,, of tail	3′ 2½″
Total ...	10′ 4″
Girth behind shoulder...	52″
,, of fore-arm below elbow	21″
,, of head	39″
Height at shoulder between perpendiculars...	42″
Length of cleaned skull over all between perpendiculars	14½″
Width of cleaned skull outside zygomatic arch between perpendiculars	10¼″
Depth of cleaned skull on a horizontal surface	6⅞″

I had practically a right and left at a pair. The tigress came first and was knocked over. Then the tiger appeared with a roar and got his right fore-arm broken. He charged, and while he was being polished off, the tigress, most unfortunately, managed to get away into heavy grass of great extent, and we could not find her.

THE POISONOUS PLANTS OF BOMBAY.

By Surgeon-Major K. R. Kirtikar, I.M.S., F.L.S.,
Acting Professor of Botany, Grant Medical College.

PART IX.

(*With Plate K.*)

(*Continued from Vol. VIII, page* 461.)

AMORPHOPHALLUS CAMPANULATUS—(*Blume*).

(Natural Order—Aroideæ.)

Marathi—सुरण.

An annual, tuberous, herbaceous, seedless plant, flowering before leafing. It has no nectaries.

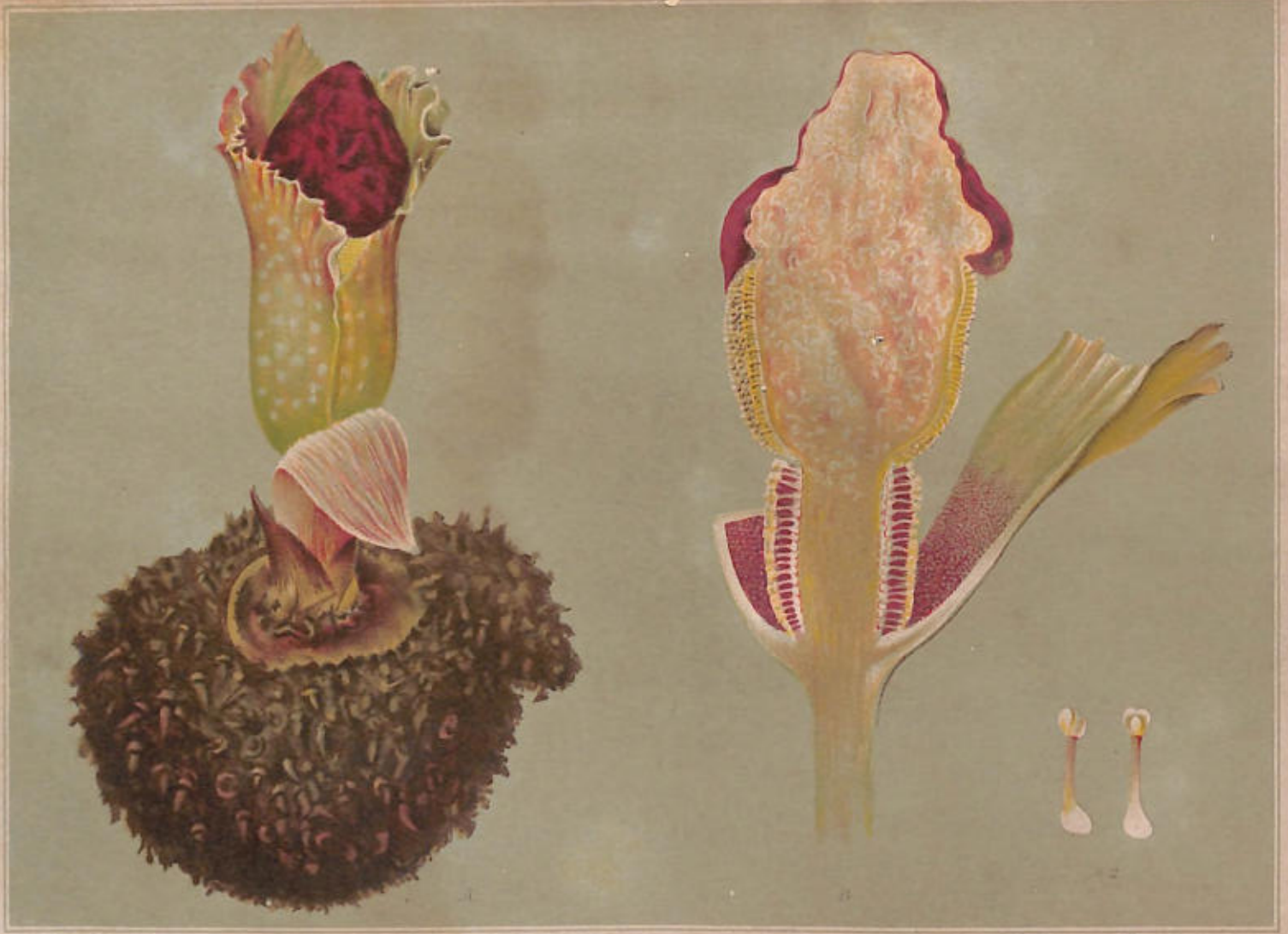
Synonym—Arum Campanulatum (Roxb.)

Tuber.—Larger in size than the adult human head ; sometimes three times as large in the cultivated variety ; smaller than the adult human head usually in the wild variety ; spheroid, with concentric tuberculate rings on the upper surface, where on the central part there is a shallow concavity or depression, often a slight circular prominence round the scape, corresponding to the attachment of the petiole of the previous year. After the leaf has completed the maturation of the new tuber, it separates, petiole and all, from this depression or prominence which is from 1½ to 2 inches in diameter and has at its central part, a mammilla marking the spot whence the flower-stalk of the future year shoots forth in the succeeding hot weather.

The substance of the tuber is hard, solid, fleshy ; externally pale blackish ; internally white, pale pink, or deep brown ; on section discharging drops of acrid, clear, shining, gummy mucus, which turns brown on standing ; the tuber is studded with numerous rootlets. The general appearance of the tuber presents a marked convexity on the lower surface, and a slight concavity on the upper surface ; sometimes the upper surface is almost flat.

N.B.—Properly speaking, the underground stem we have named as Tuber here on the authority of Hooker is a *Corm*.

Rootlets.—Long, filiform, whitish, denser near the scape, beyond which they are thicker, often of the size of a goose-quill, arising here and there in large numbers from small bubils or tubercles from all parts of the main tuber. Such is the habit of the tuber that if by any process of arrest of development, such as rotting, the entire formation



Isaac Benjamin, del.

Mintern Bros. Chromo. 4th. London.

THE POISONOUS PLANTS OF BOMBAY.

Amorphophallus campanulatus Nat. Ord Aroideæ.

½ Nat. size. A. Flower & Bulb. B. Vertical section.

of the tuber is interfered with, we find a number of small tubers of varying size and form instead of a whole spheroidal tuber. These small tubers are generally united ; sometimes detached. Whether united or detached, however, each one of these small tubers may produce a separate plant if placed under favourable circumstances, such as soft soil and proper manure. From such detached tubers, generally, there is no flower-stalk thrown out before the leaf makes its appearance in the succeeding rainy season. Thus, from such a large disorganized tuber of the previous year, I have been able to obtain in my garden several small but healthy plants, each springing from a partially separated or entirely disjointed bulbil. It seems to me that when tubers are small, flower-stalks very seldom spring forth.

THE PETIOLE.—I call it *the petiole*, for there is, as a general rule, *only one* given out by a properly formed tuber. There may be two or even more, but they are the result of improper development of the tuber as noted above, *i.e.*, where there are several bulbils of large size. The rule is, one well-formed tuber, one scape, one petiole and leaf. Another petiole or many more petioles may shoot forth from large or small bulbils. But this is a distinct deformity in the plant. The petiole of a fairly well-developed plant is radical ; rough or warty externally ; slightly sheathing near its attachment to the tuber, between the margins of which is a space for the mammilla of the future year's flower-stalk, varying in length (or rather in height) from $1\frac{1}{2}$ to $2\frac{1}{2}$ feet ; sometimes in the cultivated variety, as grown in my garden, as much as 4 feet. In the wild variety it is hardly ever more than 2 feet. In thickness it is usually $2\frac{1}{2}$ to 4 inches in diameter, cylindrical, softly fleshy, succulent. Colour varying from light to deep green, mottled with irregularly-shaped whitish, pale bluish spots ; the petiole, dividing into three parts, radiately diverges in a horizontal manner. The divisions are dichotomous, pinnatisected, with a deep channel on their ventral aspect, roundish on their dorsal aspect, slightly scabrous. There are membranaceous wings along the sides of the decurrent bases of the segments of the leaf. These segments are lanceolate or ovate-lanceolate, the margin entire, parallel veined, pale green and entirely glabrous.

SCAPE.—Solitary, 2 to 4 inches long, cylindrical, greenish, mottled with white spots, very thickly verrucose, invested below with two or

three imbricated scales or bracts which are linear-lanceolate, tough, fleshy, rose-coloured, mottled with green or purple spots.

SPATHE.—Is technically called "*marescent*," *i.e.*, not actually falling off before the spadix is perfected, but withering long before that time. In size very large; ovate; 1 to 1½ ft. long; very broad; erect; acuminate; below, of fleshy substance, infundibular, convolute; above, membranaceous, campanulate, patulous, with undulate curled margins. The convoluted part in its greatest circumference is about a foot and a half; externally, speckled with pale yellowish-greenish patches and bright green dots; internally, at the base it is purple with very thick fleshy warts, which are thickest and deepest coloured near the scape, and which become paler coloured and less dense as they approach the mid-part of the infundibular portion. The mid-part is conspicuously greenish-yellowish, without any warts. The colour of the undulate marginal portion is purplish or dark purple; that on the under or external surface is dull; that on the upper or internal surface is bright.

SPADIX.—Projecting distinctly beyond the spathe; erect, thick, club-shaped, almost half-way from below cylindrical and pistil-bearing; thence upward it is pear-shaped and thick, bearing anthers; above this part lies the apex (appendage or club) expanding in a globosely conoid irregularly formed mass when young, which becomes fungating and sinuously lobed as it matures. The texture internally is spongy, fibrous, lacunose; externally corrugated, brownish dark purple, resembling soft leather with minute warts or projections alternating in regular order with shallow depressions between. As the conoidal apex matures into the more corrugated mass of sinuous small lobules they emit an intolerably offensive odour of putrid flesh, inviting hordes of blue-bottles and other large flies which cover the whole mass with their eggs; and the subsequent maggots, which thickly beset it for the next four or five days, render the flower stalk as disgusting to the eye and nose as carrion. I have already referred to this fact in my lecture on Indian Flowers delivered before the Sassoon Mechanics Institute, Bombay, extracts from which have already appeared in one of the previous numbers of this Journal (*Vol. vii, Part* 4, *pp.* 527, 528—1892).

FLOWERS.—Unisexual; the males on the middle third of spadix, immediately below the appendage; the females on the lower third or

basal part of the spadix. Perianth absent. Male and female flowers contiguous, *i.e.*, having no neuters between.

MALE FLOWERS—

Stamens.—Numerous ; dense.

Anthers.—2-celled, sessile, close-packed, consequently compressedly cylindrical ; rounded at the top ; straw-coloured ; glabrous.

Connective.—Longitudinal, fleshy, separating the two loculi. Each loculus perforated at its apex for the discharge of the pollen by a central pore, which is at first semi-lunar, then gradually dilating to assume a roundish form.

Pollen.—Globose ; lemon-yellow, or almost orange-coloured.

FEMALE FLOWERS—

Pistils—Numerous ; not so close-packed as the stamens, but somewhat loosely and spirally arranged ; the topmost scarcely separated from the anthers by any clear space.

Stigma.—Trilobed, often bilobed ; all on the same level ; much thickened and expanded. There is a deep depression between each lobe ; slightly papillose. Cream-coloured or yellowish.

Style.—Many times longer than the ovary. Crimson or purplish. ¼ to ⅓ inch long ; deciduous.

Ovary.—2-, rarely 3-celled, with only one ovule ; purple or deep crimson ; broad and dwarf ; globose or somewhat cubical ; fleshy glabrous.

Ovules.—Attached to the inner angle of the carpel at its base ; ascending, obovoid, anatropous.

FRUIT.—Not yet known to have ever developed.

REMARKS.

The above description is mainly based on Blume's as embodied in Rumphia (vol. I, p. 139), and that of Roxburgh and of Sir Joseph Hooker, in the Coromandel Plants (vol. III, p. 70), and Flora of British India (vol. VI, p. 513), respectively. I have added, however, what I know personally regarding this very interesting species of the Aroid family. The propagation of this plant takes place by means of its tubers. It is hardly necessary, therefore, for the ovule to develop into seed. The main tuber or each small bulbil or tuber of the previous year serves as the parent of the future plant. The flower-stalk seldom, if ever, appears in young bulbils or even in tubers half as

big as the adult human head. I have come across several tubers of even larger sizes where the flower-stalk has not appeared, but in due season only the petiole has sprouted out. Blume observes that the scape is almost twice as thick as the petiole. In my experience it is quite the reverse, but this may be merely a local peculiarity.

With regard to the size of the spathe sprouting from very large-sized tubers, I have this to observe. In tubers weighing from 30 to 40 lbs., the spathe assumes an enormous size, and its terminal convolute portion and crimpled margin measure several feet in circumference. I have now before me a large tuber which, when fresh removed from the ground, weighed fully 40 lbs. The convolute portion of the spathe thrown out by this tuber measured 8 ft. in circumference ; the height of the spathe was near 2½ ft. ; the diameter of the middle campanulate portion was 1 foot ; the broadest part of the appendage was nearly of the same diameter ; the diameter of the staminal part was nine inches, whereas that of the pistil-bearing part was six inches. This shows to what an enormous size the tuber and the flower-stalk may develop under cultivation. In the uncultivated or wild variety, which goes under the name of Rân-Suran or Jangli-Suran, the plant is not known to develop to such a size. The wild variety in every part of it is altogether a much smaller plant.

It must be noted here that the wild or uncultivated variety of *Amorphophallus campanulatus* is entirely different from the tuber of *Amorphophallus sylvaticus** (Kunth), which is also locally named Jangli-Suran, and described by Dr. Dymock under that name in the *Pharmaceutical Journal* (p. 172, vol. vii, 3rd Series). Dr. Dymock was well aware of this fact at the time he first described this plant, for he has since repeated his remarks in his later works,—viz., "The Vegetable Materia Medica of Western India" and "The Pharmacographia Indica"—that "it is probable the two plants are distinct," for he adds that "it is probable the roots of the wild *Amorphophallus campanulatus* form a part of the commercial article known as *Madanmast*, which is the tuberous root of *Amorphophallus sylvaticus* peeled, cut into slices and strung upon a string."

* SYNONYMS.—(I) *Synantherias sylvatica* (Schott.)—Hooker's Flora Br. Ind., part XIX, page 617 : (II) *Arum silvaticum* (Warden and Pedler's article on the nature of the toxic principle of the *Aroideæ*—Journal As. Soc., Bengal, vol. LVII, part 2, No. 1.)

I now proceed to state what the old Sanskrit writers have said regarding the varieties of *Amorphophallus campanulatus.*

Madanpâl, in his Nighant (Pushpa-Varga, Shlokas 83 to 86), says that there are two varieties of Suran : the tuber of the one is round and well shaped, that of the other is irregular in form. The former is the better of the two ; the latter is known as Rân-Suran and has also the epithet of Vajrakand. This epithet, as applied here, means that the tuber of this variety is as irritating as Vajra, which is a synonym of Kush or Darbha, a kind of grass described by Linnæus as *Poa cynosuroides* (*Eragrostis cynosuroides*, Rom. et Sch. according to modern nomenclature). Now, it is well known that the blades of this grass, which is very commonly used in the religious ceremonies of the Hindus, are covered with long stiff hairs, especially at their margins ; these hairs produce an unpleasant, pricking sensation on the skin of persons whose tactile sense is acute. The pricking sensation produced on the mucous membrane of the mouth, throat, and tongue of those who eat the tuber of the wild variety of Suran is very much like that of Darbh grass on a sensitive human skin. The epithet of Vajrakand as given to Rân-Suran would therefore seem to be appropriate. I have so far dilated on this point as I find Dr. Dymock gives "Thunderbolt" as the English equivalent of Vajrakand (Pharmacographia Indica, vol. III, p. 547). Vajra does mean in Sanskrit thunderbolt ; but if Dr. Dymock's English rendering is to be accepted, one cannot find any connection between the term thunderbolt and the shape or properties of the tuber of Rân-Suran, unless it is meant to convey that its poisonous quality is as suddenly destructive as the thunderbolt.

Narhar Pandit, in his Râj-Nighant, another standard Sanskrit work, also mentions two varieties :—(1) Suran ; (2) Sit or Swet Suran, which is the white variety.

Dhanvantari Nighant, another old Sanskrit work, mentions only one variety of Suran. It is probably the cultivated form, as the author does not make any reference to the wild variety.

Bhâv Misra, another standard writer, in his celebrated work Bhâv Prakâsh (p. 150, Bombay Jagadishwar Press Edition, 1888), speaks of only one variety. From its description it appears to be the cultivated form, as no mention is made of the wild tuber.

Let me now proceed to notice a few points worthy of special remarks in the writings of European botanists who have studied the plant under notice. Wight, in his Icones Plantarum Ind. Orient. (vol. III), gives two plates, numbered 782 and 785. The former illustrates a gigantic flower-stalk with its enclosing spathe, and the latter depicts the tuber, leaf, and flower-stalk. He says that he depicts the gigantic flower-stalk, as he finds no reference to a flower of such size in Roxburgh's work. Botanists have to be thankful to Wight for this illustration, as it serves to persons like myself of a younger generation to emphasize what he observed in his days, by adding my own humble testimony that his picture illustrates but a gigantic, well-developed inflorescence of one and the same species as given in his plate No. 785. This I have been able to observe for a number of years in the flower-stalks thrown out by large tubers weighing 30 to 40 lbs. The larger the tuber, the more gigantic the flower. By some unfortunate mistake, however (*evidently that of the printer's devil*), Wight's descriptions of his plates 782 and 785 are transposed in the letter-press given at the beginning of the third volume of his Icones, which at first sight is confusing to one who has not had the opportunity of watching the growth of gigantic flower-stalks from very large-sized tubers. The result is that even a learned and veteran botanist like Sir Joseph Hooker, in quoting Wight in his "Flora of British India" (*vide* page 513, part XIX), is obliged to put a query against Wight's plate 782.* From my own observation, however, I am able to say—and I say it with profound respect for Sir Joseph Hooker—that Wight's plate No. 782 represents an exceptionally large flower-stalk, obtained under cultivation of a large tuber of the very same plant depicted by Wight in his plate No. 785 of the same work. If hereby I am able to satisfy Sir Joseph Hooker, I shall have done some service to Dr. Wight, however humble, in having tried to remove a doubt as regards the accuracy of his observations—a doubt which, I admit, must necessarily arise in the minds of careful investigators of the stamp of Sir Joseph Hooker wholly and solely from the unfortunate transposition of Dr. Wight's description of his plates.

* I address the remarks to Sir Joseph Hooker, although I know from his note at p. 490, part XIX of his Flora of British India that the Descriptions of the Indian Species of the Aroid Family are drawn up for his work by Mr. N. E. Brown.

It is not clear what Dr. Wight means, in the letter-press alluded to above, by saying that the flowers are "sessile with respect to the surface of the ground," for be it noted that there is a distinct scape whether the tuber is underground or aboveground at the time the spathe sprouts out. The spathe gives cover to the spadix on which, from below upward, are the three distinct parts, *viz.* : I, the pistil-bearing, and II, staminiferous portions, and above them, III, the lobulated deep purple appendage. Blume supports me in this statement, for in his Rumphia (vol. I, p. 141, 1835), he describes a distinct scape which shoots forth from the tuber *aboveground* (the italics are mine—K.R.K.) before the rains, when the tuber is entirely destitute of its large solitary leaf or smaller solitary leaves from its superimposed bubils.

Paxton, in his Botanical Dictionary (revised by Hereman, 1868), says that *Amorphophallus campanulatus* is a native of Ceylon. I may add that it is a native of Western India as well, especially of the Konkan.

With regard to the action of light on the flower-stalk of this plant, I may be permitted to observe as follows :—When the spadix sprouts out in a room where the direct rays of the sun do not reach, the purple colour is very poorly developed, it is very faint. A marked difference is noticed in the depth of the colour directly such a pale growing flower-stalk, with its tuber, is bodily removed from a dark room to one where it can enjoy the direct rays of an Indian sun. The pale purple is at once changed into a deep bright purple which might shame the Tyrian purple of ancient note.

Some botanists say that the plant is perennial. It is a mistake to suppose that either the plant or the tuber is perennial. It appears to be strictly an annual plant. The following is its life-history so far as I have observed it during the last ten years, if not more. Given a tuber of the previous year, which matures here between October and November ; in March or April, or even as late as the end of May, the flower-stalk appears ; this takes about a month to develop and throw out the pollen ; ovulation, or fruit-forming, seldom, if ever, takes place in this part of India ; the spathe, the spadix and the male and female flowers then gradually wither away ; the peduncle shrivels just before the rains, and as it is bodily falling off from the tuber, the leaf-bud of the future year's plant sprouts out not very far from the base of the

shrunken flower-stalk. All this may happen aboveground, should the tubers be preserved in a store-room; or if they be underground, the flower-stalk makes its appearance aboveground and goes through the same process of development. At the beginning of the rains the tubers have to be put into the ground. The softer the ground the better is the chance of obtaining a big uniformly well-developed tuber at the end of the rains. With the rains the plant grows quickly, waving its tripartite solitary leaf three or four feet above ground. The chief nourishment of the leaf is the starchy matter of the old tuber; as this is absorbed by the petiole and carried upward into the farthest ramifications of the leaflet, the old tuber vanishes. The leaf when mature begins about the middle of the rains to replace its old used-up tuber by the gradual formation of a new one. This new tuber is ready about the end of the rains, or the beginning of the cold weather. That this new tuber is a totally different individual from the old one is proved by the fact that where, by some error in the proper performance of the function of the leaf, *viz.*, that of using up the old starch and reforming a fresh quantity, the leafy expansion does not use up the whole tuber of the previous year, the new tuber that is formed can be seen as quite a separate individual superimposed on the old half-used-up tuber in the same way as we find corms placed one upon the other—the new above the old—in the natural order *Iridaceæ*. As soon as the growth of the tuber is completed, or rather as soon as the power of starch-formation in the leafy expansion is exhausted and the process is at an end, the leaf and petiole begin to turn yellow shortly after the rains, shrivel and dry up, and ultimately get bodily detached from the new tuber, leaving a scar in the form of a depression or prominence, from the central part of which the flower-stalk of the future plant springs forth. Such is the life-history of this interesting plant.

POISONOUS PROPERTIES.

The cultivated variety of Suran has for a long time been used by the natives of this country for culinary purposes, although it is not free from acridity even after boiling. The acrid principles are to a very large extent got rid of by soaking in water the cut pieces of the tuber intended for culinary use. Even then the tuber does not cease to be irritating to the mucous membrane of the mouth, throat, and

tongue. Some may ask why a tuber which is one of the recognized vegetables of the Indian kitchen and one of the most palatable of them when properly salted, spiced, and cooked (boiled or fried in ghee or butter), should be classed under the poisonous plants of Bombay. My reply is, the wild and the cultivated tubers are so difficult to distinguish, and the wild variety is so vilely irritating to the digestive tract, and even the cultivated variety is so frequently productive of irritation in the mouth, throat, and tongue, that it is safer to look upon the plant with suspicion even in its highly cultivated forms. For, although cultivation does to a very large extent reduce the acrid principles to a minimum, they can never be said to be altogether absent from the tubers, and cases have been met with where a sensitive throat has considerably suffered from irritation for some time after partaking of a dish of the cut pieces of even a cultivated tuber of Suran. Some throats may not suffer at all; others may suffer more or less. It is safe to be forewarned.

The poisonous properties of Suran were not unknown to the old Sanskrit writers of repute. Both the varieties mentioned in Madanpâl's Nighant are said to be productive of *itching* (Sanskrit—*Kandu*). The same property is attributed to the two varieties mentioned in the Râj Nighant of Narhar Pandit. No reference, however, is made to any irritant or poisonous property in the single variety mentioned in the Dhanvantari Nighant, probably because, as I have already observed, the writer was describing a cultivated variety in which the itching or irritant property is invariably less marked. The single variety mentioned in Bhâv Prakâsh, however, is distinctly noted as being possessed of irritant property. So far, as regards what is known from ancient indigenous writers regarding the obnoxious nature of the plant.

Let us now see what the researches of European and Native experts have done in Europe and India to settle the question of the poisonous properties of the Aroid family in general, and the Suran species in particular. I must refer the reader at this stage to the elaborate and valuable investigations of Dr. Warden and Mr. Pedler of Calcutta, as embodied in their article already referred to, as a contribution to the Journal of the Asiatic Society of Bengal. They say that from the brief resumé given by them of the Arums found in India, a belief in the toxic properties of certain species would appear to be pretty

generally entertained. Dr. Murrell's remarks as published by him in the British Medical Journal (May 7th, 1881), and referred to by Warden and Pedler regarding *Arum maculatum* (Cuckoo-pint) were not the first to point out the poisonous nature of some species of the Arum family. Sowerby and Johnson describe the plant, in their work entitled the British Poisonous Plants published so far back as 1861, as possessed of a powerful acrid principle. They note that in two or three cases leaves eaten by children produced disastrous effects. The fact that the root also of *Arum maculatum* possesses acrid properties when bitten was not unknown to them. Miss Annie Pratt had also referred to them in her illustrated pamphlet on the British Poisonous Plants long before the researches of Murrell or Warden and Pedler. *Arum maculatum* appears to be the only British representative of the Aroid family. In India we have several species developing tubers possessed of similar, more or less acrid properties. Nine of these have been stated by Warden and Pedler to be distinctly poisonous.

Sowerby and Johnson observe that "the poisonous qualities of *Arum maculatum* are wholly dissipated by heat and the plant then becomes highly nutritious." They further add that the roots of various foreign species are employed as food after being macerated in water, baked and reduced to powder. I cannot say that in every case the acridity of even the cultivated varieties of Suran *entirely* disappears on boiling. I know of no instance where in this country Suran is ever reduced to powder or baked before use. It is invariably used after boiling in ghee or butter, or mixed with molasses.

Guy and Ferrier, in their Forensic Medicine, make an important observation which is worth noting here. They say that the juice of *Arum maculatum*, when applied to the tongue, causes darting pain as if it were pierced with sharp needles. The same sensation is noticed by some after eating Suran even when well boiled. The sharp needle-like ends of the crystals (technically called *raphides*) found in the cellular tissue of Suran, and more fully described hereafter, whatever their chemical nature, would seem to account for their irritant property.

Professor Christison observes in his work on Poisons (p. 602) that he knows from personal observation that when the roots are distilled with water neither the distilled water nor the residue possesses acridity. The fact that the distilled water possesses no acridity would point to the

crystalline raphides being insoluble in water ; the residue possessing no acridity would point to the fact that the acicular raphides under the action of heat so change their form as not to be very sharply pointed and capable of entering the mucous surface of the mouth, tongue, and throat, and in consequence become inert. This remark of Professor Christison's is very important, inasmuch as we find that, if pieces of the tuber of Suran are eaten after boiling them well, they may at times be rendered free from severe poisonous effects, even although there may be a slight irritation of the throat, mouth, or tongue. Some persons may not feel this at all. Professor Christison quotes an observation made by Reinsch, which, although it refers to *Arum maculatum*, may well be applied to Suran, *viz.*, that, though the powder of the root may not be acrid to taste, it yet produces severe burning of the throat not long after swallowing it. Woodman and Tidy say that, in addition to the symptoms just mentioned, *Arum maculatum* is known to produce dilated pupils, insensibility, and coma. They refer to a case recorded by Dr. Stube (*Lancet*, 13th April, 1872), in which a man took a leaf to get rid of tapeworms. He suffered "from immediate pain and pricking sensation in the mouth downwards ; the tongue became swollen, and there was salivation and vomiting." Profuse salivation has been noted by Dr. Dymock as occurring in a congener—*Synantherias Sylvatica*, Schott (*vide* Pharm. Ind., vol. III, p. 547). The case mentioned by Dr. Frayer (Br. Med. Journ., 22nd January, 1861,) is even more characteristic, as there was a spasmodic action of all the muscles of the body, bloody froth at the mouth, dilatation of the pupils, very feeble action of the heart, and rigid closure of the jaw. These severe symptoms have never been known in the case of Suran, although it is quite possible they might develop, the nature of the irritant being identical. In another case, recorded by Dr. Frayer, of poisoning by *Arum maculatum*, there was burning pain in the mouth and lips, torpor in three hours, followed by complete prostration in six hours, with delirium, asphyxia and death in nine hours (Warden and Pedler). In a case recorded by Dr. Alliott (Br. Med. Journ., 23rd April, 1881), there was vomiting and severe purging. This is not known to have occurred in any case of Suran-poisoning.

Beck, in his Medical Jurisprudence (p. 949, ed. 1836), refers to a member of the Aroid family mentioned by Hooker in his Exotic Flora,

the poisonous properties of which are very similar to those of *Amorphophallus campanulatus*. It is the *Caladium sanguineum*, Vent, of the West Indies, where it is called *Dumb-cane* from the fact that its virulent juice, when applied to the tongue, causes a swelling which deprives the sufferer of the power of speech. Woodman and Tidy think that this species contains a large amount of prussic acid, as two drams of the juice have proved fatal in a few hours. Beck mentions another similar Aroid, the *Caladium arborescens*, also a native of the West Indies, which, on the authority of Merat, he says, is so caustic that occasionally the lips of Negroes are wetted with it as a punishment for slight misdemeanors. The poisonous action of both these *Caladiums* is narcotico-acrid. The action of several other plants of the Aroid family mentioned by Beck, such as *Arum maculatum*, L., *Arum dracunculus*, L., *Arum dracontium*, L., and *Arum triphyllum*, L., is that of an irritant poison. They are all acrid, and said to be dangerous. Beck quotes from Orfila's Toxicology (vol. II, p. 83) a case related by Bulliard, which is as follows :—"Three children ate of the leaves of *Arum maculatum*. They were seized with horrible convulsions, and with two of them all assistance was unavailing, as they could not be made to swallow anything. They died—one at the expiration of twelve days, and another at the expiration of sixteen. The third was saved with difficulty. Its tongue was greatly swelled, and hence deglutition was painful and difficult."

Arum fornicatun (Syn. for *Alocasia fornicata*), the *Bish Kachoo* of Bengal, is an equally poisonous member of the Aroid family. Warden and Pedler refer to a case noted by the Chemical Examiner of Bengal in which the tubers of this species produced symptoms of irritant poisoning. In the experiments they made with some tubers locally known as *Bish Kachoo*, which were sent to them by the Civil Surgeon of Dibrugarh, and which Dr. King thought were most probably those of a species of *Alocasia* or *Colocasia*, they arrived at conclusions of which the following is a summary. They think that the active principle is non-volatile, as there was a complete absence of any irritative action on the olfactory organs or conjunctivoræ, though there was considerable irritation of the hands while handling the tubers during their experiments. A minute fragment of the tuber applied to the tongue caused in a very short time acute lancinating pain, which continued for a considerable period. In their experiments with a viscid alcoholic

extract obtained from exhausting the powder of air-dried tubers with hot 60 O.P. alcohol, and driving off the alcohol by the heat of a water-bath, they found that the extract was without the least action on the tongue. An extract obtained with cold alcohol in which the alcohol had been driven off by spontaneous evaporation similarly produced no action on the tongue. A glycerin and an ethereal extract likewise yielded negative results. The effect of distilling fresh tubers with water was that the distillate had no acrid taste; it contained traces of prussic acid. The tubers left in the retort after distillation were, however, still physiologically active, indicating that the active principle was not dissipated by mere boiling with water. Warden and Pedler here observe that natives using arum for culinary purposes frequently add an acid vegetable or fruit, such as tamarind, to get rid of the acrid principle. This fact is well known in Western India; large quantities of tamarind are used in cooking the leaves of *Colocasia Antiquorum* (the common *Alu* of Bombay) to keep down its acrid taste. In writing in a previous number of this Journal (vol. VII, p. 315), on the irritant action of *Pythonium Wallichianum* (*Shewla*), another member of the Aroid family, I have already referred to the use of the fruit of *Bilimbi* (*Averrhoa bilimbi*) as an effectual and necessary adjunct in the culinary preparations of the flower-stalks of *Shewla*.

Warden and Pedler observe, as already noted above, that they have no reason to doubt that the Arums as a class contain a toxic principle. They say that "while drying the tubers without artificial heat deprived them practically of all activity; exposing them to the temperature of boiling water for at least half an hour, at the most only very slightly diminished their activity." They note that in the American variety of *Arum maculatum* D. S. Jones has proved the presence of a volatile acrid principle besides starch, sugar, gum, albumen, resin, fat and extractives. They also say that Bird believes in the existence of a volatile alkaloid in it. I find that Taylor also says that the irritant properties of *Arum maculatum* depend on a volatile principle, as they are lost on desiccation or distillation with water (Poisons, p. 510, ed. 1848). Enz, in 1858, is said to have obtained *Saponin* from it. Now, it is well known from the researches of Schmiedeberg that the *Saponins* are amorphous or crystalline glucosides. They are found widely distributed in the vegetable kingdom, and are all, with but few exceptions, very soluble in water and

render it frothy. Their action is related to that of *Emetine*. Injected into the blood, they cause paralysis of the central nervous system. "Small doses cause symptoms in man closely resembling the nauseant stage of emesis—that is, a raw feeling in the throat, tendency to cough, and increased secretion of mucus" (Elements of Pharmacology, p. 68). According to Lauder Brunton *Saponin* produces anæsthesia, and even both sensory and motor paralysis, if applied locally (Pharmacology Therap. and Mat. Med., p. 836, ed. 1885). It may, therefore, be presumed that it is questionable if *Saponin* is at all to be found in the species of the Aroid family we have been referring to. Paralysis has very seldom, if ever, been noted in cases of arum-poisoning; whereas, instead of there being anæsthesia, there is positive itching and hyperæsthesia.

But to return once more to the researches of Warden and Pedler. Their analysis of the ash of the tubers of Bish Kachoo indicated the presence of a large amount of potassium and magnesium; calcium was also present, but not sodium. The acids found were carbonic, phosphoric, and hydrochloric with traces of sulphuric. They also obtained marked quantities of potassic nitrate from the dried tubers. They add that the examination of the ash failed to afford them any clue to the physiological action of the fresh tubers. Their microscopical examination of a section of the tuber revealed numerous bundles of needle-shaped crystals. Similar crystals were also found in the leaves and stems. These crystals were insoluble in cold acetic acid, but easily soluble in cold dilute nitric or hydrochloric acid; caustic potash was without action. Crystalline bundles were visible in sections of boiled tubers, examined cold. Warden and Pedler come to the conclusion that these are crystals of oxalate of lime, and that the physiological symptoms caused by Arums are due purely to the mechanical irritation which they cause. "Bearing in mind the action of the re-agents on calcic oxalate," they say, "the reason why mere boiling the tubers in water failed to deprive them of their activity is explained by the insolubility of oxalate of lime in water." Again, the action of dilute acetic acid even at a temperature of 100° C. in slightly lessening the activity of the tubers is due to the very slight solubility of oxalate of lime in that acid. And, lastly, the complete loss of all physiological action when the tubers were treated with dilute nitric or hydrochloric acid is evidently due to the ready solu-

bility of calcic oxalate in these mineral acids. This was verified in every instance under the microscope. Warden and Pedler found that, on drying, the tubers practically lost the whole of their physiological activity. "Clearly," they say, "there could have been no loss of oxalate of lime on desiccation;" and as a matter of fact they found as many crystals under the microscope in the dried arum as in the fresh tubers. They admit however that this is an anomaly and explain it as follows:—"In the fresh condition of the tubers, the bundles of crystals of oxalate of lime are cone-shaped more or less, the sharp points covering a wide area and forming the base, but in the drying of the tubers the needles appear to arrange themselves more or less parallel to one another, and the sharp points thus cover a small area. And thus, instead of each crystal acting as a separate source of irritation and penetrating the tissues, the bundles act as a whole."

In the Pharmacographia Indica (vol. III, p. 547) needle-shaped crystals are mentioned by Dr. Dymock as forming the contents of the cells composing the parenchyma of the fruit and seed of *Synantherias sylvatica*, Schott.

The mechanical theory of irritation by the pointed ends of the crystals, say Warden and Pedler, has been independently adopted by Herr Stähl of Jena. They admit, however, that, in addition to local irritation, *viz.*, of the tongue, throat, and mouth, there are other and graver symptoms produced by the ingestion of arum-tubers and leaves, such as convulsions, dilated pupils, insensibility and coma, and that the occurrence of these symptoms cannot be explained by the mechanical theory. They look upon these symptoms as the result of the action of the calcic oxalate crystals on the stomach. They say that the stomach at first suffers from mechanical irritation by the crystals; the secretion of the gastric juice thereby diminishes or ceases entirely; free hydrochloric acid of the gastric juice is, in consequence, not available for dissolving the calcic oxalate crystals; the crystals thus may pass on to the intestinal canal; once in the intestines, they may induce convulsions, dilated pupils, and coma by mechanical irritation in the same manner as intestinal worms.

Believing that the irritation caused by the tubers of Suran is due to the mechanical action of the needle-shaped crystals found in their cells in close-packed bundles, I have thus freely and fully reproduced, although in the form of a summary, the exhaustive researches of Warden and Pedler. The importance of their results will be amply

apparent from what I now proceed to record for the first time, as the result of a careful examination of the tubers of the wild and cultivated varieties of *Amorphophallus campanulatus* by another careful investigator hailing from this side of India. If the naming of the needle-shaped crystals is different in the following note, it will, I hope, be considered, not that I reject the results of Warden and Pedler and accept those embodied in the observations which follow, but that I wish it to be clearly understood that, although the remarks of Warden and Pedler may apply to the Arums generally, the crystals found in Suran may not be calcic oxalates, but calcic sulphates and carbonates.

At my request, Dr. Nasarvanji Fakirji Surveyor, M.D., B.SC., M.A., M.R.C.P., a distinguished Graduate of the Bombay University, whose special training under renowned scientific workers in London, and whose marked ability and aptitude for microscopical and clinical investigation add a value of no ordinary kind to his remarks, has recently examined pieces of the wild and cultivated varieties of *Amorphophallus campanulatus*. The results of his observations are embodied in the following note which he has kindly communicated to me :—"The chief points of interest about their microscopical and chemical differences are as follows :—

"The wild variety shows *two* forms of crystals, while the cultivated variety shows only *one* form. I shall first describe those crystals which are found in both the varieties and then those found in the wild variety only. Those found in the former I shall call the *white* crystals ; while those found in the latter or wild variety only will be described as *brown* crystals. The white crystals are about 120μ * in length and 3μ in thickness. They are acicular and glistening and have a double contour. They are sharp-pointed at either extremity and always straight. They appear to be rigid ; more numerous in the older parts, while they are almost absent from the youngest part (e.g., leaf-bud). They are insoluble in cold water ; slightly soluble in boiling water. Acetic acid dissolves them with evolution of gas (CO_2 probably).

"On *incinerating* a thin film of the juice on a slide, these crystals were found to be fractured in numerous places, while many appeared to be either transversely striated or granular. This was due perhaps to the fact that the water of crystallization was driven out by the heat. These crystals were found to be scattered about, not collected in definite bundles. They were probably carbonate of calcium.

* μ = $\frac{1}{1000}$ of a Millimetre.

"The *brown* variety was only found, as has been already remarked, in the wild *Amorphophallus*. These crystals were very fine ; about one-third the size of the first. They were also acicular, but did not show a double contour. They were found in the cells arranged in sheaves, and were distinctly brown when viewed in a mass. On adding a drop of water to the juice of the tuber, these cells swelled up and discharged the crystals. When examined singly, the crystals appeared to be very thin and somewhat curved. The brown tinge was still noticeable. The length of each crystal is 50_{μ}, and thickness under $\frac{1}{4}\mu$. The crystals are sparingly soluble in warm water, freely in boiling water, so that a piece of the wild variety, on being reduced to pulp and boiled with *distilled* water, was almost deprived of the crystals, while the white crystals were still seen. By filtering the hot water, brown crystals were obtained from the filtrate by evaporation. Is it a fact that the wild variety can be eaten, if well boiled, especially with salt ?

"On incinerating the piece just as described above, I found that these crystals were not altered in the slightest manner, thus proving that they too were inorganic in nature and that they were not oxalates.

"Acetic acid dissolved them without evolution of gas. These were probably sulphate of calcium crystals ; however, I am not certain of that. I examined pieces of both the varieties for other salts after charring and incinerating them. This method showed insoluble and soluble carbonates, soluble sulphates and traces of chlorides.

"Of course, sulphate of calcium, being a poisonous salt, must have something to do with the properties of the wild variety ; however, it is perhaps not the only cause ; a glucoside or an alkaloid may be present too. As I have neither the means nor the time at my disposal, I am not able to settle that point.

"The important facts, however, are that the brown crystals are only present, as far as I know, in the wild variety, and that they are soluble in boiling water and weak acids without evolving any gas like the white crystals. These are very delicate, and appear in places to be slightly bent ; while the white crystals are rigid, straight, and thicker."

I am very thankful to Dr. Nasarvanji for these remarks. They will serve as an important guide, incomplete though they are, in understanding the poisonous nature of the plant. With regard to his query whether "the wild variety *can* be eaten, if well

boiled, especially with salt," I may say that the wild variety can be rendered partially (for I cannot say *entirely*) innocuous when well boiled with or without salt, but more so when boiled with acid fruits and vegetables. Generally the wild variety is not made use of for culinary, but only for medicinal purposes under the name of *Madan-Mast* as already observed. The wild variety is used as food in exceptionally hard times such as a famine. In the Dekkan famine of 1877-78 the leaf and tuber of the wild variety were used as food in the Khandeish District, probably not without boiling nor without the addition of salt. I say probably, because the wild tuber is very acrid, and under no circumstances can it be solely used without intense irritation of the mouth, throat, and tongue. In the cultivated plant too, there is sometimes a good deal of acridity, which, though not noticeable at the time of eating, is distinctly recognized shortly after eating. It even irritates the skin of the finger-tips as it is being cut by delicate female hands for culinary purposes in Hindu homes. Of this there is no doubt. Much of this acridity of the cultivated variety is got rid of by boiling. The slight persistent acridity would seem to be due to the presence of the stiffer and bolder white crystals which Dr. Nasarvanji pointedly observes are present even when the pulp of the wild variety is boiled with distilled water and the brown crystals are completely dissolved.

It is to be hoped that Dr. Nasarvanji may some day be able to complete his investigation of the tubers of Suran, or that some qualified chemical analyst may take the matter up and ascertain the exact nature of the needle-shaped crystals. That they act mechanically there is not the least doubt; guided by the researches of Warden and Pedler, this can be the only conclusion one can arrive at. In my own practice I have seen cases of distinct irritation of the throat, mouth, and tongue after the use of boiled Suran. In the practice of Dr. Sakharam Arjun and Dr. Vinayak Govind Gidh, swelling of the tongue and salivation were noticed in addition.

Notanda et Corrigenda in Plate K.

(i) For *Amorhophallus campanulatus* read *Amorphophallus campanulatus* (*Blume*).

(ii) For $\frac{\text{A. Flower}}{\text{and Bulb}}$ read Inflorescence and tuber.

(iii) Note that B is a vertical section of the spadix and spathe. The spathe is fully seen at the right of the reader, and only partially at the left, it being cut horizontally a little below where the pistilliferous portion of the spadix terminates.

(iv) The two bodies at the lower corner to the right of the reader are the female parts of the flower stalk twice magnified.

WOUNDED TIGERS, &c.—HOW SHOULD THEY BE KILLED?

(*Read before the Bombay Natural History Society on 10th July*, 1894.)

The occurrence of so many accidents out shikarring this hot season has induced me to write a paper on the above subject, in the hope that it may be of use to those who have little experience of big game shooting in India, and who may find themselves under the necessity of following up a wounded beast on foot. My experience of shooting in India extends over 17 years. I know that there are many of our members whose experience is greater than mine and whose opinions on this subject are entitled to greater weight. To these I would say, please continue the discussion and give us the benefit of your experience.

My remarks are intended only to apply to wounded tigers, panthers, and bears. On this side of India, it is almost impossible to get the use of an elephant, and nearly all big game shikarries are compelled to follow up wounded animals on foot. So that, unless one is prepared to shoot without an elephant, no big shooting is obtainable.

On two occasions—once in Rewah and once in the Hyderabad State—I had the use of an elephant. I never would go out shikarring without one if I could possibly help it. I know nothing grander than following up a wounded tiger on a good staunch elephant. From a position of perfect safety you are able to behold all the grandeur of the charge of an infuriated tiger, and to have all the fun of the sport without the danger of it, or, to quote the immortal Mr. Jorrocks, "all the spirit of war with only five per cent. of its dangers." To those, therefore, who can obtain an elephant, I say never follow up a wounded beast without getting into the howdah.

The weapons of the tiger and the panther are not only their teeth. The sharp retractile claws, which they fix into the man attacked, render their victims almost powerless. The blow, too, which the tiger can give with his fore-paws will almost brain a man. A wounded panther, which I lately shot on the top of one of my men, made a large hole with his claws in the man's chest to the lungs. This man was bitten and clawed all over as well and died in a few hours, but the wound in the chest through to the lungs was the worst. This panther never

left the man from the time he was seized till I shot it, and when I arrived on the scene (some 3 minutes or so after he was seized), the panther was worrying and shaking the man like a dog does a rat. The Indian bear, too (*Melursus ursinus*), can do terrible mischief with his claws. I have understood that they always try and tear the flesh off a man's face and shoulders with their claws ; at any rate, in the only instance I have seen a man attacked by a bear, the bear tore one of the man's cheeks off besides clawing and biting him in other places so badly that the man died in a few hours. I have often had beaters knocked down or clawed in the beat by unwounded tigers and panthers when breaking back, but I have never seen a man seriously injured by an unwounded beast.

The question is, when the beast is wounded what should be done? Some may say leave him alone, but if this is done the next innocent native wood-cutter or herdsman who should be so unfortunate as to come near the beast will get killed. I need only mention as an example the case of my friend, the late Mr. G. L. Gibson, of the Bombay Forest Service. He wounded a tiger in Khandesh, but darkness coming on he had to leave it. Next morning he went out after it, and, close to the place where he left the tiger the previous night, he came across the body of a native boy who had been tending cattle and had just been killed by this wounded tiger. Whilst examining the boy, or shortly afterwards—I forget which—the tiger rushed out, seized Mr. Gibson, and from the wounds received he died. The plan I have always adopted in following up a wounded beast is to get as many beaters as I can and form them into a solid body, then place myself with the other guns in the front rank, having my spare rifle-bearer close behind me. The whole body then move slowly forward. It is necessary to move slowly and carefully, and occasionally to turn round to see that the men are not straggling. Every now and then I make the beaters throw stones forward into the thickest jungle and I encourage them to make a noise. The wounded tiger or panther more often than otherwise reveals his presence by growling. I have known, however, a wounded tiger which allowed me to get within eight yards of him in Karvé reeds without growling. I discovered his position there by hearing his heavy breathing caused by a lung wound and by the movement of the reeds. My theory

is, that a wounded beast will not charge home into a solid body of men. He may commence his charge, and if any of the men were to rush out in terror from the main body, it is probable the animal might seize him, but I think if all stand firm he will not come on. Native beaters seem to be great believers in this theory. I have often known them, when a tiger breaks back or roars near them, gather together in a mass and shout for the purpose of keeping the beast off them. It may be said that one ought not to allow the beaters to run any risk as they are unarmed. To this I would reply, the beast must be killed, and if the sportsman goes in the front rank I see no objection. It would not be right to force beaters against their will to join in a following up, but in my experience I have always found a large portion of the native beaters very plucky, and often recklessly brave, requiring restraint and frequent words of warning. Here I am tempted to say words in praise of native shikarrees and jungle men. In this class I do not include the Bombay professional native shikarry. How often have I seen them unarmed do the bravest of deeds, which it would be brave even for a man armed with the best modern weapons to undertake. In following up especially, when I have had few men with me I have also adopted the plan of moving from tree to tree and then sending up a man to the top of the tree to spy around. I once wounded a tiger, which got in very high reeds; when we got within 40 yards of him he commenced to growl. I moved near a tree and sent a man up who reported he could see him. I climbed to the very topmost bough and from that postion I could just see him and was able to kill him. In hilly ground I always work from above, so as to have the advantage of being on higher ground when the charge comes. There can be no question I think that a wounded tiger, panther or bear will charge home in the face of both barrels discharged point blank into him. He will make good his charge against one or two men, but not, as I said before, against a mass. Often, too, a wounded beast will commence a charge, but draw back when he sees his adversary facing him like a rock showing no fear. He will then swerve off. The soul-stirring growl he makes whilst charging is, no doubt, made for the purpose of causing fear, and in many instances the bravest of men quail when suddenly hearing it. In

the late unhappy accident to Colonel Hutchinson, the Revd. E. Jenkins Bowen informs me the tiger charged from a distance of 30 yards, four guns in a line, but separated by an interval of two or three yards. Seven barrels were discharged into this tiger whilst he was charging—one by Colonel Hutchinson as the tiger was about to strike Mr. Bowen with his claws, and another barrel by Mr. Bowen, at a distance of three feet from the muzzle of his rifle, when the tiger was actually seizing or had seized Colonel Hutchinson ; but in spite of this the tiger not only shook and mauled his victim, but carried him off some ten yards before he was killed. In this case the beaters were not with the guns: Mr. Bowen informs me he sent back all the beaters, thinking the occasion to be one in which no beaters were required. This, however, must have been an exceptionally fiendish tiger.

To those who shoot alone, of course, the danger of following up is greater, as it is impossible for a man, who has been seized by a beast, to fire his rifle. I have done a great deal of my shooting alone, but in following up, I have generally been able to get a sepoy, or some one who knows, at any rate, how to aim and fire a gun, to accompany me. Such a man may be very useful at a pinch and his services should be always requisitioned. A shikarry, who carried my second rifle and who just knew how to load and fire from what I taught him, saved me from a mauling once; and on another occasion one nearly blew my brains out at a very ticklish moment ; but " this is another story," as Rudyard Kipling would say. I think everybody should go tiger-shooting with a companion, but of course this cannot always be, and my advice is to avail yourself of the services of some one who can fire a gun for you, even if that some one has but a little knowledge of the use of firearms. I often think the danger of following up a wounded beast is a little over-rated. Most sportsmen speak and write as though every wounded beast charged at once and never shrank from turning in his presence. My experience is that wounded tigers, panthers, and bears are often arrant cowards and curs. It is only the exceptional ones that are brave enough to make good their charge, and I do not think young sportsmen should be discouraged from following up on foot when every care and precaution possible is taken. Every now and then

the sportsman must expect to come across a fiend, and then, of course, he must be prepared to fight in real earnest.

Now a word as to bears. These are the most foolish of animals. Wound a bear and he commences to fight with his companion if he has one. His brain-power is very deficient. After he has been marked down, walk up to his lair and wake him up. He takes five minutes before he even knows he is awake. When wounded, he will generally show fight, and I think he should be attacked in the same way as the tiger. After firing at him, if he still continues his charge, I recommend the sportsman to throw his sun-topee at him and then bolt. By an accident I found out a wounded bear would stop and claw up a topee instead of pursuing his enemy. I once, in thick jungle on the ghauts, fought a wounded bear nearly all day. On the first occasion I got quite close to him and in a second he charged out at me. I fired both barrels point blank into him and turned and fled. After going but a short distance—the bear following me—a branch knocked off my pith topee. To my surprise the bear stopped, seized my topee and smashed it to smithereens and chewed one end of it in his rage. I loaded up and went back. He charged in the same way and I fired right and left into him, but he was too sick to come on and ran back.

I am aware this paper lays me open to the charge of egotism. This I cannot help. The nature of the paper requires it, and I hope my fellow members will pardon me and overlook it.

REGINALD GILBERT.

ADDITIONAL NOTE.

Since the above paper was read, a friend has drawn my attention to Rice's book on tiger-shooting in India. This book, which is now very difficult to get, was published in 1857, and I see the author holds exactly the same opinions as I do. At page 57, after alluding to forming up the party, he says: "The whole "party in a compact body keep close together, move at a snail's pace, yell with "their utmost power, and create what really is a most infernal din. No tiger "will face such a mass of men and noise as this. They sometimes charge down "within even a few yards, but then invariably turn off, mostly getting well "peppered or are shot dead in the attempt. With this system there is perfect "safety to every one, no matter how dense the jungle may be." It may be noted the author gives his party's bag in Rajputana for one year at 68 tigers killed and 30 wounded, 3 panthers killed and 4 wounded. Bears killed 25, wounded 26. Oh, ye gods!

R. GILBERT.

THE FOOD OF THE ROSY PASTOR OR JOWARI BIRD (*PASTOR ROSEUS*, LINN.)

By E. C. Cotes,

Offg. Deputy Supt., Indian Museum, Calcutta.

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A very interesting series of reports on the subject of the destruction caused amongst locusts of the species *Acridium peregrinum*, Oliv., in the Punjab, by the Rosy pastor (*Pastor roseus*, Linn.), which is known as the *Sanch*, *Tilia*, or *Jowari* bird, have been furnished by the Secretary to the Government of India in the Revenue and Agricultural Department. Reports also that have been furnished through the Director of Land Records and Agriculture in Bombay show that the same bird has long been noticed as very effectual in destroying locusts in Sind. The species to which the bird belongs has been determined by Mr. W. L. Sclater from specimens received from Bannu, Kohat, and Gujranwala, forwarded to the Museum by the Director of Land Records and Agriculture, Punjab, through whom also most of the reports have been procured. In view of the great effect which the bird undoubtedly has in keeping the locusts in check, it has been suggested in several quarters that it might be a good thing to take measures to have it protected by legislation. It seems very doubtful, however, to what extent any such measures would be useful in the end, in view of the great injury which the bird is said to do to grain crops in India.

The following account of *Pastor roseus*, Linn. (the rose-coloured Starling or Rosy pastor) is taken from Jerdon's *Birds of India*, Volume II, page 333 :—

"It usually makes its appearance in the Deccan and Carnatic about November, associating in vast flocks, and committing great devastations on the grain fields, more specially on those of the cholum or jowaree (*Andropogon sorghus*), whence its familiar name in the south. Mr. Elliot, in his manuscript notes quoted in my catalogue, says: 'Is very voracious and injurious to the crops of white jowaree,' in the fields of which the farmer is obliged to station numerous watchers, who, with slings and a long rope or thong, which they crack dexterously, making a loud report, endeavour to drive the depredators away. The moment the sun appears above the horizon they are on the wing, and at the same instant shouts, cries, and the cracking of the long whips resound from every side. The Tilliaers, however, are so active that if they are able to alight on the stalks for an instant, they can pick out several grains. About 9 or 10 o'clock A.M. the exertions of the watchmen cease, and the Tilliaers do not renew their plundering till evening. After sunset they are seen in flocks of many thousands retiring to the trees and jungles for the night. They prefer the half-ripe jowaree, whilst the farinaceous matter is still soft and milky. When they can no longer get grain, they feed on various grass and other seeds, flower-buds, fruit, and also on insects, seeking them on the ground, but they are rarely seen with cattle in India. The Telugu name is derived from the name of a plant whose fruit they are particularly fond of. Mr. Blyth remarks that 'they visit the neighbourhood of Calcutta only at the end of the cool season, when flocks of them are not unfrequently observed upon the arboreal cotton tree then in bloom.'

"Burgess states that he has seen them busily feeding on the flowers of the leafless caper, a shrub very common in the Deccan, on the banks of the larger rivers. Dr. Adams says that 'it is very abundant in the Punjab, committing great havoc on the grain there.' In the north-west of India, and in Afghanistan, they devour large quantities of mulberries in spring,

hence called the '*Mulberry-bird*' in the north-west, disappearing afterwards. They at times, however, feed much on insects, and are called the 'locust-eater' in Persia, according to Chesney. They do not breed in this country, quitting the south of India in March, but lingering in the north a month or so longer. It is ascertained that they breed in vast numbers in Syria and other parts of Western Asia, in rocky cliffs. Burgess states his belief that they breed in India somewhere, and was informed by a native that they do breed in the Ghats. This however is, doubtless, totally without foundation. Mr. Layard states that one year he saw large flocks of these birds in July, that they remained only a week, and then disappeared. They were entirely unknown to the Natives. Burgess also states that in 1850, towards the end of August, he saw a large flock of the rose-coloured starlings feeding on insects in an open field. These instances of their appearing so early are very unusual, and more especially their occurrence in Ceylon in July, by which time the young could only have been just fairly fledged."

Mr. M. F. O'Dwyer, Settlement Collector of Gujranwala, quotes an interesting Hindoo legend, to the effect that in response to the prayers of the people, the locusts have been imprisoned in a deep valley, surrounded by impenetrable mountains in the west of the Himalayas. The exits from this valley are guarded by *Tilliars* (rosy pastors), commissioned by heaven for the purpose. Now and then, when the sentinels fail in their duty of watch and ward, the locusts escape and are hotly pursued by the *Tilliars*, who, unable to drive them back to their prison in the hills, slay them wholesale.

The origin of this legend is supposed to be the fact that the locusts and *Tilliars* generally arrive in Gujranwala from the direction of the hills at about the same time in the spring. It has been noticed also that, when the locusts enter a grain field, the *Tilliars* do not pursue them into it, but station themselves all round its borders and kill the locusts as they issue forth.

The following are abstracts of the information that has been received upon the subject of this bird :—

The locusts in parts of Sind in 1889-90 were reported to have been exterminated by *jowari* birds, which did not attempt to eat the locusts, but snipped them in two and left them. In Khandesh also, in 1883, the *jowari* bird or rosy pastor was mentioned by Mr. Ommanney as a great enemy of the locusts.[1] (Annual Report, Director of Land Records and Agriculture, Bombay, 1889-90.)

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[1] The locusts referred to by Mr. Ommanney probably belonged to the species *Acridium succinctum*, Linn., which invaded the whole of the Bombay, Deccan and Konkan in the years 1882-83.

Specimens of the Rosy pastor (*Pastor roseus*) were forwarded (8th September, 1891) by Dr. F. Chand, Civil Surgeon, Gujranwala, as very effectual in destroying locusts.

The Deputy Commissioner, Dera Ismail Khan, wrote (1st September, 1891) that *Sanch* is believed to be the Yusafzai-Pashtu for a starling known as *Tilliar* in Hindi and *Sirokka* in Pashtu. He noted that the bird eats, or rather destroys, locusts in a most voracious manner.

On 7th October, 1891, specimens of the *Sanch* bird, said to have destroyed a large number of locusts in the Bannu district, were forwarded to the Indian Museum by the Director of Land Records and Agriculture, Punjab. They were identified by Mr. W. L. Sclater as belonging to the species *Pastor roseus*, Linn. (Rosy pastor).

The Acting Deputy Commissioner of Thar and Parkar, Sind, reports (21st December, 1891) that the *jowari* birds have very materially assisted in clearing the district of locusts.

The Deputy Commissioner, Lahore, notices that the Naib Muhafiz Daftar of Peshawar informs him that *Sanch* is the Pathan name for the bird known in Lahore as *Tilliar* (Rosy pastor).

In the *Civil and Military Gazette* of 24th July, 1891, it is reported that a bird known by the Afghans as *Sanch* has appeared in vast numbers in the provinces of Jellalabad and Lataband, and done much good in destroying locusts.

Major H. P. Leigh, Deputy Commissioner, Kohat, writes (27th August, 1891), that all the natives he has questioned agree in describing the *Sanch* bird, said to have appeared in such large numbers in Afghanistan, as a *Tilliar* (starling or rosy pastor). This bird appears in Kohat in large numbers, mixed up with large flocks of Kabul sparrows, when the mulberries are ripe, and migrates down country, re-appearing in the autumn on its way north. The flocks chatter tremendously and dash from tree to tree, but have not been noticed on the ground. The bird is known in Kohat as *Kangira*, and it preys on the locusts, though curiously enough it has been almost a stranger in Kohat during the past year, perhaps because it found such abundant food among the locust swarms in Afghanistan and adjacent countries. It is said that the *Kangira*, if in small numbers, will not face a dense flight of locusts.

In a letter, dated 29th August, 1891, Major H. P. Leigh, Deputy Commissioner, Kohat, recorded the alleged destruction of a flight of locusts by the rosy pastor. Specimens of the bird were at the same time forwarded to the Indian Museum and identified by Mr. W. L. Sclater. The Tehsildar, who was sent from Kohat to arrange for the destruction of some locusts which has appeared in the neighbourhood, reported that the swarm had been destroyed by the starling. He watched them for some time, and noticed that, after killing a dozen or so of insects, the bird would fly off to water, cleanse its bill, and begin again, appearing rather to kill the locusts for amusement than for food, as it left them in the most mutilated condition.

The Deputy Commissioner, Dera Ghazi Khan, wrote (26th August, 1891) that the common *Tilliar* or starling (rosy pastor) eats locusts greedily. On one occasion in July, when flights of locusts invaded the station of Dera Ghazi Khan, the *Tilliars* were said to have flown out in a swarm to meet them and attacked them fiercely. The locusts tried to avoid them, but did not succeed in doing so, and were beaten off. The damage done in the station was consequently very slight. The *Tilliars* are most numerous in Dera Ghazi Khan, from about the middle of July to the end of August.

THE CHEROOT BORER.

By E. C. Cotes,

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In the rainy season of 1891 attention was again called to the "cheroot weevil," *Lasioderma testaceum*, Redtenb (*Dermestidæ*). This insect drills the small round holes which are so often met with in Indian cheroots, and is said to interfere very seriously with the exportation of Indian cheroots. So far as is known, the beetle lays its eggs on the leaf, and the little curved white hairy grubs, which emerge from these eggs, tunnel their way through the tobacco, and finally transform into white motionless pupæ from which the beetles emerge ready to cut their way out of the cheroot, and thus form the round holes which are so characteristic a sign of the presence of the insect. The length of time spent by the insect in the various stages has not yet been traced, and there is still a good deal of doubt as to the stage in the manufacture at

which the eggs are usually laid. In some old broken-up cheroots, kindly furnished by Mr. G. W. L. Caine, in August, 1891, were found both some very young larvæ and also two minute eggs which were thought to belong to this species. The eggs were transparent-white in colour, showing the yolk cells by transmitted light. They were oval in shape, with a number of minute protuberances at one pole, and they measured, one of them, about a fifth, and the other about a third, of a millimetre in length. They were found loose amongst the broken pieces of tobacco leaf. The eggs were evidently alive when found, and their presence in the old cheroots goes to show that eggs are at least sometimes laid after the cheroots have been matured. This indicates that care in packing and storing the cheroots is likely to tend to reduce injury by the insect, though it would not, of course, prevent damage in cases where eggs had been laid on the leaf before it was made into cheroots. It was suggested that subjecting the cheroots to a temperature of 80 or 90 degrees centigrade for a few hours before packing might serve to destroy any eggs or grubs they contained. This treatment, however, was found to injure the flavour of the cheroot, so could not be recommended. Upon the whole, the most likely means of reducing damage by the weevil seem to be—firstly, to keep the leaf, during the process of its manufacture, as much as possible out of the way of old cheroots and refuse tobacco of all kinds where the insect is likely to breed; and, secondly, to pack the cheroots in as air-tight a manner as possible so as to prevent the mother beetles getting into the boxes to lay their eggs. The insect is known to attack stored rice, opium, and other vegetable substances, as well as tobacco, so the cleaning up of the manufactory should be as thorough as possible.

A BOTANICAL TOUR IN KASHMIR, 1892.

By J. F. Duthie, B.A., F.L.S.

[*From the Records of the Botanical Survey of India.*]

I left Saharanpur for Kashmir on the 15th April, travelling by the ordinary rail and tonga route *via* Rawal Pindi and Murree. I had to halt a few days at each of these places in order to give time for the heavy baggage to reach Baramula, at which place I arrived on the 1st May. Leaving by boat on the same day I arrived at Srinagar on the 3rd. A few days were spent collecting plants in the neighbourhood and arranging for botanical tours in other parts of the valley.

I left Srinagar on the 9th for Pirni in the Jhelum Valley, about six miles below Baramula. Here I was delayed some days owing to the illness and death by cholera of one of my botanical collectors. On the 15th I ascended the Kájnág range from Pirni to an elevation of about 9,000 feet, and remained there one day to collect specimens. On the following day the camp was moved to the summit of the ridge, which is nearly 12,000 feet. The weather was fine.

and remarkably clear views were obtained of the snowy ranges towards the north, including Nanga Parbat.

On the 18th I left the ridge, and descending by a steep path on the southern side, pitched my camp in the Limbar *nullah*. On the following day some interesting specimens were collected up to 12,000 feet in a branch of the Limbar *nullah*, called the Taltal *nullah*.

On the 20th I went down the Limbar *nullah* to the Jhelum Valley and crossed the river at the ferry close to the village of Nowshera.

From here I took the short cut to Gulmarg, 22 miles distant. The path is very steep, and not a desirable one in wet weather. I halted at Sumbliáli that night, and spent the next day collecting plants in the Sumbliáli *nullah* up to about 11,000 feet.

The most interesting discovery on this day was a minute kind of Mistletoe parasitical on the branches of *Pinus excelsa*. I originally found this plant in 1884 just within the border of Western Nepal, growing on the same kind of tree and at about the same elevation (10,000—11,000 feet). It is published in the "Flora of British India" under the name of *Arcenthobium minutissimum*. It was afterwards gathered by Mr. Lace in Kunáwar, and I have since seen it, at Gulmarg, in the Sind Valley, and in the Gudhai Valley of the Astor District. It is abundant also near Gurais in the Kishenganga Valley.

I arrived at Gulmarg on the 23rd, and spent several days there exploring the vegetation of the neighbourhood, which offers great variety owing to the abundant rainfall, the dense forests encircling the marg, and the elevation of the surrounding mountains.

Baltistán and Gilgit Tour.—A brief sketch is here given in order to indicate more clearly the route which was followed.

Starting from Gulmarg on the 20th of June the route taken was as follows :— From Baramula by the Jhelum and Sind rivers to Gandarbal, up the Sind Valley *via* Sonamarg, to Báltal, and over the Zoji La to Dras. From Dras we proceeded in a north-westerly direction up the Marpu *nullah*, and over the Marpu La to Golteri in the Shingo Valley. Descending the Shingo Valley as far as the village of Fransart, we crossed over a high ridge, the water-shed of the Shingo and Shigar rivers, to the village of Shigar. After crossing the Shigar River by a jhula bridge we turned in a northerly direction up the Karpuchu Valley and went over the Bári La to a camping-ground overlooking the north-east corner of the Deosai plains. From here, keeping still towards the north, we crossed over the Shátung La, and forded a big stream flowing towards the Deosai plains. About 500 feet above this was another pass which we had to cross in order to reach the head of the Khorbala *nullah*. From here, descending by a very steep and rocky path, we entered the Satpur Valley, and passing Satpur Village and Lake arrived at Skárdu in the Indus Valley on the 14th July.

From Skárdu we went one march up the Indus Valley to a place called Katzura, and from there up the Shigarthang Valley and over the Alampi La

to Gudhai on the road from Bandipur to Gilgit. The rest of the journey to Gilgit was made along the new road *viâ* Astor and Bunji.

From Gilgit I made a short expedition to the Naltar Valley *via* Nomal in the Hunza Valley.

Returning from Gilgit on the 10th of August we took the same route as far as Gurikot below Astor. Here leaving the main Gilgit road, we kept up the Astor Valley crossing the stream from the Rupal *nullah*, and thence into the Kamri Valley, and over the pass of that name, to Gurais in the Kishenganga Valley. After a few days' halt we proceeded, *viâ* the Trághal, to Bandipur on the Woolar Lake, and thence by boat to Srinagar.

I shall now give a rather more detailed account of this journey.

After traversing the Woolar Lake, the usual course for boats proceeding to Srinagar is by the Noru Canal, which joins the main Jhelum River a little below the village Shádipur, so called from the junction of the Sind River with the Jhelum. A large portion of the Woolar Lake during the month of June is a perfect garden of water-lilies and other aquatic flowering plants, including the four-spined Singhára (*Trapa Natans*), which is very abundant here. The water of the Sind is beautifully clear by comparison. This river winds for miles through some fine pasture-land and water-meadows filled with tall handsome sedges, whilst the surface of the water is covered with innumerable flowers of white water-lilies.

The river ceases to be navigable beyond Gandarbal. From Gandarbal the Sind Valley extends some 58 miles up to the Zoji La, a pass leading into Baltistán. The total rise is about 6,000 feet.

The lower part of the valley is extensively cultivated, rice being the principal crop. Fruit-trees are also largely grown near the villages, which have an appearance of prosperity. Higher up the valley cultivation becomes more limited, and the villages contain a poorer class of people.

The vegetation of the valley from a botanical point of view is rich and varied. There is plenty of water brought down by numerous snow-fed streams; and the hill-sides, especially such as face the north, are thickly clothed with fine forests. As the elevation increases the submontane character of the vegetation gradually gives way to more temperate forms until, after passing the gorge below Sonamarg, a distinctly alpine element is observed, as at Gulmarg, the elevation of which place is about the same.

The village of Sonamarg consists of a few miserable-looking huts uninhabited during the winter months. It boasts, however, of a Post Office and Telegraph Office. After crossing the river at Sonamarg the road passes over undulating pasture-ground, and here and there through patches of forest composed chiefly of *Pinus excelsa*, mixed with willow and Himalayan poplar.

The two principal feeders of the Sind River join near Báltal; the larger one from the south rises in the neighbourhood of the famous Amarnath Cave, whilst the other, a small narrow torrent, comes in from the direction of the pass.

Báltal is a little over 9,000 feet. There is no village here; only one or two huts occupied by the dák runners between Kashmir and Leh. On the day following my arrival at Báltal I explored for some miles the valley to the south leading to Amarnáth. For considerable distances the river is completely covered over with snow. Further up we came to a place where, owing to the absence of snow bridges, it was impossible to proceed further. Many interesting plants were collected in this valley.

The Zoji La is rather a dangerous pass when covered with snow; otherwise there is no difficulty whatever. I crossed over on the 29th June, at which time there was no snow on the road.

The views from the summit looking north and south are striking from their contrast. On the northern side the mountains are bare and rocky, and there is not a tree to be seen in the valley leading to Dras; whereas on the Kashmir side the Sind Valley is beautifully wooded. The different climatal conditions prevailing on the Dras side are indicated by the presence of many Tibetan plants; also by the whistling cry of the marmot. The top of the pass is 11,287 feet. Some interesting plants were found on the ridge to the west of the pass up to 12,000 feet.

After descending the valley for a few miles I made another detour towards the east, and collected a variety of specimens near a glacier at about 13,000 feet.

My camp was pitched at Minimarg, 4 miles further down the valley; and many new plants were collected on the way.

Before reaching Minimarg we passed a very promising-looking valley towards the east, called Suk *nullah*, which I explored on the following day, the camp in the meantime having been moved down the valley to Mataiyan. The view looking up towards the pass is very fine. The sides of the valley here are very precipitous, and apparently quite bare of vegetation.

Between Mataiyan and Pandrás the road crosses from the right to the left bank. A tall aromatic fennel-like plant, called "*A'pat Kanphur*" (*Ferula fœschkeana*), is very abundant in this part of the valley. It is much valued by Kashmiris as a fodder plant, and is cut for winter use. On the Pir Panjál it is called "*Kangwa*." The valley suddenly opens out before reaching Dras, an unimportant-looking place consisting of a few scattered hamlets. There is, however, a small fort here, also a Tehsil and Post Office. The elevation is just under 10,000 feet. The surrounding mountains are very bare and rocky. Trees are scarce; only a few willows and poplars are to be seen near the villages. I halted for one day, and left on the 3rd of July with a new set of ponies and coolies.

The road to Leh continues down the valley in an easterly direction. This is also the ordinary route to Skárdu, but a very hot one during the summer months. The route which I took is a high-level one, and much more interesting for botanical exploration.

After crossing the valley in a north-westerly direction through fields of buck-wheat, *masur* (*Lens esculenta*), etc., the road begins to rise in zig-zags

along a very rocky valley almost bare of vegetation for the first few miles. At 12,000 feet the botany becomes more interesting. The white variety of the marsh marigold fringes the sides of the stream ; a brilliantly yellow-flowered Draba was conspicuous, growing in masses near the top of a pass ; and mixed with it was a rare Anemone (*A. albana*). The tents were pitched at a place called Pattarkhan Brangsa, between 12,000 and 13,000 feet. There is an enormous rock here which affords good shelter for coolies.

I went over the Marpu Pass on the following day. It is over 15,000 feet, and forms a portion of the watershed between the Dras and the Shingo rivers, both of which flow into the Indus. It is quite an easy pass, but the path is a very stony one, and on this account a little more snow would have been an advantage.

The next camping-ground is at Pattar Dokas, about 2,000 feet below the pass. The stream of this *nullah* flows into the Shingo River, a few miles below the village of Golteri, which was my next halting stage. This village is on the right bank of the river, and is situated on a plateau of moraine debris. The elevation is about 11,000 feet. I stayed here for one day as the botany was interesting, and I had to make arrangements for another set of coolies. The pencil cedar (*Juniperus excelsa*) is plentiful in this valley, but the trees are stunted. The Shingo River rises near the Burzil Pass and flows into the Shigar, one of the tributaries of the Indus.

I left Golteri on the 7th of July, and went down the valley on the left bank to a place called Chamlong. The river is crossed by a small rope bridge just below Golteri ; close by here and alongside the river is the village polo-ground. The path keeps near the river all the way, and is very rocky in places. One great feature of this valley is the abundance of a very floriferous sweet-scented rose (*R. Webiana*). The flowers vary from deep pink to white. The people here call it *sermang*. Many other interesting botanical specimens were gathered. A wild-looking valley, called the Shwaran *nullah*, has to be crossed by a rope bridge before reaching Chamlong.

On the following day we continued down the river to the village of Fransart by an extremely rocky and rather difficult track, and some parts of it must be quite impassable when the river is at all high. There is an alternative and longer route at a much higher level. The elevation of Fransart is about 10,000 feet. There is a large extent of cultivated ground in this part of the valley, including many fields of barley. After changing coolies we had before us a steep ascent up to 12,000 feet in order to cross over into the Shigar Valley. The small village of Shigar is prettily situated at some distance above the river. The valley just here is rather wide, and some side valleys open into it on the opposite side where the mountain scenery is very grand. Their lower slopes are clothed with forest, consisting chiefly of *Pinus excelsa* and *Juniperus excelsa*. Mosquitoes are very troublesome here at about sunset, and at higher elevations up to 14,000 feet they are even worse. It must, of course,

belong to a different species from that of the plains of India. The wild flowers here are very beautiful and interesting. On the following day we had to cross the Shigar over rather a difficult rope bridge, 112 yards long. The loads were taken over by a few experienced men. The water is very deep here, and so quiet that one wonders why they do not use ferry boats instead of this twig bridge, which has to be constantly repaired. After seeing all the baggage safely over, we took the path leading to the entrance of the Karpuchu Valley, where there is a village called Matral, and a fort or tower built of alternate layers of wood and stone. From here the road winds up the valley, gradually ascending through a forest of pine and juniper to our next camping-ground at about 12,000 feet. This place is called Karpuchu, and consists, as far as I could see, of a single shepherd's hut. On the following day we made another march further up the valley to about 14,000 feet. Heavy rain came on before the camp could be pitched, and an uncomfortable night was spent under wet canvas which was frozen hard before the morning. We had not far to go the next morning (July 11th) before reaching the summit of the Bári Lá, about 15,000 feet. There are several small tarns on the further side. A good deal of snow was lying about, and vegetation was scanty, consisting chiefly of Primulas, Sedums, and Saxifrages. A very curious plant called Galgal is abundant here. It is a species of *Saussurea* (*S. obvallata*). The pale yellow bracts are very large, and loosely envelope the composite heads of flowers, which are strongly scented. The stillness at these high elevations is always very striking. After descending, however, for a short distance on the other side, the air was filled with the shrill cries of the marmots. Our next camping-ground was close to a big mass of rock at about 14,000 feet, and looking down the valley towards the north-west one could see a small portion of the Deosai Plains.

Coolies and all were glad to leave this bleak and inhospitable spot, but we had a hard day before us, with two passes to get over, and a long steep descent into the Satpur Valley.

The first pass we came to is called the Shátung Lá, about 13,500 feet. There was a good deal of snow here in a melting state, which made walking rather difficult. The descent is into a valley watered by a stream called the Tikatsichu. From here the path ascends to the pass leading into the Kharbula *nullah*. There is a small lake at the summit of this pass, and a good view of the Deosai Plains can be seen from here. The path descends steeply from here into the Satpur *nullah*, at the head of which is the camping-ground called Ronishikar or Jalna Bránsa. It occupies a small piece of flat ground on the spur of a mountain, and the elevation is about 12,500 feet. Looking down the valley a view is obtained of some distant mountains on the further side of the Indus.

The floor of my tent was carpeted with edelweiss, *Anemone albana*, and other interesting specimens.

The path down this valley is very steep and very stony. My intention was to have gone on to Skardu from here, but finding the botany so interesting, I decided to halt halfway near the village of Satpur. Several bushes of a handsome *Spiræa* (*S. hypericifolia*) were met with on the way down. This species is not included in the "Flora of British India." My friend Captain Hunter Weston, R.E., brought me flowering specimens of this shrub discovered by him in Baltistán three years ago. The plant, however, is well known to the natives, who call it "*Saber*." The wood is hard, and the bark is of a reddish-brown colour and smooth. Native shikaris from Kashmir nearly always take back with them a bundle of sticks cut from this shrub. Many other rare plants were also collected.

There is a good deal of cultivation in the neighbourhood of Satpur. The fields which have been skilfully terraced contained fine crops, especially of wheat and barley, nearly ready for the harvest. Other crops are peas, called here *kukan* beans or *bakla*, the Balti name of which is *bararak*, and turnips (*gonglu*); wheat is called *kanak*, and barley is *nas*. The general name for all kinds of grasses is *kash*. Several kinds of fruit-trees are also grown here, such as walnuts, mulberries, and apricots.

After leaving Satpur the road follows the bed of the river and then over grassy and more or less marshy land until the lake is reached. The path then ascends and is carried along the east side of the valley at some distance above the lake. The lake occupies the whole width of the valley, which is about a mile across, and its length is nearly two miles. It contains fish. We passed a curious old wall which extends down the side of the mountain and ends in a fort overlooking the lake. After passing the lake the path (a very bad one) keeps more or less by the river until it suddenly emerges into the Indus Valley immediately opposite Skárdu. I halted two days here, and my time was fully occupied replying to the numerous letters which had been awaiting my arrival for many days, and attending to the large collection of specimens recently collected.

Captain Townsend, of the Central India Horse, was here in command of some Kashmir Imperial Service Troops, and was the only Englishman in this place when I arrived. I am much indebted to him for his kind assistance in various ways, as well as for his hospitality. The Tehsildar, who is practically the governor of Skárdu, was also most obliging. A great deal might be written regarding the history of this interesting place, also of the scenery, which is very striking. All cultivation is carried on by means of irrigation, the channels for which extend for miles from the sources of supply. The numerous villages which are scattered throughout the valley are conspicuous by their settings of vivid green patches in the midst of a sandy desert. A very superior kind of apricot is to be obtained from some of the gardens. When ripe it is extremely juicy, more like a plum in this respect, and the flavour is delicious. It is called *chilu*, but is very different from the ordinary hill apricot

met with in this country; the flesh of which is more or less of a firm consistency. Walnut trees are plentiful, also some superior kinds of mulberry.

I left Skárdu on the 17th of July for Katzura, a small village about 16 miles up the valley towards Rondu. It lies on the left bank of the Indus, close to the large torrent which comes down roaring and foaming out of the Shigarthang Valley. This is a very trying march owing to the long stretches of sand which throw off an immense amount of heat during the day. For the first few miles out of Skardu the path is shaded by an avenue of poplars, but suddenly this avenue abruptly terminates at the edge of a sandy desert. One of the villages I passed through was inhabited by Kashmiris. I found a man manuring his tobacco field with freshly-cut plants of a kind of thistle (*Cnicus arvensis*), which he called *kanish*. The tobacco was of the coarse round-leaved variety (*Nicotiana rustica*).

I rested for a short time at the village of Hoto, and was much refreshed by some apricots which were presented to me. The wheat here was much rusted. This village is liable to the encroachment of the Indus as well as to inundations of blown sand. After this the road begins to rise gradually towards Katzura. A pretty lake is passed, and soon after that the Shigarthang Stream is crossed by a bridge. A few hundred yards further on is the village surrounded by fruit-trees (walnuts, apricots, and mulberries). On arrival I was presented with a basket of excellent large round black mulberries. This variety is called "*kachilosa*" or "*shahtut*." Wheat, beans, and tobacco are cultivated here in small patches. The elevation of this place is about 8,000 feet.

The next day's march was to Shigarthang, about 16 miles up the Shigarthang Valley. Soon after entering this valley the road takes a sudden turn to the south. The ascent is easy at first. The village of Tzok with its fruit-trees and grassy meadows is prettily situated in an open part of the valley. From here the road turns round to the north and is carried by a bridge to the left bank. The scenery now becomes very wild. Bare precipitous rocks hem in the valley on all sides and the road becomes steep and stony. Vegetation is very scanty, but what there is is interesting. The *Saber* (*Spiræa hyperioifolia*) was found again. A kind of ash (*Fraxinus xanthoxyloides*) was plentiful at about 9,000 feet in fruit, also *Juniperus excelsa*. After this the road takes a sudden turn to the west, and ascends steeply between innumerable boulders of an enormous size, severed from a mountain on the left, and extending down to the river, where they help to form a series of beautiful waterfalls and cascades. Above this is a small village, near which I came across some of the tiniest full-grown cattle I have ever seen. They were covered with long black hair, and looked more like bears.

At Shigarthang the main valley takes a sharp turn to the west towards the the Alampi Lá and the Banok Lá. Two other valleys open out into this bend of the Shigarthang Valley, on the east the Dora Lumba from the direction of the Burji Lá, and the Munda Lamba from the south. The village is on the

right bank of the main stream and is situated on a high plateau composed of moraine debris. The elevation is over 10,000 feet.

The people of this place are a wild-looking lot, but cheerful and full of humour. Their head-gear is of the Hunza pattern, *viz.*, a long bag with the edges rolled in until it forms a cap. The men whose lot it was to carry the loads on the next march appeared in the morning with their caps decorated with the crimson flowers of *Rosa Webbiana*, shouting and chattering in a language which none of my servants could understand. As these men had to accompany me over the Alampi Lá and for some distance down towards Astor, arrangements had to be made for their rations, and I was unable to make a very early start. We made a short march therefore to a place, called Rimo Chagma (or Ringmo Chami), close to the river and between 12,000 and 13,000 feet, and on the following day started with the intention of going over the pass.

By the time, however, we had reached the foot of the first serious climb towards the pass, it was too late in the day to attempt the long and difficult journey across the snow. The weather was perfect, and without a cloud in the sky. The elevation was about 13,000 feet. In the evening I went up for a few miles towards the head of the main valley and collected some plants.

Early the next morning (July 21st) we made for the pass, beginning with a steep more or less grassy ascent up to 14,500 feet. Beyond this is a wide *corrie* surrounded by an amphitheatre of precipices, and with a lake at the bottom and patches of snow all about. From here turning to the west we had another stiff climb before us with a good deal of snow to cross at a disagreeable angle, for the snow was frozen hard and steps had to be cut. Having reached the top of this slope, we found ourselves in another hollow basin. Here was a much larger lake all frozen over. There was nothing now to be seen but rocks and ice and snow.

After skirting the shores of this lake, we reached the foot of the final climb, a steep staircase of rock, and at last arrived at the summit of the pass, the elevation of which is 15,200 feet. The descent on the western side is into a valley which was covered with snow for 2 or 3 miles. The upper part of the snow slope was very steep and hard, and steps had to be cut for a considerable distance. We got off the snow at about 1,000 feet below the summit of the pass, and rested for a short time by some big boulders. From here the finest view of Nanga Parbat is obtained, and it was seen to perfection on this day.

Looking about amongst the boulders for botanical specimens, I came across some human bones, and beside them a few pieces of cloth, also a portion of a gun-stock. They were altogether in a sort of small cave formed by an overhanging boulder, which may have afforded the unlucky traveller temporary shelter, but which eventually became his tomb.

We had to go down the valley to about 12,000 feet before we could find a suitable camping-ground. The botany was most interesting, and many new plants

were discovered. The whole way down to Gudhai on the Gilgit Road the scenery in this valley is very fine. It is richly wooded in parts, the chief trees being *Pinus excelsa*, *Juniperus excelsa*, and willows. We passed a few small villages, the most important of which is Bobin ; its elevation is a little over 11,000 feet. Some fine *nullahs* open into this valley on either side. At about 10,000 feet Karbe Village is passed. Near here I came across a number of Commissariat coolies, mostly Punjabis, cutting grass for the Gilgit transport animals.

From here there is rather a steep descent to the Burzil Valley. The two rivers join close to Gudahi, the elevation of which is about 9,000 feet.

We are now on the main Gilgit road, a few miles from Naugáun, where I dismissed my Shigarthang coolies, and got a fresh set to take my loads on to Astor the next day.

On arriving at Naugáon I found the entire population either playing, or assisting as spectators, at an exciting game of polo. The flat roof of a house served as a grand stand, and here the village band played a variety of tunes.

The next day's march was to Astor. The road for the first few miles is very rough and dusty. This is really a piece of the old road, the new portion which is being carried at a higher level, not then being open for traffic. After crossing the Burzil Stream and the Astor River, the road ascends to Gurikot, where there is a good deal of cultivation and many groves of fruit-trees. From here the new road leads by easy gradients to Astor. The edible pine (*Pinus gerardiana*) is common in this portion of the valley, the elevation being about 8,000 feet. The local name is *Garol*. *Juniperus excelsa* is also abundant here, and is called *chili*.

The scenery of this portion of the valley is remarkable. The villages on either side are perched on the slopes of an enormous moraine, through which the river has cut a deep channel with high precipitous cliffs of moraine debris on either side. Astor itself is high above the river.

The Hollyhock (*Althæ rosea*) with pure white or mauve-coloured flowers is abundant here along the hedges of cultivated ground. It is not indigenous, and was probably introduced at some time or other, along with the large white-flowering Iris, for planting over graves.

I remained at Astor for a day, and left on the 26th July for Daskin. After passing the fort the road descends to Harcho, and then ascends to Daskin, keeping high above the river, Daskin being considerably higher than Astor.

The sides of the Astor Valley look almost completely bare of vegetation. There are, however, many juniper trees scattered over the rocky hill-sides which at a distance give the grey colour of the rocks a speckled appearance. Some interesting plants are to be found in the rock crevices and in the more shady nooks. At elevations above 10,000 feet the climate is cool and moist, and the vegetation is correspondingly luxuriant. These conditions prevail throughout this part of the country and up to and beyond Gilgit. Nearly

every *nullah* which opens into these hot, dry and comparatively low valleys afford views of forests and green pastures extending up to the snow line.

Beyond Daskin the road still ascending passes through the lower portion of one of these forests, which extend more or less all along the high-level ridges from Astor to Doian. This proved to be one of the most interesting bits of botanical ground met with during the whole of my tour. The principal trees are *Pinus excelsa, Pinus gerardiana,* and the Pencil cedar. Streams of clear water cross the road at intervals, and many rare plants may here be found. After passing through this forest the road again enters the arid waterless tract, until Doian is reached, close to which place the same kind of forest extends.

There is a small bungalow at Doian belonging to Messrs. Spedding & Co., the road contractors. As rain came on in the afternoon, I was glad to avail myself of it, and so saved my tents from getting wet. There is a splendid view from here in clear weather, looking down into the Indus Valley and across to some very high snowy peaks beyond.

It rained steadily all night and the next morning, and remained cloudy during the rest of the day. This was an advantage, as the next march down to Rámghát is a very hot and trying one on a sunny day. The old route over the Hattu Pir must however have been very much worse.

At Rámghát there is a bridge over the Astor River, which rushes through the gorge here at a furious pace. This spot is known locally by the name Shaitán Nára. The camping-ground is about a mile beyond this, on the left bank of the Dachkat or Misikin Stream. This torrent, like many other glacier streams, rises and falls at different times of the day, and during the summer months it is quite unfordable towards evening.

From this place there is a good road mostly over a stony plateau to Bunji, the elevation of which is under 5,000 feet. This used to be a much more important place until the great flood of 1841 destroyed it and laid waste a large extent of cultivated land. There is a very good bungalow here and a garden of fruit-trees, in which I pitched my camp.

Captain Yielding, D.S.O., arrived here that evening from Srinagar, and I had the pleasure of his company as far as Gilgit. The distance is nearly 40 miles by the new road. It is certainly a journey to be undertaken as quickly as possible, for the whole valley is extremely hot during the day-time, there being no shade whatever until you reach the village of Minawar, about 8 miles from Gilgit. Finding that my coolies were a long way behind, I was obliged to halt about 6 miles short of this place on a gravelly plain near the river. As some portions of the new road between this place and Minawar were not then open for traffic, we had some difficulty with the loads, especially at certain spots where the debris from the new road was being shot down on to the only other possible track. I found Captain Yielding at Minawar early the next morning, and we rode on from that to Gilgit.

The views of the snowy peaks towards the north-east were wonderfully fine,

one of them, Rakapushi, over 25,000 feet, standing out clear against the blue sky. The first sight of Gilgit from the Jutial Ridge is very striking, as you look down upon the wide expanse of orchards and cultivated fields, the colours of which appeared so vivid by contrast with the surrounding bare and dazzling rocks.

I stayed at Gilgit for one day, and left early on the morning of the 2nd of August for Nomal in the Hunza Valley. After crossing the bridge over the Gilgit River the road follows the left bank of that river in an easterly direction for about 3 miles and then turns round towards the north up the Hunza Valley. The distance from Gilgit to Nomal by this road is about 16 miles. This is a very hot and trying march in summer, as there is not a particle of shade except at one place, about half-way, where a landslip has brought down some big boulders. There is no water either, except that of the river, which at this time of the year is quite muddy and looks more like a mixture of ink and milk. After entering the Hunza Valley the road traverses for some miles an undulating sandy tract covered in parts by a large bushy species of *Ephedra* (*E. intermedia*). After passing the *half-way boulders* the road is carried for a considerable distance along the side of a precipitous hill, descending again to more level ground before reaching Nomal. The elevation of this place is 5,500 feet.

On the following morning I left the Hunza road, and went up the Naltar Valley towards the north-west. For the first few miles the valley is confined within bare precipitous rocks. Some interesting specimens were gathered near the river, which has to be crossed by bridges four times before reaching the village of Naltar, the elevation of which is about 6,500 feet. There is plenty of vegetation here, and some good crops were seen of wheat, barley, *kangni* (locally called *pirpit*) and *chena*. Walnuts, apples, and vines are also grown here.

After resting for a little while I continued up the path for a few miles, and found a capital camping-ground in a forest of silver fir at an elevation of about 9,000 feet. Beyond this the valley opens out, and is clothed with fine forests containing silver fir, juniper, and blue pine (*Pinus excelsa*). On the slopes facing the north-east these forests extend to a considerable elevation mixed with birch and willow. There is a path leading up to the head of this valley to a pass which separates it from the Chaprot Valley. Numerous glacier-fed streams come down into this valley from either side. As I had only two days to spare for botanical exploration, I found it difficult to decide as to which route to take on each day, there being so much promising-looking ground in every direction. My expectations were fulfilled on the first day, and the cooly-load of drying paper which I took with me was very soon used up, and the collecting box crammed full of rare specimens long before I had reached any great elevation. In fact, owing to the richness of the vegetation and the difficult nature of the ground, I managed to get up only to about 2,000 feet above my camp.

I explored another side *nullah* on the following day (August 5th), and found this one even more difficult. In one place I had to circumvent a big waterfall, and by the time I had got round to the top of it evening was coming on and rain too. This waterfall was rather a remarkable one on account of the rocks of all sizes which were constantly being carried over the fall. My attention was first attracted by the peculiar sound produced by the rattling of the stones.

I much regretted being obliged to leave this beautiful valley, which would require several days for its proper exploration. There was a good deal of rain in the night, and all the streams were much swollen when I left for Nomal the next morning. The river too was very high, and the two bridges near the village of Naltar looked very insecure when we passed over them, and one or both must have collapsed very soon afterwards.

On reaching Nomal I was told that the Gilgit bridge had been carried away and that the only communication with Gilgit was by the rope bridge. The damage done by swollen rivers during these few days appears to have been caused by a wave of warm air acting over a large extent of country; for, on my way back to Kashmir, I saw in many places signs of the havoc done to roads, bridges, and village water-courses, all of which happened at about the same time. At Bunji one of those curious mud streams came down and destroyed the water-courses; and at Ramghat the Dachkat torrent gave much trouble. At Harcho, in the Astor Valley, a bridge was carried away, and in the Kamri Valley a good deal of damage was done.

In order to escape the heat of the Hunza Valley during the day, I left Nomal at about 2 A.M. and reached Gilgit in time for breakfast. The rope bridge was a decidedly disagreeable obstacle at the end of a long and tiring march. In addition to the sense of insecurity which a man with a fairly good head for giddy heights need not be ashamed of, and with an inky black river rushing beneath him at a racing pace, there is a considerable amount of physical exertion required.

I remained at Gilgit for two days, and I gladly take this opportunity of expressing my obligations to Mr. Robertson, the Officiating British Agent, for his kindness and hospitality. I had the pleasure also of making the acquaintance of Surgeon-Captain Roberts, the Medical Officer attached to the Agency. His knowledge of gardening does justice to the capabilities of the climate in the production of good vegetables and fruit. He also takes an interest in botany, and through his kindness I have since received from him a very interesting set of specimens collected in the neighbourhood of Gilgit. I am also indebted to Captain Younghusband, not only for many acts of kindness during my stay at Gilgit, but also for a very interesting collection of plants gathered by him during his memorable journey across the Pamirs.

In a dry and rocky country like Gilgit there must always be considerable difficulty in arranging for a continuous supply of fodder for any large number

of transport animals. Along certain sections of the Gilgit road beyond the Burzil Pass, the local supply being practically *nil*, a good deal of expense is necessarily incurred by carriage.

With the exception of the village sites, where cultivation is carried on by means of irrigation channels, the hill slopes on either side of the road, in consequence of the very small amount of annual rainfall, are extremely bare of vegetation, and what there is is coarse and unpalatable. The most abundant plant on these hill-sides is a species of worm-wood (*Artemisia maritima*), which mules and donkeys will eat for lack of anything better. I have seen no record of any species of *Artemesia*, several of which are known to occur in India and along the north-west frontier, as affording fodder for ponies and mules. But two Himalayan species, *viz.*, *A. parviflora* and *A. sacrorum*, have been mentioned as being eaten by sheep and goats.

A certain amount of grass and weed herbage is to be found along the edges of irrigated village fields, which, even were it not required by the villagers for their own animals, would prove to be but a small contribution.

Large quantities of grass and weeds of sorts had to be procured last summer from the nearest *margs* lying within the more elevated moist zone, and accessible from the main valley by certain *nullahs*. The grasses and other plants collected from these localities should afford excellent fodder in the form of hay. The great drawback to this source of supply is the expense of cutting and the carriage.

The section between Bunji and Gilgit offers at present the greatest difficulties, as there are so few villages in the neighbourhood. There are, however, several abandoned village sites, where, I am informed, attempts have been made, after repairing the old water channels, to grow crops. In a dry rocky or sandy country it is wonderful how luxuriant the growth of vegetation becomes by irrigation alone. Every opportunity should therefore be taken to utilize any surplus village water, and as far as possible to repair and make use of the old water-channels of the abandoned villages. By the use of manure, of which there should be an ample supply, considering the large number of animals daily passing up and down the road, a considerable quantity of green stuff might be rendered available.

I have reason to believe that large quantities of valuable fodder might be prepared locally in the form of silage. Many nutritious plants are rejected by animals by reason of the thorns or bristles with which they are protected. In a comparatively rainless and rocky country like Gilgit this is the usual character of the spontaneous vegetation. The same plants, which only camels or donkeys will touch in a fresh state, would, after being siloed, become palatable and wholesome food for ponies as well as for mules.

I left Gilgit in the afternoon of the 10th of August for Mináwar, and on the following day rode to Domel in the Indus Valley, close to the flying bridge erected by Captain Aylmer, R.E. The views from here of Nanga

Parbat and Rakapushi are exceedingly fine, and I was fortunate in being able to see these wonderful mountains by moonlight as well as at sunset and sunrise. I rode into Bunji the next morning and spent the rest of the day there, and collected some plants in the evening.

I rode to Rámghát on the following morning (13th August), and walked from there to Doain, a steep ascent of 4,000 feet, and on the following day explored the ridge above Doian up to 12,000—13,000 feet. There were fine views looking over into the Leta and Buldár *nullahs* and down the Indus Valley towards Chilás. A large number of most interesting plants were collected in the forest above Doian and on the open parts higher up, the most important discovery being that of *Pyrola secunda*, a species new to the flora of British India.

On the 15th I got as far as Harcho, and arrived at Astor on the following day. I had to stay here four days to try and recruit my health, which had commenced to give way at Gilgit owing to extremes of temperature and over-exertion.

Mr. A. C. Blaker, of the firm of Messrs. Spedding, Mitchell & Co., had a permanent camp here, and he gave me much assistance and was most kind and hospitable.

I left Astor on the 21st, intending to go as far as Chugam below Rattu in the Kamri Valley, but was detained a short way below where the Rupal Stream joins the Astor River. A bridge had given way and was being repaired. There is a grand view from here looking up towards Nanga Parbat. Some interesting specimens were collected near the banks of the river.

The next day I made an attempt to reach the village of Társhing in the Rupal Valley, and at the foot of one of the big glaciers below Nanga Parbat. I managed to get up the valley about half-way, when I unfortunately became ill again and I had to return. The botany near the glacier must be extremely interesting, and I still hope I may be able some day to explore this locality.

I encamped that night near the village of Rattu in the Kamri Valley; elevation 6,800 feet. The valley here is open, and with fine views of Nanga Parbat to the north and the Mir Málik Valley which joins the Kamri Valley a few miles further up towards the south-west. Beyond the village there are broad stretches of undulating pasture-land known as the Rattu plains. The whole valley, in fact, is beautifully clothed with grass, and there are some fine patches of forest, especially on the sides of the *nullahs* coming down to the left bank of the river.

I went on to Gumin the next day, a very beautiful march, and excellent for botany, elevation about 9,000 feet, and on the 24th arrived at the camping-ground of Kálapáni, the elevation of which is about 10,600 feet.

On the following day, leaving my camp here, I started off in the early morning to explore one of the *nullahs* on the western side of the valley. I managed to get up to an elevation of 12,500 feet, where a large number of interesting specimens were obtained.

On the 26th I went over the pass (about 13,000 feet), and descended about 3,000 feet on the other side to the village of Gurikot in the Burzil Valley. I collected some interesting plants on the pass. One very striking feature in the vegetation of the upper part of the Kamri Valley is the abundant growth of a most remarkable cruciferous plant called *Megacarpæa polyandra*. It has thick hollow stems upwards of 4 or 5 feet high. It grows in open grassy places, and at some little distance these tall herbaceous plants look very like young trees. The local name is *chach*, and the young leaves are used as *sag* or spinach. It is also found on the Pir Panjal Range, where it is called *chattarhak*, or *chatri*.

I marched to Gurais the next day (27th), about 13 miles of very pretty road along the banks of the Burzil Stream, which joins the Kishenganga about one mile above Gurais. I had to stay here and rest for a few days and was getting back my strength when I unfortunately met with an accident resulting in a broken rib. This, of course, interfered a good deal with further botanical exploration. I had with me, however, an experienced collector who was on the look-out for anything new.

The poisonous grass (*Stipa sibrica*) is abundant on the wooded slopes of the Gurais Valley.

I have reason to believe that the results of this tour will prove to be a valuable contribution to our knowledge of the botany of Baltistán and Gilgit. A complete set of the specimens has been prepared for the Saharanpur Herbarium; and two other sets have been distributed, one to the Royal Herbarium at Kew and the other to Dr. King at Calcutta. The whole of the mosses, of which a large collection was made, have been sent to Dr. Brotherus at Helsingfors in Finland for determination, also a complete set of the grasses to Dr. Hackel in Austria.

The remaining sets will be distributed next cold weather to various institutions in Europe, and elsewhere by way of exchange.

MOSQUITOES.*

By J. Alston Moffat, London, Ont.

The mosquitoes belong to the order *Diptera*, or two-winged flies, which includes all insects of whatever size, form, or colour which have but two wings, making them easily separable from the *Hymenoptera*, to which the bees and wasps belong, which are possessed of four wings.

Again, the mosquitoes belong in that order to the family *Culicidæ* which are characterized by long and slender mouth-parts, long legs and antennæ, of which there are many genera, and the genus to which the mosquito belongs is called *Culex*, which is recognizable from the other genera of the family by its biting propensity, whilst the distinguishing or specific name of our

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common form is *pipiens* of Linnæus, a name suggested by the constant piping produced during its flight by the rapid stroke of its narrow wings, which are said to vibrate three thousand times a minute.

A large number of species have been described and named by different authors—30 are given to America, 35 to Europe, and 100 to the rest of the world.

Mr. F. W. Urich, in a paper read before the Trinidad Field Naturalist's Club, says: "So far as Trinidad is concerned, I may say I have observed at least ten different kinds of mosquitoes, varying in size and colour, and the bite of some of them is far from being pleasant." But, as in other departments of natural history, species have been created upon very slight differences, the probability is that many of those so-called "species" are but local variations of one species. Yet certain it is, very considerable difference in size is to be observed in the same locality, but as all creatures are given to vary in size, the same liberty may be allowed to *Culex pipiens*. Whether the bite of the large ones is severer than that of small ones does not seem to have been specially observed, but personal experience corroborates the statement that all bites are not equally sharp.

The name "Mosquito" is a Spanish term, signifying "little fly," and would probably be applied to any biting winged insect, regardless of structure, by the Spaniards who first landed on the continent. And those of them that returned to their own country would relate stories of suffering they had to encounter and endure from their tiny foes, which were of more than Aztec ferocity and tenacity. Even yet extraordinary tales are told of the size and savage nature of the mosquitoes of some localities over those of others. The fame of the New Jersey breed and the Mississippi gallinipper has gone far abroad, but I suspect that the principle cause of suffering in one locality over another is to be attributed to numbers, rather than to any difference in the size of the insects. Travellers have recorded their experience with mosquitoes in all parts of the world; some declaring that those of the Arctic regions are the worst they ever encountered; but South America, from its climatic conditions, and its low-lying lands, which are frequently flooded, is in a position to carry off the prize against the world for its crop of mosquitoes, and that the early travellers there were duly impressed with this fact is evidenced by the names given to places such as the Mosquito Coast, Mosquito Bay, and Mosquito Town. In ancient history we read of armies on the march being arrested on the way and made to beat a hasty retreat from the attack of these tiny warriors, which is quite believable; for if we take into consideration the scant and loose covering which they probably wore, which gave the wearers so much more space to defend, they were not in a condition to pursue human foes when every man of them was engaged in a double-handed conflict with such pertinacious insect enemies.

There is a prevalent opinion in Europe that mosquitoes are an exclusively American production, and in England especially it is the general belief. We

often see it in print and hear it confidently asserted that there are no mosquitoes in England. The usual expression is "We have gnats but no mosquitoes," whilst the fact is, the English Gnat and the American Mosquito cannot be separated generically and probably not even specifically, the two names being but local synonyms for the same insect. But even scientific authorities have assisted in perpetuating the misunderstanding. Newman, in his "Familiar introduction to the history of insects," has a paragraph headed "Mosquitoes or *Simulites*," in which he refers to a wood-cut of a *Simulia*, which strongly resembles that terrible pest to the early settlers of the country, the "Black Fly," *Simulium molestum*, whilst he gives Gnat as the common name for the genus *Culex*.

The settlers of this country adopted the common name Mosquito for *Culex pipiens*, and used the name Gnat to designate an insect that was more felt than seen. So microscopic was it that the excessive irritation produced by its attack on exposed parts was often the first intimation of its presence; yet so abundant were they at times that small clouds of them were distinctly visible from their density. They were active only in the evening, or in densely shaded woods. This pest seems to have entirely disappeared with the clearing up of the country.

Many people call all mosquito-like insects by that name, or, if in Europe, they would call them gnats, and include under these names the families *Tipulidæ* and *Ephemeridæ*, which are quite innocent of all biting propensity. So that, when these names are used and alarming reports circulated as to their abundance, it is impossible to be quite sure what insect may be meant. It is recorded that in 1736 gnats were so numerous in England that vast columns of them rose in the air from the spire of Salisbury Cathedral, like smoke, which made the people think it was on fire. Mention is made of a column—pyramidal in form, over a tree, 50 or 60 feet in height (?)—whilst, at a more recent date, another column is mentioned as being seen in a garden 3 feet in diameter and 20 feet high. We may justly conclude that these columns were not composed of *Culex pipiens*. And when we are informed that "every part of these columns was in the liveliest motion," we may at once infer that they were composed of some of the *Ephemeridæ*, which Wordsworth alludes to, as

> "The gilded summer flies,
> That mix and weave their sports together in the solar beam."

And when we are told that "their bite was so envenomed that it was attended with violent and alarming inflammation," we may safely say that these bites did not belong to those columns, but to the genus *Culex*, whose habits are quite different. Who ever saw *Culex pipiens* in a playful mood? She is ever intensely absorbed in business; even her song seems to indicate that her thoughts are bent in that direction; at least it turns ours very quickly to her business methods.

Whilst on the subject of these dancing columns, I will give an illustration of their remarkable powers of sustained flight which came under my own

observation. I was returning from an excursion by rail on a fine summer evening, and to have an opportunity of enjoying it to the utmost, I took my seat on an open car which had been fitted up to provide extra accommodation. The car in front of me was high roofed, and over a rear corner of it had gathered one of these clusters, high and dense, which was vigorously besporting itself in the rays of the setting sun. I thought to myself "when we go, you will get left," but I was mistaken. When the train started it went with it, and the cluster maintained its position with as much apparent ease as when the car was at rest. Did each individual of that cluster keep its eye on the car, so as not to fall behind? But it could not accommodate its movements to suit the lateral swaying of the car; every now and again it found itself a little more off or on the corner. It maintained its position until darkness obscured or dispersed the dancers.

Culex pipiens, like many of its relations, lives the earlier part of its life in the water. The female mosquito, when ready to deposit her eggs, seeks for stagnant water as the most suitable place on which to do so. The Rev. J. G. Wood thus clearly describes the operation: "Placing her front legs on a piece of floating stick, straw, or anything that will support her tiny weight, she allows the middle pair of legs to rest on the surface of the water, and crosses the hind pair so as to look like the capital letter X. She then deposits a rather long and spindle-shaped egg, and places it upright with the base downward in the angle of the X. Another egg is quickly placed by the side of the first and followed by others, all of which are glued together by a cement which is not affected by water. Guided by the crossed legs, the eggs are formed into a boat-like shape, and are left to float on the surface of the water."

These boat-like masses are often longer than wide, the lower end of the eggs being the largest, where the head of the future larva is to be, gives more surface below than above, which naturally turns the ends upwards and helps to give them the boat-like form. In a few days' time, according to the weather, the eggs mature, and the tiny larva is ushered into what is for the time its native element. In this state it is a particularly interesting creature, large in head, slender in body, with two openings at the tail; one situated a little to one side, and surrounded with fine hairs, opens into the breathing tubes, the other being the end of the digestive canal. It is very active, propelling itself through the water, with a peculiar jerking and wriggling movement, which has procured for it the appellative "wriggler," going to the bottom to feed, then rising to the surface to breathe. It may at times be seen resting head down, with its breathing tube above the surface and its mouth-parts moving as if it was taking nourishment. Having changed its skin several times and eaten all it wants, it prepares for another change of form, and throwing aside its larval covering, it emerges a pupa. Its form is greatly altered, much larger at the head-end, where the mouth-parts, wings and legs of the future mosquito are bunched together in a rudimentary state, the abdomen

slender with two propeller-like blades at the end to assist its movements, for it is still active, but, more singular still for a pupa, it breathes now, not through a tube at the tail as formerly, but through two projections which it has been provided with, which are situated on the top of the thorax, so that when it rises to the surface of the water to breathe, it holds its head up now—a wonderful change of habit in so short a time ; whilst living in this state, it also enlarges, but does not feed. Having thoroughly matured, it is now ready to change its aquatic life for an aërial one. The pupa comes to the surface of the water, the thorax rising above it, the hinder part straightens out, and almost immediately the pupa-case bursts on the top of the thorax, and the head of the mosquito appears in the opening ; by a contracting and expanding of the abdominal segments, the head and thorax are pushed forward and out sufficiently far to free its legs, when it feels for a support which may be the pupa-case which now floats on the water as a boat. The wings now expand, the abdomen is withdrawn from the case, and *Culex pipiens* is off on other business. The whole time required for this last transformation is a minute or less. The length of its preparatory life is variously estimated, the weather having a powerful influence—a month is considered quite sufficient. Three or four days to mature the eggs, fourteen or eighteen for the larval stage, and five to seven for the pupal. But Prof. Riley says : "Their development is rapid, and with one species at least it has been ascertained that the entire life-round from egg to adult is undergone in less than two weeks."

As soon as they have got their wings they make for the thickest vegetable shade within reach. It is said that they will fly for miles inland, but never fly far over water. We read of travellers on the South American rivers, that they prefer to pass the night in their small boats anchored out on the river, rather than attempt to sleep on shore ; willing to run the risk of being devoured by alligators in order to escape the certainty of it by mosquitoes.

Culex pipiens is a frail and delicate creature to be possessed of such a vicious and blood-thirsty disposition. But here it must be stated that the sexes differ in this respect. It is the female only that bites ; she alone is responsible for all the evil reputation which has been attached to the species ; the male has not the power, even if he had the will, whilst her will and power seem to be commensurate.

The mouth-parts of the female constitute a wondrously elaborate and complex apparatus, which no verbal description can do justice to. What appears to the naked eye to be a single sting is composed of no less than seven distinct and separable parts. What is taken for the sting is only the sheath in which the sting rests when not in use. Two of the parts are barbed at the point for

cutting the skin. All but the sheath enter two-thirds their full length before they begin drawing the blood, the sheath doubling up under the body of the insect.

The manner in which the mosquito draws up the blood to satisfy its cravings is probably similar to that by which a butterfly secures the nectar from the flowers. Let us consider the long proboscis as lips, the mouth proper being situated in the head at their base; when the lips have entered the fluid the muscles around the mouth are contracted; that produces a cavity which is necessarily a vacuum, and the fluid naturally rushes in to fill it. When it is filled the muscles around the mouth relax, a valve at the base of the lips closes and prevents its return, and the fluid is forced down the gullet.

The rapidity with which the mosquito thus pumps up the blood, and the quantity it secures in a given time, may easily be observed by any one curious to know by allowing one of them to operate on the back of the hand and watching the filling up of the abdomen. I once clipped the end off the abdomen of one thus situated without disturbing its operation, and it pumped away until a pool of blood that had run through it formed on the back of my hand and began to run off, when I stopped the performance. I had been informed that this could be done before I succeeded in doing it.

No poison gland has yet been found in the mosquito, but the irritation resulting, and often continuing long after the bite is given, has led to the general conviction that poison must be conveyed with it. One writer relates that a drop of clear fluid has been observed at the end of the trunk, whilst Reamur says he saw fluid in the trunk itself. Some contend that this fluid is used for diluting the blood so as to enable it to pass through the extremely fine tube, but the quantity that they produce is so small, as compared with the amount of blood they take, that it could have but little effect in that way, unless it was endowed with some powerful chemical property. Some have stated that if they are allowed to take all they want, there will be no after irritation, the poison being all removed with the blood taken. But personal experiments in this direction do not confirm the statement.

There is a great diversity in the effect of the mosquito bite on different persons, just as there is in the sting of a bee, not from any difference in the sting and bite, but from something in the constitution of the individual. The Rev. J. G. Wood tells us of the effect of a single gnat-bite on himself, given at the junction of the thumb with the wrist. (It is *culex pipiens* he is speaking of.) He says: "The hand swelled up until it looked like a boxing glove, was purple in colour where it was not crimson, and it was more than three weeks after the bite was inflicted before I fully recovered the use of my hand." This may be considered a serious case, and if he had received several bites at the same time, some of them about the face we shall say, there is no saying how much more serious it might have been. I copy the following from a

communication by H. Stewart of North Carolina, dated Nov. 3, 1891, given in *Insect Life*, vol. 4, p. 277, as illustrative of this point:

"I was interested in reading a recent number of *Insect Life* to the effect that the poison of the mosquito was provocative of insanity. When I was engaged in exploring in the vicinity of the north shore of Lake Superior about twenty-five years ago, I had more than one proof of this fact. One of my men was badly bitten, and seemed to suffer more than any others of the company. He became violently insane and ran off in the woods, and in spite of efforts he eluded pursuit and was never found again. Another man on a different occasion was affected in a similar manner, and was captured with difficulty after a long chase, in which he exhibited the utmost terror, but after a few days' close confinement in the camp he regained his reason. Afterwards he was so seriously affected by the poison that he had to be sent home. I have noticed that the poison affected persons differently, causing severe swelling in some, fever in others, pains in the limbs in others, while some were but slightly annoyed. I was myself very little troubled by these pests." Along with that we may place the report given by a German professor, of a Mexican doctor who was attending a lady suffering from inflammation of the brain. She had been unconscious for twelve hours, and gave signs of approaching dissolution. The doctor removed the mosquito net and opened the windows, giving the mosquitoes free access to his patient for two hours, when consciousness returned and the lady given up for lost started on the way to recovery; which is quite a likely thing, as blood-letting would be an excellent method for relieving the congested parts.

We frequently read in the newspapers of people suffering from alarming sores, the result of "a mosquito bite," some of them ending fatally. Thoughtless persons, or those ignorant of the nature of mosquito bites, will persist in rubbing the bitten parts, which only tends to increase the irritation and calls for more rubbing. This, continued, may break the skin, blood-poisoning may then ensue, and, if combined with an unhealthy condition of the system, death may quite likely be the result. I have seen children whose bodies were covered with sores caused by their scratching the mosquito bites.

To those who have not lived in a mosquito-infested district and have formed their opinions by reading such reports it might seem that life in such a place would be constant misery, and would expect to find the inhabitants covered with sores and bandages; but such is not the case. There is unquestionably a kind of inoculation that takes place in those much exposed to the attack, which gives them immunity from any inconvenience after the bite is given. The writer of the article "Mosquito," in the *Encyclopædia Britannica*, says: "Even in Britain the annoyance caused by the gnats—*Culex pipiens*—is very great, and in marshy districts often unendurable, especially to new comers, for it seems probable that the insects really attack a visitor more furiously than they do the natives of the district, but, on the other hand, the

latter may be more indifferent to their assaults." Now, we cannot suppose that the mosquitoes prefer a stranger to a native, or that the native does not feel the bite. It is the consequences that make the difference ; the visitor dreads these, the native does not, as there are none to him, he having been thoroughly inoculated ; the bites may be felt equally by both, although there are some endowed with a greater amount of pachydermatous insensibility than others. It is undoubtedly new comers to an affected district that suffer the worst—that is if they have not previously been subjected to the attack. Usually a bite on such a one raises a spot about the diameter of half a pea, hard and whiter than the rest of the skin, with a distinct red dot in the centre, producing an immense desire to rub the spot, which, if indulged, causes various degrees of inflammation and redness, with an increased inclination to rub, lasting for two or three hours with some, but twenty-four or more with others. This sort of thing may have to be endured for the whole of the first summer. After that the bite may be felt just as sharp as before, but no such after-discomfort will follow. Hence the apparent indifference of the native, but sufficient numbers would make even him quail before their assault, but, being once clear of them, no further inconvenience is felt by him. This kind of inoculation is vividly illustrated in the case of children going into an infested locality to live ; for the first season every bite leaves its mark conspicuous, but afterwards bites show no more than if they had not been given.

How long the mosquito lives in the mature state is not known with any degree of certainty. Dr. C. V. Riley says : " So far as we know, our northern mosquitoes pass the winter in the imago state, but in limited numbers." Supposing these hibernators are the parents of the summer crop, they might in this latitude begin depositing their eggs—of which they lay about 300—in the beginning of May, and allowing a month between egg and imago, we see that by midsummer the number, under favourable circumstances, would be great. But the question to settle is, how long does the female live in the summer before depositing her eggs ? for we cannot suppose that, contrary to the nature of other insects, she lives long afterwards, unless she does not lay them all at once. When one visits a piece of wood situated a long way from stagnant water every few days and finds an unlimited supply kept up for weeks, or even months together, it does not seem to favour an early demise. Another interesting question in this connection is, are these hibernating females fertilized before winter sets in, or do the males live over also ?

It is the prevailing opinion that mosquitoes live exclusively on animal blood, and yet, probably, not one in a million of them ever gets a taste of it. It is not reasonable to suppose that the life, even of the mosquito, can be sustained long without food of some sort. Several reports have been made from time to time of a vegetable-feeding species of mosquito having been seen. Is it a separate species, or is it our old acquaintance *Culex pipiens* indulging in a little of her natural vegetable diet ? I once saw a mosquito on the smooth

bark of an aspen poplar, seemingly engaged in an effort to extract something out of it, but with very limited success, so far as the appearance of the abdomen indicated ; yet it went through all the movements required to make the success complete. If they will attack the hard bark of a tree, how much more likely is it that they would try the soft stems of succulent plants. When we understand that this is one of the habits of the insect, we see that there is a double reason present why they should seek the cover of rank vegetation ; one, protection from the direct rays of the sun, which they cannot endure; the other, that they may obtain food to sustain life. Yet, no matter what amount of vegetable juice they may take, it never slacks their thirst for blood. This the unfortunate collector well knows to his cost when he has been allured, in the pursuit of some attractive specimens, to the stirring up of a tall and luxuriant clump of weeds in a damp and shady place.

Many remedies have been suggested for relieving the irritation produced by mosquito bites. The Rev. Mr. Wood says arnica saved him from a vast amount of torture. A wash of ammonia is said by others to give immediate relief.

To rid the house of their presence in the evening, so as to get peaceful rest at night, all are familiar, either by observation or report, with the use of smoke. Indeed, the primitive "Smudge" was the only method available in new settlements ; but now we have a more clean, convenient and efficacious material to use for the same purpose in insect-powder, "pyrethrum." Make a little pyramid of the powder about an inch and a half in diameter at the base, on some incombustible material, and ignite it at the top. It will consume slowly, producing smoke enough to fill a large room, which will kill or stupify every mosquito in it.

I copy the following from *Insect Life*, vol. V, p. 359 : "The *Indian Medical Journal* for March 16th says that a Bombay newspaper calls attention to the virtues of the castor-oil plant as a means of protection against mosquitoes. In Egypt it is planted about houses to drive the insects away. In towns a better plan is to have the growing plants in pots and bring them into the house for a day or two at a time, but they must not be kept too long in the shade, for *Palma Christi* is a sun-loving plant. A writer is cited as saying that the mosquitoes are killed by a poison they find on the lower side of the leaf, but it is stated that if a dozen leaves are placed about a room that swarms with mosquitoes they will disappear without leaving any dead ones lying about." But vigorous efforts should be made in all mosquito-infested localities to reduce as much as possible the opportunity for their breeding. Stagnant water is well-known to be the principal source whence comes the mosquito plague. This, then, should be got rid of as soon as possible. When this cannot be done at once it should be treated with a little coal oil, which will put an effectual stop to their propagation, as has been demonstrated by Mr. L. O. Howard's experiment, published in the last Annual Report of the Society, and thus an immense amount of suffering will be saved to man and beast.

DESCRIPTION OF A NEW SPECIES OF *SMINTHUS* FROM KASHMIR.

By Oldfield Thomas.

From the Annals and Magazine of Natural History, Ser. 6, Vol. XI, February, 1893.

The remarkable genus *Sminthus*, which, *nota bene*, is a member of the *Depodidæ*,* not of the *Muridæ*, has been until recently considered to consist of only a single species, *S. subtilis*, Pal. (*S. vagus*, auct. plurim.), ranging from Denmark to Central Asia. Quite recently Dr. Buchner† has described a second species, *S. concolor*, from Ganssu, China, a species which has not the characteristic black dorsal stripe of *S. subtilis*; and I have now the opportunity of describing a third one of the same most interesting group.

The type specimen is a skin with skull, obtained in Kashmir, at an altitude of 10,000 feet, by Major G. H. Leathem, of the East Surrey Regiment, in whose honour I propose to name the species

Sminthus Leathemi, sp. n.

Extremely similar in size, colour, and general appearance to *Mus sylvaticus*, from a British specimen of which it is at first sight hardly distinguishable, except that the ears are decidedly smaller.

Fur long and soft. General colour rufous-grey, becoming clearer rufous on sides; no trace of a darker dorsal stripe. Belly white from chin to anus, but the hairs slate-coloured for their basal three-fourths. Ears short, rounded, their visible parts when folded (*i.e.*, the posterior two-thirds of their inner and the anterior third of their outer surfaces) thickly clothed with short chocolate-brown hairs. Arms and legs whitish; hands and feet silvery white on their upper surfaces; palms and soles naked; hallux reaching to the base of the second toe, fifth toe to the middle of the second joint of the fourth. Tail elongated, conspicuously bicolor, brown above, both hairs and scales, white below.

Skull decidedly larger than that of *S. subtilis*, narrower and more elongated anteriorly, and with a longer and more oval brain-case; interparietal bone decidedly broader than that of *S. subtilis*, its antero-posterior only about a third of its transverse diameter. Anterior palatine foramina shorter, extending backwards only to the level of the middle of the premolar; palate posteriorly ending close behind the posterior molars, while in the allied species it is continued backwards for a distance equal to the combined lengths of p. 4 and m. 1.

* This view of the true affinities of *Sminthus*, first published by Winge in 1887 ('Gnavere fra' Lagoa Santa'—E. Museo Lundii, p. 109), had been held by me long previously, and I still think it is unquestionably correct.

† Bull. Ac. Sci. St. Petersb., vol. xiii, p. 267 (1892).

Teeth apparently quite as in *S. subtilis*, except that m. 3 is longer, as long as broad, instead of being transversely oval ; m. 3 is also correspondingly slightly longer in proportion to the other teeth.

Dimensions of the type (a male) :—

Head and body (measured in the flesh by Major Leathem) 66 millim. ; tail (ditto) 112 ; hind foot (from skin) 19 ; ear (from skin, approximate) 8·3.

Skull : greatest length (occiput to nasal tip) 20·7 ; nasals, length 7·7, greatest breadth 2·7 ; interorbital breadth 4·2 ; greatest breadth across brain-case 9·6 ; interparietal, length 2·3, breadth 7·0 ; palate, length 8·2 ; diastema 5·0 ; length of palatine foramina 4·0 ; length of upper tooth-series 3·1.

Hab.—Krishnye Valley, Wardwan, Kashmir. Altitude 10,000 feet. Type obtained June 24, 1892.

As may be seen from the above description, this new species is widely removed from *S. subtilis* and approaches in many characters the Chinese *S. concolor*. From this it is distinguished externally by its conspicuously bicolor tail, by its brighter coloration, and shorter ears. In the skull it agrees closely with the same animal as regards the general measurements and in the "starker verschmalert and schlanker ausgezogen vordere Partie" (both being compared with *S. subtilis*) ; but it is impossible to believe that so careful an observer as Dr. Buchner could have overlooked the marked differences in the palate and interparietal had they also been present in his species ; so that I suppose *S. concolor* agrees with *S. subtilis* in these respects.

As to the structure of the teeth, all the members of the genus seem to have the small fifth cusp on m. 1, which is stated by Dr. Buchner not to be present in *S. subtilis* ; for in three specimens of that species in the Museum, from widely different localities, I find it clearly visible, although smaller than in *S. Leathemi*. I presume, therefore, that Dr. Buchner had under examination only specimens with worn dentition.

Major Leathem is to be congratulated on his discovery of this interesting little animal, the first representative of its genus found within British Indian territory.

MISCELLANEOUS NOTES.

No. I.—NUX VOMICA.

Strychnos Nux Vomica described by Surgeon-Major Kirtikar in our Journal, vol. VIII, No. 3, is known in the Kolaba forests, and I suppose it to exist in those of Tanna. But I have not seen it as a forest plant in the latter district, and I suppose that we are at the edge of its province.

One fine specimen grows, or did grow, in the camping ground at a village about a mile from Birwadi Fort, Rohe Taluka, Kolaba District. I think the name of the place is Chinere ; but it is many years since I was there, and I have no map here that shows so small a place. However, it is a recognized camp for District Officers, and *was* called a "shooting camp." Large game are not now abundant in that country, but the forests are extensive and dense; the marshes wide and much frequented by fowl. My men brought me good fresh-water fish from the little river, and other men much salt-water fish from the numerous back waters of the Kundalika Estuary.

On the whole, it is the sort of place that another of our members may be in some day ; and so I record the tree. This tree was covered with leaves and ripe (over-ripe) fruit in April. I have not happened to get ripe fruit off any other tree, nor have I seen any tree of the species leafless to my knowledge. Of course a leafless tree, unless bearing the very conspicuous fruit, would be apt to escape notice.

In a thoroughly tropical country like the Konkan, where the range of temperature is small, a little matter will put leaf, flower, or fruit of trees back or forward.

Late or unseasonable rain affects all these strongly, and soil still more, especially in the case of trees introduced, or at the edge (as in this case) of their province.

A *Pongamia* in my garden, which has been evergreen for two years, was lately quite bare of leaves ; and *Polyalthias* in the same place are evergreen ; while others within a mile are naked for weeks every year; neither being watered in any way.

W. F. SINCLAIR.

TANNA, *April*, 1894.

No. II.—STRANGE BEHAVIOUR OF A PANTHER.

It is only by request that I send the following account of a small adventure I had with a panther on the 17th January last. I have no desire to be thought a disciple of the famed Col. Bowlong, and, therefore, have hesitated about sending the account. I relate the story now with the most careful accuracy it is possible for a man to give when relating the story of an episode which happened to himself. It was nearly mid-day, and I had finished the bit of forest inspection I had come out to do and was about to return to my

camp some 3 or 4 miles away, when I thought I would like to have a look at the quality of the coppice growth in a piece of forest that had come under the axe six years before, and which adjoined the forest I had just been inspecting. Thinking I might turn a partridge out of the sort of stuff I was going to prowl through, I took my gun from the forest-guard who had been carrying it hitherto, and loaded it with No. 8 shot cartridge in each barrel. Presently I got to the top of a ridge where walking was a bit difficult, and having a guard and two villagers following me in single file, I thought it wise to put the gun at half cock. I went a couple of hundred yards along the ridge and then commenced to descend again through a thicket of coppice, dense enough to make progress slow and laborious. I placed my gun in the hollow of the left arm, gripping the stock from beneath and sloping the barrels outwards, whilst, with my right hand, I cleared a way as I went down the slope. I had got about half way down, and had just reached a small level bit of open grass-land, when, as I emerged from the thicket, I saw a panther charging straight for me. I had only time to seize the gun in my right hand and to get the thumb on one hammer in an endeavour to cock it, when the beast was at my feet. Visions of a hospital flashed across my mind and I did the only thing I could think of at the moment, which was to hit the panther over the back with the gun. From the way I was holding the gun it will be understood that the blow I was able to give was not a hard one. It was, however, sufficient to turn the panther. He slewed to my left, brushing my leg the whole length from two inches above the knee to the ancle with his body, and sprang on to some rocks about five yards to the left, where he appeared to halt for a fraction of a second before springing down and bounding out of sight. As he sprang away from me I finished the cocking of the right barrel and brought up the gun to my shoulder, but the thought occurred to me that a charge of No. 8 shot in the stern at five yards could not be immediately, if at all, fatal, and might bring the panther round upon us, and whilst I debated about firing, he disappeared. The men who were with me had seen nothing of the panther till he slewed away from me, they being close behind me. But their faces were a study when they did see the brute and their ejaculations interesting. I was both figuratively and metaphorically glad to see the end of that panther. He was a sleek, handsome brute, hardly full grown, but near it. About 100 yards further away from where I met him I found the flattened space where he had been lying in the grass. Why he should have charged me deliberately in the way he did (his ears were flat to his head and he came at full speed but *ventre à terre*) and then have made no effort to scratch or bite me is best known to himself. My theory is that he mistook me, coming quietly through the dense thicket, for a *bekri*; my shikar clothes and putties may have aided the deception. He started to charge and win an easy prey and was as flabbergasted as myself when he saw the mistake he had made. I gave him a day to recover his composure and then beat for him in that and the surrounding

forest, but he was not to be found. The incident happened in the Ghaveda forest of the Mahim Taluka, in the Thana District, and the Patel of the village was one of the men with me.

G. P. MILLETT.

TANNA DISTRICT, *4th April*, 1894.

No. III.—THE SPOTTED-BILLED DUCK.

This duck is very prevalent between Allahabad and Umballa, owing, I believe, to the fact that in this region, which comprises the country between the Ganges and Jumna, there are a number of small feeder streams which run into these two large rivers. All these little streams, which occur every 10 or 12 miles along the length of the larger rivers, are in fairly deep beds flanked by raviny and therefore uninhabited land, for a width varying from a quarter of a mile to three or four miles. The waters are consequently undisturbed. In the dry-season the streams either cease to run, or are reduced to an almost imperceptible current. In the curves, however, there are deep pools, and these frequently are taken possession of by a pair of "spotted bills" for the breeding season. The young brood are brought up there, without chance of molestation.

I have found eggs in July and August in such localities, but not later. I have, however, seen young birds in October and November which might have been hatched at a somewhat later season. I have also found eggs and young birds on the banks of the canal. During the last fifteen years I have taken some trouble (with Mr. Phipson's assistance on more than one occasion) to send this bird to England. It could, I believe, be easily domesticated. Some of those I sent home took the first prize at the Crystal Palace Show two years in succession and produced young freely at the Zoological Gardens. Some of the produce were sent to the ornamental waters at Sandringham, and I was told by Mr. Bartlett that the ducks sent there interbred with the wild ducks which visited England in the winter, and that the young half breds inherited the non-migratory habits of the "spotted bills" and did not leave the waters when the Northern visitors departed in the spring. It would be interesting if further experiments could be made in this direction. If a non-migratory wild duck, so well adapted for the table as is the "Spotted Bill," could be established on English or European waters, a useful result would be obtained.

E. C. BUCK, I.C.S.

SIMLA, *April*, 1894.

No. IV.—THE DESTRUCTIVENESS OF BANDICOOT RATS.

The specimens sent in are saplings of *Polyalthia longifolia*, a tree of the order *Annonaceæ*; that is, a distant relation of the Custard-apple. They are three years and nine months old from the seed, and did belong to a generation of about an hundred such until they were nibbled by Bandicoots. I may as

well observe that they are called in Marathi "Ashok"; and in Gujarathi "Asso Pál"; but are not at all connected with the Hisdustani Ashoka (*Jonesia Asoka* or *Saraca Indica*), which we here call "Jasud."

In the same compound, with these saplings, dwelt many families of Bandicoots—each in its own burrow—and now and again these would nibble the bark of a young "Ashoka," but the wound generally healed over. Tropical trees are mostly very hard to kill when healthy. But in March, 1894, the Ashoka saplings, near a particular Bandicoot burrow, were cut down at the rate of two or three every night for some days. Only one was attacked at the root; all the rest were cut into at two points, usually about 3″ and 5″ above the ground, and the wood torn away between the cuts in strips not unlike "Tandstickers." No tree was quite cut through; many were cut half or three-quarters through, some seven-eighths or more. The largest saplings attacked were six inches round at the lower cut. The cuts showed many grooves of concave section, both in diameter and on the longer axis. These were in pairs, meeting each other near the centre of the remaining wood. The widest groove measured was $\frac{1}{4}$″ wide; the longest $\frac{3}{4}$″ long. But they had trespassed on each other so that few remained of full size.

I have gone into these details because they may be useful to others. In this case they showed clearly enough the work of a good sized rodent; and no hare nor giant-squirrel inhabits the spot. So there could be little doubt as to what to do next; and the rat-catchers were called in. They caught eighteen bandicoots, but no rat of any other species in the whole compound, though it is in the middle of a large town.

Perhaps these large rats "fear, like the Turk, no brother near"; or, perhaps, the numerous little village cats can keep down other rats and mice, but are not equal to killing an old bandicoot. The "musk-rat" exists in the compound and is carefully protected; but he is not really a rat at all.

Those bandicoots caught in the neighbourhood of the injured trees had their stomachs full of *Polyalthia* splinters. The others had not. The saplings are all over the compound, but in most of it there is also *Haryali* grass or other root forage, which these rats are very fond of.

In one place they had dug up a lot of dwarf-lily bulbs; tasted them and dropped them in disgust. The particular corner where the *Polyalthia* trees were attacked happened to contain, it would seem, no other forage to their taste; and the supply of plunder obtainable at my expense had been sharply reduced by the departure of about eighteen adult human beings and six horses and ponies in different directions, leaving only two temperate native families cooking and eating in the place.

The method of capture was fumigation with dry grass and red chillies; very scientifically fanned into the holes. There was some digging, but very little, in no case amounting to "digging out." Whether stupefied or not, the bandicoots were very stupid, and were easily caught by hand with little

resistance. A Norway rat, 6 inches long, would have showed more fight than these brutes, of which several were over a foot head and body "between standards." As they were not living in gutters on garbage, their skins were clean, and the long black hairs glossy. You could not call them handsome (though some rats are), but they were not loathsome even to look at, like a gutter-snipe bandicoot.

Generally, their scrapings for food do more harm than their actual eating, but there are one or two plants they will never let off, *e.g.*, *Arabia Guilfoylei*, a common ornament of our gardens, which seems to have a root much to their taste. I rather think that they eat some insects, especially the larvæ of beetles and large moths, but have no proof.

That they are not generally fond of eating young trees is clear. I have over 500 young trees of forty species in the compound, and only the *Polyalthias* have suffered noticeably. Four other species of the same order (*Annonaceæ*) have never been touched.

When the gardeners fear the attack of rats upon any root, they protect it with prickly-pear leaves (*Opuntia*), and I have known cowage (*Pencuna pruriens*) to be used in the same way; but it is harder to handle and in some places harder to get. A generation ago, the old hands used to tell great stories about bandicoots eating babies in the cradle and invalids in bed. But these seem to be rather out of print now. That the Norway rat will eat anything that he can overpower, when hungry, I do not doubt for an instant. But these creatures seem to be of a lower vitality and vice.

W. F. SINCLAIR, I.C.S.

TANNA, 10*th April*, 1894.

No. V.—THE PISA TREE AND THE INDIAN WILLOW.

Actinodaphne Hookeri, Meissn. *Vernacular*, Pisa.—This small tree, common on the Western Ghâts and some other parts of India, yields at the commencement of the hot season a superabundance of saccharine sap that is often forced through the bark of branches as a fine shower or rain, covering the leaves, twigs, etc., on the ground beneath with a syrupy layer that gives them a varnished appearance. The excessive amount of saccharine sap that this tree yields during the hot season suggests that it might furnish a possible source of sugar, as is the case with the sugar maple in America. Dr. Watt, writing of the genus *Acer*, says :* "If they were found to take naturally to the soil and climate of Indian sub-Alpine regions, they might supply the poor hill tribes with the little-known luxury of sugar." If attention were given to the systematic tapping of this tree, it would probably yield abundance of crude sugar.

* Watt, 'Dictionary of the Economic Products of India,' vol. i, p. 67.

Salix tetrasperma, Roxb.—At the commencement of the hot season, when tropical trees are at their maximum of physiological activity, the upper surface of the leaves of this tree are occasionally covered with a syrupy exudation which dries up in thin white flakes to a sugar or manna. The same trees often yield this exudation several years in succession, but it appears to be confined to a few trees, and is not common. Those from which I gathered it were growing on a laterite soil at an elevation of 4,300 feet at Mahableshwar in the Western Ghâts. I could not make out whether the exudation was caused by the punctures of insects or otherwise, but a microscopical examination of the leaves would probably show this. Two or three other species of *Salix* have also been observed to yield a saccharine exudation; *Salix fragilis* in Persia, *S. Chilensis* in Chili, and *Salix sp.* in the Punjab. The exudation from the species was very soluble in water, about one in two, yielded a slight precipitate with acetate of lead, and melted at about 150° C. Assayed with Fehlings' solution it afforded 10 per cent. of a reducing sugar. M. Raby* analysed a sample of manna said to be derived from the leaves and young branches of a willow found in Persia, which appears to closely resemble the exudation under notice.

J. G. PREBBLE.

[The above is extracted from Notes on Economic Botany by Mr. J. G. Prebble of Bombay, which appeared in the Pharmaceutical Journal on 8th July, 1893.—ED.]

No. VI.—A STRANDED DOLPHIN.

I forward, for our museum, a fairly complete skull of *Sotalia plumbea* (Flower), the Leaden-coloured Dolphin. The specimen was cast ashore a couple of miles north of the town of Dhanu, Tanna District, and there I found it and was able to rescue so much of it. Carrion beasts and birds and putrefaction made exact measurements as impossible as the preservation of the entire skeleton, but enough of the tough skin was left to show that it was unspotted, The length was over six feet and under seven and a half. The carcase was much contorted and mutilated and stank fearfully, so it could not be accurately measured, and indeed the skull was only obtained by a liberal remuneration to people who know no distinction of smells.

I may here observe that although the stranding of the larger *Cetacea* is not very uncommon, I have never, in 40 years' acquaintance with them, seen a stranded Dolphin before.

W. F. SINCLAIR, I.C.S.

TANNA DISTRICT, *April*, 1894.

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* Hooper, 'Chemical Notes on Mannas,' *Pharm. Journ.*, [3], vol. xxi, p. 421.

No. VII.—A TIGER EATING A BEAR.

Last April, while taking an afternoon stroll down a lovely road cut through Sál Forest, which had been cleared to a breadth of 200 feet, I observed that one of the numerous bees' nests, at the top of the trees, seemed to possess an unusual amount of vitality, and close inspection convinced me that the disturbance was due to the presence of a bear; so I sent a man off to my camp for an elephant and a gun. As soon as these arrived, I approached the tree and fired at the bear, whereupon he descended at a pace not conceivable to the uninitiated; whilst doing so he was badly hit in the body and bled profusely, but he went off through the high grass jungle at a great pace and we lost him. The next morning we took up his trail, which was an easy matter, as the blood spots had not been obliterated and we found his carcase being devoured by a tiger! We came on to the scene so suddenly that I was not prepared for a shot and the tiger disappeared into the forest and escaped.

I have heard of tigers eating their dead companions, but never heard of them appeasing their hunger on bears before. My mahaut, however, told me it was not unusual.

T. J. CAMPBELL.

DHUBRI, ASSAM, *September*, 1893.

No. VIII.—FOOD OF THE WHITE-EYED BUZZARD.

I had proof the day before yesterday that hawks feed on land-crabs, a fact that personally I was not before aware of, and which may not be known generally; so I write this for record and to elicit information from others.

I was strolling along a path by the bank of a jungle stream, and, as I came round the corner, I saw a few yards off a hawk on the ground apparently tearing at something; on seeing me the bird rose to fly away and I shot it. On picking up the specimen I found that it had one claw of a crab firmly fixed to its beak. Going back to the spot the bird rose from, I could find nothing, but I concluded that it had killed a crab, of course to eat, that the crab had nipped it, and that when I came up it was trying to disentangle itself. I had the bird skinned and send it down to you. It was not till some time after I got home that the claw relaxed and fell off, but I have tied it on as I found it.

I know that tigers and jackals eat land-crabs, but never knew before that hawks did.

KENNETH MACKENZIE, Colonel.

CHIKALDA, BERAR, 20*th April*, 1894.

[The bird sent down by Col. Mackenzie is a young specimen of the White-Eyed Buzzard, *Butastur teesa*.—ED.]

No. IX.—THE STRYCHNINE TREE.

The Strychnine tree, *Strychnos Nux-vomica*, Linnæus, grows wild in the South Konkan and several other parts of India, especially in the coast districts. According to Kurz and others, it is found in Burma, Assam, and Cochin-China, extending as far as Northern Australia. Flückiger and Hanbury state that it is indigenous to most parts of India, and Dr. Wellington Gray is of opinion that it is one of the indigenous species. Sir Emmerson Tennent remarks that it is abundant in the prodigious forests of Ceylon, and says that it grows in great luxuriance in the vicinity of ruined tanks. He also states that, "Among the Malabar immigrants there is a belief that the seeds of the goda-kuduru (*Strychnos Nux-vomica*), if habitually taken, will act as a prophylactic against the venom of the cobra-de-capello (*Naia tripudians*); and adds that he has been assured that "the coolies coming from the coast of India accustom themselves to eat a single seed per day in order to acquire the desired protection from the effects of the serpent's bite." From Tennent's remark, it appears that the drug as a medicine is of modern introduction in Ceylon, and that the Sinhalese seem to have learnt its uses from Indian coolies and other immigrants. Flückiger and Hanbury's statement and Dr. Wellington Gray's opinion, as well as Tennent's remark, go against the suggestion that the plant was introduced from Ceylon. The island of Ceylon is so very close to India that the Ceylon flora is, in many respects, very nearly allied to that of the southern coast of India. It is a well-known fact that there is a large number of plants which are indigenous both to India and Ceylon, and it seems to me the strychnine tree is one of them.

The strychnine plant is a moderate-sized tree. Its stem is usually short, thick, and often crooked. It bears small greenish-white tubular flowers arranged in terminal corymbs. In Western India, and all along the coast, the tree begins to flower in March and April, and in places where it flowers late it continues to do so till the beginning of the rains, or sometimes even later. In Burma, according to Kurz, it flowers in April and May, and that is obviously due to the Burmese climate. The fruit is an indehiscent berry of the size and shape of a small orange, and, when ripe, is of a deep orange-yellow colour. It is filled with a very bitter, gelatinous, white pulp, in which the seeds are vertically placed in an irregular manner. According to Brandis the pulp is orange-coloured. W. R. Dunstan says "the pulp when fresh has a very bitter taste, and is white, but on drying becomes dark brown." It seems the colour of the pulp changes according to the age of the fruit and the locality in which the plant grows. The seeds are of a light greyish hue and have a satiny or glistening appearance. They are flat, rounded, and small, a little less than an inch in diameter, by about a quarter of an inch in thickness. They are extremely compact and horny, and have a very bitter taste.

Note.—This letter appeared in the *Times of India* on 5th May, 1894.

The strychnine tree sheds its leaves like most other trees, and there appears to be no doubt about the fact. The time, however, depends upon climatic influence. In Western India this usually happens towards the end of the cold season, when the tree begins to get new leaves. In Burma, according to Kurz, it sheds its leaves in the hot season, and it appears to do so, though the hot season would seem to be a curious time to do such a thing. The hot season in Burma is not so trying as with us, and always includes nearly a half of what is commonly known as the cold season on this side of India. Besides, it should be borne in mind that the process of shedding the leaves, which begins towards the end of the cold season, is not always finished till the hot season has actually begun, or in some cases till it is in full swing. In a country where the women do all the outdoor work and attend to business in almost all its departments, while the men stay at home to mind the baby, it is not at all strange for the strychnine tree to shed its leaves even in the hot season.

Roxburg was the first to remark that the pulp of the fruit seemed innocent and was eaten by many birds. According to Hugh Cleghorn's "Forests and Gardens of Southern India," the fruit is eaten by the horn-bill, *Buceros malabàricus*. Sir George Birdwood, in the "Vegetable Products of Bombay," says, "The fruit is commonly eaten in the Konkan for the sake of the pulp enclosing its deadly seeds." Beddome, in the "Flora Sylvatica" of Madras, remarks that, "the pulp of the fruit is quite harmless and the favourite food of many birds." In the *Bombay Gazetteer*, for North Kanara, it is stated that "the pulp is harmless and is eaten by horn-bills, crows, monkeys, and even by cattle." Ainslie, however, has rightly observed that the pulp is poisonous, and his opinion has been confirmed by Flückiger and Hanbury. The experiments made by Flückiger and Hanbury gave abundant evidence of the presence of poisonous alkaloids in the fresh as well as the inspissated juice of the ripe fruit. It is to be regretted that almost all the botanical observers have not mentioned the specific names of the various birds and monkeys they say they have seen eating the fruit. The only bird that has been seen eating the fruit voraciously is the Malabar Pied Horn-bill, *Hydrocissa coronata*. Cleghorn's *Buceros malabaricus* is the same as this bird. Jerdon says the Malabar Pied Horn-bill is very fond of the fruit of the kuchla, *Strychnos Nux-vomica*. The ring-necked parrakeets, *Psittacus torquatus*, do sometimes peck at the fruit, and drop it in large numbers, as it were out of mere wantonness, or perhaps in search for a tolerably good fruit. Crows are occasionally seen chasing the horn-bill on the tree, and this circumstance may have led some persons to believe that the crows go there to eat the fruit, an assertion which requires verification. The flying-fox, *Pteropus medius*, appears to be fond of the fruit, but it seems to eat only the outer rind, and throws down the broken fruit as if it did not like it very much. Among monkeys, the only creature that is extremely fond of the fruit is the dark-faced monkey *Semnopithecus entellus*, the *Langur* or *Hanuman* of Western India. Any man who has spent a day or two, especially the early mornings and evenings, in the

forests of Ratnagiri and Sawantwady, when the plant is in fruit, must have noticed these as well as other particulars. The pouch-mouthed bonnet monkey, *Macacus sinicus*, which is tolerably common in the Konkan and on the coast, always avoids the fruit. The Toque monkey, *Macacus pileatus*, of Ceylon, has never been known to eat the fruit; its cousin, the pouch-mouthed Bengal monkey, *Macacus rhesus*, has been reported to be susceptible to strychnine poison. Blandford says certain vegetable poisons are said to be taken by *Semnopithecus entellus* with impunity, doses of five and even ten grains of strychnine having been given to one without effect, although the same drug killed *Macacus rhesus* quickly. Village cattle, which go out every day for grazing purposes, do always avoid the tree instinctively. The remarks in the North Kanara *Gazetteer* that the pulp is even eaten by cattle cannot be very well understood. Horses, which lead quite a different life, may possibly make a mistake, but it is probable they find it out before it is too late. The leaves of the strychnine tree are so bitter that they are not likely to find favour with cattle or horses, even during the time of scarcity. The tender sprouts, however, are eaten by goats and some bullocks. I know of a bullock just now that is very partial to the pink leaves. The poisonous character of the young twigs, sprouts, leaves and fruit increases as they reach maturity, but even then the amount of the poison they contain is not large enough to cause the death of the insects, birds and mammals which feed upon them. The fruit, if eaten beyond a certain limit, will undoubtedly bring about fatal results; but Nature has so ordained that the birds and mammals, which live on the fruit, eat only as much of it as is sufficient for their wonderful digestive powers.

"These are Thy glorious works, Parent of good."

The commercial product of the plant is the seed known as *nux vomica* in the drug market. As a medicine *nux vomica* does not seem to have been used among the Aryans. In fact, the medicinal uses of the drug were unknown to the ancient Hindoos. The Arabians are said to have been the first to use the drug medicinally; but, for want of sufficient evidence, it is not universally accepted. It is probable the early Arab traders on the coast may have learnt the uses of the drug from the Nairs and other aboriginal tribes living on the south-western coast of India, among whom the uses of the drug appear to have been known from time immemorial. In Europe, however, the drug was introduced in the sixteenth century, and in England, according to Parkinson, about the year 1640.

The seed contains two alkaloids, *Strychnine* and *Brucine*, with a peculiar acid known as acid *trychnic* or *egasuric* acid. The bitter taste and highly poisonous character of the drug are due to the presence of these alkaloids. In addition to these, the seed is said to contain also mucilage and sugar. *Strychnine* is not restricted to the seed, but occurs also in the wood, bark, leaves, twigs and roots. Dr. Edward John Waring, in the *Pharmacopœia* of India, says that the leaves of a certain parasitic plant of the order *Loranthaceæ*, "growing on *Nux-vomica* trees (*Strychnos Nux-vomica*) in the neighbourhood of Cuttack, have

been found to possess poisonous properties similar to those of the tree on which it grows." Dr. Waring then quotes from a letter received by him from Sir W. O'Shaugnessy, and adds that O'Shaugnessy says he saw "an athletic European sailor killed in less than an hour by half a drachm of the powdered leaves taken by mistake for cubebs." The action of *Strychnine* on lower mammals and birds has been experimented upon in Ceylon and elsewhere. A series of these interesting experiments have already been put before the public by another correspondent, and I shall not repeat them here.

Extract of *Nux Vomica* and tincture, as well as *Strychnine*, are officinal not only in the British Pharmacopœia, but also in the leading Pharmacopœias of Europe. In India, the wood, bark, leaves and seed are all used in native medicine. An empyreumatic oil is prepared from the fresh seeds and is used in native medicine. The medicinal and economic uses of the drug are fully described in medical and other books, and it is needless to reproduce them in this note. In the South Konkan, opium eaters, in the absence of opium, are known to chew the seed, which is said to produce a kind of intoxication similar to that of opium. The seed, on account of its stimulating and aphrodisiac properties, is habitually chewed by Brahmins and others along with *pan*, *Piper Betle*, the betel leaf. Owing to the difficulty of reducing the seed to powder, it is seldom used for criminal purposes. The leaves, however, are sometimes eaten by native women with a view to commit suicide. The antidote usually employed is a drastic purgative.—Yours, &c.,

BOMBAY, *April* 6, 1894. R. M. DIXON.

No. X.—THE POISONOUS PLANTS OF BOMBAY.

The difficulty of knowing whether a plant is poisonous or not, and the somewhat divergent opinions of competent authors quoted by Dr. Kirtikar, recall an incident which may have some bearing on this point. Being camped at Mandvi on the Tapti, I was strolling in the cool of the evening with the local Doctor, a Sonar by caste, and a good fellow to boot. There were plants of the "Atrophied Carcass," more classically dubbed *Jatropha curcas*, scattered about, and among other things I enquired if the seeds were not edible. He replied that he did not think any one ever ate them except children, whereon I ate half a dozen, and liked them. Next rains in Surat, a young Civilian and myself, being great friends, were out for an evening walk, and finding the *Jatropha* seeds ripe, I tempted him and we both ate, one of us a single seed and the other two. We soon experienced an acrid burning sensation at the back of the throat, followed by nausea and general malaise, which laid us up all next day. The conclusion I came to was that chemical changes go on in some seeds for long after they are ripe. This would account for many divergencies of authorities. I fear the conclusion my friend came to was that I was neither botanist nor epicure, though he was too good to show it.

POONA, *May*, 1894. F. GLEADOW.

No. XI.—SOUTH AFRICAN SNAKES.

During a recent visit to Natal, I was much struck by two facts which came to my knowledge about the local snakes, and which seems to me worth recording.

First :—Is the power (possessed by certain Natal snakes) of springing clear off the ground. On two occasions, I saw a snake spring at least eighteen inches off the ground in attempting to strike its enemy. In both cases it was of a species known as the "Night Adder," and measuring about 30 inches in length. I regret I failed to discover its scientific name. I was told that the "Puff Adder" can and does make similar springs, by persons who had seen it do so. This is all the more extraordinary because the Puff Adder is a stout heavy snake. Several other species are popularly credited with a similar power.

Second :—Is the power possessed by one of the two local cobras (? *Naja caffra*) of *squirting* venom at an enemy. A member of this society learned in such things tells me that this fact has been mentioned more than once by African travellers. I have it from two reliable witnesses. My brother and Dr. Lang, the Residency Surgeon of Maseru Basuto-land, when attacking one of these cobras together, were met by a jet or spray of poison squirted at them by the snake. The doctor received it on the cheek and in one eye (my brother had protected his face with his raised arm). The result was very severe inflammation, which only subsided gradually and after the free application of carbonate of soda. The poison must have been squirted a distance of at least 5 or 6 feet.

Somali-land has now become an Indian hunting ground, and it will be well for future visitors there to keep in mind these two traits of South African snakes, for their North African cousins may possess the same power and habits.

There are said (locally) to be two species of cobras in Natal—one black and the other mottled. I never saw the former, but the latter often. It is much smaller than our cobra, and handsomely marked on a pale ground. I did not see any well-marked spectacles, but the hood was quite plain when the beast was angry. In company with my brother I killed one of these cobras in Basuto-land in January—February, and after opening her took out 16 young ones. These were each only about 3 inches long, but were apparently fully formed. Each youngster, in utero, was isolated by a gelatinous environment, but there was *absolutely no sign of any egg-shell.* I was under the impression that the cobras and all that division of the snakes were invariably oviparous. This specimen most certainly was not.

I heard terrible tales of a snake known as the "Black Mamba." How at certain times of year it "runs amok" (? at breeding time) and charges indiscriminately at anything living it sees or hears. In deadliness our King Cobra is a harmless worm compared to it, &c., &c. But I had these tales only on popular (though unanimous) report.

BOMBAY, *May*, 1894. R. C. WROUGHTON.

No. XII.—*EUPODOTIS EDWARDSII.*

When out coursing on the 5th June I came across a fine specimen of this bird on an extensive *maidan* near some low sandy hillocks; only about 12 miles from Gurmukhtesar on the Ganges. As this is the first I have seen or heard of in a seven years' residence in Babugarh, their occurrence in the Meerut District must be rare enough to be worth recording. Jerdon says: "I have not heard of its occurring anywhere in the valley of the Ganges."

Some four years ago I came on two houbara (*Houbara Macqueenii*) near here.

Florican visit us in small numbers during the rains and cold weather; two flocks of the large sand grouse (*Ptrocles Arenarius*) also come in during the winter. One haunts the plain on the Gurmukhtesar road, the other a *maidan* between the two little *naddis* on which the Civil Veterinary Department Depôt is situated.

G. M. RAYMENT,
Veterinary Major.

BABUGARH, *6th June*, 1894.

No. XIII.—A PANTHER SMOKED TO DEATH IN A CAVE.

In May last I was out shikarring for a few days and had *khubber* of a panther marked down in thick jungle. I had a beat, but nothing appeared. The man said the panther must have gone into a cave in this jungle, and, accordingly, for about one hour they tried to smoke the beast out of this cave, but without avail. Next day a man reported to me that a panther's pugs had been seen to come out of the cave, but on the morning of the second day another man came to say there was a great smell coming from it, and he thought the panther must have been smoked to death. I accordingly sent off some men and they brought back to me the body of a fine male panther which they had with considerable difficulty dragged out of the cave. As the panther had been dead at least 36 hours and stank badly, his skin was useless. Next day I went to examine the cave. I found it was in a *nullah* under some very massive rocks. There were 4 if not 5 entrances; none of them very large, and in only one of them could a man crawl. Two of the entrances were about 8 feet higher than the others. I do not think any passage in the cave could have been longer than 20 feet, but as the entrances were so small, I could not possibly examine the place. At the two upper entrances the men had lit fires, and at one of the lower entrances they had made another small fire, but it was put out at once, so as to allow the panther to escape through this entrance. It was near this latter entrance the dead panther was found. One of the men said he heard a panther growl when he lit the fire, but my *shikari* listened and hearing no sound disbelieved the man. I cannot understand why this panther was so foolish as to stay and be smoked to death, and thinking the incident may be worthy of record, I beg to submit it for our Journal.

REGINALD GILBERT.

BOMBAY, *8th June*, 1894.

No. XIV.—MUSCULAR ACTION AFTER DEATH.

I see in the last number of the Society's Journal an account of the vitality of a snake's tail after its separation from the body. Perhaps the following may be interesting to some of our members :—

In the month of July, some 4 or 5 years ago, I was out shooting florican with a friend of mine in Guzerat. We had had fairly good luck, and as we were making our way to the Railway Station to catch the early train back to Ahmedabad, I noticed my friend, who was shooting in line on my left, suddenly point his gun at something on the ground and fire, and, on asking what it was, he said it was a large black cobra and that he had shot it in two pieces, the head portion disappearing down a hole. As we were in a hurry to catch the rain we went on, but very soon heard one of the beaters calling out, and looking back saw him running towards us *with the head portion of the snake following him, with the hood expanded.* It appeared that he had remained behind trying to dig out the cobra, and the result was that it came out of the hole and went for him. Of course the snake could not get much pace on and was quickly killed.

KARACHI, 1*st June*, 1894. S. B. DOIG.

CORRESPONDENCE.

No. 3576 OF 1894-95.

MUNICIPAL COMMISSIONER'S OFFICE,
BOMBAY, 14*th May*, 1894.

From H. A. ACWORTH, Esq., I.C.S.,
Municipal Commissioner for the City of Bombay,

To THE HONORARY SECRETARY,
Bombay Natural History Society.

SIR,—I have the honor to forward copy of an extract from a communication addressed to me on 11th instant by Surgeon-Lieut.-Colonel T. S. Weir, Health Officer to the Municipality. Members of the Natural History Society have in times past frequently interested themselves in the condition of Vehar and Tulsi lakes with special reference to the piscine life within them, and I should be grateful for any suggestions with which the Society may be able to favor me. I need not add that every assistance within my power will be given to members of the Society desiring to visit the lakes.—I have the honor to be,&c.

(Sd.) H. A. ACWORTH,
Municipal Commissioner for the City of Bombay.

Extract from the Health Officer's letter, No. 5412, *dated* 11*th May*, 1894, *to the address of the Municipal Commissioner.*

"Suggestions have occurred to me as the result of my inspection, and I "venture to submit them. I was very much impressed on this occasion by the "greater stagnation of the Tulsi water and the few evidences of life other

"than vegetable matter within it. The contrast between Tulsi and Vehar and "Tansa is very great. Fish are abundant in Tansa and also numerous in Vehar, "but there are few to be seen in Tulsi. I observed that while the water from "the lake had no odour, water taken by me from an air-cock half way between "Vehar and Tulsi had an odour of decay such as the water delivered in the "city had at one time. This water was tepid.

"I have a suggestion hereafter to make in regard to this. It seems to me "that it might be well to consult the Bombay Natural History Society in "regard to the Tulsi lake, and the fish it might be advisable to bring into the lake from Tansa. Having the Natural History Society, advantage might be "taken to secure the assistance of scientific men in the conservancy of the lake."

PROCEEDINGS

OF THE MEETING HELD ON 10TH APRIL, 1894.

A meeting of the members took place at the Society's Rooms on Tuesday, the 10th April, 1894, Dr. D. MacDonald presiding.

NEW MEMBERS.

The election of the following new members was announced :—

Dr. Pandurang Gopal (Bombay), Khan Bahadoor Nawab Mahomed Salamullakhan (Booldana), Mr. Cecil Richardson (Bombay), Surg.-Captain R. S. F. Henderson (Deesa), Surg.-Captain R. Pearse (Calcutta), Mr. A. C. Crampton (Monywa, Upper Burma), Mr. J. Du Boulay, I.C.S. (Dhulia), Major G. S. Rodon (Belgaum), Mr. C. H. Travers (Ganjam, Madras), Mr. A. W. Peet (Vizagapatam), Mr. Muncherjee Framjee Khan (Bombay), Surg.-Capt. C. Donovan, I.M.S. (Maymyo, Burma), Rev. L. M. Haslope (Bombay), Lieut. C. C. Boileau (Fort Aijal, N. Lushai Hills, Cachar), and Capt. J. C. Francis (Deolali).

CONTRIBUTIONS.

Mr. H. M. Phipson, the Honorary Secretary, acknowledged receipt of the following contributions received since the last meeting :—

Contributions.	Description.	Contributors.
2 Monkeys (alive)	Macacus sinicus.....	Mr. W. Winiker.
1 Fish	Holacanthus nicobariensis.	Major W. G. Forbes.
1 Snake (alive)	Gongylophis conicus.....	Mr. F. A. Little.
A number of insects and land shells, from Bisrampur..	.....	Mr. J. A. Betham.
1 Fossil Tooth of an Elephant	.....	Col. K. Mackenzie.
Striped Hyæna.....	Hyæna striata	Surg.-Major J. P. Barry.
1 Snake	Zamenis mucosus	Do.
1 Mouse Deer	Tragulus meminna.....	Mr. W. F. Sinclair, I.C.S.
Dobson's Wrinkled-lipped Bat	Nyctinomus tragatus.....	Do.
1 Screech Owl (alive)	Strix javanica.....	Mr. A. C. Lloyd.
1 Large Sea Mussel.....	Pinna squamosa.....	Mr. C. F. G. Lester.
1 Cowfish	Ostracion cornutus	Capt. E. L. Shopland.

Contributions.	Description.	Contributors.
1 Snake	Dipsas trigonata.....	Mr. T. Harris.
Specimens of Marine animals, from the Arabian Sea ...	.....	Mr. M. Malting.
Nest and Eggs of the purple-rumped Sunbird	Arachneckthra zeylonica ...	Mr. G. de Bildt.
A collection of insects from Kharaghora	.....	Mrs. Pearson.
Marine Specimens from the Arabian Sea Cable of 1872	.....	Capt. Greery, R. N.
1 Snake	Zamenis gracilis.....	Mr. L. Butcher.
13 Snakes, from Shillong ...	.....	Capt. C. A. R. Browne.
A series of Photographs of Wild Animals	.....	Mr. H. A. Heath.
1 Rock Horned Owl (alive).	Buto bengalensis	Mrs. Godfrey.
1 Klipspringer's Head	Nanotragus oreotragus	Capt. J. C. Francis.
1 Oryx Head	Oryx beisa	Do.
1 Gazelle Head	Gazelle sœmmeringii	Do.

CONTRIBUTIONS TO THE LIBRARY.

The Canadian Entomologist, Vol. XXVI, No. 1. In Exchange.
The Flowering Plants of Western India (A. K. Nairne). From the Author.
Proceedings of the Linnæan Soc. of N. S. W., Vol. VIII. In Exchange.
The Indian Forester, Vol. XX, No. 3, Part II. In Exchange.
The Geography of Mammals (W. L. Sclater). From the Author.

A NEW BOOK.

The Honorary Secretary drew the attention of the members present to a very handy little volume just published by the Rev. A. K. Nairne, through the Education Society's Press, Bombay, on the Flowering Plants of Western India, and stated that the author would be glad to receive corrections and additions from members of the Society with the object of perfecting the Second Edition of the work.

PAPERS READ.

The following papers were then read and a vote of thanks was passed to the authors :—The larva and pupa of *Spalgis epius*, Westwood, by E. H. Aitken ; Fertilization of the Vanilla flower by bees, by W. F. Sinclair, I.C.S. ; Annelide reefs, by W. F. Sinclair, I.C.S. ; The Flamingo found breeding in India, by Lieut. C. D. Lester ; Curious instance of muscular action after death, by E. J. Ebden, I.C.S. ; The breeding season of the Spotted-billed Duck, by C. Hudson, I.C.S. ; The breeding season of the Spotted-billed Duck, by Sir E. Buck, I.C.S. ; Measurement of Tigers, by Surg.-Capt. H. F. Cleveland ; Wolf Cubs, by Capt. G. B. O'Donnell ; and Stalking Sambar, by Major G. S. Rodon.



F. C. S. Baker del.

CALLIOPE TSCHEBAIEWI.

The Tibet Ruby-throat.

Martern Bros. Chromo lith. London.

JOURNAL

OF THE

BOMBAY

Natural History Society.

Vol. IX.] BOMBAY. [No. 2.

THE BIRDS OF NORTH CACHAR.

PART III.

By E. C. Stuart Baker, F.Z.S.

(*With Plate C.*)

(*Continued from page* 24.)

Family *Laniidæ*.

Sub-family *Laniinæ*.

(194) Lanius collurioides.—The Burmese Shrike.

Oates, No. 474 ; *Hume, No.* 260 *Ter.*

This bird is, strange to say, not a winter but a summer visitant to the North Cachar Hills, and it is probable that it works its way north-west through Manipur from Burma. It is, at no time, a common bird, and some years I have not seen a single one. It never extends to the west of the district, and is most often to be met with on the loftier hills of the extreme east. I took its nest for the first time in May, 1890, and since then have taken some half dozen. The nests are just like those of *L. nigriceps*, and the eggs only differ in being somewhat smaller ; 12 of them measure, on an average, ·87″×·71″.

(195) L. ERYTHRONOTUS.—The Rufous-backed Shrike.

Oates, No. 476 ; *Hume, Nos.* 259 *and* 237 *Bis.*

A very rare bird, but resident wherever it is found.

(196) L. TEPHRONOTUS.—The Grey-backed Shrike.

Oates, No. 477 ; *Hume, No.* 258.

Very common during the cold weather, and a good many birds remain to breed on the hills over 4,000 feet. The nest is a very deep massive cup made of coarse and fine grasses and very neatly lined with the latter. Sometimes the nest, in the same manner as the nests of some other shrikes, is made entirely of fine, strong, flowering grasses, so placed that the feathery ends are all outside ; most of my nests have been taken from stout forks of stumpy trees, about four to six feet from the ground as a rule, but sometimes as high up as 20 feet or even more. On the other hand, I have seen one nest in a scrubby bush, and others again in high straggly ones.

The eggs are generally four or five in number, but once I took one with five eggs, on the point of hatching, and two young ones which had just emerged from the shell.

Most of my eggs are of the pale greenish-grey type of egg, so common amongst the eggs of *L. nigriceps*, but one clutch of two is much brighter coloured, the ground-colour being quite a bright tint of green, and the blotches also of a much clearer colour than usual. I have also seen a few clutches of the pink type.

Twenty eggs averaged ·90″×·73″.

(197) L. ISABELLINUS.—The Pale-brown Shrike.

Oates, No. 479 ; *Hume, No.* 262.

I have seen but one specimen of this bird, which was obtained in these parts. It is now in the collection of Mr. H. A. Hole, and was shot, I think, in November, 1891.

(198) L. CRISTATUS.—The Brown Shrike.

Oates, No. 481 ; *Hume, No.* 261.

This is the commonest of the shrikes during the cold weather, and some few remain to breed during the early rains. From August to the middle of November I have never met with a bird.

The nidification appears to be very similar to that of *L. vittatus*, but the eggs are more boldly blotched and marked than are those of that bird. The nest is also less deep than most shrikes' nests are.

(199) HEMIPUS PICATUS.—The Black-backed Pied Shrike.

Oates, No. 484 ; *Hume, No.* 267.

I have met with two birds, males of course, which were undoubtedly of this species, but the common type is the next.

(200) H. CAPITATUS.—The Brown-backed Pied Shrike.

Oates, No. 485 ; *Hume, No.* 267 *A.*

This is the common form of Pied Shrike met with in these hills. It is to be found everywhere from 2,000 feet upwards at all times and in considerable numbers. They are very sociable birds, and, even in the breeding season, they collect in small flocks when feeding. I have taken four eggs from a nest on one occasion, and on two others have taken three. They have a very sweet little song, though a short and rather jerky one.

(201) H. OBSCURUS.—The Malay Pied Shrike.

I met with an undoubted specimen of this species at Laisung in 1888. The bird had been caught on the nest in a hair noose and was brought to me with the eggs and nest. This latter was a beautiful little cup made of shreds of soft grass, covered outwardly with cobwebs. There was no lining of any sort, but so soft was the material used that none was required. It was built in a small fork of a branch at about six feet from the ground, and, as far as I could ascertain from the Naga who brought it to me, in a very exposed position beside a track leading through some heavy forest.

The eggs, of which there were three, are quite unlike those of either *Hemipus capitatus* or any other kind of shrike with which I am acquainted, yet, for all that, they *have* a certain shrike-like character about them.

In ground-colour two are a pale yellowish-grey, in the third more a yellowish-brown. The markings consist of small, fine, irregular lines and specks of vandyke-brown, and others paler and more cloudy in character, of neutral tint or blue grey ; in the third egg there are also cloudings of pale sienna-brown, and the bluish secondary blotches are confined to the extremity of the larger end, in the other two being fairly equally, though sparsely, distributed throughout.

In general character these eggs are much like eggs of *Schœniparus mandellii.*

They measure ·76″ × ·56″ and ·68″ × ·52″.

They are regular ovals in shape, being but slightly compressed towards the smaller end ; the texture is fine and close with a decided surface gloss, though the shell is very thin and fragile.

(202) TEPHRODORNIS PELVICUS.—The Nepal Wood-shrike.

Oates, No. 486 ; *Hume, No.* 263.

Old females sometimes, though very rarely, attain the black bill, for I have one female in my collection which was sexed by myself, and the bill is *very nearly entirely* black. In old males the irides are bright yellow, in adult, but young birds, it varies from yellow to brownish-yellow in females, and in males of the first year the iris is a dull pale glaucous-blue.

I believe the flocks never to consist of more than one pair of birds and their last brood. On one occasion I shot all the six birds in a flock, and they proved to be an adult male and female, and four young. On another, I found eleven birds feeding together, but, when they eventually left the tree, they divided into two parties and flew off in opposite directions.

This bird is very common in North Cachar, more especially in the scattered oak forests to the north of the sub-division. During the breeding season they leave the more open country and take to evergreen forest and heavily wooded ravines and valleys. The nests I have taken of this bird were far more like the nests of *Hemipus* (except of course in size) than that described in Hume's "Nests and Eggs" (Vol. I, p. 330) as belonging to this bird, and which seems very much like the commonest type of nest of *Lanius nigriceps*. The three nests I have personally taken were all rather broad, shallow structures made of coarse grasses, twigs and lichen, strongly bound together and lined with fine seed down.

The eggs contained in the first nest I obtained differ in size only from the eggs of many Minivets ; the ground-colour is white with a very faint tinge of green, and the markings consist of large spots and small blotches of vandyke-brown, rather pale ,and different shades of neutral tint ; they are fairly numerous everywhere, but most so at the larger end.

The three eggs measure ·90″×·70″, ·57″×·69″ and ·83″ × ·67.″ The next nest contained only two eggs, in coloration exactly like the most common type of eggs of *Pericrocotus erythropygius*, the ground-

colour is a very faint brownish-white, and the markings, which are very numerous, are nearly all brown with only a few big underlying ones of dull purplish. The character of all the marks is distinctly longitudinal, and they form no distinct ring or cap at the larger end though they are so numerous there that they become blurred and ill defined.

They, the eggs, measure ·94″×·70″ and ·93″×·68″.

The third clutch of eggs in shape and colour closely resemble the eggs of the common Wood-shrike.

(203) T. PONDICERIANUS.—The Common Wood-shrike.

Oates, No. 488; *Hume, No.* 265.

Quite a rare bird and never, I believe, found here above 2,000 feet.

(204) PERICROCOTUS SPECIOSUS.—The Indian Scarlet Minivet.

Oates, No. 490; *Hume, No.* 271.

The typical *P. speciosus* is decidedly rare here. I obtained a pair of these birds and a nest containing two eggs on the 31st May, 1891.

I may say at once that in no single detail do these eggs or the different nests I have seen agree with those described by Hutton. (Hume's "Nests and Eggs," Vol. I, p. 335.) The first nest I ever saw was one which was pointed out to me by a Naga boy on the 13th May, 1891, and which was built low down in a fork of a small dead sapling. In shape it was a shallow, broad cup, measuring internally 3·2″ by 1·5″ and inwardly 2·5″ by less than half an inch in depth. It was made, just like all other minivets' nests, of fine grasses, fern and moss roots, a few fine soft twigs and thin weed stalks, all massed closely together with innumerable cobwebs, and finally completely covered, outwardly, with lichen. Another nest, which contained two young ones, was brought to me towards the end of the same month, and I myself found a nest in April, 1892, from which the young flew as I climbed the tree. Both these nests agreed almost exactly in every detail with that already described.

The only two eggs I have seen were in *shape* and *texture* typical minivets, but I have come across no other eggs of this genus *coloured* the same; the ground-colour is a decided greenish-white and the markings are all of the same kind, *i.e.*, pale reddish or purplish-brown spots rather smeared longitudinally in their shape and character, sparsely scattered all over the eggs. There are no real secondary spots though some few markings are pale and indistinct.

The two eggs measure ·87″×·60″ and ·91″×·61,″ being thus far less broad than Hutton's eggs.

(205) P. FRATERCULUS.—The Burmese Scarlet Minivet.

Oates, No. 491 ; *Hume, No.* 271 *Ter.*

This is the common type in these hills, though it is hard to say of some birds whether they belong to this or the last species.

As regards wing measurements, I have birds with wings of the following size : 3·7″, 3·72″, 3·78″, 3·82″, 3·88″, 4″, and 4·1″.

Now, as Oates gives the wing measurement of *P. speciosus* as 4·15″ and *P. fraterculus* as 3·7″, it will be seen that there is a complete series of intermediate sizes, so that it would seem as if wing measurement must be put on one side and cannot be used as a distinguishing feature between these two species. This leaves only the tail to go by, which is absolutely useless, for my biggest bird has the central tail feathers wholly black, the next biggest has the outer webs red for three-quarters of their length, and yet again a bird whose wing is only 3·71″ has his two central tail feathers without a speck of red on them, and has in addition a great part of the second pair also black on the inner webs.

This species is found everywhere from the plains up to about 4,000 feet. It is an early breeder, and, by the end of April and early in May, the young are all hatched and many nearly fully fledged. I have never yet taken its eggs, but have often seen the nest, which is just the same in every way as the one I described belonging to *P. speciosus*. Personally, I believe *P. fraterculus* to be a bad species and think it should be suppressed.

(206) P. BREVIROSTRIS.—The Short-billed Minivet.

Oates, No. 495; *Hume, No.* 273.

I have never met with this bird except towards the low lands north and south of the sub-division up to some 1,500 or 2,000 feet, but below this altitude it is not rare.

(207) P. NEGLECTUS.—Hume's Minivet.

Oates, No. 496; *Hume, No.* 273 *Ter.*

I obtained a male which, I believe, belonged to this species, in October, 1891.

(208) P. SOLARIS.—The Yellow-throated Minivet.

Oates, No. 498 ; *Hume, No.* 274.

Fairly common. Found on the very highest peaks. I took a nest of this bird at Hangrum containing two young birds and an addled

egg. The nest was 3″ across and about 1″ deep. The materials used were the ordinary ones, but the lichen on the outside was very scanty.

The one egg might almost have been mistaken for that of a sparrow, rather longer in shape than usual. It is quite the darkest minivet's egg in my collection, and the markings, which are brown and inky, are very numerous, coalescing at the larger end. The egg measures ·89″×·56″ and may prove to be an abnormally large one.

(209) P. ROSEUS.—The Rosy Minivet.

Oates, No. 499; *Hume, No.* 275.

Not uncommon in the higher well-wooded valleys, and more especially is it to be frequently met with in the valley of the Laisung.

The only nest containing eggs which I have taken of this bird was found in the above valley on the 14th of May, 1891. The eggs are like the second one described in Hume's "Nests and Eggs" (Vol. I, p. 338), and are like lightly-marked eggs of *Passer montanus*.

The nest and others I have seen either empty or containing young were all *lined inside* and *densely* covered outside with lichen, so that it is only possible to ascertain what materials have been used by tearing the nest to pieces.

(210) P. PEREGRINUS.—The Small Minivet.

Oates, No. 500; *Hume, No.* 270.

Common up to 2,000 feet, and not met with over 4,000.

(211) CAMPOPHAGA MELANOSCHISTA.—The Dark Grey Cuckoo-shrike.

Oates, No. 505; *Hume, No.* 269.

Not uncommon in the cold weather, and some birds also remain to breed on the higher peaks.

(212) C. SYKESI.—The Black-headed Cuckoo-shrike.

Oates, No. 508; *Hume, No.* 208.

I have two or three times met with this bird in these hills, once getting a hen bird, together with the nest on which she was trapped.

(213) GRAUCALUS MACII.—The Large Cuckoo-shrike.

Oates, No. 510; *Hume, No.* 270.

Common everywhere, from the plains to the highest hills.

Sub-family *Artaminæ*.

(214) ARTAMUS FUSCUS.—The Ashy Swallow-shrike.

Oates, No. 512; *Hume, No.* 287.

Very common in suitable places throughout the sub-division.

I have carefully studied the variations in the bill of this bird and have come to the following conclusions : Nestlings have the whole bill a blackish-brown, the gape yellow. In the autumn of the first year the bird has the bill a dull dark brown, the basal third alone being of a dull livid blue.

In the male of the second year the bill becomes brighter and only the terminal third is a dark brown. In the third year, the whole bill becomes a bright mauve-blue with merely the tip of both mandibles black.

In females the oldest birds have their bills almost as blue as the males, but it is more of a livid than a mauve tint.

Family *Oriolidæ*.

(215) ORIOLUS INDICUS.—The Black-naped Oriole.

Oates, No. 514 ; *Hume, No.* 471.

I have taken two nests of this bird, each containing two eggs. The nests in no way differed from those of *O. melanocephalus* and were built in creepers hanging very high upon lofty trees in situations extremely difficult to get at.

The eggs are of the usual oriole type, three have a decidedly pink ground and are marked in the ordinary way with rather dark reddish-brown, and the fourth only differs in being paler and rather more boldly and sparingly blotched with a darker brown.

This species is not rare here during the months of December, January and February; but the birds which were taken with the two nests, above mentioned, are the only ones I have seen between March and October.

Two of the eggs measure 1·09″×·76″ and 1·05″×·79″.

The other two eggs I sent to the Indian Museum, Calcutta, without measuring them first ; but, if I remember rightly, they were rather larger than those in my own collection.

(216) O. TENUIROSTRIS.—The Burmese Black-naped Oriole.

Oates, No. 515; *Hume, No.* 471 *Ter.*

Very rare here and I have but seldom met with it. The only eggs I have seen were a pair brought to me in Silchar, together with the remains of the parent birds.

They are small eggs, measuring only 1·01″ × ·74″ and ·98″ × ·73″, and in colour they are a *very* faint pinky-white, boldly marked with

light reddish-brown, these marks being principally confined to the larger end. The nest I did not see, but it was said to have been taken from a Babool tree, about five feet from the ground.

(217) O. MELANOCEPHALUS.—The Indian Black-headed Oriole.

Oates, No. 521; *Hume, No.* 472.

Common everywhere.

(218) O. TRAILII.—The Maroon Oriole.

Oates, No. 522 ; *Hume, No.* 474.

Rather rare here, but still to be met with pretty frequently in suitable places. In the cold weather I have seen it in the plains of Cachar and I have taken its nest at Hangrum, at a height of nearly 6,000 feet.

It always seems to build its nest at an immense height from the ground, and generally amongst the small outer branches of the tree selected. Twice I have only managed to save one out of three eggs contained in the nest, twice two out of three, and but once have I brought (or, I should say, had brought) down all three eggs in safety. The four I have measured are 1·2″ × ·8″, 1·14″ × ·76″, 1·12″ × ·77″ and 1·17″ × ·82″.

The eggs are just like rather deep coloured ones of *O. kundoo* or *O. melanocephalus*, but one has one or two most peculiar long wavy lines of a dark greenish-brown colour and also a few blotches of the same. This is, most likely, altogether abnormal, for neither of the other two eggs in the same nest possessed any such ; for, though one was too broken to keep, I examined it carefully in order to ascertain if such was the case.

Family *Eulabetidæ*.

(219) EULABES INTERMEDIA.—The Indian Grakle.

Oates, No. 524 ; *Hume, No.* 693.

This grakle is very common in North Cachar, breeding freely everywhere up to some 3,000 feet. The eggs are in general colour the same as those of *Sturnopastor*, rather brighter and perhaps less glossy ; in most eggs the markings consist of large blotches and spots of chocolate-brown, with others underlying them of pale inky and lavender. In some eggs, however, the marks are all of the secondary type, and even these are very faint, one egg in my collection appearing entirely blue unless closely looked into.

My smallest egg measures 1·31″×·99″ and the largest 1·62″×1·14″. The average size of sixteen eggs is 1·47″×1·02″. They seem to prefer trees, for building purposes, which have no branches for some height from the ground. Year after year they return to the same tree, sometimes making use of an old hole, but more generally making a new one close to it; in this way some trees may be seen with half a dozen, or even more, nest holes, all within a few feet of one another. They always build at a great height from the ground.

(220) CALORNIS CHALYBEIUS.—The Glossy Calornis.

Oates, No. 527 ; *Hume, No.* 690 *Bis and No.* 690 *Ter.*

Fairly common, more especially during the cold weather.

Family *Sturnidæ.*

(221) STURNIA SINENSIS.—The Chinese Myna.

Oates, No. 536 ; *Hume, No.* 688 *Ter.*

I saw a flock of these birds once during March feeding on a large cotton tree near the Stockade. I had no gun with me at the time, and before the man I sent to fetch one had time to return, the birds flew away and I did not again come across them.

(222) S. MALABARICA.—The Grey-headed Myna.

Oates, No. 538 ; *Hume, No.* 688.

A very common bird here. I once shot a bird of this species (?) with the whole of the underparts white ; with the exception of the vent and a broad rufous pectoral band.

(223) AMPELICEPS CORONATUS.—The Gold-crest Myna.

Oates, No. 543 ; *Hume, No.* 693 *Ter.*

A very rare bird in North Cachar; seems to be more common in some places in the plains not far from the hills.

(224) TEMENUCHUS PAGODARUM.—The Black-headed Myna.

Oates, No. 544 ; *Hume, No.* 687.

I came across this bird on one occasion at Deyungmukh in the end of April. It was then there in some numbers, but though I have repeatedly been to the same place since and at about the same time I have never again seen a single specimen.

(225) ACRIDOTHERES TRISTIS.—The Common Myna.

Oates, No. 549 ; *Hume, No.* 684.

When I came here, these birds were very uncommon above 500 feet, but they are yearly making their way higher, are now common up to 1,500 feet, and are met with now and then up to 3,000.

(226) ÆTHIOPSAR FUSCUS.—The Jungle Myna.

Oates, No. 552 ; *Hume, No.* 686.

Common up to 1,500 feet or 2,000.

(227) Æ. ALBICINCTUS.—The Collared Myna.

Oates, No. 554 ; *Hume, No.* 686 *Ter.*

I have shot one specimen of this, a male, which I got in March, 1890.

(228) STURNOPASTOR CONTRA.—The Pied Myna.

Oates, No. 555 ; *Hume, No.* 683.

Common at the foot of the hills, and extending a short way up the bigger streams.

(229) S. SUPERCILIARIS.—The Burmese Pied Myna.

Oates, No. 556 ; *Hume, No.* 683 *Bis.*

I have seen only two specimens of this bird, both caught on the nest and brought to me by Nagas.

Family *Muscicapidæ.*

(230) HEMICHELIDON SIBERICA.—The Sooty Fly-catcher.

Oates, No. 558 ; *Hume, No.* 296.

Very rare here, but a few birds are nearly always to be met with at Hungrum, where some remain to breed and where I have once obtained a male and twice a female.

On the 14th of May, 1891, I got a nest containing two eggs. Close by the Government Road, and situated in heavy tree jungle, with an undergrowth of *Caladiums* and similar plants, was an old stump, covered with a mass of yellow convolvulus, and passing this one day I observed a bird fly out and commence using very bad language, evidently in the hopes of driving me from the tree ; naturally the effect was to make me search the tree in the hopes of finding a nest and, sure enough, I soon found a massive moss cup wedged in between the stump and the remains of a bough. Having discovered the nest, I shot the bird and found it to be a female of this species ; the nest was a deep, compact cup made entirely of fresh green moss and lined with moss roots only ; outwardly the diameter was about 4″, and the depth fully 2½″; inwardly the cup was rather less than 2″ across and about 1·2″ deep.

The eggs, two in number, are quite typical fly-catcher's eggs, of the *Cyornis* type ; in general colour they are pale fawn or stone-colour, and

they are minutely stippled with reddish at the larger end, where the marks form a sort of blurred cap; these marks or stipplings being practically non-existent towards the smaller end. One egg also has a very fine, straggly line, of a red-brown, or clotted-blood colour, on the cap. The two eggs measure ·63″ × ·52″ and ·64″ × ·52.″

Another egg brought to me, *said* to belong to this fly-catcher, was much the same, but the freckles even more blurred, and nearly equally distributed over the whole surface of the egg. This egg measured ·67″ × ·54″. All three eggs are broad ovals, decidedly compressed and pointed towards the small end. The texture is smooth, but porous and not glossy, and the shell is also extremely fragile.

(231) H. FERRUGINEA.—The Ferruginous Fly-catcher.

Oates, No. 559 : *Hume, No.* 299.

Like the last, an uncommon bird, but resident wherever found.

Of the three nests I have taken, I have only got full descriptive notes of one. This was taken quite close to my bungalow at Gunjong, and was found in a small hollow in a dead stump which stood in a nullah well overgrown with bamboos, trees and thick bushes; outwardly the nest was of no shape, fitting the hollow in which it was found, only the side towards the opening being finished off with a neatly rounded edge. The receptacle for the eggs was about two inches in diameter by rather less than an inch deep.

With the exception of a few dead leaves at the bottom of the hole, which probably only got there by accident, the whole of the material used was moss, the lining and all being composed of scraps from 1″ to 3″ long.

The eggs were just what would be expected, and may be matched by many of *Cyarnis rubeculoides* and *C. tickelli*, etc.; but are more boldly marked than the majority of these birds' eggs. The ground-colour is a pale greenish-stone, and they are distinctly freckled and speckled with reddish-brown. In shape they are rather long, obtuse ovals, and they measure ·77″ × ·54″, ·78″ × ·56″ and ·74″ × ·55″.

(232) SIPHIA STROPHIATA.—The Orange-gorgeted Fly-catcher.

Oates, No. 560; *Hume, No.* 319.

Only an occassional visitant.

A pair of these little fly-catchers used to frequent my garden all through the winter of 1890, and I then often noticed them sitting on the ground. Nearly every morning and evening they might be seen

perched somewhere about on one of the railings or, less often, on some shrub or small tree, taking short flights after insects or flying down to the ground after a grasshopper or similar insect, constantly spreading their tails and flirting them up and down. Their note is that common to the genus, and sounding like a very low single "churr."

(233) S. ALBICILLA.—The Eastern Red-breasted Fly-catcher.

Oates, No. 562; *Hume, No.* 323.

A very common winter visitant, many staying as late as April, and some few birds possibly breed on the higher peaks, for one of my servants once caught a female in the beginning of May, whose ovaries contained eggs the size of a small pea.

(234) CYORNIS HODGSONI.—The Rusty-breasted Blue Fly-catcher.

Oates, No. 565 ; *Hume, No.* 322.

I have only met with this fly-catcher in the cold weather, and then but rarely.

(235) C. HYPERYTHRUS.—The Rufous-breasted Blue Fly-catcher.

Oates, No. 566 ; *Hume, No.* 321.

A rare bird, but resident. I have shot one in May and another early in August, and a third was brought to me with three unfledged young on the 20th July.

(236) C. LEUCOMELANURUS.—The Slaty-blue Fly-catcher.

Oates, No. 567 ; *Hume, No.* 320.

Not uncommon, more especially to the east. I saw it several times in the lofty peaks about Hungrum and Lere ; but failed to get its nest.

(237) C. SUPERCILIARIS.—The White-browed Blue Fly-catcher.

Oates, No. 568 ; *Hume, No.* 310.

Not rare in the same parts as the last bird. I took a nest on the road between Hungrum and Lere, which *may* have belonged to this species. I found the nest in a hole in a way-side stump and shot a male *C. superciliaris* which was fluttering about the tree in a great state of excitement. The nest was a mass of moss, with a neat little cup in the centre, and I think there is no doubt that it did belong to a fly-catcher of some sort, but the egg is different in character to any other that I know of this family. The ground-colour is a greenish-greyish-yellow or yellow stone-colour, often enough to be seen in fly-catchers' eggs, but the stipplings are of grey and greyish-brown such as I have never met with.

Their distribution is not unusual, being fairly numerous over the whole surface, and forming, also, a well-defined ring. The shape is just like that described of *H. sibirica*, but somewhat blunter. The only egg the nest contained measured ·61″ × ·52″.

(238) C. MELANOLEUCOS.—The Little Pied Fly-catcher.

Oates, Nos. 569 ; *Humes, Nos.* 324 *and* 326.

A very common little bird in the cold season, many remaining throughout the year. They are sociable little birds, and I have several times seen two pairs together. Their song is very sweet, though weak.

(239) C. ASTIGMA.—The Little Blue and White Fly-catcher.

Oates, No. 570 ; *Hume, No.* 311.

A very rare bird, but resident on some of the higher peaks.

(240) C. OATESI.—The Rufous-bellied Blue Fly-catcher.

Oates, No. 572; *Hume, No.* 309 *Bis.*

I shot a male of this species on the 14th of April, 1892. This is the only one I have ever seen.

(241) C. UNICOLOR.—The Pale Blue Fly-catcher.

Oates, No. 574 ; *Hume, No.* 303.

Not rare, but very local. None near Gunjong, but generally to be met with more to the east.

(242) C. RUBECULOIDES.—The Blue-throated Fly-catcher.

Oates, No. 575 ; *Hume, No.* 304.

Almost the commonest fly-catcher in North Cachar and to be met with in numbers up to the highest hills.

In *most* birds of this district the red of the breast does run *well* up into the blue of the throat, sometimes reaching almost up to the chin.

(243) C. TICKELLI.—Tickell's Blue Fly-catcher.

Oates, No. 576 ; *Hume, Nos.* 305 *and* 306.

Very nearly as common as *C. rubeculoides*, but seems to keep more to the lower hills and valleys.

(244) C. MAGNIROSTRIS.—The Large-billed Blue Fly-catcher.

Oates, No. 577 ; *Hume, No.* 308.

The nest of this bird is exactly like that of the two last, but is more often than not placed on the ground or else in some hole in a bank. I have only seen one taken from a hollow tree. The eggs are also much the same, but average larger. Two clutches I have taken, both of two eggs, might have been taken for eggs of *Drymoichares nepa-*

lensis; the ground-colour is so much brighter and clearer than usual and, as with the eggs of that bird, the markings are nearly all confined to the larger end. The ground-colour is a pale clear greyish-green and the stipplings are of a dull purplish-red.

Another clutch is very different; the ground-colour is a pale stone yellow, but it is almost entirely obliterated by rather bright tan freckles, so that, at a short distance, the eggs appear to be a pale olive or tan brown. The largest egg is ·84″ × ·61″, and my smallest ·70″ × ·56″; the average of fifteen being ·79″ × ·58″.

The bird is by no means common, and it is now more than a year since I obtained my last specimen. Nearly all the birds I have got were trapped on the nests by the Nagas, who are wonderful adepts at catching and snaring all sorts of birds and animals. I have not heard it utter any song, but this will, most probably, be found to be the same as that of *C. rubeculoides* and *C. tickelli*.

(245) NITIDULA HODGSONI.—The Pigmy Blue Fly-catcher.

Oates, No. 578; *Hume, No.* 313.

On the few occasions I have met with this bird, it has appeared to me to be hunting the leaves for insects, much after the manner of some of the smaller babblers, but every now and then taking short flights after them into the air. It is not common, and I have not seen it below about 3,500 feet.

(246) STOPAROLA MELANOPS.—The Verditer Fly-catcher.

Oates, No. 579; *Hume, No.* 301.

By no means common in North Cachar.

(247) ANTHIPES LEUCOPS.—Sharpe's White-gorgeted Fly-catcher.

Oates, No. 584.

I shot a bird in 1889, which I then identified as belonging to this species, but I did not preserve the skin.

(248) A. POLIOGENYS.—Brook's Fly-catcher.

Oates, No. 586.

This is a very common bird in the cold season, but very few seem to remain to breed.

A nest—the only one I have ever seen of this species—was brought to me on the 19th June, together with a female. It was said to have been placed in amongst a number of large loose boulders on the bank of a steep, densely wooded nullah, at the bottom of which ran a small

stream. The nest, which was made entirely of moss, was of no particular shape outwardly and had probably fitted the base of the hole in which it was built. The egg cavity measured about 2·5″ across by about 1″ deep. The eggs, three in number, are of the *Cyornis* type; in ground-colour a very pale greyish-green; two eggs were covered with rather distinct freckles of reddish-brown, numerous everywhere, but more especially so at the larger end where in one they form a narrow ring. In the third egg the marks are of the same colour and character, but are confined almost entirely to the large end, there running into one another and forming a well-defined cap.

The three eggs measure ·77″ × ·56″, ·75″ × ·55″, and ·72″ × ·55″. They were just beginning to show signs of incubation.

(249) ALSEONAX LATIROSTRIS.—The Brown Fly-catcher.

Oates, No. 588; *Hume, No.* 297.

Only, I think, a winter visitant.

(250) A. RUFICAUDUS.—The Rufous-tailed Fly-catcher.

Oates, No. 589; *Hume, No.* 307.

I shot a bird which, I believe, belonged to this species in May, 1891, on the Hangrum Peak at about 5,600 feet elevation. I did not preserve the bird, and I cannot now be *absolutely* sure that my identification was correct.

(251) A. MUTTUI.—Layard's Fly-catcher.

Oates, No. 590; *Hume, No.* 299 *Ter. and No.* 307 *Bis.*

I found this little fly-catcher breeding in the Laisung Valley and took three or four nests. Unlike most of its nearest relations, it does not *invariably* place its nest on the ground or else in some hole or stump. The first nest I ever saw was one shown to me by a small Naga boy built in amongst a mass of wild raspberry shoots and neatly placed in a fork of one of the larger branches. The nest itself was a most beautifully compact, well-made little hemisphere of moss and lined with fine fern and moss roots.

In diameter it was about 2·8″ outwardly and 1·75″ or less inwardly, the depth of the cavity being about ·85″. It contained five eggs which bore the stamp "Fly-catcher's" plainly on them and but for their small size might well have been mistaken for eggs of *Cyornis*. The colour is pale stone, but this is almost entirely obliterated with the dense stipplings and freckles of light olive-brown, so completely

so that it requires most careful examination to discern the ground-colour at all.

The five eggs measure ·68″ × ·52″, ·67″ × ·54″, ·67″ × ·51″, ·68″ × ·52″, ·63″ × ·51″. The next was taken on the 1st of May, 1891.

(252) CULICICAPA CEYLONENSIS.—The Grey-headed Fly-catcher.

Oates, No. 592 ; *Hume, No.* 295.

Very fairly common up to about 2,500 feet, above which very few seem to wander.

(253) NILTAVA GRANDIS.—The Large Niltava.

Oates, No. 593 ; *Hume, No.* 316.

Common to the east above 3,500 feet, breeding everywhere above this height, but most commonly on the high peaks to the east of the sub-division.

(254) N. SUNDARA.—The Rufous-bellied Niltava.

Oates, No. 594; *Hume, No.* 314.

Much the rarest of the three niltavas in these hills; the distribution being the same as that of the last, *i. e.*, everywhere and anywhere during the cold weather, but confined to the higher ranges after March.

(255) N. MACGRIGORIÆ.—The Small Niltava.

Oates, No. 595 ; *Hume, No.* 315.

This little niltava is very common on the Hangrum and Léri ranges, breeding in great numbers on all the peaks over 4,000 feet. The nest here is generally placed in amongst the stones which lie all over the hills of these two ranges, often forming regular banks or walls. The eggs vary very much, some I have being just like those of *Microcichla scouleri*, others miniature facsimiles of the eggs of *N. grandis, stoparola*, etc.

(256) TERPSIPHONE AFFINIS.—The Burmese Paradise Fly-catcher.

Oates, No. 599; *Hume, No.* 289.

It may be as well to put on record here the changes of plumage undergone by a young bird I kept in captivity in a large wire aviary for over two years. It was brought to me in the autumn, being then in its first plumage.

Forehead and crown black, fading into dark ashy on the chin, throat and upper breast ; the nape is a darker shade of the same colour and is slightly glossed ; the back, rump, upper tail coverts, tail and wing coverts bright, dark chestnut ; primaries chestnut-brown, edged

with chestnut ; remainder of lower plumage ruddy-orange, inclining to albescent on the belly. (This is not invariably the case.)

Second year the bird assumed the black plumage of the adult, but the chestnut plumage remained the same, the breast below the black and the belly turning white, and two long chestnut tail feathers appearing.

In the third year the bird was in a sort of transition stage, retaining the chestnut upper tail coverts and many chestnut feathers in the wing coverts and scapularies.

Amongst the peculiar forms I have seen was a young cock with the quill feathers of the wing mixed chestnut and white, most of the primaries being of the former and most of the secondaries of the latter colour. Another young male shot on the nest had the following plumage : head and crest, black; cheeks, shoulders, chin and breast, grey below albescent ; remainder of plumage that of male of second year, but with the long feathers white, and a single white feather in the upper tail coverts. A remarkable form, which I once saw, consisted in the retention of the grey plumage of the young bird on the nape and breast, whilst elsewhere the plumage was that of the adult.

Old males often have the pair of feathers next the central ones much lengthened, sometimes as much as to 7 or 8 inches.

In May, 1890, I took a most peculiar nest of this bird, the outside of one half and the bottom of the interior were entirely coated with mud. The nest contained three eggs, and I shot the female as she flew off the nest.

My eggs—and I have measured about 80—average far smaller than those mentioned in Hume's "Nests and Eggs" (Vol. II, p. 47), being only ·75″ × ·55″. April 14th is the earliest date on which I have taken eggs and July 10th the latest.

(257) HYPOTHYMIS AZUREA.—The Indian Black-naped Fly-catcher. *Oates, No.* 601; *Hume No.* 290.

The commonest fly-catcher in North Cachar.

(258) CHELIDORHYNX HYPOXANTHUM.—The Yellow-bellied Fly-catcher. *Oates, No.* 603 ; *Hume, No.* 294.

I have had two nests brought to me, said to belong to this species. The first nest was brought without the bird, but a bird of this genus was trapped and brought in afterwards. In shape the nest was a *very*

compact, deep little moss cup with straight walls, the base being, if anything, broader than the top, in diameter not more than 2″ and about 2·5″ in depth, whilst the egg cavity measured about 1·4″ by 1″. Nothing was used in its construction except moss, and there was no lining. This nest was said to have been built on the ground amongst a quantity of small boulders beside the Laisung Stream. The second nest was brought to me with the parent bird in May, 1892, and exactly resembles that just described in every respect. Instead, however, of having been built on the ground, it was placed on a horizontal branch just as are so many nests of *R. rhipidura*. The first nest contained three eggs of a type quite unlike that of *R. rhipidura*, and I cannot help thinking I was deceived with them. The ground is a very faint creamy-white, and the markings consist of a few faint blotches of reddish-brown. The shape is long and rather pointed, the texture coarse and strong for the size of the egg, and, though smooth, exhibits no gloss. They measure ·61″×·41″, ·61″×·41″ and ·60″×·40″.

The second nest also contained three eggs, two of which were too much broken to preserve. The third egg (the other two closely resembled it) is a broad obtuse oval, measuring ·55″ × ·45″; the shell fragile and smooth without any gloss.

In colour it is white faintly tinged with yellow-cream, and it is spotted and blotched profusely at the larger end with grey and yellowish-brown, the blotches forming a blurred and badly defined ring.

I believe both the nests to have belonged to *Chelidorhynx*; but, if the last described egg is correct, then the others cannot be, unless, which is unlikely, the eggs of this bird vary as much as do those of *Franklinia* and *Alcippe*.

(259) Rhipidura albifrontata.—The White-browed Fantail Fly-catcher.

Oates, No. 604; *Hume No.* 292.

Though not very common, still by no means as rare as one would imagine, considering how seldom it is met with in other parts of Assam.

(260) R. albicollis.—The White-throated Fantail Fly-catcher.

Oates, No. 605; *Hume, No.* 291.

Rather more common than the last.

Family *Turdidæ*.

Sub-family *Saxicolinæ*.

(261) PRATINCOLA CAPRATA.—The Common Pied Bush-Chat.

Oates, No. 608 ; *Hume No.* 483.

A common bird ; a few resident throughout the year.

(262) P. MAURA.—The Indian Bush-Chat.

Oates, No. 610 ; *Hume, No.* 483.

A very common bird throughout the cold season, but very few seem to stay to breed. During the six years I have been in Cachar I have taken but a single nest, and have seen but few birds during the breeding season. Those I have seen were all at an elevation of about 4,000 feet.

(263) P. LEUCURA.—The White-tailed Bush-Chat.

Oates, No. 611 ; *Hume, No.* 484.

I have seen very few specimens of this bird in North Cachar, and all my notes refer to birds seen in April and May, so that it would seem that these birds merely pass through North Cachar on the way to their breeding haunts, which may, possibly, be some of the high ranges in the Naga Hills of Manipur.

(264) OREICOLA JERDONI.—Jerdon's Bush-Chat.

Oates, No. 614 ; *Hume, No.* 487.

Very common in the cold weather, and some few do undoubtedly remain here to breed on the higher hills, but hitherto I have never been so fortunate as to get their nest or eggs.

(265) O. FERREA.—The Dark Gray Bush-Chat.

Oates, No. 615 ; *Hume, No.* 486.

Even more common than the last bird and a good many stay and breed in the east of the District, here and there also a pair remaining elsewhere. On one occasion only have I found a nest; this was in 1890, but the nest and eggs were just as usual, and I seem to have recorded no notes on them.

Sub-family *Ruticillinæ.*

(266) HENICURUS GUTTATUS.—The Eastern Spotted Fork-tail.

Oates, No. 631 ; *Hume, No.* 584 *Bis.*

Fairly common everywhere, but deserting the larger streams and rivers entirely during the breeding season. Most of my eggs are decidedly drawn out and often considerably pointed towards the smaller end, and almost invariably they are very long in proportion to their

breadth; of course, their size renders them distinguishable from all other fork-tails' eggs, except *H. leschenaulti*, and from these they differ a good deal in colour. Most of my eggs have the markings consisting principally of fair-sized blotches, and, in two out of three, these are almost entirely confined to the larger end. The ground is white generally tinged with green, less often with grey or greyish-yellow; generally, too, the markings are of a reddish-brown, but they also vary considerably, ranging between clear pale rufous-red and a dark violet-brown, now and then pale violet spotted eggs being met with.

(267) H. SCHISTACEUS.—The Slaty-backed Fork-tail.

Oates, No. 632; *Hume, No.* 586.

The bird of these hills averages very small, and the following are the measurements of the birds I have met with :—

Length 8·2″ to 8·6″ according to the length of the tail 4·4″ to 4·8″ (one bird measured 8·8″ and had a tail almost 5″); wing 3·3″ to 3·6″; bill at front ·6″ and from gape ·8″; tarsus ·97″.

All the specimens in the Indian Museum, Calcutta, are far below Oates' measurements.

In immature birds the crown of the head is a rusty-black. My eggs are like those described in Hume's "Nests and Eggs," but are *not* like those of *H. guttatus*. In most of my eggs the spots are pretty equally distributed over the whole surface.

(268) H. IMMACULATUS.—The Black-backed Fork-tail.

Oates, No. 633; *Hume, No.* 585.

Just as common as the last bird.

I have taken numerous nests and have found them to exactly resemble those of *H. schistaceus*, though the lining of skeleton leaves, so invariably found in nests of that bird, are not quite so invariably found in those of the present bird.

The eggs, too, closely resemble those of *H. schistaceus*, but on the whole they are decidedly darker, both in general colour and markings, which are generally more numerous also. I have never seen a ring or cap in any of these birds' eggs.

(269) H. LESCHENAULTI.—Leschenault's Fork-tail.

Oates, No. 634; *Hume, No.* 584 *Ter.*

Very rare in North Cachar and, as far as I know, entirely confined to the Laisung River and the small streams which empty themselves

into it. I have taken three nests, each containing three eggs. All three were very massive deep cups made of moss, two being thickly lined with skeleton leaves and the third having some half a dozen of them quite at the bottom of the cup. Outwardly the nests varied in diameter from 6″ to 7·5″, and in depth from 3·75″ to 4·5″. Internally the egg cavities measured about 3·5″ across by 2″ to 2·5″ deep.

Of the three nests, one was placed in a hollow amongst the roots of a large tree growing on the banks of the Laisung ; another was placed under a large boulder, over which water was perpetually falling, though not exactly over the part under which the nest rested ; and the third was built in amongst the loose stones of a dry nullah in the Laisung Valley. The first two nests were very well hidden, but the last mentioned could be seen from a distance of three or four paces, being only half concealed by a projecting stone, and there being practically no small vegetation about it.

The eggs are of two types. Six eggs are much like the commonest type of *H. guttatus*, the ground-colour a pale greenish-white and much blotched and speckled with pale pinkish-brown and lavender, so numerous as to run into one another at the larger end, thence gradually decreasing in number as they approach the smaller; they can be distinguished from the eggs of *H. guttatus* by their greater dullness, somewhat browner tint, and less defined markings.

The second type is exactly matched by a clutch of eggs I possess of *Limonidromus*. The ground-colour is a dull yellowish stone-colour far deeper in shade than that of any other fork-tail's eggs I have seen, and it is marked with small blotches of light brown, and others, secondary, of lavender-gray, both, in especially the latter, smudgy and indistinct. These eggs have the blotches evenly distributed over the whole surface but nowhere very numerous. In shape the eggs are long ovals, but slightly pointed, and the texture is very coarse and quite glossless ; the shell is thin and fragile.

The nine eggs measured between ·95″ and 1·03″ in length and in breadth varied between ·67″ and ·71″, the average being ·98″ × ·70″.

(270) MICROCICHLA SCOULERI—The Little Fork-tail.

Oates, No. 637 ; *Hume, No.* 587.

I have only taken one nest, capturing at the same time one of the parent birds. In a deep ravine running into the Laisung I saw one

of these birds fly into a deep rift in a massive piece of flat rock, and, on examining the place, saw the nest with the bird on it and, before she had time to fly out, thrust my hand into the hole and caught her. The nest was oblong in shape, being about 3″ across and fully 6·5″ in length, fitting the bottom of the rift, well into the back of which it was placed. It was made of moss as usual, but of very small, short pieces, and was also lined in the typical fork-tail manner with skeleton leaves, though these were rather small and scanty. The cup was almost a perfect hemisphere, measuring 2·3″ by 1·2″.

There were only two eggs, those being of a very pale *clear* stone-colour blotched with pale reddish, and, where they form a ring at the large end, they are also intermixed with a few others of pale lavender-grey. The character of the markings are longitudinal in the same way as with all the eggs of this family. The shell is smooth and fragile with a slight gloss ; still the texture is not at all fine. In shape they are long ovals compressed suddenly for fully two-thirds of their length, and they are decidedly pointed. They measure ·77″ × ·53″ and ·72″ × ·53″.

This member of the sub-family is decidedly rare here ; twice during the cold weather I have seen it on the Jetinga, a big stream, and a few times on smaller ones. Like some of its larger brethren, it is a bit of a bully, and I once watched a pair for some time engaged in bully-ragging a plumbeous redstart (*Rhyacornis fuliginosus*).

(271) CHIMARRHORNIS LEUCOCEPHALUS.—The White-capped Redstart.

Oates, No. 638 ; *Hume, No.* 506.

About the most common of the frequenters of rivers and streams in North Cachar during the cold weather, and a few birds undoubtedly *do* breed on the higher streamlets, as I have on the following dates recorded having seen them :—11th and 13th May, 1891, 24th May, 1892, 7th June, 1891, and 10th July, 1892. The remains of a nest were brought to me by a Naga, containing two sound and one broken egg, together with the remnants of a white-capped redstart which was *said* to have been caught on the nest.

This (the nest) was too much broken and torn to give any idea of what its original shape was, beyond that it was a somewhat bulky affair of moss, lined with moss roots and dead (not skeleton) leaves.

The eggs are pure glossy-white speckled and blotched with bright rufous-red, with a few secondary small blotches of lavender confined entirely to the larger end. The marks are very numerous at this end, decreasing towards the smaller. In one egg, quite at the extremity of the larger end, there is a fairly distinct ring about ·2″ wide, and in the other there is a very ill-defined cap. They are very bright, glossy eggs, smooth and close-grained, but rather brittle. They are long ovals, one being very obtuse, the other rather pointed; the former measures ·89″×·62″, and the latter ·9″×·6.″

(272) RUTICILLA FRONTALIS.—The Blue-fronted Redstart.

Oates, No. 639 ; *Hume, No.* 503.

A very rare resident. I have shot one bird in Gunjong (2,500 feet), and another near Halflong (about 3,500).

(273) R. AUROREA.—The Daurian Redstart.

Oates, No. 641 ; *Hume, No.* 500.

Not at all rare from October to March.

(274) R. HODGSONI.—Hodgson's Redstart.

Oates, No. 643 ; *Hume, No.* 498.

I have shot but three of Hodgson's redstart, all males and all shot between the 1st November and 15th January.

(275) R. RUFIVENTRIS.—The Indian Redstart.

Oates, No. 644; *Hume, No.* 497.

Very common during the winter, and as many birds do not leave until late in April their breeding place must be somewhere near North Cachar, a few probably remaining to breed. A nest containing a single egg which was brought to me belonged, I am almost sure, to a redstart of sorts and more likely to this than to any other species.

(276) RHYARCORNIS FULIGINOSUS.—The Plumbeous Redstart.

Oates, No. 646 ; *Hume, No.* 505.

Extremely common from the beginning of October to the end of March, but I have seen none during the other six months. I imagine that the young males do not don their full plumage until the second year, as many males shot during the months above mentioned were in female plumage. For every male shot in North Cachar I think there must be fully three females, and to every bird in full male attire there are nearly twenty in female dress.

This little redstart seems to feed principally on the wing, and it is also a very late feeder. I have watched it catching mosquitoes over a rapid, seating itself on the stones and shingle forming the bank of the river, thence taking flights after its prey and when I finally left it was too dark to see its dusky little form against the dark water or grey stones, but when I *did* last see it, it was still actively engaged in dining.

(277) CYANECULA SUECICA.—The Indian Blue-throat.

Oates, No. 647; *Hume, No.* 514.

Shot a male in October, 1889.

(278) CALLIOPE CAMTSCHATKENSIS.—The Common Ruby-throat.

Oates, No. 650; *Hume, No.* 512.

By no means a very rare visitor in North Cachar and extends well into the plains. Mr. H. A. Hole sent me a beautiful specimen of this bird and also one of the next to identify for him. Both these were, I believe, got by him in the plains, at the foot of the North Cachar Hills, and I see that, in a late issue of the *Asian*, he records both these birds as being common.

(279) C. TSCHEBAIWEI.—The Tibet Ruby-throat.

Oates, No. 652.

A rare but regular winter visitant.

(280) TARSIGER CHRYSÆUS.—The Golden Bush-Robin.

Oates, No. 653; *Hume, No.* 511.

A rare bird but resident, breeding in the higher ranges and valleys. An egg was brought to me by a very intelligent and honest Naga, which was said to have belonged to this bird. Oates' description in Hume's "Nests and Eggs" (2nd Edn. Vol. II, p. 68) would do equally well for this one, *i.e.*, "very regular oval, a little pointed towards both ends; the surface of the shell is rather uneven, but there is a fair amount of gloss * * The colour is a uniform rather deep blue." My egg measures ·79″×·58″. No nest was brought to me, but I was told that it was made of moss and leaves, lined with the latter, and that it was placed in a hollow of a stump. The nest was taken at an elevation of over 4,000 feet. I believe this egg to be authentic.

(281) IANTHIA RUFILATA.—The Red-flanked Bush-Robin.

Oates, No. 654; *Hume, No.* 508.

I shot a single female in the winter of 1886-87.

(282) I. INDICA—The White-browed Bush-Robin.

Oates, No. 655 ; *Hume, No.* 510.

I have shot three of these birds, all obtained on the same day in January, 1892, at Halflong. These birds were catching insects on a huge leafy tree in thin forest ; they were searching the leaves, making occasional dashes into the air as the insects they disturbed tried to escape them. The stomach of one contained a large mass of half-digested insects, most of which appeared to be a kind of small yellow beetle, and one other which looked like a small golden tree-bug.

(283) NOTODELA LEUCURA.—The White-tailed Blue-Robin.

Oates, No. 659 ; *Hume, No.* 477.

Very common everywhere above 3,000 feet and breeding freely above that elevation.

(284) COPSYCHUS SAULARIS.—The Magpie-Robin.

Oates, No. 663 ; *Hume, Nos.* 475 and 475 *Bis.*

Very common everywhere. I have noticed it in the Lèri Range at elevations over 5,000 feet, in some places over 6,000.

(285) CITTOCINCLA MACRURA.—The Shama.

Oates, No. 664 ; *Hume, No.* 476.

Common up to about 3,000 feet, above which I have very seldom noticed it ; never over 3,300 feet.

Sub-family *Turdinæ.*

(286) MERULA ALBICINCTA.—The White-collared Ouzel.

Oates, No. 672 ; *Hume, No.* 362.

I have only seen this bird on a tiny stream running below the village of Ninglo, about 3,800 feet altitude. I did not shoot it, but it was very distinctly visible as it sat on a small sapling, and I do not think I could have made a mistake in my identification.

(287) M. CASTANEA.—The Grey-headed Ouzel.

Oates, No. 673 ; *Hume, No.* 363.

A not uncommon visitor during the winter, descending to the level of the plains.

(288) M. FUSCATA.—The Dusky Ouzel.

Oates, No. 674 ; *Hume, No.* 366.

I have but two birds, which I can with absolute certainty assign to the species. These are both females and were shot at an elevation of about 3,000 feet.

(289) M. RUFICOLLIS.—The Red-throated Ouzel.

Oates, No. 675 ; *Hume, No.* 364.

This is recorded from Cachar, but I have not obtained a specimen.

(290) M. BOULBOUL.—The Grey-winged Ouzel.

Oates, No. 676 ; *Hume, No.* 361.

Very common during the cold weather, and a good many birds stay and breed, though the majority migrate elsewhere, in all likelihood to the higher ranges of hills in the Naga Hills District and some to Manipur.

(291) M. ATRIGULARIS.—The Black-throated Ouzel.

Oates, No. 677 ; *Hume, No.* 365.

Extremely common, and may often be seen in considerable numbers feeding together in the rice *jhums*. Nearly the whole of the visible portions of the under tail-coverts are whitish, and it is only in summer, when the feathers are abraded, that the brown shows at all distinctly. The mouth is yellow, and in young birds the commissure, on the upper mandible, is tinged yellow.

I had a bird sent to me to identify, which had been shot by Mr. H. A. Hole in the plains, I believe in April.

(292) M. PROTOMOMELÆNA.—The Black-crested Ouzel.

Oates, No. 679 ; *Hume, No.* 358.

The only bird I have seen of this species was one shot by my taxidermist on the 20th February, 1893.

This was a female, and was obtained on a hill over 3,000 feet high, feeding high up in a large tree.

(293) M. OBSCURA.—The Dark Ouzel.

Oates, No. 680 ; *Hume, No.* 369 *Bis.*

I shot one of these birds out of a flock of five, which were all together on a high tree. It was shot on the same hill as that on which the last bird was obtained.

The irides are a dull brown, the legs dark fleshy-brown, and the lower mandible yellow with a dark tip.

(294) M. FEÆ.—Fea's Ouzel.

Oates, No. 682 ; *Hume, No.* 369 *Ter.*

A sepoy shot one of these birds feeding on a large cotton-tree close to the stockade, and the skin was brought to me ; but it was far too

much torn to be of any use, though I had no doubt as to its being a skin of *M. fœæ*.

(295) GEOCICHLA WARDI.—The Pied Ground-Thrush.

Oates, No. 683 ; *Hume, No.* 357.

A rather rare resident in North Cachar. I have taken but one nest, which might have been mistaken for one of *G. citrina*, but was more massive than most of that bird. The eggs were three in number and just like English blackbirds', measuring 1·07″ × ·81″; 1·09″ × ·8″ and 1·01″ × ·79″.

(296) G. CITRINA.—The Orange-headed Ground-Thrush.

Oates, No. 686 ; *Hume, No.* 355.

Very common all over the district, but not ascending quite the highest ranges and seldom breeding below 1,000 feet.

The average of 40 eggs is 1·05″ × ·765″, the greatest length and breadth being 1·13″ × ·81″ and the least ·91″ × ·71.″

(297) PETROPHILA ERYTHROGASTRA.—The Chestnut-bellied Rock-Thrush.

Oates, No. 690 ; *Hume, No.* 352.

Not very common at any time and found only on the higher ranges during the breeding season.

(298) P. CINCLORHYNCHA.—The Blue-headed Rock-Thrush.

Oates, No. 691 ; *Hume, No.* 353.

Rather common all through the cold weather, a few birds remaining to breed on the most lofty peaks. My eggs are all of one type, *viz.*, a pale buff ; darker than in *Geocichla* or *Merula* eggs, marked indistinctly with freckles and specks of pale brown and very pale grey, and with a few irregular-shaped spots and blotches of umber-brown. The three clutches, each of three eggs, which I have measured, average respectively 1·04″ × ·71″, 1·06″ × ·68″ and ·91″ × ·71″.

(299) P. SOLITARIA.—The Eastern Blue Rock-Thrush.

Oates, No. 692 ; *Hume, No.* 351 *Ter.*

Very common all through the cold weather, its favourite haunts being the lofty, rocky banks of some of the larger streams. It descends, of course, well into the plains.

Its note is a low chuckling "chur," sounding almost like the croak of a frog.

(300) OREOCINCLA DAUMA.—The Small-billed Mountain-Thrush.

Oates, No. 698 ; *Hume, No.* 371.

This thrush is very rare here, but probably the few there are are resident, for I once shot a pair in June and these on dissection proved to be breeding, the female containing eggs, the first of which would have been laid in some three or four days. No nest could, however, be found, though a good deal of time and trouble was spent in the search.

(301) O. MOLLISSIMA.—The Plain-backed Mountain-Thrush.

Oates, No. 701 ; *Hume, No.* 370.

Rare. Probably resident, but as yet I have never met with it either in the hot weather or rains.

(302) ZOOTHERA MONTICOLA.—The Large Brown Thrush.

Oates, No. 704 ; *Hume, No.* 551.

I have not met with this bird half a dozen times in as many years —never except from November to February. I doubt if it is resident here, though it may, probably, breed in the higher parts of Manipur and the Naga Hills. Of the five birds I have shot, four were males (three young and one adult) and the fifth was a young female.

(303) Z. MARGINATA.—The Lesser Brown Thrush.

Oates, No. 705; *Hume, No.* 350 *Bis.*

The commissure is reddish, paler than the rest of the bill. The young bird differs from the adult only in having the tips of the wing-coverts *all* with fulvous spots and the black margins of the feathers of the lower plumage broader ; thus making the breast look almost wholly black. By no means common, but found scattered throughout the district in the cold weather ; in the hot weather and rains being confined chiefly to the high ranges of the east, where it breeds in June and July. The first nest I ever took of this bird was rather abnormal in its construction, so I give the description of it which appeared at the time in the *Asian.*

"The only nest I have ever seen of this bird was found on the 18th of June, 1890, and was taken from a thick tangle of cane-bush and creepers, in which it was placed at a height of some six feet from the ground. My attention was attracted to the bush in question by the bird flying out, and, on shooting it, I found it to be of this species. The nest was placed well inside the bush, and it was not until I had cut away a considerable amount of leaves and branches that I could get at

it. It was a rather massive, shallow cup, about 4″ in internal diameter by rather more than 1″ in depth ; the exterior materials were coarse fern roots, grass, twigs, and dry stalks of plants, all intertwined with one another, and with here and there a dead leaf fastened in. The lining was of grass and fine fibres and was fairly thick."

The eggs, which were three in number, are quite like the eggs of *G. citrina* in appearance ; the ground-colour is a pale greeny-grey profusely speckled with a reddish-brown, the markings coalescing to the larger end and gradually decreasing towards the smaller. They were hard-set, therefore the shell was very fragile, otherwise much as in *G. citrina*. In size they are larger than the average egg of that bird, measuring 1·09″ × ·8″, 1·08″ × ·76″ and 1·08″ × ·75″. The next nest taken was found on the 12th June, 1892. In shape, position, &c., it was just the same as that described above, merely being a shade smaller ; the material used, however, was three-quarters moss mixed with a few twigs and roots, and lined with moss and fern roots. This nest contained three eggs of the same character as those already described, but having a pale yellow-buff ground-colour, and the blotches far redder and somewhat brighter.

One egg was smashed before being measured ; the other two were 1·14″ × ·82″ and 1·1″ × 81″.

Several nests taken in July this year (1893) were made entirely of living moss outwardly, then moss both dead and alive mixed with fern and moss roots, and with the lining of fine moss and fern roots. In a few nests there were a certain number of fine bamboo roots used next the lining ; in one or two nests there were a few twigs, and in one three leaves and a bamboo spathe. In size these nests averaged about 5·75″ across and 2·25″ deep, the inner cup being about 3·6″ × 1·5″.

The eggs were like those already described.

(304) COCHOA VIRIDIS.—The Green Thrush.

Oates, No. 707 ; *Hume, No.* 608.

Reported from Cachar, but I have not yet obtained a specimen.

(305) CINCLUS ASIATICUS.—The Brown Dipper.

Oates, No. 709 ; *Hume, No.* 347.

Very common on all the larger streams during the cold weather, descending well below 1,000 feet. I took a nest of this dipper from the banks of the Laisung, high up near its source. It was a large and

massive oval made of moss and leaves, and was placed in between two rocks, being covered by a third. In height it was about 8″, in length only about 6½″ owing to the walls, where they came next the rocks, being much thinner than the base or roof. The interior must have been very nearly a perfect sphere, some 4″ in diameter. The eggs were so unlike what I expected that, had I not found the nest myself and repeatedly seen the parent birds I should have believed them to belong to *Garrulax leucolophus*. Like the eggs of that bird, these possessed a hard glossy shell, and in the same way also the surface was distinctly pitted.

The four eggs measure 1·12″ × ·88″, 1·12″ × ·88″; 1·11″ × ·88″ and 1·09″ × ·89″.

(306) C. PALLASI—Pallas's Dipper.

Oates, No. 710; *Hume, No.* 349 *Bis.*

I got two specimens of this bird on a small stream running into the Jiri River at an altitude of about 3,500 feet. I also saw what I believed to have been this species on the Ninglo Stream; but, as I did not shoot it, I cannot be certain. This year (1893) a pair were to be seen every day in July on the Laisung Stream; but they were very wild and would not allow any one to approach within shooting distance.

Family *Ploceidæ*.

Sub-family *Ploceinæ*.

(307) PLOCEUS MEGARHYNCHUS.—The Eastern Baya.

Oates, No. 721; *Hume, No.* 694 *Bis.*

Very common indeed up to 2,500 feet, and less so up to some 500 feet higher, above which height I have not seen it.

(308) P. BENGALENSIS.—The Black-throated Weaver-Bird.

Oates, No. 722; *Hume, No.* 696.

Only met with at the foot of the North Cachar Hills. Once I came across a small colony breeding on the Umrung Plateau, in 1890; but I have not since then seen any.

(309) P. MANYAR.—The Striated Weaver-Bird.

Oates, No. 723; *Hume, No.* 695.

As far as I have been able to ascertain, rare even in Cachar and only occurring in North Cachar as an occasional straggler.

Sub-family *Viduinæ*.

(310) MUNIA ATRICAPILLA.—The Chestnut-bellied Munia.

Oates, No. 726 ; *Hume, No.* 698.

Excessively common on the plains and close to them, but not common above 2,000 feet and very locally distributed. I have found them breeding as late as October.

(311) UROLONCHA ACUTICAUDA.—Hodgson's Munia.

Oates, No. 727 ; *Hume, No.* 702.

Extremely common from the level of the plains up to the highest elevations. Breeds principally in July and August, many in September, and I have taken a nest with fresh eggs late in December.

(312) U. PUNCTULATA.—The Spotted Munia.

Oates, No. 735 ; *Hume, No.* 699 (699 *Bis, Ter. and Quat.*).

Not common in the hills though very much so in the plains.

(313) SPORÆGINTHUS AMADAVA.—The Indian Red Munia.

Oates, No. 738 ; *Hume, No.* 704.

I have seen but one pair of these birds in North Cachar, though I believe they are by no means rare in parts of Cachar itself.

Family *Fringillidæ*.

Sub-family *Coccothraustinæ*.

(314) MYCEROBAS MELANOXANTHUS.—The Spotted-winged Grosbeak.

Oates, No. 744 ; *Hume, No.* 727.

In 1890 I saw a pair of birds near Hungrum, which, I feel sure, were of this species ; unfortunately I had not a gun with me so could not make *absolutely* sure of the fact, though it is unlikely that I could have been mistaken in so striking a bird. Hungrum is only about two miles from the borders of Manipur, in which state the bird was obtained by Godwin-Austen.

Sub-family *Fringillinæ*.

(315) PROPYRRHULA SUBHIMALAYENSIS.—The Red-headed Rose-Finch.

Oates, No. 752 ; *Hume, No.* 736.

I have seen this bird several times on the Léri Range.

(316) CARPODACUS ERYTHRINUS.—The Common Rose Finch.

Oates, No. 761 ; *Hume, No.* 738.

A very common winter visitant.

(317) HYPACANTHES SPINOIDES.—The Himalayan Green Finch.

Oates, No. 772 ; *Hume, No.* 750.

The only bird I have seen of this species was one brought to me by a Naga who had caught it near Asalu. It was a very dirty remnant, and it was impossible to tell the sex, but it was either a young male or a female.

(318) PASSER DOMESTICUS.—The House Sparrow.

Oates, No. 776 ; *Hume, No.* 706.

This bird does not ascend the hills at all in North Cachar, and, though they have twice been brought to Gunjong and turned out, they have all left.

(319) P. MONTANUS.—The Tree Sparrow.

Oates, No. 779 ; *Hume, No.* 710.

Fairly common on the north and west and very common elsewhere. I took a nest of this bird containing nine eggs, but as four of these were hard set and five fresh, I am inclined to think they were laid by two birds, more especially as the latter eggs seemed slightly darker and more *finely* marked than the former.

(320) P. CINNAMOMEUS.—The Cinnamon Sparrow.

Oates, No. 780 ; *Hume, No.* 708.

A rare bird in North Cachar. It appears to be very fond of perching on the extreme summit of dead branchless trees, and it is in such positions I have shot *all* the birds I have. My eggs average even smaller than Oates' dimensions in "Nests and Eggs" (Vol. II, p. 165). One of my eggs measures only ·69″ by ·54″.

Sub-family *Emberizinæ*.

(321) EMBERIZA FUCATA.—The Grey-headed Bunting.

Oates, No. 790 ; *Hume, No.* 719.

A not uncommon winter visitant.

(322) E. PUSILLA.—The Dwarf Bunting.

Oates, No. 791 ; *Hume, No.* 720.

Very common throughout the cold weather, arriving late in October or early November, and leaving at the end of March—a few as late as early April.

(323) E. AUREOLA.—The Yellow-breasted Bunting.

Oates, No. 797; *Hume, No.* 723.

A common winter visitant,

(324) E. SPODOCEPHALA.—The Black-faced Bunting.

Oates, No. 798 ; *Hume, No.* 717.

Uncommon in North Cachar ; but Mr. Hole reports it as common at the foot of the hills. The bill is dark horny-brown, two-thirds of the lower mandible, the commissure and gape pale, fleshy horny.

(325) E. RUTILA.—The Chestnut Bunting.

Oates, No. 801 ; *Hume, No.* 722 *Bis.*

I shot a pair of these birds and saw several others on the Halflong Peak in 1891.

(326) MELOPHUS MELANICTERUS.—The Crested Bunting.

Oates, No. 803 ; *Hume, No.* 724.

Very fairly common.

Family *Hirundinidæ.*

(327) CHELIDON NEPALENSIS.—Hodgson's Martin.

Oates, No. 807 ; *Hume, No.* 94.

In 1892, from the 1st to the 12th July, a number of these birds frequented my compound daily, often entering the verandahs of my house; and I began to hope they meant breeding in them; but, on the 13th, they all disappeared and I have seen none since.

(328) COTILE RIPARIA.—The Sand Martin.

Oates, No. 808 ; *Hume, No.* 87.

The only bird of this species that I have got in North Cachar was shot by me as it was hawking for insects which were rising from some grass being burnt near my bungalow. I saw one or two others the following day, but they were flying too high to shoot. A colony of these sand martins used to breed on the banks of the Barak, just below Lukhipore in Cachar, and probably do so now. Early in November, 1888, they were busy breeding there.

(329) C. SINENSIS.—The Indian Sand Martin.

Oates, No. 809 ; *Hume, Nos.* 88 *and* 89.

Some of these birds used to breed in a lofty sandy bank of the Diyung ; but one year, during some heavy floods, the face of this bank was washed away, and the nest-holes all destroyed. The following year the birds all left and have made no attempt to breed anywhere near the same place.

(330) HIRUNDO RUSTICA.—The Swallow.

Oates, No. 813 ; *Hume, No.* 82.

There is no bird in North Cachar which is an absolute typical *H. rustica*, still there are many which are nearer to this than to the next species. I say species, as Oates puts them as such, and I am following his classification ; but I do not for a moment consider the birds distinct myself.

(331) H. GUTTURALIS.—The Eastern Swallow.

Oates, No. 87 ; *Hume, No.* 82 *Bis. and No.* 82 *Quat.*

Common all over North Cachar, breeding in large numbers in the Naga villages. I have a bird of this species, with a pure white chin and throat, the lower throat, next the pectoral band, being mottled with rufous. I have yet another bird, which is a hybrid between this type and *H. daurica* or *H. nepalensis* ; the striations are perfect and the tail is marked like that of *H. rustica* or *H. gutturalis.*

(332) H. TYTLERI.—Tytler's Swallow.

Oates, No. 815; *Hume, No.* 82 *Ter.*

I have seen very few of these birds ; but Mr. H. A. Hole says, in a late number of the *Asian* : "I have only seen them in *any numbers* during the cold weather," so I presume they are common about Jellalpur during that season, and comparatively rare during the hot weather and rains.

(333) H. SMITHII.—The Wire-tailed Swallow.

Oates, No. 818; *Hume, No.* 84.

I have only noticed this bird as a migrant through North Cachar, and I do not think it ever breeds here.

(334) H. STRIOLATA.—The Japanese Striated Swallow.

Oates, No. 820; *Hume, No.* 85 *Quat.*

This is one of the swallows, specimens of which are often difficult to identify correctly ; personally, I do not consider this form and *H. nepalensis* distinct, and have birds with wing measurement intermediate between the limits assigned by Oates to either bird.

A nest was brought to me together with a male typical *H. striolata*, which was said to have been caught on it. The nest was just like that of *H. rustica*, but very bulky, and was built on a rafter in the *guest* house of the village. I should have expected the eggs of this bird to be white, but the four the nest contained were very boldly

marked, even more so than most eggs of *H. rustica* or *H. gutturalis*. They measured ·72″ × ·51″, ·73″ × ·5″, ·72″ × ·5″ and ·71″ × ·5″.

(335) H. DAURICA.—The Daurian Striated Swallow.

Oates, No. 821; *Hume, No.* 85 *Ter.*

A great many swallows in North Cachar are of this form, having the lower surface distinctly suffused with rufous.

A nest taken on the 17th May, 1891, was like the nest of *H. rustica*, but with the mud shell very thin—not more than ·25″ in the thickest portion.

(336) H. NEPALENSIS.—Hodgson's Striated Swallow.

Oates, No. 822; *Hume, No.* 85 *Bis.*

The common form in North Cachar, but few birds breed here, though every now and then a pair or two may be met with building in the Naga villages, and I have taken one or two of their nests.

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Isaac Pergamin. del.

Mintern Bros. Chromo Lith. London.

THE POISONOUS PLANTS OF BOMBAY.

Moringa pterygosperma. Nat. Ord. Moringeæ.

½ Nat. size. A. Fruit. B. Horizontal section.

THE POISONOUS PLANTS OF BOMBAY.

By Surgeon-Major K. R. Kirtikar, I.M.S., F.L.S.,
Acting Professor of Botany, Grant Medical College.

PART X.

(*With Plates L and Supplementary L.*)

(*Continued from Vol. IX, page* 60.)

MORINGA PTERYGOSPERMA—(Gært).

Natural Order—Moringeæ.

MARATHI—शेगट; शेवगा.

The tree is commonly known as the horse-radish tree. Some call it the drum-stick tree. Sir George Birdwood calls it the *smooth* horse-radish tree.

ROOT.—Pungent; young parts tomentose or puberulous.

BARK.—Soft, gray, corky, whitish-green covered with a fine brownish epidermis; innermost part white; external surface reticulate, about one inch thick; deeply cracked; the bark of the young branches of some varieties of this tree is distinctly crimson; the ventral surface of some petioles is in such cases tinged with light crimson; the dorsal surface on the other hand is light green.

WOOD.—Soft, light, coarse-grained, spongy, perishable, white; rather light brown says Jaikisson Indraji. Young wood and branches very brittle and break with almost a resinous fracture.

From incisions, made on the trunk by the human hand or by insects which infest the bark, there exudes a pinkish, reddish gum in vermicular tears.

LEAVES.—Alternate, decompound, 1 to 2 ft. long, 2 to 3-odd-pinnate; usually 3-odd-pinnate near the extremities of branches.

Pinnæ.—4 to 6 pair, opposite; the lower 3 to 4 pair, bipinnate.

Pinnulæ.—Opposite, 6 to 9 pair; the four lower pair generally with 3 to 7 leaflets; the rest consisting of single leaflets.

Leaflets.—6 to 9 pair, opposite, ½ to ¾ inch, quite entire, ovate or obovate, blunt; lateral nerves indistinct, glaucous-green above, pale beneath, slightly pubescent along the midrib beneath, caducous as well as the pinnules.

PETIOLE.—Slender, sheathing at the base.

PETIOLULE.—Slender, short.

Note that the petioles, petiolules, and leaves are all articulated at base.—(Baillon).

STIPULES.—Absent ; glands instead, linear, hairy, stalked. These glands are sometimes also found at the origin of the petiolules and leaflets.

INFLORESCENCE.—Axillary ; in numerous panicled racemes ; spreading at the ends of branches. Baillon says that the inflorescence " consists of very numerous flowers in much ramified racemes of cymes."

BRACTS.—Linear, shorter than pedicels.

ÆSTIVATION.—Slightly imbricate.

FLOWERS.—Very numerous, rather large ; white, yellowish-white, or reddish-white ; irregular, hermaphrodite, pedicelled, 1 inch in diameter, honey-scented; pedicels 6 to 8 lines long. Baillon observes that " the receptacle of the flower is cup-shaped, lined by a glandular disk with a prominent free border; on its oblique mouth are supported the perianth and androecium, while the gynœcium springs from the bottom." (" Natural History of Plants," Vol. III, 1874).

CALYX.—Cup-shaped, 5-cleft.

SEPALS.—Distinctly petaloid, unequal, linear-lanceolate, reflexed, deciduous ; sometimes tinged pink and white, sometimes greenish-white. Baillon observes that " the præfloration of the sepals is quincuncial." (Vide *Supplementary Plate L.*) The five alternating petals are usually of cochlear-imbricate præfloration. The anterior, internal in the bud, and differing in form slightly from the rest, remaining erect on anthesis, while they become reflexed on the receptacle like sepals.

COROLLA.—Petals free, 5, unequal, linear, narrowly spathulate ; according to Hooker the upper petals are smaller. Lindley describes them as " ascending ;" the lateral petals are ascending ; the anterior are larger. Le Maout and Decaisne describe the petals as follows :— " Five inserted on the calyx, linear, oblong, the two *posterior* (the italics are mine.—K.R.K.), rather the longest, ascending, imbricate in bud."

ANDRŒCIUM—

STAMENS.—Perigynous, unequal, inserted on the edge of the disk; declinate; in two whorls of five each; the outer whorl sterile, being reduced to mere slender antherless filaments; the inner whorl fertile, callous and villous at the base, superposed to or opposite the petals. Hooker and Brandis say that the sterile stamens are sometimes seven in number. Note that the sterile stamens are superposed to or opposite the sepals. Le Maout and Decaisne say that the stamens are 8 to 10, and line the base of the calyx. Baillon observes that "the androecium is most developed towards the anterior side of the flower, so that the fertile stamen superposed to the enveloped anterior petal is the longest of all; the posterior pair are the shortest." (Vide *Supplementary Plate L.*)

FILAMENTS.—Flattened and hairy at the base, free below, and above; slightly petaloid, connivent, united above the middle, unequal; the posterior ones longest; those opposite the calyx-segments shorter and imperfect.

ANTHERS.—Yellow, occasionally reddish; dorsifixed, consequently introrse; one-celled or simple as Lindley calls them, dehiscing longitudinally. Brandis describes them as oblong; Wight and Arnott describe them as peltate; Le Maout and Decaisne describe them as ovoid-oblong.

CONNECTIVE.—Thick, convex.

POLLEN.—Ovoid with three folds; in water it becomes spherical, with three papillose bands (H. Mohl, *Ann. Sc. Nat. Sér.* 2, III, 343, —quoted by Baillon).

DISK.—Concave; lining inside of calyx-tube, with a short free margin. Baillon, as referred to already, describes the disk as glandular; the colour of the disk is green.

GYNŒCIUM—

OVARY.—Superior, stipitate, hairy, lanceolate, one-celled, but composed of three carpels.

STYLE.—Slender, filiform, terminal, cylindrical, tubular (Baillon); obliquely recurved, but not obliquely inserted (Wight and Arnott); undilated at its stigmatiferous apex.

STIGMA.—Perforated, simple (Lindley). Le Maout and Decaisne say it is truncate; Kurz says it is perforate and truncate.

OVULES.—Numerous, suspended or descending, anatropous ; with their micropyle upwards and inwards ; arranged in two rows, on three parietal placentas ; raphe ventral and very prominent.

Baillon observes that " in the one-celled ovary there are three parietal placentas, whereof two are posterior." He adds a note, however, that we do find two or four carpels with the same number of placentas and valves to the fruit. I am quite familiar with this tree, having seen it during the last thirty years, if not more, growing wherever I have lived, and I can confidently say that I have not yet seen a two-carpellary or four-carpellary ovary in this plant either in Bombay or in Thana.

FRUIT.—A capsule, elongate, 9 to 18 inches long, sometimes a little over two feet in length, ½ to 1 inch thick, rostrate, pendulous, torulose, 3 to 6-angled, with nine longitudinal ribs, 3-carpelled, 1-celled; loculicidally 3-valved, valves bearing the seed along the middle of their inner surface. The capsule is succulent and soft within when unripe ; corky and pitted when mature and about to dehisce ; the outer coat of the capsule, which is chiefly formed of the ribs referred to above, consists of tough fibrous plates longitudinally, oftener torulosely, arranged and bound together by a green substantial parenchymatous substance.

SEEDS.—Trigonous, numerous, in pits of the valves, " half-buried in their fungous substance *produced from the inner wall of the pericarp* " (Baillon). Hamilton* says that each capsule when full-grown contains about fifteen seeds. In size the seed is considerably larger than a pea. *Chalaza*, apical, corky (Le Maout and Decaisne).

TESTA.—Corky, winged at the angles. Baillon thus describes this winged nature of the testa from which the plant derives its characteristic name of *pterygosperma* :—" In *M. pterygosperma* the superficial seed coat is hypertrophied into a vertical wing, which extends into the sinus between the two valves. These wings are imbricated with those of their neighbouring seeds, which may at maturing be arranged in a single vertical row along the axis of the capsule." " The number of wings," adds Baillon, " will vary of course with that of the valves, and also because the wing may remain exceptionally rudimentary on one or two angles of the seed, or not be formed at all, as is normally the case in *M. aptera*, an African, Arabian, and Syrian species."

* Pharmaceutical Journal, Vol. V, pp. 58 and 59, 1845-46.

ALBUMEN.—Absent.

EMBRYO.—Straight, "large, fleshy, oily" (Baillon). "Large, fleshy, occupying the whole interior of the seed" (Lubbock's "Seedlings.")

COTYLEDONS.—Plano-convex, almond-shaped, fleshy.

RADICLE.—Very short, superior, turned to the hilum, included between the bases of the cotyledons and lying close to the micropyle at the hilar end of the seed.

PLUMULE.—Many-leaved. Sir John Lubbock observes in his work on Seedlings that "the plumule is well developed, and shows the primary leaves in a compound form" ("Seedlings," Vol. I, p. 381).

REMARKS.

The following are the synonyms of the plant as given by Wight and Arnott ("Prodromus," p. 178) :—

M. Oleifera, Lam. Encycl. Meth. 1, p. 398.

M. Zeylanica, Pers. Syn. 1, p. 460.

Guilandina Moringa, Linn. sp. p. 546; Roxb. in E.I.C. Mus., t. 58.

Hyperanthera moringa,* Vahl. Symb. 1, p. 30.
Spr. Syst. 2, p. 327.
Roxb., Fl. Ind. 2, p. 368.

Anoma moringa,† Lour.—Rheede Malb. 6, t. 11.
Rumph : Amb. 1, t. 74.

Hooker gives the following in addition ("Flora Br. Ind." Vol. I) :—

M. polygona, D. C. Prod. II, 478.

Hyperanthera decandra, Willd.

It must be noted that *M. polygona*, D. C., is considered by Wight and Arnott (Prodromus) as perhaps a mere variety of the *M. pterygosperma* we have been describing here. They add, however, that they have never seen a specimen of the former. The character of *M. polygona* is described by them thus :—"All the stamens bearing anthers ; capsules many-angled ; seeds 3-angled, the angles expanding into wings" D.C. (Prodr. 2, p. 478). The synonym of this also is given by them as *Anoma moringa*, Lour. (Burm. Zeyl., t. 75 ; Rumph. Amb. 1, t. 75). Note that *Anoma moringa*, Lour., as

* Also mentioned by Griffith in Notulæ IV. 572, t. 609.

† Willd. 2·536 : Asiat. Res. II. 168. (Stamens half the number fertile, half sterile.)

mentioned above is also the synonym they have given to *M. pterygosperma*; so that practically *M. polygona*, D.C., and *M. pterygosperma* must be considered the species of the same plant. The species with wingless seeds known as *Moringa aptera*, which is a native of Arabia and Africa, is not very distinct from *M. pterygosperma*. Sir George Birdwood observes that DeCandolle doubts the distinctness of these two species; "and it may be," says he, "that the Indian *Moringa*, although it has not the hard wood and oil seed of the Arabian, African, and West Indian plants, is yet specifically identical with them."

The species described by Dalzell and Gibson as *M. Concanensis*, Nimmo (in Graham's Catalogue, p. 43) would appear to be a mere local variety of *M. pterygosperma*. It is thus described :—A tree something like *M. pterygosperma*, but distinguished by very much larger and rounder leaflets, and a much more powerful odour of horse-radish; flowers yellowish, with pinkish streaks; anthers 5, perfect but only one-celled; 5 abortive and much smaller; flowers in November in the jungles near Penn (Kolaba Collectorate). Dalzell and Gibson have found it also on the hills in Lus, and have expressed an opinion that it very probably will be found in Arabia.

Nairne, our latest writer on the Flora of Western India, in referring to *Moringa Concanensis*, observes that the plant is like the *M. pterygosperma*, but that its leaves and panicles are larger; its leaflets also larger oval, roundish; flowers sweet-scented; petals yellowish, red-streaked at the base. Nairne further remarks that the *M. Concanensis* is wild at various places in the Konkan, also in Sind and Rajputana. That it grows wild in Rajputana is evidently asserted on the authority of Brandis, who, as I have already noted in my former papers, is one of the most accurate observers and descriptive writers on the Indian Flora. It is just as well to quote his remarks *in extenso* :—"*M. Concanensis* grows wild on the dry hills of Rajputana (*Sainjna*) near Kishengurh and Bednore, also on the hills of Sindh (Mhua) and the Konkan. It has yellow flowers, bipinnate leaves, pinnæ 4 to 6 pair simple pinnate, except sometimes the lowest, which are bipinnate, with broadly ovate leaflets one inch long, on petioles $\frac{1}{2}$ inch long, with 4 to 6 pairs of rather prominent lateral nerves."

As a rule *Moringa pterygosperma* is more largely found near human habitation—on the outskirts of existing or extinct villages, in cultivated

fields and in gardens—than in the forest. But that it also grows wild cannot be doubted in the face of authoritative testimony. For instance, T. N. Mukharji, F.L.S., of Calcutta, an accomplished and well-informed Botanist, in his Hand-book of Indian Products (p. 98, 1883), remarks that *M. pterygosperma* is found wild in the Sub-Himalayan regions.

Wherever it is cultivated, it is useful for its root, bark, gum, leaves, flowers and fruit. There is no part of this interesting plant but that it is used for culinary purposes. Every part of the plant is more or less pungent, the root notably so, and it may be added that every one of them is used to a more or less extent for medicinal purposes, and not without success. The root is mostly, I should say principally, used as a garnish at the Anglo-Indian table, as a substitute for the genuine European horse-radish, the *Cochlearia armoracia* (N. O. *Cruciferæ*). Opinions however differ with regard to the flavour of the root of *M. pterygosperma* as an acceptable substitute for the genuine horse-radish root. Firminger says that as a substitute for horse-radish it is much inferior in flavour. Surgeon-General Balfour* says that the roots of *M. pterygosperma* have *precisely* the flavour of horse-radish. Dr. Hamilton† says that the roots of *M. pterygosperma have all the flavour and properties of the horse-radish.* Dr. O'Shaughnessy‡ observes that the roots *have precisely the flavour of horse-radish and seem identical in chemical composition* (the italics are mine.—K. R. K.). Dr. J. Bidie of Madras regards *M. pterygosperma* as a perfect substitute for *C. armoracia*—the true horse-radish. To this I may add my own humble testimony, having constantly tasted in England the true *C. armoracia* root as a garnish, that the root of *M. pterygosperma* is by no means inferior in pungency to the root of *C. armoracia.*

Passing next to the bark of *M. pterygosperma*, it may be observed that, apart from its noxious properties, to be dilated upon hereafter, it yields, says T. N. Mukharji, a coarse fibre for the manufacture of mats, paper, and rough cordage. From the very fragile nature of the bark I have very grave doubts as to whether it could afford useful

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* Balfour's Encyclopædia of India, Vol. II, p. 986, 1885.

† Pharm. Journal, Vol. V, 1845-46, pp. 58 and 59.

‡ The Bengal Dispensatory and Pharmacopœia, Vol. I, p. 289, 1884.

cordage, notwithstanding the reticulate nature of its fibres; yet I can safely recommend it to the serious consideration of our indigenous paper-manufacturers as worthy of trial in the manufacture of coarse paper. I am all the more strengthened to make this remark, inasmuch as the plant is a very quick grower. Not only are seedlings said to be quick-growers, so quick as to bear flower and fruit within a year, but they are also easily propagated. Dr. Hamilton says that the tree is of most rapid growth, coming into flower within a few months after the seed has been sown, and continuing to produce seeds and blossoms afterwards throughout the year. I have no personal knowledge of this plant being ever raised from seeds in Bombay or in the Thana District, which is the northern part of the Konkan; but I know this, that the plant takes so kindly to the soil, especially where there is plenty of water, as to give me the impression that it is easier to propagate it by cuttings than by sowing its seed. A branch, full two inches thick in diameter, if put into ground in the early part of the monsoon, which generally begins in Thana in the first week of June, by April following the cutting gives substantial fruit. I have Firminger's authority to say that even the seedling is of exceedingly rapid growth. He recommends the seed to be sown in June and July.

As regards the timber of this tree, Dr. Hamilton notes that it gives out a blue colour in spirit and water, which, by transmitted light, appears of a golden yellow; the blue is destroyed by acids which leave the tincture or decoction of a bright yellow, but is restored by the addition of an alkali.

Next, as regards the height of the tree, it is variously given. Brandis says it is twenty feet. The trunk, he says, is straight; its girth from four to five feet, and there are a few large divergent branches. Kurz reckons the height as from thirty to forty feet, which is about the correct estimate I think. The height of the clear stem, according to Kurz, is from ten to twenty feet, and its girth from three to four feet. I may observe, however, that both in Bombay and Thana, the tree very seldom shows so much height in a clear stem. It is often irregular in appearance; in some places markedly so. Dalzell and Gibson call it a small tree. Drury, again, is nearer the known height. He says that the tree is from thirty to thirty-five feet high.

There are differences of opinion regarding the nature of the stipules. As a rule, they are, as stated above, absent. Hooker, Kurz, Baillon and

others say that, instead of the stipules, there are glands. Le Maout and Decaisne say the stipules are deciduous. Henfrey and Bentley say they are thin and deciduous. Lindley adds that they are coloured besides.

With regard to leaves, Jaikisson notes that they are acrid and have a burning taste. With regard to the shedding time of the leaves, Brandis observes that the old leaves are shed in December and January. The leaves are shedding now (October) in some plants in Thana. Fresh foliage appears generally with the appearance of the flowers or immediately before the flowers are out. Some say that fresh foliage appears in March and April; the flowering time is also variously given. Brandis notes that fresh foliage appears in March and April, and the flowers between January and April before the leaves are out. He adds that, in the Konkan, flowers appear in November. In other places I have seen them all throughout the year more or less, but chiefly between January and April. It must be noted, however, that the same plant never flowers and fruits more than twice a year whatever the months it may blossom in. Brandis found it in leaf and flower in December, 1869. Drury says the flowering time is from January to July. Kurz says that the plant flowers in the cold season, and the fruit is ready in the hot season; Brandis notes that the capsules ripen from April onward, and, unless pulled off, remain long on the tree, and, I may add, even dehisce *in situ*. Firminger says the fruit is produced in March.

The colour-markings of the flowers are variously given. These, it may be generally observed, must be, in my opinion, attributed to effects of climate and season. Dalzell and Gibson, who are quite familiar with the Konkan Flora, say that the flowers are white. Drury and Hamilton also say that they are white. Brandis says they are white, with yellow dots at the base. Woodrow says that the colour is yellowish-white. Paxton says that the colour of the flowers is yellow (Bot. Dict., p. 378, 1868). Roxburgh refers to a red-flowered species or variety which is found in the vicinity of Malda; its Sanskrit name is *Madhu-Shigru*. I may observe here, however, that *Madhu-Shigru* is not always a red-flowered variety. (*See Raj Nighant*, Mr. M. C. Apte's Edition, *Shloka* 64.) The term is also

used to represent a white-flowered variety. The red-flowered variety is sweet-scented (*Shloka* 66). Old Indian writers recognize three varieties: *Swet* (the white), *Nil* or *Krishna* (the black), and *Rakta* (the red) (*Nighanta Prakash*). Bhâvaprakash mentions two varieties, white and red. Udoy Chund Dutt notes that the root of the white variety is said to be a stronger rubefacient, while that of the red is preferred for internal use for promoting the appetite and acting on the excretions ("Sanskrit Materia Medica," p. 118). In the Benares Edition of Raj Nighant (1883, p. 58) four varieties of Shegat are given, viz. :—yellow, black, white and red. There is really no black variety. By the term *Nil* or *Krishna* it is meant to express probably the greenish colour which the petaloid sepals often assume.

With regard to the fruit, it may be said that it is useful to the natives of this country as a vegetable. The unripe capsules are cooked and eaten with relish. To some Europeans it affords a good substitute for asparagus, and I can say from personal experience that it is by no means a bad substitute, only that it should be properly cooked. Besides, it must be remembered that the fruit of different trees is not alike in taste. Some capsules are distinctly sweet, others are bitterish. It is the sweet variety which has the taste and flavour of asparagus. Not unoften the taste of some capsules is so bitter as to render a seasoned dish void of all enjoyment. The leaves and flowers are often cooked as vegetables in fritters and curries, but they have a mawkish taste; the leaves are more so than the flowers.

With respect to the gum which exudes from the bark of the plant, it may be observed that it is insoluble in water, and has a strong resemblance to that known as tragacanth obtained from *Astragalus verus*.

The seeds, observes Dr. Hamilton, appear somewhat like pith-balls when their winged papery envelope is removed. The seeds, upon dividing them with the nail, says he, are found to abound in a clear, colourless, tasteless, scentless oil, of which the proportion is so large that it may be expressed from good fresh seeds by the simple pressure of the nail. O'Shaughnessy says that the seeds contain so much oil that it exudes on compression between two fingers. "Geoffry informs us," says Hamilton, "that he obtained 30½ ounces of oil from 8 pounds of the decorticated seeds, being at the rate of very nearly 24 lbs. of oil from

100 lbs. of seed." The oil thus obtained is the celebrated oil of Ben or Behen, which at one period constituted a valuable branch of commerce with the East, until excessive imposts and extensive adulteration brought it into unmerited disrepute. Dr. Hamilton distinctly calls *Moringa pterygosperma* the "Oil of Ben" tree. In his Catalogue of the Economic Products of the Bombay Presidency (p. 149, 1862), Sir George Birdwood states, what is well-known here—in the Bombay Presidency at least,—that within his observation no oil is obtained from the seeds of *Moringa pterygosperma*. The people use the fruit so largely as a vegetable when it is young and tender that it is removed from the tree long before the seed matures. The best fruit for culinary purposes is one in which the seed has but just formed. From what Mukharji says, it appears that what is called Oil of Ben is derived from other seeds than those of *Moringa pterygosperma*; for he says that the seeds of *Moringa pterygosperma* yield an oil "*similar to the Oil of Ben.*" Not only does Hamilton say that *M. pterygosperma* is the source of Ben oil, but even Lindley, Henfrey, Drury, Dalzell and Gibson say the same thing. Balfour and others say that *M. pterygosperma* produces Oil of Ben. Balfour moreover adds that the oil is an aperient and used by the native doctors in gout and rheumatism. Brandis, Baillon, Le Maout and Decaisne, on the other hand, differ from the writers just mentioned on this point. They say that Ben oil, as it used to be sold in the market in former days, was derived from the true Ben-nuts which are the seeds of *M. aptera*. This is what Brandis says regarding the subject:—"From the seeds of another species with *unwinged* seeds, *M. aptera*, Gaertn, of Africa, a valuable oil (the Ben oil of watchmakers and jewellers) is obtained; but so far as is known, no oil is extracted from the seeds of this species in India." The following are the observations made by Baillon on this point:—"The oil of Ben (*M. aptera*) is sweet, inodorous and limpid; does not easily turn rancid, and finally separates into two parts, one of which coagulates (in cold countries observe.—K. R. K.), while the other always remains fluid. It is used in the extraction of certain perfumes, and the more fluid part is often used by the watch-maker." Probably oil might be extracted, says Baillon, from the winged Ben from tropical India, which also contains a quantity of oil, but it does not appear to have been much used hitherto. Le Maout and Decaisne

observe that the *Moringeæ* are tropical Asiatic, Arabian and Madagascar trees. The best-known species is *M. aptera*, of which the seed called Ben-nut yields a fixed oil of much repute in the East, because it does not become rancid and is used by perfumers and mechanists in cold countries from its not freezing.

The concluding remarks of Dr. Hamilton's paper before the Pharmaceutical Society I have been hitherto quoting are so graphic, and seem to me to be so useful to lovers and manufacturers of scents, that I am tempted to quote them *in extenso*, in the hope that they may encourage some of our indigenous scent-manufacturers to cultivate the *Moringa pterygosperma* plant for its seed, with the view of obtaining from the seed that bland oil which has been in the past a very useful scent-storer, and may in future add largely to the manufacture of numerous essential oils and essences from indigenous scented flowers and leaves. To quote, then, the remarks of Dr. Hamilton, he says:—"The oil which is so profusely obtained from the seeds is peculiarly valuable for the formation of ointments, from its capability of being kept for almost any length of time without entering into combination with oxygen.

"This property, together with the total absence of colour, smell, and taste, peculiarly adapts it to the purposes of the perfumer, who is able to make it the medium of arresting the flight of those highly volatile particles of essential oil which constitute the aroma of many of the most odoriferous flowers, and cannot be obtained, by any other means, in a concentrated and permanent form. To effect this, the petals of the flowers, whose odour it is desired to obtain, are thinly spread over flakes of cotton-wool saturated with this oil and the whole inclosed in air-tight tin cases where they are replaced by fresh ones, and the process thus continued till the oil has absorbed so much as was desired of the aroma ; it is then separated from the wool by pressure, and preserved under the name of *essence* in well-stoppered bottles. By digesting the oil thus impregnated in alcohol, which does not take up the fixed oil, a solution of the aroma is effected in the spirit, and many odoriferous tinctures or waters, as they are somewhat inaccurately termed, prepared which could not otherwise be obtained. By this process most delicious perfumes might be obtained from the flowers of the *Acacia tortuosa*, *Pancratium carribeum*, *Plumeria alba*, *Plumeria rubra*, and innumerable other flowers of

the most exquisite fragrance, which abound within the tropics, blooming unregarded, and wasting their odours on the barren air." It would hardly be within the scope of these remarks to add to this interesting quotation the names of such of our odoriferous plants as would give really very agreeable and delicate oils and essences, and open up a wide field of research and occupation to our would-be scent-growers were it possible for them to obtain a sufficient quantity of the oil of the *Moringa pterygosperma* seed. As it is my intention to write an independent paper on the scent-producing plants of Western India on a future occasion, I do not pursue the subject here any further.

The following notes from Watt's Chemical Dictionary may be read usefully in connection with the foregoing observations :—Benic acid, obtained from oil of Ben, and sillistearic acid, from the fruit *Stillingia sebifera*, have the same composition (Watt's Chemical Dictionary, Vol. I, page 538). Oil of Ben (Watt's Chemical Dictionary, Vol. I, page 538) constitutes the oil expressed from the fruits of *Moringa Nux Behen*, Desf.; *Guilandina moringa*, Linn.; or *Moringa oleifra*, Lam. It is colourless or slightly yellow, of specific gravity 0·912, thick at 15° C, solid in winter.* It has a mild taste, is neutral to test-paper, and does not readily become rancid. "It is used in perfumery to extract the odorous principles of fragrant plants. In India it is used as an embrocation for rheumatism. According to Völcker (Ann. Chem. Pharm., LXIV, 342), it is saponified perfectly by potash, 400 grammes yielding about 18 grammes of a mixture of solid fatty acids together with oleic acid. The solid fatty acids are :—1. An acid soluble in strong alcohol, insoluble in ordinary alcohol, melting at 83° C, and containing 81·6 per cent. carbon and 13·8 hydrogen, numbers which approximate the formula C_{45} H_{90} O_2; but the quantity obtained was too small for complete investigation.† 2. Ordinary margaric acid. 3. An acid resembling stearic acid and called by Völcker *Benic acid*."

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* *N.B.*—In Europe.—K. R. K.

† Here is a field for further analytical research.—K. R. K.

"Another kind of oil of Ben, said to be obtained from the seeds of *Moringa aptera*, yields by saponification four fixed fatty acids, *viz.*, stearic acid, margaric acid, and two peculiar acids, *benic acid** and *moringic acid* (Walter, Compt. Rend. XXII, 1143)."

With regard to the fragile nature of the young branches of this tree, the late Mr. Govindji Narayan, who spent his valuable life in enriching the Marathi literature with original, entertaining and instructive works, and whose graphic descriptive power no Marathi writer of his day, except the renowned Rao Saheb Mahadeo Govind Shastri Kolhatkar, ever surpassed, if any equalled, makes the following remarks in his *Vriksh Varnan* (Description of Plants) :—"The *Shevga* tree is so fragile that even by an ordinary violent wind its branches break. The tree is sometimes so overloaded with capsules that the branches break even by the very weight of the fruit." Mr. Govindji also notes that the trees which grow in the Bassein Prânt afford fruit which is excellent eating ; that they grow in any kind of soil, and do not require any special care. He corroborates my observation that the trees flower all throughout the year. He describes the flowers as being white. Another indigenous writer, who appears to be well informed in Indian plants, Raghunathji Indraji of Junâgadh, who is popularly known as Katâ Bhat, in his *Nighant Sungraha* (1893, p. 320) makes the following observations regarding the *Shegat* plant :—"The flowers are white, red, or greenish. The white-flowered variety is the most common. Its green bark is very pungent, and has the smell of powdered mustard. The juice of the bark yields an oil. Both the juice and the oil are used externally to reduce swellings and enlarged glands." Mr. Vasudev C. Bapat, another writer, a resident of the Ratnagiri District, recognizes only one variety of *Shevga*. (*Vanaushadhi Prakash*, Vol. II, page 419).

Moringa pterygosperma as a member of the phanerogamia is a plant of very great interest. In the classification of plants it has been difficult for botanists to assign this plant its proper place. It has ever been a puzzle under what *natural order* to class it. In the days

*N.B.—*Benic acid* is a name applied to two different fatty acids, both obtained from oil of ben, the one by Völcker, the other by Walter. For distinction, Völcker's acid, which has the higher melting point, may be called the benostearic acid and Walter's benomargaric acid.

of my boyhood I used to hear of the fifth proposition in the first book of Euclid as the *pons asinorum*. Were it pardonable to parody this quaint expression, in the advanced days of my scholastic career, I should say that the *Moringa pterygosperma* has ever been the *pons botanicorum præstantissimorum*. For witness how various botanists have variously attempted to classify this plant, and yet how far we are, even at the present day, from arriving at a satisfactory solution of the difficult question of giving it its proper place among the natural orders.

The classification of plants in *Hooker's Flora of British India*, which, from the extreme care with which it is compiled, with the assistance of some of the best and most accomplished botanists now living, must at all times, at any rate for many years to come, be a standard work of reference to Indian botanists, is based on Bentham and Hooker's exhaustive *Genera Plantarum*. Hooker accordingly places the Natural Order *Moringeæ* next to *Sapindaceæ* among the *Discifloræ*, a division which was generally, in days gone by, included among the *Thalamifloræ*, but which was first made into a separate division by Bentham and Hooker. The following are the characteristics of the division *Discifloræ* :—"Flowers generally with a conspicuous disk, on or about which the stamens, which are nearly always definite, are inserted. The flowers are mostly regular; in the *Moringeæ* they are markedly irregular, somewhat resembling those of the *Papilionaceæ*, which form one of the sub-orders of the natural order *Leguminosæ*.

"The *Moringa pterygosperma* tree," says Mr. E. M. Holmes, F.L.S. (*The Tropical Agriculturist of Ceylon*, Vol. III, 1883-84, page 285), "is a very interesting one from a botanical point of view, being allied to the *Leguminosæ* in habit, and, indeed, very erroneously included by Linnæus in the genus *Guilandina*. It resembles the plants of this family in having compound leaves, stipules" (glands according to some botanists, as already mentioned.—K.R.K.) "and flowers which chiefly differ from those of the tribe *Cæsalpineæ* in the odd petal being inferior, in the one-celled anthers, tricapillary ovary, and anatropous ovules. In the last two characters it approaches *Violaceæ*, as well as in the three-valved fruit, parietal placentation, and hollow apex of the style. In properties it resembles the *Cruciferæ*, *Capparidaceæ* and *Resedaceæ*. By Grisebach it was

placed in the *Capparidaceæ*, and by other botanists it has been compared with the *Polygalaceæ*, *Bignonaceæ*, and *Sapindaceæ*." Mr. Holmes further remarks that "in the classical *General Plantarum* of Bentham and Hooker, it follows *Sapindaceæ as an anomalous genus of doubtful affinity*."

Lindley has written an elaborate and learned note on the *Moringaceæ* or "Moringads" as he calls them. He classes them among the *Hypogynous exogens, Violales*. "This is a little group of small trees," says he, "with an appearance so peculiar that one hardly knows with what to compare them. It seems, however, generally admitted that they resemble some plants of the *Leguminosæ*, and it is to the vicinity of those that all botanists, except myself, seem agreed in referring them, moved thereto by their pinnated leaves, with glands between the leaflets, declinate decandrous perigynous stamens, and pod-like fruit. DeCandolle, who did not overlook the anomalous structure of *Moringa* as a leguminous plant, accounted for the compound nature of its fruit on the supposition that although unity of carpels is the normal structure of the *Leguminosæ*, yet the presence of more ovaries than one in a few instances of that order explained the constantly trilocular state of that of *Moringa*." I may observe here that the term unity of carpels used by Lindley is likely to mislead not a few. What Lindley means is "one-ness," "single-celled" nature and not union of many carpels or "cohesion;" for let it be remembered that unity also means "union;" witness the old adage "unity is strength." It would be well to briefly state here what these leguminous plants bearing a many-celled fruit are. Loudon says that *Callistachys lanceolata* and *Callistachys ovata*, belonging to the *Leguminosæ* bear pods, which are many-celled, stalked, and woody before ripening.* They are both natives of Australia; very handsome shrubs bearing spikes of yellow flowers. Another leguminous plant, *Afzelia Africana*, a tree growing in the Colony of Sierra Leone, and bearing black seeds with a scarlet arillus, has many-celled pods.† "It was named by Sir J. E. Smith," says Loudon, "after Dr. Adam Afzelius, an amiable and excellent Swedish botanist, resident,

* *Encyclopædia of Plants*, p. 338, 1829.

† *Op. cit.*, p. 339, 1829.

for many years in the service of the African Company, at the Colony of Sierra Leone."* *Cathartocarpus javanicus,* a native of Java, as the name indicates, is another of the leguminous plants bearing pink flowers, which has a many-celled pod.† *Cassia fistula,* our well-known *Bâhawâ* plant, so familiar in the Konkan and strikingly beautiful, with its dense, long, bright yellow panicles, reminding one of the poet's "Laburnum drooping gold," bears a long woody pod, which botanists are accustomed to describe as spuriously many-celled. The spurious dissepiments in this pod, be it noted, are horizontal and regularly arranged between each seed as it lies imbedded in a black honey-sweet pulp. Such are the deviations of the fruit among the *Leguminosæ* from the normal one-celled ovary.

To resume our reference to Lindley, "it has, however, always seemed to me," says he, "that the resemblance which botanists have found with leguminous order, *are*" (? *is*—K. R. K.) "trifling, while the discrepancies are of the first importance. For example, the habit of the plant consists of a doubly pinnated foliage, which would do as well for Roseworts, or Citronworts, or Rueworts ;‡ the declinate stamens are found in Rueworts, Milkworts, Capparids, and many others ; and as to the pod-like form of the fruit, it is not worth a thought. The objections are that the sepals are of the same texture as the petals, the anthers one-celled, the ovary composed of three carpels which have not the power of turning inward their sides so as to form dissepiments, and that the attachment of the carpel is strictly parietal. It is true that the latter circumstance will not be so much at variance with the leguminous structure as it appears to be, if it should be proved that the sutural and parietal placentation are of the same nature, which seems to be the fact. But connected as it is with other points of difference, and considering that it is parietal placentation in excess, it appears to be of considerable moment. This has always led me to regard the Moringads as members of some great parietal alliance and as claimants of a nearer affinity

* *Op. cit.*, p. 347, 1829.

† *Op. cit.*, p. 339, 1829.

‡ Note that both the Citronworts and Rueworts of Lindley are now classed under one head called the *Rutaceæ*—(K. R. K.)

with Violetworts* (*Violales*) than with any other order. And to this opinion I adhere for the following reasons :—The stamens are definite in number, the corolla is manifestly irregular, the placentation is parietal, and the flowers are not isomeric, the parts of fruit being three, while those of the calyx, corolla, and stamens are five. The main objection to this view is derived from the stamens being perigynous, and it will be seen from the altered arrangements introduced into the present volume" (from which these remarks are quoted.—K. R. K.) "that I now attach much more importance than formerly. But it must be remembered that *Moringa* is not at all more perigynous than *Verrucularia* and others among Malpighiads, or than Reseda among the Crucifers, or than Escholtzia among Poppyworts ; and that, in fact, it may be very well regarded as standing in the same relation to Violetworts as *Escholtzia* to Poppyworts. While, however, the parietal placentation seems to turn the scale in favour of the near affinity of the Moringads to Violetworts, there can be little doubt that they also approach the anisomerous Sapindal alliance, especially Milkworts, in their declinate stamens, one-celled anthers and petaloid calyx." Such are the learned observations of the accomplished Dr. Lindley of unrivalled botanic fame. To question his authority would be mere presumption.

The following observation in Professor Henfrey's Botany (edited by Masters and Bennett, p. 235, 1884) may be read usefully in connection with the foregoing remarks of Lindley. "The species of the order *Moringaceæ* have been referred to the vicinity of the *Leguminosæ* principally on account of their perigynous irregular flowers, pinnate leaves and pod-like fruit. The structure of the ovary entirely removes them widely from the *Leguminosæ* on account of the parietal placentation. Since, judging from the *Rosaceæ* the occurrence of additional carpels in *Leguminosæ* would be accompanied by an apocarpous condition or at least by axile placentation. *Diphaca* and *Cæsalpinia digyna* (*Leguminosæ*) are in fact described

* For the proper understanding of Lindley's argument, I may here mention the natural orders which he includes among the Violales. They are as follows :—
Flacourtiaceæ, Lacistemaceæ, Samydaceæ, Passifloraceæ, Malsherbaceæ, Moringaceæ, Violaceæ, Frankeniaceæ, Tamaricaceæ, Sauvagiaceæ, Crassulaceæ, and Turneraceæ.

as having *two legumes** ; but the monstrous forms of *Gleditschia* referred to by De Candolle are said to have two coalescent carpels. Hence Lindley places this order in the neighbourhood of *Violaceæ* and conceives it approaches *Polygalaceæ*. Others place it between Capparids and *Resedaceæ*, to the former of which it is closely allied."

Passing on to another botanist, although Baillon includes the *Moringa* series in the nat. ord. *Capparidaceæ*, he begins his remarks by saying that the series represented by the *Moringa* is of somewhat doubtful position among the *Capparidaceæ*. Baillon is of opinion that *Moringa* shows close analogies with *Leguminosæ*, differing essentially only in the number of its parietal placentas ; he says that *Cordyla*, which belongs to the leguminous series *Tounateæ* or *Swartzieæ*, was formerly placed in *Capparidaceæ*, and is only distinguished therefrom by its single placenta. Baillon gives a reference to *Adansonia* (IX, 335) for the enumeration of the different groups to which *Moringa* has been referred, even bringing it near *Monopetaæ*, such as *Bignoniaceæ*. I am sorry I have not the means of referring to *Adansonia*, else I should have been able to make this part of my paper complete. One has to be content in this country with only a few books of reference in the absence of a well-furnished scientific library, and make the most of scanty resources for acquiring scientific knowledge. According to J. G. Agardh, the *Moringaceæ*, though collateral with the *Capparidaceæ*, appear to be more allied to the *Leguminosæ* on account of their pentamerous, nearly symmetrical flowers, and perigynous stamens.

Le Maout and Decaisne† are more decided in their opinion regarding the position of the *Moringeæ* among the natural orders. "It is amongst the *Capparideæ*," they say, "that we must search for the real affinities of *Moringeæ*." "The genus *Moringa*," they observe, "has been by some botanists placed in *Papilionaceæ* on account of a slight resemblance in the flower, which, however, indicates no true

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* A double ovary sometimes occurs as a monstrosity in *Wistaria sinensis*, in *Gleditschia* and in the French bean (*Phaseolus*); and a *Mimosa* with 5 carpels (thus a symmetrical flower) is said to have been seen by St. Hilaire (Henfrey p. 239).

† *Descriptive Botany* (translated by Mrs. Hooker), p. 236, 1873.

affinity. Hooker (following Lindley) compared it with *Violarieæ*, "which resemble it in their irregular flower, with unequal dorsal petal, in their perigynous insertion, tubular style, one-celled ovary with three parietal nerviform placentas and anatropous ovules; but *Moringeæ* are widely separated by habit, one-celled anthers and exalbuminous seeds." The affinities of *Moringeæ* with the *Capparideæ* are to be observed "in their polypetalous imbricate corolla, perigynism, stamens more numerous than petals, stipitate one-celled ovary, parietal placentation, siliquose capsule, exalbuminous embryo, alternate leaves, and caducous stipules." To these must be added *the acrid root*, *leaves*, and *bark* which are common to both families, recalling the smell and taste of the horse-radish, and associating Moringa with the *Cruciferæ*, themselves so closely allied to *Capparideæ*.

Kurz places this plant between the *Capparideæ* and *Violaceæ*, as orders belonging to sub-division *Parietales* (*i.e.*, having parietal placentas) of the thalamiflorous plants. The observations of Wight on this question are too interesting to be omitted in such a general consideration of the true position of the *Moringa* in the series of natural orders. He realizes the difficulty of assigning the *Moringa* its exact place. "This small order," says he,* "consisting of one genus and about three species, long associated with *Leguminosæ* though sufficiently distinct, and so peculiar in its relations that it is not yet distinct where it should stand in the series of orders, the structure of the ovary placing it among the parietose group, near *Violarieæ*, while according to the flowers it is more justly referable to the tribe *Cæsalpineæ* of the *Leguminosæ*." Notice that some botanists think the *Moringa* is more allied to the sub-order *Papilionaceæ*. "The characters derived from the tribe *Cæsalpineæ* of *Leguminosæ* as being the more conspicuous of the two seem to have induced botanists to prefer placing it near the *Leguminosæ*, the more so as the habit still further associates it with that order."

* * * * * * *

"*Affinities.*—As stated above, these are very obscure owing to the peculiar structure of the ovary, one-celled with three parietal placentæ, the fruit afterwards splitting into three valves. Arnott (*Encyclopædia*

* *Wight's Illustrations of Botany*, pp. 186-187, 1840.

Britannica, 7th Edition) remarks, formerly considered as part of the *Leguminosæ*, but now separated by Mr. Brown. It seems, however, to have more affinity with these than with others ; nor do we see in the fruit very grave objections to such a supposition, as the flowers of *Gleditschia* have occasionally two carpels united in the same manner as the three of *Moringa*."

" Of the correctness of this view, or otherwise," Wight goes on to say, " I can offer no opinion, being altogether unacquainted with *Gleditschia* ;* Lindley however holds an opposite opinion ; he says, ' DeCandolle, who did not overlook its anomalous structure as a leguminous plant, accounted for the compound nature of its fruit upon the supposition that though *unity of carpels* is the normal structure of *Leguminosæ*, yet the presence of more ovaries than one in a few instances in that order explained the constantly trilocular state of that of *Moringa*. To this, however, there are numerous and grave objections which cannot fail to strike every botanist. What its proper station should be remains to be determined ;' again, Decaisne seems to think it has more affinity with *Leguminosæ* than with any other order. On these passages it may be observed," says Wight, " that it would have been more satisfactory had some of the grave objections been stated, since it is quite undeniable that Messrs. DeCandolle, Arnott, and Decaisne are all eminent botanists and yet they do not seem to have been struck by them. While I thus object to such sweeping conclusions as the above, I confess I cannot help coinciding with Dr. Lindley in thinking that the doctrine he opposes is pushed, in this instance, much too far by these authors, though I scarcely feel myself sufficiently master of the subject to join issue with them on this, one of the most difficult questions in botany."

I have thus placed before my readers the different views expressed by eminent botanists regarding the position of the *Moringa* plant in the series of natural orders ; and must now bring to a close the lengthy quotation, which I have introduced more for the purpose of bringing together the scattered information on this point than with any hope of arriving at a definite conclusion as to which of the

* A North American genus, of which the honey-locust tree is a species (*G. triacanthos*). There are two Chinese species of this genus besides.

natural orders *Moringa pterygosperma* should finally belong. In monographic papers of the sort I am writing in this series, it seems desirable that all that is worth knowing should be stringed together ; that is my only apology for such lengthy extracts.

I might add a distinct chapter describing the various savoury Indian dishes that could be turned out of the fruit, flower, and leaf of *Moringa*, with the requisite flavouring ingredients, such as pepper (red and black), salt, cocoanut scrapings, cumin seed, onions, &c., but it would be foreign to the purposes of the paper to do so. In fact, knowing how valuable the whole of this plant is from a culinary point of view, and judging from my own personal taste and experience what a substantial article of diet the *Moringa* capsule is, I am conscious I shall be asked why I include this tree among the poisonous plants of Bombay. Not only will the captious critic, but even the earnest inquirer, the careful student in search of botanical knowledge, ask me to explain what is apparently a paradoxical statement, *viz.*, that the plant is both poisonous and wholesome. This I shall try to explain in the following remarks.

THE POISONOUS PROPERTIES.

It is not by any means to be supposed that, because one part of a plant is edible, any other part of the same plant is not poisonous, using the word poison in its broadest sense to signify whatever is hurtful to the human body. Instances are not unknown among other plants, where one part of the same is safely used for culinary purposes, whereas another has proved to be distinctly poisonous. French beans, for instance, are known to serve as an excellent vegetable. Few will believe, however, that the root of the French bean runner when eaten is poisonous. Mr. Bartlett has recorded an instance (*Pharmaceutical Journal*, Vol. II, page 721, 1842-43), in which the poisonous effects of the root were distinctly noted. "A customer of mine," says he, "last Christmas was digging up some roots of the French beans or Scarlet runners and, observing them to be very large and look very white when broken, thought he would taste them, thinking there could be no harm in partaking of the root of a vegetable which had formely supplied his table. His family and maid-servant being also in the garden, all partook of some, pro-

nouncing them good and pleasant to the taste; presently, the servant complained of giddiness and sickness, and while rendering assistance, the master himself, with the mistress and five children, followed in the train; the sickness continuing for half an hour."

Another instance occurred last year in my own practice in the Thana Jail. For years it was the practice in the Thana Jail to cook up the tender tops and leaves of the sweet potato (*Batatas edulis*) and serve as vegetables to the jail inmates without any deleterious effects. One night, last cold weather, I was suddenly called by my Jail Hospital Assistant to attend to five or six cases of almost epidemic vomiting and purging, in a more or less severe form, among prisoners both male and female in the different barracks of the jail. These five or six cases rose to fifty within the next two hours. If I had been hasty in my investigation of these cases, I might have put down this sudden outburst of vomiting and purging to an epidemic of cholera. But there was no cholera in the town, nor was it raging in the districts around, which supply our jail with its daily fluctuating population. I made a careful examination of the vomits of the affected prisoners, and in those vomits I found undigested portions of the sweet potato leaves, which I thought might be the probable cause of this almost epidemic suffering of the jail inmates, the jail population at the time being over 700 souls all told. To have to treat fifty prisoners within two hours is decidedly a serious affair. Under prompt treatment, the details of which need not be mentioned here, fortunately for all concerned, there was no death. My next step was to obtain a sufficient quantity of the leaves and tender tops of the sweet-potato plant, which I submitted for analysis to my friend Mr. Stephenson, F.C.S., then of Messrs. Kemp & Co. Mr. Stephenson discovered a glucoside in the plant which I consider was the cause of the ailment. It is well known that at certain times plants, which produce substantial roots or tubers, are rich in glucosides in the sap of their leaves before they finally store up all their starch in their roots and tubers. The glucoside discovered by Mr. Stephenson was probably not unlike that found in the tubers of Jalap (*Exogonium purga*) belonging to the nat. ord. *Convolvulaceæ*, of which the sweet-potato is no mean member.

There are several other instances which may be cited here to show that even although one part of a plant may be perfectly innocuous, another may be obnoxious. Thus, *Abrus precatorius* (Marâthi *Gunj*, nat. ord. *Leguminosæ*), the root of which is perfectly harmless and considered a safe substitute for the liquorice-root (*Glycerrhiza glabra*, nat. ord. *Leguminosæ*), bears seeds which, if used internally, act as powerful gastric irritants producing symptoms not easily to be differentiated from those of cholera. I have several instances of such affection, which I shall mention in detail when I describe the plant in a future number of this series of papers on the poisonous plants of Bombay.

Take, again, the mature seeds of *Bâdyân* (*Illicium anisatum*, nat. ord. *Magnoliaceæ*). The curious looking star-like fruit of this tree is largely employed as a carminative, and serves as a valuable and much appreciated flavouring adjunct in Indian curries and *pullâos*. But the seed is distinctly poisonous if eaten when perfectly mature. Dr. Rozario of Mazagon has come across some cases of poisoning from such seeds. In my own practice at the J. J. Hospital of Bombay, I came across a case in 1887. Mr. J. Gallagher, the House Surgeon then, brought the case to my notice. He has since recorded another case of a fatal nature which occurred very recently in the J. J. Hospital, where the seeds had been swallowed outside the hospital.

One more instance I may add to these. From personal experience I know that a quarter-inch square piece of the bark of *Mimusops elengi* (Marathi *Bakul* or *Wowlen*, nat. ord. *Sapotaceæ*) chewed at the instance of a zealous benefactor for relieving a bad tooth-ache produced within twelve hours a terrible œdema of the uvula and the mucous membrane of the whole mouth, and an incessant flow of saliva for over two hours. Fortunately the bark was only chewed and its irritant juice not swallowed, else to a certainty violent gastric inflammation had followed. This was a case of the patient ejaculating " *Save me from my friends* !" Be it noted, on the other hand, that the fruit of *Bakul* is edible and perfectly harmless. It has a sweet astringent taste.

I have thus tried to justify my insertion of the *Moringa pterygoperma* plant among the poisonous plants, however largely and without harm it is used for culinary purposes.

Now let me turn to the consideration of what constitutes the poisonous nature of the plant. Rheede was not unacquainted with the poisonous nature of the root of this plant. His knowledge on this score was mainly derived from the native Vaidyas, learned in the existing flora of the Malabar tract of this country, who materially helped him in the production of that encyclopædiac work, known as the *Hortus Malabaricus*. "The root," says he, "causes abortion." I may be permitted to add that the bark is equally mischievous. Last year, I had to give evidence in an abortion case before Mr. Patwardhan, the District Deputy Collector and First-class Magistrate of Thana. In this case, the woman, who had successfully used the bark, admitted she had done so. From 2 to 3 lbs. of the pounded bark had been used externally on the hypogastric and pubic regions for the distinct purpose of procuring abortion. The woman was a poor unfortunate middle-aged widow—and the fate of poor helpless young or middle-aged widows is very hard in this country; she had been deceived and saddled with the burden of a growing fœtus; to avoid disgrace she tried to destroy the fœtus, and she succeeded. This is an instance of how the *Moringa* bark is abortive. O'Shaughnessy does not notice it in his *Bengal Dispensatory*. All that he says is that the root reduced to a pulp affords an external irritant. Other writers say that the root acts as a rubefacient and vesicant, and causes great pain. Udoy Chandra Dutt says that the root of the white-flowered plant is said to be a stronger rubefacient, while that of the bark is preferred for internal use for promoting the appetite and acting on the excretions. (Sanskrit *Materia Medica*, p. 118, 1877.)

The ancient Hindu writers, as for instance the author of *Raj-Nighant*, of *Bhavprakash*, of *Madanpal-Nighant*,* do not refer to the abortifacient property of any part of the *Shegat* plant. In *Amar-kosha*, a very old Sanskrit dictionary, *Shegat* is said to be *pungent*.† No mention of the abortifacient property of this plant is made

* Dr. Bonavia gives the date of this work as 1360 A. D. (*The Cultivated Oranges and Lemons*, p. 215, 1890).

† Dr. Bonavia gives the date as the 8th or 9th century A.D., and observes that, according to Reinaud, it appears that *Amarkosha* was written in the 5th century. (*Op. cit.*)

in *Dhanvantari Nighant*. None of the later writers, such as the compilers of *Nighant Ratnakar*; Udoy Chandra Dutt, of Calcutta; Dr. Sakharam Arjun, Dr. Pandurang Gopal, and Mr. Govindji Narayan, of Bombay; Kata Bhat, of Junagadh; and Mr. Wâsudeo Chintâmon Bâput, of Ratnagiri;—make any allusion to its abortifacient effects. Mr. Jaikisson Indraji, of Porebunder, however, distinctly says that the bark is used to procure abortion. "It is also used," says he, "as a substitute for Laminaria tents for dilating the *os uteri*." He says that the gum is also abortive. Dr. Dymock says the same thing. So far as I know the gum is inert. It is insoluble in water, and if left in it for some time, swells into a gelatinous mass like gum Tragacanth obtained from *Astragalus verus* (nat.ord. *Leguminosæ*). "Rumphius and Loureiro state," says Dr. Dymock, "that the bark is emmenagogue and even abortifacient. In Bengal half-ounce doses of the bark are said to be used to procure abortion." This would point to the fact that the bark is used internally, *i.e.*, taken by the stomach. Dr. Dymock, in corroborating the statement of Jaikisson, adds a remark that "it is difficult to obtain reliable evidence upon a point of this nature. It would be quite possible to use it as a tent to dilate the *os uteri as it is very tough** and swells rapidly when moistened."—(*Pharmacographia Indica*, Vol. I, p. 398). That it swells rapidly it cannot be doubted as the wood is porous. But I doubt if any part of *Shegat* can be said to be tough except the pericarp of the capsule. The plant is essentially fragile, and in no way can it be said to be tough. Dr. Dymock himself says that the wood of the root is soft and porous, and that the bark of it is thick and soft. The parenchymatous cells of the bark "are loaded with globules of essential oil" which is highly pungent and very much like the horse-radish oil or mustard oil in its irritating properties. Dr. Dymock observes, however, that "the odour of *Moringa* oil is distinct from that of mustard and garlic, and more offensive." Dr. Dymock further says that the *Moringa* bark "contains a white crystalline principle answering to the reactions of an alkaloid."

My authority for including this tree among the poisonous plants of Bombay is Dr. Norman Chevers. It is on his authority that

* The italics are mine.—K. R. K.

Dr. Lyon also includes this tree among the abortifacients. These papers of mine on the poisonous plants of Bombay are essentially supplementary to Dr. Lyons' standard work on Medical Jurisprudence, which in a great measure may be said to be the originator of these my contributions to the *Journal of the Bombay Natural History Society.*

On the authority of that veteran scholar, Rai Bahadur Kannya Lall Dey, C. I. E., who to his extensive knowledge of the botany of India adds the acumen of a careful observer, Dr. Norman Chevers makes the following remarks regarding the *Moringa* plant*:—"A piece of *Sujna* bark" (*Sujna* is the Bengal name for *Shegat.*—K.R.K.) "about half an ounce in weight, is pounded with twenty-one black pepper-corns, made into a paste and swallowed to procure abortion. This is said to be a very dangerous means, as the woman, as a rule, dies with the fœtus." I may observe that, as stated before, the external application of the pounded bark has succeeded in expelling the fœtus, but has left the mother uninjured and fit to be tried in a court of law for fœticide. Dr. Norman Chevers further observes that "in all the cases where the application of the substance *per vaginam* is required, a good amount of tact and skill is needed on the part of the applier."

Be it noted here that, in communicating this valuable information to Dr. Chevers, Rai Bahadur Kannya Lall Dey observes that he has obtained these facts regarding the various modes of producing abortion in use near Calcutta by paying a woman who is perfectly conversant with the practice. Dr. Norman Chevers further says that "he speaks confidently of the statements of Kannya Lall Dey as *facts*, because he finds them to be perfectly in accordance with nearly all that he had previously learnt on the subject."

To pursue the subject further and enter into the question of the physiological action of the bark on the gravid uterus would be perhaps groping in the dark, inasmuch as what is as yet known about the abortive properties of the bark is more in a general way than as the result of physiological or clinical investigation. In other words, it is not known whether the bark produces tonic or clonic contraction of the uterus. It is known as an emmenagogue; and what is an emmenagogue in small doses, may prove, and has proved, aborti-

* *N. Chevers' Medical Jurisprudence*, p. 716, 1870.

facient in large doses. Mr. Holmes distinctly observes that "the decoction of the root or of the bark is given as an emmenagogue; but it is said to be liable to produce abortion." The various parts of the plant are diuretic; and diuretics are in a few cases known to have caused abortion (*Ogston's Medical Jurisprudence*, p. 97, 1878). The leaves are said to be emetic. Excessive vomiting, whether due to pregnancy or to emetics which are not unknown to abortion-producers, causes exhaustion of nerve-force and thereby leads to the expulsion of the fœtus. Bapat says that four tolas of the juice of leaves produces bilious vomiting. The juice of the bark is said to be purgative, acting especially on the biliary organ; should it by any chance produce hypercatharsis, indirectly it may be the means of causing abortion. Baillon says that the embryo is bitter and purgative. Royle says that the seeds are aperient. The question is, whether in the case of *Moringa*, abortion is caused by any expellant action on the part of the volatile oil contained in the bark acting on the uterus through the mother's blood. It may be noted that no special abortive property is required in the bark when used locally, *i.e.*, to the *os* itself. Such artificial direct violence or injury to the *os* or fœtus, even when the substance used is physiologically non-irritant, may produce abortion. Under such circumstances, as a general rule, the healthy uterus takes long before it expels a healthy fœtus. Dr. Barnes lays it down as an axiom that "*the healthy ovum clings to the healthy uterus with wonderful tenacity.*" It is where the system is diseased, weakened and worn out by incessant worry, anxiety, great mental prostration, starvation, exposure and other weakening causes, that such local means take ready effect.

It is for the future investigator to find out the physiological effects of the volatile oil of *Moringa* on the uterine system. Let it be remembered that the bland oil expressed from the seed of *Moringa* is entirely different from the volatile oil found in the leaves, root and bark, which latter has a disagreeable odour, and is similar to the mustard and horse-radish oils. The oil of the seeds, apart from its use and importance in the manufacture of scents, is non-irritating. Let me quote again the remarks of Holmes on this point. "It is a noteworthy point," says he, "that whereas the whole plant is so offen-

sive, its seeds are scentless to a remarkable and almost to an incredible degree ; nevertheless the practical experience of all previous observers goes to show that the seed-oil is absolutely scentless, and free from all irritating properties."

Carl Hubatka has shown that the mustard and horse-radish oils are identical in composition (*Ph. Journal*, p. 291, Vol. III, 1843-44).*

"It is singular," says he, "that man should have selected horse-radish and mustard as condiments on account of their analogy in taste, as he also thus detected the analogy between tea and coffee." In contrast with this, Broughton says that the oil of the Moringa plant is different from either oil of mustard or oil of garlic. All these oils, however, belong to the Allyl compounds. (*Roscoe and Schorlemmer's Organic Chemistry*, Vol. III, Pt. 2, pp. 436-451.) They are not only disagreeable but pungent. Roscoe observes "that the Attic Greek comedians mention mustard as a biting substance which causes a flow of tears, but is an excellent substance for giving a relish to certain kinds of food." Such is also the experience of those who greedily chew an extra large bit of the scrapings of the *Moringa* root at an Anglo-Indian table. I wish I could say that this flow of tears is not unknown to me personally!

DESCRIPTION OF PLATES.

PLATE L. The solitary flower to the left is drawn as if looked at from above after full expansion of the corolla, showing only the anthers in the centre.

A. Fruit, a capsule, showing its torulose nature.

B. Horizontal section of the half mature capsule about the middle, showing the one-celled nature of the fruit, with the seed in a diminutive state and the wings greenish, imbedded in the white pulp. It is in this condition that the capsules are best used for culinary purposes.

PLATE L. (Supplementary.)

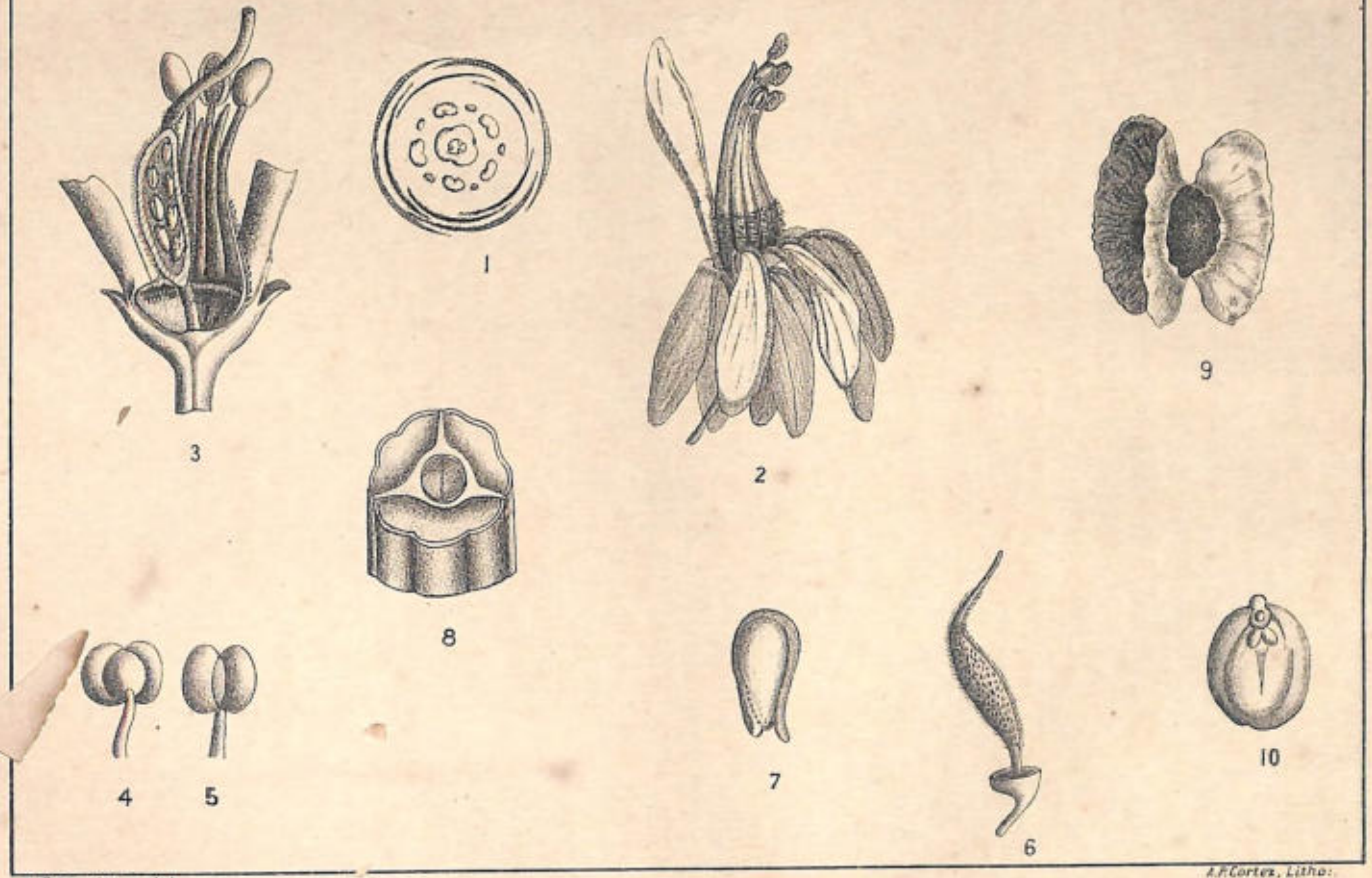
1. Arrangement of the Floral whorls (*Diagramatic*). [After Le Maout and Decaisne.]

* Quoted from *Ann. der Chem. und Pharm.*, xlviii, pp. 153, 157.

2. Flower ($\frac{2}{1}$). [After Baillon.] All sepals and petals, except the dorsal petal drawn turned down to show the stamens.
3. Longitudinal section of flower ($\frac{2}{1}$) through the stipitate ovary, showing the ovules and the cup-shaped disk. [After Le Maout and Decaisne.]
4. Anther, dorsal view, showing the peltate connective.
5. Anther ventral view.

} Magnified. [After Wight.]

6. Ovary on the disk and base of calyx. (Magnified.) [After Wight.]
7. Ovule. (Magnified.) [After Le Maout and Decaisne.]
8. A full-grown capsule cut transversely to show its three valves and winged seed *in situ*. (Natural size.) [After Wight.]
9. Mature seed detached and showing the three wings. (Natural size.) [After Baillon.]
10. One of the cotyledons showing the ventral surface, with the radicle at base and plumule. (Magnified.) [After Wight.]



K.R. Kirtikar, del:. A.F. Cortez, Litho:.

THE POISONOUS PLANTS OF BOMBAY.

Moringa pterygosperma N. O. Moringeæ.

MULE-BREEDING.

By Veterinary-Major G. J. R. RAYMENT,

Late Supdt., Civil Veterinary Dept., N.-W. P. & Oudh.

If horse-breeding is little understood in India and by few, mule-breeding is even less so. Many people, who take the greatest interest in the breeding and rearing of horses, for racing, army, or hack purposes, know nothing whatever of this important industry, which is daily gaining ground in many parts of the country. Under these circumstances, I venture to add my mite, gathered during an experience of seven years and-a-half, to the very meagre literature already existing on the subject. Where so little is known every contribution, however small and imperfect, will prove of some value.

MULES AND JENNETS.

2. It is perhaps hardly necessary to premise by saying that the animal known as a mule is the hybrid produced by crossing the male ass or jack with a horse-mare, the jennet being the produce of the female ass or jenny by the horse-stallion.

DONKEY-STALLIONS.

3. The donkeys used by the Government in India are Italian, French (Poitou), Spanish (Catalonian), Cyprian, Persian, Arab, Home-bred, Punjabi and a few Bokhara and Khorassani.

Italian.—This donkey is far and away the best. He has been carefully bred for many generations past, and the result is that he has a decided stamp not to be mistaken when once learnt. He stands about 12 hands 2 inches. He is a handsome beast, and the tan markings about his face and eyes, his dark coat and white belly, remind one of the black buck. He has a good straight back, big joints, and as a rule for a donkey is straight behind, with his hocks fairly well under him. Above all, being of his kind thorough-bred, he stamps his stock, transmitting his good points to his progeny. Again, his coat is finer and more silky than that of the ordinary jack, so he feels the heat less and stands the Indian climate better than the others. The great drawback to his general use is his high price. He costs over Rs. 1,200 in these days of depreciated currency by the time he reaches the Babugarh Depôt.

4. *Spanish* (*Catalonian*).—These resemble generally the Italian. They are bigger, coarser, and inclined to be leggy. They stand 13·1 to 13·2; frequently carrying heavy coats they do not bear the climate so well. Their stock run larger than the Italian, but are not so compact. All the same they are not by any means a bad class of sire.

5. *French* (*Poitou*).—The foregoing remarks apply with equal force to this donkey. He unfortunately carries if anything a heavier coat than his Spanish brother, frequently curling in long coarse locks all over his body. He stands 12·2 to 13·1. A rather amusing incident occurred with a French donkey some years ago in this connection. A new Assistant Superintendent of Horse-breeding, while attending a Horse Show in the Punjab, came across a very fine donkey picketted in the lines. Finding his owner quite ready to deal he purchased him for Rs. 150 and was much elated at having chanced on such a good specimen of the indigenous animal. Sending him down to the Depôt he wrote a glowing account of the beast to the General Superintendent, who, of course, was also much pleased. On the animal's arrival at Babugarh, the Overseer in charge looked at him very hard and shook his head. "Seems to me I know that donkey," he muttered. In the evening when he again saw our friend, a sudden idea struck him, and, seizing a pair of scissors, he proceeded to clip the long coarse hair from his shoulder. As the clippers ploughed their way through the coat, behold the register number branded on Government donkeys came into view, and the mystery of the remarkably fine Punjabi was solved. He was a young Poitou jack cast and sold the year before for impotence. The great coarse coat had completely hidden all traces of the brand and, as the Assistant Superintendent was a new hand, he had, of course, failed to recognize the animal as an old acquaintance.

6. *Cyprian.*—Some years ago we obtained several nice batches of donkeys from Cyprus; but after some time they fell off so rapidly that we were obliged to discontinue their importation. They are altogether a lighter donkey than any of the above, run smaller, are frequently narrow, and wanting in bone. Though considerably cheaper than other European jacks, I doubt even at the price if as good value is obtained for money spent on these animals. Their height is about 12 hands 1 inch.

7. *Arabs* are as a rule fairly well shaped. They are generally white in colour, some being mouse. They run small and often light in bone. Some of them are wanting in back rib and are inclined to be flat sided. These are not easy to keep in condition, and once they fall off are difficult to restore. They average about 12 hands.

8. *Persian.*—The Persian in many instances has bone, substance, and depth, with a good back. As a set off he falls off terribly behind, and his hocks are much too far away from him. His big head and large ears give him a stupid look. Though possessed of many good points, he is an ugly animal and a strong contrast to the good looking Italian. He stands about 12 hands 1 inch.

9. *Home-Bred.*—Years ago the Department of Horse-breeding Operations obtained some Arab donkey-mares. These were crossed with Italian stallions and the result is the Home-bred donkey. Several of these have grown even larger than their sires. The average are somewhat smaller than the Italian, but have bone, substance, and looks, and are as a rule great favorites with breeders; but few of the original mares remain, the herd being now chiefly composed of their daughters and grand-daughters. He averages 12 hands.

10. *The Punjabi* is a very useful class of sire when he can be obtained. He is of fair size, bone, and depth, is hardy and for a donkey a ready coverer. He stands somewhat under 12 hands; of course, I speak of the best specimens. There are thousands of crooked-legged, cow-hocked, weedy, worthless brutes in the Punjab as elsewhere.

11. *Bokhara* and *Khorassani* resemble the Persian, but run rather larger.

ADVANTAGES OF MULE-BREEDING.

12. There is one great advantage in mule-breeding which recommends itself to the poorer class of mare-owners. A pony, worth 20 rupees, if put to the ordinary village tat will produce progeny as bad as herself, if not worse; put to a decent donkey, she brings forth a mule, which he can sell as soon as weaned from 40 to 60 rupees, and which at four years of age will quite possibly be up to Government Transport form and so be worth Rs. 150. Thus, no outlay is necessary to start mule-breeding. If a poor man has to keep a pony and selects to have it a mare, he can cross her with a Government

donkey whenever he wishes. There is no selection and no risk to be run, as in breeding from Government horse-stallions, where a long price has to be paid for a brood-mare to begin with. We also, as horse-breeders, have an object in encouraging the industry. For the mule being sterile, whatever faults of conformation and unsoundness he inherits from his dam, go no further. The mare does good work in producing a very useful class of animal, her faults die with her and her immediate progeny, and are not handed on to successive generations. The improvement of the Indian horse depends much on getting rid of these worthless dams, which can thus be disposed of profitably. If we, in addition, can induce Government to levy a small tax on all entire ponies and horses over two years old in the breeding districts, except on such animals as are approved by the officers of the Civil Veterinary Department, so as to induce owners to castrate freely, a marked improvement must follow at no distant date. The above is the view in which we may regard the mule in its relation to horse-breeding.

But there is another stand-point, from which mule-breeding must also be considered. That is, a profitable industry *per se*.

As I have endeavoured to show in the foregoing, a mare, whose pecuniary value is very small, will produce a mule which, by the time it is weaned, is commonly worth twice as much as its dam. If we wish to produce valuable mule stock, we must breed from something better than these. Let us take a mare with fair bone, straight back and not too crooked behind, from 13 hands to 13·3 at the outside, value Rs. 80 to Rs. 120. Putting her to a good donkey-stallion we shall get mules from 13·1 to 14 hands, for which Government is ready to pay Rs. 300 to Rs. 400, and even more for Mountain Batteries of Artillery and Ordnance at 4 years of age. As a mule is cheaper to rear than a horse, is hardier, less liable to disease, and will grow and flourish where a horse-colt would starve, or grow up a stunted weed, it requires but little consideration to understand how profitable an industry mule-breeding may be made. The natives in many parts of India, more particularly in certain districts of the Punjab, are awake to this fact. Not only have they gone in extensively for the industry, but they attend the large mule fairs, where they buy up young, immature stock and rear them, with a view to their sale at an adult age to Government

or Native States. A few years ago some persons, interested in horse-breeding, became much alarmed at the number of mares that were being put to the donkey in the north of India, and raised a great clamour on the subject. They proved by statistics that, at the present rate of progress, in a given number of years, there would be no mares left to breed horses from at all. They seemed, however, not to realize the fact that, in Italy, France, Spain, South America and Persia, where mule-breeding has been carried on for many centuries, it has not up to date been shown to have had any appreciable effect on the horse-supply of those countries. Furthermore, mare-owners take to the industry because the supply of mules is not equal to the demand; they therefore command a good price. But when the supply equals or exceeds the demand the value of the animal will go down, and the breeders, finding that it does not pay so well, will themselves withdraw from the trade. Again, should the number of mares be decreased appreciably their price will rise. The enhanced value of the dam will therefore act as a check on her being used to produce hybrids, and at the same time encourage people to breed ponies to meet the demand. The whole question depends on ordinary commercial laws, and may be safely allowed to rest there. It must be remembered, too, that there are large tracts of country in India quite unsuited to breed anything better than a small pony, but which are admirably adapted to produce donkeys and mules.

DONKEY-STALLIONS.

13. A good donkey-stallion should stand about 12·2 to 12·3. He should have good girth and shank measurements; be deep, but not too round in the barrel; well ribbed up; not too much droop in the quarters, and his hocks should not be very much away from him, nor sickle. A certain amount of straightness of shoulder may be overlooked. Above all things for pack work, a leggy sire should be avoided. All round, the Italian donkey best meets these requirements, but, as I have already said, his high price is much against him. It has been proposed, in my opinion very wisely, to allot a certain number of these jacks every year to donkey-breeding only, so as to secure for the future a supply of country-bred sires; but I fear that present financial difficulties stand in the way of its adoption to any great extent. We have a certain number of donkeys even now

standing for the service of jennys in various parts of the North-West and the Punjab, but not nearly enough to produce any large results.

COVERING.

14. Donkeys are very uncertain coverers. Slight changes in temperature, strangeness of surroundings, awkwardness on the part of the attendants and many other seemingly trivial circumstances will often make them point-blank refuse to touch a mare, even of their own species. The difficulty is still further enhanced when they are required to serve horse-mares. Every year, when our new batch of jacks arrives, we have a certain number who refuse to do what is required of them for weeks and months. More particularly is this the case in instances where they have been allowed even once to leap a jenny. Our mode of procedure is to take the recruit out with an old stallion who is a ready coverer, and walk them both slowly round and round the pony who stands hobbled in the centre. The old hand, when ready, is allowed his leap in front of the new comer, who is thus acted on by both amorous and jealous feelings. After a few lessons he generally takes to the work. If not, a donkey-mare in season is presented, and when he is sufficiently prepared a pony is substituted. Occasionally he refuses both. We have sometimes been obliged to turn stallions loose for weeks together with the herd of donkey-mares before we could induce them to touch one at all. To show how peculiar and fastidious they are, I will give an extract from Mr. Sutherland's excellent little *Memorandum on Mule breeding in India* :—

"A jack I knew in Poitou had been hand-reared by a little girl, owing to his dam having been burnt to death the night he was born. This jack always required a *maquignon* or groom to clothe himself with a horse-rug round his legs before he would prepare himself."

The same authority tells us, that the presence of anything which the animal has been brought up with when young is often necessary. A jack reared with cows will sometimes require a horned beast to be present. In some countries a jack when born is taken away from his own dam, and put to a horse-mare to be suckled. When this cannot be arranged, he is put amongst horse fillies as soon as he is weaned. I have been perhaps a little prolix on this subject, but I wished to show the difficulties we have to contend with. Often, a thoroughly tested donkey

is issued only to be reported within a week of his arrival at an outstand as refusing his mares. He has then to be marched back, and frequently the weary round of teaching and testing to be gone through again.

MARES FOR MULE-BREEDING.

15. A mare to breed good mules should be a low, lengthy, cobby animal, 13 hands to 13·3, with short shanks, good bone, not too sloping pasterns, good depth, not narrow in front and fairly straight behind. Soundness from hereditary affections is not so imperative as in selecting a dam to breed horses, though, of course, the sounder she is the better. As in the brood mare proper, the best age is between six and twelve. An old mare will throw a good mule. Senility of the sire or dam does not affect the produce to anything like the extent that it does in horse-breeding. It would be advisable though to mate an old mare with a young and vigorous jack and *vice versa*. In America it is the practice, when a mare is considered too old for the horse, to get a mule or even two from her. An American Artillery Officer assured me that excellent mules were obtained in this way. I have on two or three occasions induced Zamindars to put an old dam to the donkey, but only saw the result once. He was certainly a very promising little beast, but too young to judge.

Authorities on the subject tell us that the size of the mule depends on the mare ; this of course is true. But small mares produce much larger mules than themselves. One often sees an eighteen-month old mule standing higher than his dam by an inch or two.

MULES.

16. Mules from 13 to 13·3 are the best. Below this they are often not strong enough. Above this height involves a large amount of extra work in lifting their loads from the ground to the saddle.

The back should be long and straight, to give plenty of room for the pack ; a slight inclination to convexity, *viz.*, roach back, may, however, be overlooked. A concave, dipped or hollow back is, however, a serious defect. With such a conformation there is not room for the pack saddle, and galls are very likely to occur owing to the difficulties in adjusting the panels to the curve. The shoulders may be a bit straight without much detriment, but his shank should be short, and have plenty of bone. Pasterns should not be much sloped. There ought to be plenty of depth, but not too much roundness of rib. The latter, though a good point in many ways, does not give a flat support for

the saddle, which on animals with this conformation is apt to roll from side to side or even slip off altogether. The elbows should not be turned in ; the toes should be straight. The greater loin-power, straighter croup, more muscular thighs and gaskins the better. Big hock joints, even if they are rough, are a decided advantage, more especially for hill-work. Sickle, cow-hocks, and hocks far out are defects. These are so common that it is not easy, when buying mules in large numbers, to avoid them. Though it is better to get as sound a mule as you can when purchasing, still there are many defects, which would render a horse almost valueless, which affect the working power of the mule hardly at all. I have been informed that a spavin causes a certain irregularity of gait which makes the saddle work over to the opposite side and produces galls ; that is to say, if a pack animal be spavined in the near hock he will gall on the off wither or ribs. A Veterinary Officer, who had a large experience of Spanish mules, told me this, but I have not noticed it myself amongst Indian, Persian and Egyptian animals.

All the foregoing applies to pack mules. For riding we require better shoulders, a good rein and fair action at the trot. As long as they are not too light and leggy they may be of any height. A good riding mule will walk five miles an hour with ease, can trot and canter as smoothly as a horse and will often jump like a deer. Being as sure-footed as a goat he is an excellent mount for a hilly country. As he is wanted for fast work, more care must be devoted to examine him for soundness.

For draught much the same points must be looked for as in a harness horse, and a mule of any height may be used.

HANDLING MULES.

17. Mules are frequently difficult to handle. They rarely bite, but they are extremely handy with their heels, and kick with both force and precision. Now and then, they strike with their fore-legs. They have too a knack of suddenly sitting down like a dog and then rolling over which is most disconcerting. Beating them and all ill-treatment only make them worse, for they have plenty of pluck and obduracy. There is only one way that I know of dealing with a really refractory mule. Get him by the ear and give it a twist, and he subsides instanter. It has to be done pretty quickly, for they soon learn the trick and do their best to prevent a hold being taken.

A NOTE ON BIRDS FROM CENTRAL INDIA IN BARNES'S HANDBOOK.

By W. T. Blanford.

In Lieut. H. E. Barnes's "Handbook to the Birds of the Bombay Presidency," I find some species included that, to the best of my knowledge, do not inhabit Western India. Several of these, I find, are given on Jerdon's authority as occurring in "Central India," with the remark that no other observer has found them in that area. For instance, of *Strix candida* (p. 61) Mr. Barnes says:—"Dr. Jerdon procured the grass-owl in Central India, as did also Colonel Tickell. Neither Colonel Swinhoe nor myself met with it there."

Mr. Barnes and Colonel Swinhoe understand by Central India the area now known as the Central Indian Agency between Rajputana and the Central Provinces, and particularly the neighbourhood of Mhow, Indore, and Neemuch. This is the country to which their paper "On the Birds of Central India" ("Ibis," 1885, pp. 52, 124) refers. The Central Indian Agency, as represented on maps, comprises a considerable tract to the eastward, including Bundelkhund and Rewah, but these are not, I think, regarded by Mr. Barnes as within the country to which his work on the "Birds of the Bombay Presidency" is restricted, for he speaks of the book in the preface as "dealing exclusively with that portion of India proper garrisoned by Bombay troops."

Jerdon's Central India is a much wider area. In the introduction to Vol. I of the "Birds of India," he divides India into Northern, Central, and Southern, and he thus writes: "Central India includes Nagpore, north of the Godavery, the valley of the Nerbudda, with Saugor and Mhow, Bundelkhund *and the countries extending on the east towards Cuttack and Midnapore.*" I put the last words in italics, because, as will be seen, they contain the explanation of Mr. Barnes' mistake, or what I think is his mistake. Dr. Jerdon's Central India included, besides the Central Indian Agency, the whole of the Central Provinces* and the region commonly known as Chutia or Chota Nagpore.

* Jerdon's book is dated 1862, the year after the Central Provinces were formed out of the Nagpore country and the region formerly known as the Saugor and Nerbudda territories, with some adjoining districts. The name by which the area is now known is never, so far as I am aware, used by him.

The important fact is this. The country between the Ganges and the Godavery, east of the meridian of about 80° east longitude, is a great, thinly populated forest region, with a different fauna from that of the Western Central Provinces, the Bombay Deccan, and the Central Indian Agency. By far the best account of the birds of this eastern tract is by my friend, Dr. V. Ball, in "Stray Feathers" (Vols. II, p. 355; III, p. 288, and especially VII, p. 191). His last paper on the subject, "From the Ganges to the Godavery," contains a complete list of all the species recorded by various observers. This list should be compared with Colonel Butler's Catalogues of the birds of the Bombay Presidency in the "Bombay Gazetteer." Both lists are excellent and are amongst the most important contributions existing to our knowledge of the distribution of Indian birds. The area, east of 80° east longitude, is the tract that many years ago ["Journ. As. Soc. Beng.," XXXIX, pt. 2, p. 337; "Ann. & Mag. Nat. Hist." (4), XVIII, p. 282 (1876)] I proposed to call the Bengal sub-province, whilst that immediately to the west of that meridian I distinguished as the Deccan sub-province, both belonging to the Indian province of the Oriential region. The Bengal sub-province is distinguished by being the area of the sal tree (*Shorea robusta*), the Bara Singha deer (*Cervus duvauceli*), the black partridge (*Francolinus vulgaris*), and the red or Bengal jungle fowl (*Gallus ferrugineus*), and is inhabited by several Malay and Burmese birds that are either unknown further west or only re-appear in the Bombay and Malabar coast-lands. Such, for instance, are the black and white hornbills (*Hydrocissa*), the imperial pigeons (*Carpophaga*), the bronze-winged doves (*Chalcophaps*), and the green pigeons of the genus *Osmotreron*. To the westward, and not in the eastern area, or only as occasional stragglers on its frontiers, are found gazelles, sand-grouse and bustard (*Eupodotis*), *Gallus sonnerati* and *Francolinus pictus*. The difference is due in part to the eastern region being a forest area with a heavier rainfall, but this does not account for the circumstance that it is inhabited by *Francolinus vulgaris*, which is found also in the almost rainless plains of Sind, nor for several other peculiarities of the fauna.

In 1833 a paper was published by Colonel (then Lieutenant) S. R. Tickell, entitled "List of Birds collected in the Jungles of Borabhum and Dholbhum" ("Journ. As. Soc. Beng.," Vol. II, p. 569). Borabhum

and Dholbhum are small states situated south of Purulia, and between Midnapore on the east and Chyebassa on the west. This is in the extreme east of the Chutia Nagpore country, indeed the tract in question is often referred to as part of the South-Western Bengal.

It is evidently from this paper of Tickell's that Jerdon has taken from it a considerable number of references to birds which he described as inhabiting Central India. He was never, I think, in Chutia Nagpore, South-Western Bengal, or Orissa himself, and when he writes about the country west of Ganjam, which he did, I believe, visit, he calls it Goomsoor. But he once made a journey to Bastar and the Indrawati valley, and it was there, I think, that he must have met with some of the birds that are recorded in his book as having been seen or obtained by himself in Central India. It will be noticed that he draws the limit between Central and Southern India at the Godavery, and Bastar is north of that river.

The following is a list of species included by Mr. Barnes in his handbook on account of their having been recorded from Central India. I am doubtful whether any of them have been obtained in the Bombay Presidency, and in any case it may be useful to call attention to the possibility of their having been attributed to the area in error:—

Limnaetus kienerii, p. 35.

Circus melanoleucus, p. 52.

Strix candida, p. 61.

Chætura sylvatica, p. 84.

Caprimulgus albonotatus, p. 90. (I regard this and *C. atripennis* as local forms of *C. macrurus* ; *C. atripennis* has been obtained in the Bombay Presidency, as stated in the handbook.)

Micropternus phaioceps, p. 118.

Surniculus lugubris, p. 128.

Chrysococcyx maculatus, p. 128.

Centropus bengalensis, p. 133. (Jerdon certainly in the "Madras Journal," Vol. XIII, pt. 1, p. 172, stated that Elliot found this bird in the Southern Maharatta Country, but I suspect a mistake, as nothing of the kind is stated in the "Birds of India." This species is found in Mysore however.)

Lanius nigriceps, p. 144.
Pericrocotus speciosus, p. 151.
Dissemurus grandis, p. 156. (*D. paradiseus*, which is only, I believe, a variety, is of course found in the Concan and Syhadri.)
Erythrosterna albicilla, p. 167.
Erythrosterna maculata (*Cyornis melanoleucus*), p. 167.
Mixornis rubricapillus, p. 176.
Pycnonotus pygæus, p. 188.
Abrornis cantator, p. 231.
Carpophaga ænea, p. 287.
Gallus ferrugineus, p. 303.

Perhaps one or two of the above have not been included in the "Birds of the Bombay Presidency," solely because they were recorded by Jerdon from Central India. For instance, *Circus melanoleucus* is said by Jerdon to be "rare in the Deccan and Central India." This bird may perhaps be found in some part of the Hyderabad territory, as it ranges along the plains of the east coast to the Carnatic, but there is not, so far as I have been able to trace, any record of its occurrence in the Bombay Deccan, nor in the Western Central Provinces.

As regards *Carpophaga ænea*, it may perhaps be found in some of the Syhadri forests, as it is common further south in Malabar. Butler, in his supplementary list (section II), in the "Bombay Gazetteer," says that Major Lloyd includes it as a Concan species, and that he believes he himself once saw one on the Ghats west of Poona. I may add that there is a specimen, labelled Bombay, in the British Museum. But it is clear that Butler attaches very little importance to the supposed occurrence, or he would not put the bird amongst the list of doubtful species, and neither Fairbank, Vidal nor Davidson mentions the species as occurring. It is a noisy and conspicuous bird not easily overlooked. The British Museum specimen was derived from Colonel Sykes' collection, but there is no mention of the species in Sykes' Catalogue (P. Z. S., 1832), and moreover there is a specimen of the Himalayan *Columba* (*Dendrotreron* or *Alsocomus hodgsoni*), back also from Sykes' collection and also labelled Bombay. There was at one time great want of accuracy about localities in European

collections ; thus all Hodgson's collections, even marine fish, are labelled "Nepal," and Jerdon's and Elliot's specimens from the South Mahratta Country, the Niligiris, Malabar, and Travancore are all labelled "Madras" in the British Museum, so the circumstance of a specimen being labelled Bombay in that collection proves nothing.

There is another name in Mr. Barnes' work that might, I think, have been omitted with advantage. *Cercomela melanura* was included in Jerdon's "Birds of India" on very slender evidence. Blyth (J. A. S. B., XVI, p. 131) observed "amongst Barnes' drawings there is a rude figure of what is probably *Sax. melanura*, Tem." Now, the drawings obtained by Sir A. Barnes in Sind and Afghanistan were very far indeed from being good, they were in fact indifferent figures by, I believe, very second-rate native artists. Hume ("Stray Feathers, Vol. I, p. 188") showed how probable it was that a bad figure of a *Saxicola* had been identified by Blyth with *C. melanura*. I know the latter bird well and have seen and shot it repeatedly on the Abyssinian coast-land and at Aden, and I certainly never saw it in Baluchistan nor in Sind, where I passed three cold seasons in traversing the province. It is a conspicuous bird for its size, and easy of recognition. None of the ornithologists who have collected in Sind—Hume, Butler, Doig, James, Murray, Le Mesurier, and others—has ever met with the species. But in the last number of "The Ibis," Lieut. Cordeaux relates how he saw a bird in Kashmir that corresponded exactly with Jerdon's description. Of course, the bird was not secured, and it is unnecessary to say that it is far less probable that *C. melanura* should be found in Kashmir than in Sind.

NOTES ON THE NIDIFICATION OF CERTAIN BIRDS, THE NESTS OF WHICH HAVE NOT BEEN PREVIOUSLY RECORDED IN INDIA.

By B. B. Osmaston.

During a recent tour in Tehri-Garhwal, in May, I was fortunate enough to find the nests and eggs of two or three species of birds, which have not, I believe, been previously recorded in India.

The locality visited by me is in a rather isolated group of hills in the upper valley of the Tons River, and is situated about forty miles north of Chakrata.

The altitude of the main ridge (called Changsil) varies from 8,000 to 13,000 feet above the sea, and the vegetation of this zone consists of silver and spruce firs at the lower elevation mentioned, passing, as we go up, into Karshu Oak, Birch, Rhododendron, Juniper, and lastly, about 12,000 feet, grass only.

(1) Siphia strophiata, Hodg.

The first nest to be described is that of the orange gorgetted fly-catcher (*Siphia strophiata*). On May 23rd I noticed a bird fly into a hole, about eight feet from the ground, in a dead Yew branch, which I found, on examination, contained a nest with two freshly-hatched young birds and one addled egg.

I watched the parent birds for some time with binoculars. They were very wary and would not again visit the nest; however, I saw sufficient to satisfy myself as to their identity.

On the following day I found a second nest of the same species in a rift in a Karshu Oak, about five feet from the ground. It contained three much incubated eggs, exactly similar to the egg found on the previous day. The nest was rather a loose structure, cup-shaped, composed of moss and maiden-hair rachis, lined with the latter chiefly, but also with a few feathers and some yellow papery substance resembling birch-bark. I shot one of the parent birds (the male) for identification.

The eggs were pure white, elongated ovals and fairly glossy. The average of their measurements gave—

Length ... ·76 inches.
Breadth ... ·53 „

The above nests were both found at an elevation of about 9,000 feet.

(2) ANTHUS PRATENSIS, Lin.

On May 25th I was walking along a bare grassy slope varied with patches of snow, near the ridge, and at an elevation of nearly 11,000 feet, when a bird flew out from under my feet, disclosing a nest and three fresh eggs, of the regular pipit type. I returned to camp for my gun, and waited for the bird, which shortly returned and was duly secured. The skin was sent for identification to the Superintendent of the Indian Museum, Calcutta, by whom it was pronounced to be *Anthus pratensis*—the English meadow-pipit or titlark.

This bird, so common at home, has rarely, if ever, been shot in India, and its nest has never before been found in this country.

The nest and eggs were similar to many I have seen at home; the former being cup-shaped, placed in a hollow in the ground and composed of fine grass stalks. The eggs were rather broad ovals, thickly spotted all over with slatey-gray and dark brown, the ground-colour, where visible, being grayish.

The average of the three eggs measured was :—

Length ... ·81 inches.
Breadth ... ·61 „

I shot another specimen out of many more of these pipits seen in the neighbourhood, all of which were probably breeding near by.

(3) RUTICILLA FRONTALIS.—The Blue-fronted Redstart.

I found two nests of this pretty redstart on the 25th and 29th May respectively, at about 11,000 feet. The former contained three hard-set eggs, the latter four half-fledged young. The nests were very similar in structure and position, being placed in holes in rocks, about three feet from the ground, and composed of moss interwoven with a woolly composite plant and some grass, and lined with moss, a few feathers, and musk-deer hair. The eggs were rather long ovals coloured pinkish café-au-lait, with a zone of confluent pinkish-brown markings and a few gray specks near the larger end.

This colour is most extraordinary for a redstart and I cannot but think that they are abnormal. There could be no possible doubt as to the identity of the bird which I shot off the nest, and sent to Calcutta, where my own opinion was confirmed.

(4) LOPHOPHANES DICHROUS.

On May 1st I saw a strange tit come out of a small round hole in a dead branch of a wild Cherry tree. I shot the bird, which proved to be a brown-crested tit (*Lophophanes dichrous*), and then investigated the hole, which was at a height of about ten feet from the ground. On breaking off the branch, just below the hole, I discovered to my regret that the nest contained four freshly hatched young. It was placed at the bottom of a cavity about nine inches deep and reminded one much of the nest of the European crested tit, the nest cavity having apparently been excavated by the birds themselves, as is often the case with the latter species. The nest was composed of moss below, then a quantity of fine hair (probably rats') above and lined with the same material with the addition of a few monal feathers, apparently for ornamental purposes.

This nest was found at about 8,000 feet.

I may here add that the white-browed bush-robin (*Ianthia indica*) is fairly common throughout these forests from 8,000 to 11,000 feet, and I have no doubt that it breeds here, though all my attempts to find its nests proved unsuccessful.

The distribution of this bird is put down in the Fauna of British India as "Nepal and Sikhim extending into western China." The fact of its having been hitherto overlooked in these parts seems somewhat strange, but is no doubt owing to its retiring habits and difficulty of approach.

Its song, although of only a few notes, is very clear and strong and most characteristic, and when once heard it cannot be mistaken.



From a Photograph by J. D. Inverarity. Mintern. Bros. Photo imp. London.

THE FOUR HORNED ANTELOPE

Tetracerus quadricornis.

THE FOUR-HORNED ANTELOPE.

TETRACERUS QUADRICORNIS.

BY J. D. INVERARITY.

(*With a Plate.*)

(*Read before Bombay Natural History Society, on 26th October*, 1894.)

This small antelope is only found in India and is a forest antelope, living entirely in the jungle. They are not gregarious, but are met with either alone or in pairs. The female brings forth one or two young, and, occasionally, the two old and two young ones will be seen together. Though not forming a special object of pursuit, a shot at the 'baikrie,' as it is generally called, on the Bombay side of India, is often got when out stalking other game. If you see one, before it sees you, it is fairly easy to stalk; but it more often happens that they see you first, when they will not admit of approach. On three or four occasions they have stood stupidly looking at me as I walked in full view slowly towards them and allowed me to get within 20 yards before bolting. This only occurs when you do not want to shoot them. Forsyth says that the females are much more numerous than the bucks, and bear the same proportion to each other as the does and bucks of the black buck. At one time I thought the same myself, but further experience has made me sure that this is not the fact, and that bucks are nearly, if not quite, as numerous as does. The female is hornless. The male has four horns, the posterior and longer pair in a good specimen will be 4 inches long or a little more. One and-a-half inches is a good length for the anterior horns and not often exceeded; to get a head as good as this is rare. In some heads, the anterior horns are absent, though the bony knobs on which they would grow can be felt under the skin. In others these bony knobs are covered with a callous black skin. In some the anterior horns will be only $\frac{1}{4}$ or $\frac{1}{2}$ an inch long, and you may shoot a great many before you get a really good head. The three best heads I have measured—

		No. 1	No. 2	No. 3	
Posterior	Horn...	$4\frac{1}{8}$	$3\frac{5}{8}$	3	inches.
Anterior	Horn...	$1\frac{1}{2}$	$1\frac{7}{8}$	1	inch.

A head in the possession of this Society measures—posterior horn $3\frac{1}{2}''$, anterior horn $2\frac{1}{16}''$. The suborbital gland of this antelope is large.

REVIEW.

BUTTERFLIES FROM CHINA, JAPAN AND COREA.*

Our knowledge of the butterflies of Eastern Asia has been greatly added to by this work by Mr. J. H. Leech, which has been appearing in parts during the past three years and has been concluded with very praiseworthy expedition. The paper and type are excellent, while the plates are, both for accuracy and execution, far and away the best that we have seen in a similar work. In his arrangement, Mr. Leech has adopted that followed in the "Butterflies of India" and "*Lepidoptera Indica*," and we are glad to see has not considered it necessary to strike out a line for himself. We do not quite understand why Mr. Leech should adopt Mr. Moore's subdivisions of *Euplœa* and *Danais* as generic, while he entirely ignores the same author's subdivisions of *Mycalesis* and *Lethe*, and does not apparently consider them even of subgeneric value. We do not quite agree with him here and think the correct way to treat all the subdivisions in these genera is as subgenera; since by ignoring them altogether a great help to identification is lost, while by admitting them as generic it is implied that the different species are much less closely allied to one another than is really the case. In the case of *Ypthima* we are quite at one with Mr. Leech—that the various genera into which it has been split are not of sufficient importance to be treated even as subgenera.

We think Mr. Leech has certainly gone wrong in the genus *Melanitis*. He admits *Melanitis aswa*, Moore, as distinct from *M. leda*, (*auctorum*, *nec* Linnæus), but treats *M. bela*, Moore, not as the dry-season form of *M. aswa* but as "a seasonal form of *M. leda* in the district under consideration." However, since both *M. bela* and *M. aswa* as they occur in China are practically inseparable from the forms found in India, where they are without doubt seasonal forms of one and the same species, it is quite certain that they are also forms of one species in China. The true *M. ismene*, Cramer, with its rainy-season form *M. determinata*, Butler (= *leda auct.*), also occurs in Japan and China, though this is not clearly shown in Mr. Leech's book. Mr. Leech is no doubt quite right in his suggestion that the *Melanitis leda*, var. *a* of

* *Butterflies from China, Japan and Corea.* By John Henry Leech, B. A., F.L. S., F. Z. S., F. E. S., &c. R. H. Porter, 18, Prince's Street, Cavendish Square, London, W., 1892-94.

"The Butterflies of India" is really only the female of *M. aswa*. We have long had this form in our collection as the rainy-season form of the *M. duryodana* of the "Butterflies of India" (*nec* Felder), which Mr. Moore has recently shown to be the female of *M. bela* (= *M. aswa* dry-season form).

Not much in the *Nymphalinæ* calls for comment, except that, on Plate XXV, Mr. Leech appears to have figured a specimen of *Symbrenthia hippoclus* in mistake for *S. asthala*, the latter belonging to the *S. hypselis* group which has the underside tessellated with black. It is not quite clear why Mr. Leech adopts the name *Neptis eurynome*, Westwood, in preference to *N. leucothoë*, Cramer, which has priority, but which Mr. Leech sinks as a synonym. This species is the one that is known to Indian Lepidopterists under some eight or ten names, of which *N. varmona*, Moore, is the least fictitious.

In the *Pierinæ* the synonymy given by Mr. Leech is very voluminous, but we doubt if he is correct in all instances, especially in the genera *Terias* and *Pieris*. We notice that Mr. Leech has followed Cramer in his erroneous sexing of *Tachyris paulina*, and that he describes the female of this species as a male.

Mr. Leech seems to have devoted a considerable amount of attention to the *Hesperiidæ*, of which family he figures many species and notes some new synonymy. We do not, however, think that he has succeeded in every instance in assigning species to their correct genera, *e.g.*, *Notocrypta goto*, Mabille, and *Notocrypta tibetana*, Mabille, both certainly belong to *Celænorrhinus*, and the former appears to be identical with *Celænorrhinus asmara*, Butler; *Hidari grandis*, Leech, is *Erionota acroleuca*, Wood-Mason and de Nicéville, a species which has been named by at least six authors. *Padraona trimacula*, Leech, *Aëromachus delai-lama*, Mabille, and *A. nanus*, Leech, are all certainly nearer to *Ampittia* than to the genera in which they are placed. *Rhopalocampta translucida*, Leech, has certainly nothing to do with *Rhopalocampta*, but belongs to a genus closely allied to if not identical with *Pisola*; and it is almost certain that *Celænorrhinus omeia*, Leech, is a female not only of the same genus but of the same species as *translucida*.

We do not like the continual use of the word "var." throughout the work, generally with the meaning of a local race; but also used for seasonal forms and casual varieties. In our opinion the term "var."

should only be used for the last, and no name should be given to such varieties. Seasonal forms too, we think, should certainly not receive names ; but the case of local races is a quite different one, and in many instances it is difficult to say whether a particular form is a good species or a local race. In describing local races the form first described is usually treated as the parent race, though this must inevitably be frequently quite wrong, and all the principles of evolution teach us that of two geographical races occurring in different areas at the same period neither would be the parent race but both would be modifications of one progenitor. We have, therefore, to be very careful when assigning local races to make certain that we are grouping together the local races of one and the same species ; for instance Mr. Leech admits that the species he once considered to be a race of *Augiades sylvanus*, he now considers to be a race of *Erynnis comma* ; and again why should *Yphthima chinensis* be treated as a race of *Y. newara* rather than as a race of *Y. nareda* ; and many other cases could be quoted. Furthermore if some subsequent naturalist ascertain that a form, which Mr. Leech has described as a "var." of a certain species, has really nothing in common with it and belongs for example to a different genus, as in the case quoted above, in such a hypothetical case should Mr. Leech's name stand although he may have gone utterly astray ?

We therefore think this sub-specific treatment has its drawbacks, and should only be used in cases where there is absolutely no question as to the correctness of the conclusions drawn ; this no doubt is the case in the large majority of instances in the present work but in such instances as mistakes have been made, if any there be, the labour of subsequent authors will be considerably increased.

On the whole, we can certainly congratulate Mr. Leech on having brought out a most valuable work, which will remain the standard authority on the districts dealt with for many years to come, and, if some slight errors have crept in, that was only to be expected, and if others carp at Mr. Leech's treatment and synonymy, is not that to be expected still more ?

A BOTANICAL TOUR IN SIKKIM.

By G. A. Gammie.

[*From the Records of the Botanical Survey of India.*]

I departed to collect botanical specimens in Sikkim and on its frontiers on the 6th June, 1892. As Mr. White, the Political Agent, informed me that he would probably be at liberty to accompany me on a journey to the little-known district of Lhonak, I arranged to meet him at Guntok in about six weeks' time, when we should make the necessary arrangements for our travelling together. To my regret the exigencies of his appointment prevented him from carrying out his intention, and I was obliged to abandon the idea of going alone to Lhonak, as Mr. White considered it inadvisable on my part to attempt it while important negotiations concerning the frontier were pending with the Tibetans.

He kindly forwarded to me parwanas written in Tibetan and addressed generally to the headmen of villages, ordering them to render me whatever assistance I required ; but at the same time he wisely advised me not to depend on procuring carriers or supplies from the inhabitants. His passports were of the utmost value to me on the rare occasions I had to avail myself of assistance from the villagers—a service these indolent people would have been loath to afford me had I not been supported by such indisputable authority. As I had no hope of procuring supplies in the country, I made thorough arrangements for food sufficient for all to be sent at intervals to different stations, regulating my movements in accordance with the plans laid down, thus, at all times, avoiding a possible scantiness of rations, which would have disheartened my men and caused their desertion,—a most undesirable contingency.

The slothful and improvident habits of the inhabitants prevent them from growing more grain than is actually necessary for their bare subsistence—a condition of affairs concomitant with their lack of mercantile enterprise, which is probably due to their isolation from the outer and more civilized world.

Being thrown on my resources, and having permission from Mr. White to travel in any part of the country, excepting Lhonak and Cholamoo, I decided to devote the remainder of the allotted time to exploring the Lachung Valley with its ramifications, the Lachen Valley and the Chola Range from Tumlong to the Zeylap La, from whence I could return to Darjeeling by the Gnatong road.

In anticipation of the meeting with Mr. White, I considered that the first month of deputation would be most usefully spent in traversing the Singalelah Range to Kinchinjunga, from which I could march to Guntok by way of Yoksun.

As I was requested to confine my attention as much as possible to the collection and observation of temperate and alpine vegetation, that of low

elevations being already well understood, I must omit anything but casual mention of the tract between Yoksun and Tumlong, and also the valley of the Teesta to the junction of the Lachen and Lachung. This restriction divides my narrative into three parts—the first dealing with the vegetation of the exceedingly moist mountains forming the western boundary of Sikkim, the second with that of the temperate and drier territory north of the junction of the Lachen and Lachung, and the third with that of the Chola Range.

First Tour.—Journey along the Singalelah Range to the tracts on the southern flank of Kinchinjunga, and the march across the valleys of the Ranjit and Teesta to Tumlong.

This excursion lasted from the 7th June to the 7th July. The rainy monsoon broke with almost unparalleled severity on the day of my departure, and the most interesting portion of the journey, namely, that at high elevations, was accomplished through incessant fogs and storms of wind and rain. I thus enjoyed few opportunities of viewing the surrounding scenery, and had perforce to confine my observations to the vegetation within access to practicable paths.

The Singalelah Range is an elevated mountain mass, springing from the face of Kinchinjunga and extending southwards to the plains of India. Owing to the facilities of travelling afforded by the Nepal frontier road to Phalut, the range so far is much frequented by general travellers, and is in consequence too well explored to induce one to linger on the way in search of novelties. Some Yew trees (*Taxus baccata*) grow close to the road beyond Tonglu, and *Abies Webbiana* is first seen on the last ridge between Tonglu and Sandakphu, from whence onwards it exists in profusion up to 13,000 feet in elevation, covering mountain sides with dense and sombre forests. There are trees of *Tsuga Brunoniana* below Phalut, and *Juniperus pseudo-sabina* abounds near the path to Cheabhanjan, but the other species of Conifers, so characteristic of drier Sikkim, are altogether absent. Above 11,000 feet the most notable plants are Aconites and *Meconopsis Wallichii*, and a few species each of the genera *Ranunculus, Anemone, Potentilla, Primula*, &c., *Fragaria Daltoniana* occurs here and there, bearing narrow oblong fruits, reminding one of small strawberries and resembling them in flavour. The road from Sandakphu to Phalut passes through a forest of *Abies Webbiana*, associated with *Pyrus foliolosa, Betula utilis, Acer caudatum* and *Prunus rufa*, &c., underneath which are thickets of various Rhododendrons and two species of bamboo. One of the latter is *Arundinaria spathiflora* which flowered two years ago, a fact attested by the dead culms still bearing the withered spathe-like sheaths of the inflorescence. Its average height is 10 to 12 feet. The other is what Mr. Gamble named *A. Gammieana* from specimens of the foliage only; but having since examined flowers, he has discovered it to be *A. racemosa*, Munro, a plant which, although so abundant round Darjeeling as to be almost exclusively used as fodder for ponies, has never been known to flower there. The Phalut plant, which differs so much in size and appearance,

having reddish stems with an average height of 3 feet, may of course owe its diminutive size to the more rigorous climate of higher levels preventing its attainment to a normal growth. These two bamboos, the most Alpine species in Sikkim, grow in impenetrable scrubs in the same spongy soil which affords support to Rhododendrons and Pines.

On the slopes immediately below the summit of Phalut arboreal vegetation is scanty and confined to sheltered ravines. The ground is everywhere covered with a sward of herbaceous plants. *Anemone rivularis* with blue and white flowers predominates. *Primula rotundifolia* and *P. sikkimensis* (the latter affecting marshy situations in company with *Calathodes palmata*) are common. *Meconopsis Wallichii* is extremely abundant. The Bhutias eat the young stems of this plant, and the shoots of a *Polygonatum* are much esteemed by the Gurung shepherds. The young shoots of bamboos are cooked and eaten. *Rheum acuminatum* is prevalent throughout the whole of Alpine Sikkim, but is not utilized as food. *Allium Wallichii*, which is equally abundant, is consumed largely, sharing with the common onion the reputation of being an efficacious antidote against the physical discomforts experienced by men and animals at high elevations.

From Cheabhanjan onwards to Kinchinjunga, the only available path is that used by the shepherds, who pasture their flocks along the whole range during summer. For many miles this track follows the contour of the spur's crest, so that every day's march comprises many descents and ascents. As might be inferred from the proximity of the path to the ridge, streams supplying a sufficiency of water for our camp were few and far between, often necessitating long marches to obtain our two chief *desiderata*—a space large enough to contain our tents and water for cooking. At the end of the first day we found such a place at Ewanangi, a halting stage for shepherds. Its elevation by B. P. thermometer was 11,174 feet. The camping ground was covered with young plants of the formidable *Cnicus eriophoroides*, a large thistle. At the commencement of this march we struck the Islumbo Pass and continued in a northerly direction. The path runs through woods of *Rhododendron arboreum*, *R. cinnabarinum*, *R. Falconeri*, *R. barbatum*, and *R. Hodgsoni*, *Acer caudatum*, *Betula utilis*, *Pieris ovalifola*, *Juniperus pseudo-sabina*, *Abies Webbiana*, *Prunus rufa*, *Arundinaria spathiflora*, &c. These trees grow so densely that very few herbaceous plants exist beneath them. *Saxifraga ligulata*, a few species of *Polygonum*, ferns of two species, and several species of *Potentilla* being most in evidence. A variety of beautiful mosses grow on the rocks. On open knolls the soil is carpeted with *Gaultheria nummularia*, and the heather-like *Cassiope fastigiata*.

The following day's march was from Ewanangi to Megu. Two Gentians become common about 12,000 feet. One *Gentiana stylophora*, with large, terminal, greenish lily-like flowers ; the other *Swertia Hookeri*, conspicuous by its brown leaves and inflorescence growing together in whorls on a stem often six feet high. A white and pink *Primula* is common. *Rhododendron Anthopogon*

is abundant. Its fragrant leaves are largely collected and burned as incense in Buddhist temples. Small trees are represented by the species of Rhododendron formerly enumerated, by *Pyrus foliolosa*, *Prunus rufa*, and the bushy variety of *Juniperus recurva*, which forms excessively close thickets. *Spiræa bella* and *Pyrus rhamnioides* grow in open situations. *Clematis montana* with large white flowers climbs over bushes and at once arrests attention. A succession of steep ascents and descents, where we first saw plants of *Meconopsis simplicifolia* in flower nestling under Berberry bushes, was followed by a comparatively level path running over the rocks of a glacial deposit, at the end of which lay the large and grassy flat of Megu, the elevation of which by B. P. thermometer was 12,767 feet. Its bright green surface was interspersed with many plants of white primroses and yellow *Calathodes*, a refreshing sight after travelling through such a long waste of *Rhododendron*. A colony of marmots lived in the rocks above the camping ground. I always understood that they avoid the damp climate of the Sikkim mountains and live only in the dry regions beyond the snows. The tailless rat, another denizen of the same dry climate, was represented by numerous individuals scampering amongst the Rhododendrons. A great extent of land beyond the camping ground is swampy and covered with *Rhododendron campanulatum*. The stepping stones across the wettest parts are formed of slabs of a slate-like gneiss which are resonant when struck. Various species of *Sedum* of the section *Rhodiol* and the golden *Chrysosplenium alternifolium* are common in the clefts of stones, partly submerged in the water. The ridge above is steep, and its black barren crags of foliated gneiss present a most forbidding appearance.

The following day we marched to Gambothan. Since we left Phalut our marches had been along the crest of the Singalelah, excepting when we rarely descended to and traversed the Nepalese side; but here the path, after running through the swamp at Megu, ascends steeply and passes to the Sikkim side through a narrow depression guarded on each side by weather-worn cliffs. Grass covers this ascent, and the bright blue flowers of *Primula pusilla*, *P. glabra*, and *Delphinium alpinum* give an unique character to the place by their plentiful presence. In the clefts of a rock we found a small simply pinnate *Polypodium* and a species of *Pellæa*.

The tract into which we emerged wore a different aspect to that we had just left. Above us towered enormous walls and pinnacles of bare rock, intersected by equally stony valleys, all tending towards the broad and terraced slope over which we marched without difficulty. *Rhododendron Anthopogon* and *R. setosum* were the only woody plants. On the sides of the rocks along the terraces, *Saxifraga imbricata* and *S. Jacquemontiana* grew in dense moss-like cushions spangled with white and yellow flower. The soil is covered with a thick turf of grass and sedges, amongst which are innumerable plants of *Primula Stuartii* and a species of *Anemone*. Beyond this first terrace the route led over alternate flats and ravines, and passed four lakes. At first the rocks near the path are scattered singly over the ground; further on the

whole surface of the hill is covered by a confused mass of glacier-deposited boulders, where the path is marked at intervals by upright white stones. Very little vegetation, except moss, maintains an existence in this wilderness. Sir Joseph Hooker, in his admirable account of the Physical Geography of Sikkim, thus explains the cause of this barren desolation:—"Glaciers, again, descend to 15,000 feet in the tortuous gorges which immediately debouch from the snows of Kinchinjunga, but no plants grow on the debris they carry down, nor is there any sward of grass or herbage at their base, the atmosphere immediately around being chilled by enormous accumulations of snow, and the summer sun rarely warming the soil."

Attaining a ridge marked by a rudely-built monument bearing a small flag we descended a steep gorge, down which a stream urged its turbulent course. Its bed was cumbered with gneiss blocks, with many of a fine-grained granite transported from higher levels. This stream effects a junction with two others to form the Rangbi River at a flat expanse called Gambothan. The sheltered situation of this place favours the growth of large pine trees, and copses of a willow, *Salix Wallichiana*, fringe the river bank. From eastward another tributary flows through a broad grassy valley, which rapidly attains a high elevation, and for a short distance towards the south the united rivers flow calmly through a forest of *Abies Webbiana*. The most noteworthy plant growing in the desolate locality we had traversed is the gigantic Rhubarb (*Rheum nobile*) always associated in the traveller's mind with barren precipices where it delights to grow, and where it heightens the weird effect of such scenery by its cadaverous stave-like stems; for only by closer inspection can the actual beauty of the plant be realized. The only perfect specimens existed on inaccessible rocks, as the shepherds collect and devour all they find within reach.

The elevation of Gambothan, by B. P. thermometer, was 12,400 feet.

Leaving Gambothan, a steep ascent was made to the summit of the ridge—13,300 feet in elevation. For half the distance there is a scattered forest of *Abies Webbiana*, *Juniperus recurva*, *Rhododendron campanulatum*, *Prunus rufa* and *Betula utilis*, the upper part being almost wholly occupied by *Rhododendron Anthopogon* and *R. setosum*. These when bruised or trodden upon exhale a strong perfume from the superficial glands with which they are covered, aggravating the headaches to which all are subject at high elevations *Gentiana stylophora* is exceedingly common. Beyond the ridge is the broad open summit of Bokto covered with grass, on which two large flocks of sheep were feeding. From this a descent has to be made into the valley of the Yangsap through dense growths of *Rhododendron*, *Abies Webbiana*, *Pyrus foliolosa* and *P. microphylla*; beyond is a steep hill almost devoid of vegetation and covered with boulders. The path winds up its right flank to a depression below its summit at about 14,000 feet elevation. There is a fine wood of *Juniperus pseudo-sabina*, and the shrubby vegetation mainly consists of a *Berberis* not yet in leaf. Descending somewhat, we crossed two small plains

with a steep low ridge intervening. On these level tracts, intersected with sheep-walks, it would have been almost impossible to keep the proper path, had not the shepherds marked them with upright slabs of stones at regular distances. Leaving the second plain, a steep scramble along the inclined foot of an enormous black gneiss cliff brought us to the bank of the Ratong River, on whose further side we camped on a flat grassy knoll, the only cleared spot in a waste of Rhododendrons.

Next morning we took the Kanglalama path and continued up the valley towards the north-west. We crossed one or two alternating flats and transverse ridges, and surmounted a high spur coming out on a large plain rendered exceedingly swampy by a network of shallow streams. It seemed of very large extent, but we could not define its boundaries through the fog. There was no inducement to stop or proceed further in this direction ; so we retraced our way to within a short distance of our last camping ground, and then ascended a grassy slope to the east. The descent on the other side led steeply through grassy pastures in which grew a species of *Astragalus* and a dark purple species of *Anemone*. The floor of this valley is also a succession of terraces each terminated by a bank, over which the river pours in masses of foam. There are signs of a more varied vegetation later in the season, but at present there is very little scope for botanising.

Primula denticulata and *P. reticulata* resembling *P. sikkimensis* grow on the verges of water-courses. The valley lower down descends precipitately, and the flanks of its spurs are clothed with Pine forests. The next day we halted at this place, called Rongjing by the shepherds. As rainy weather had prevailed without intermission since the commencement of this expedition, my men were quite disheartened ; and, being afflicted with complaints induced by wet and cold, they begged me to hasten into the warmer valleys of Sikkim.

Being reluctant to subject them to further hardships in this inhospitable region, I acceded to their request and informed them that I should go to Yoksun after spending a few days at Jongri, a locality which I was anxious to see, as it was the goal of one of Sir Joseph Hooker's most heroic expeditions.

Returning to Tegyap La, we followed the course of the Ratong for about a mile, crossed it by a bridge and travelled eastwards up a very steep hill covered with Rhododendrons ; *Cryptogramme crispa* was plentiful along the path. The entrance to the undulating top of Jongri is marked by a shallow lake said to be dry in the winter. We camped on a terrace immediately below two stone huts. Many plants were springing up amongst the grass, but the only ones in bloom were *Potentilla pedunculoris*, *P. microphylla*, *P. coriandrifolia*, *P. albifolia* ; *Primula reticulata*, *P. Stuartii*, *P. pusilla*, *P. glabra* ; *Pedcularis iphonantha*, *Geranium polyanthes*, *Ranunculus affinis*, *Meconopsis simplicifolia* and *Phlomis* sp. A majestic species of *Meconopsis* grew near the huts in dense clusters 2 to 3 feet high. The flowers vary in diameter from 5 to 7 inches, are of an intensely vivid blue on opening and change afterwards to purple. I was informed by the Bhutias that it was not a native of Sikkim,

but had been introduced by them from Nepal. The mountain top of Jongri, which is admirably described by Sir J. D. Hooker, is formed of alternating knolls and hollows ranging from 13 to 14,000 feet. Much of its surface is covered with *Rhododendron Anthopogon* to the exclusion of other vegetation. To the east of the camping ground is a wood of Rhododendrons, mostly *R. lanatum* and *R. campanulatum*. About 12,500 feet *Primula pulchra* flourishes on the rocks.

After staying a few days at Jongri I marched down to Yoksun. For about a mile the path runs eastward along Jongri, and then descends steeply for 7,000 feet, enabling one to pass in review the gradation of vegetation from Alpine regions to the sub-tropical zone. A few gigantic Yew trees grow a little above the Ratong. After crossing the Ratong, we travelled along the slopes on its left bank by one of the most difficult and dangerous paths in Sikkim to Yoksun. This place is unique from its peculiar formation amidst such precipitous surroundings. The copse-wood which once enhanced the beauty of the flat is now reduced to a gaunt gathering of pollarded and charred trunks, but the beautiful little lake is still surrounded by forest trees. Here, and everywhere in Sikkim at the same elevation, there are large areas covered with *Edgeworthia Gardneri*.

I halted for two days to allow my men to recuperate in such a congenial climate. *Polypodium rostratum*, so rare in the Darjeeling district, is the commonest fern here. As Mr. Gamble once told me that Mr. Levinge had found it growing on the same *rhizome* with *Drymoglossum carnosum*, I searched carefully for a confirmation of the fact, but I failed to find an instance of it: indeed I did not perceive one plant of the latter species.

Variety of ferns is a notable feature of Yoksun. The commonest are *Polypodium rostratum*, *P. membranaceum*, *P. lineare*, *P. Boothii*, *P. fissum*, *P. amœnum*, *P. lachnopus*, *P. argutum*, *Nephrodium hirtipes*, various varieties of *N. Filix-Mas*, two forms of *Aspidium aculeatum*, one of *A. auriculatum*, *Oleandra neriiformis*, *Pteris aquilina*, *P. Wallichiana*. Of orchids I observed *Malaxis sikkimensis*, *Microstylis biloba*, *Cœlogyne ochracea*, *C. cristata*, *Otochilus sp.*, *Eria alba*, *Cymbidium Hookerianum*, *Dendrobium chrysanthum*, *Saccolabium calceolare* and a species of *Calanthe* in leaf. *Remusatia vivipara*, *Amorphophallus sp.*, *Arisæma speciosum*, *Hedychium coronarium* and *Piper nepalensis* were common on the rocks. The principal trees are *Erythrina arborescens*, *Castanopsis tribuloides*, *Pieris ovalifolia*, and two species of *Aralia*. The shrubby vegetation is composed of *Mœsa rugosa*, *Edgeworthia Gardneri*, *Dichroa febrifuga*, *Camellia drupifera*, and a few other species. The villagers grow clumps of a *Bambusa*, and a few plants of *Arundinaria Hookeriana* have recently been planted near the lake. This beautiful bamboo abounds in Sikkim from 5 to 7,000 feet, and is the kind exclusively used for roofing temples and houses. For this purpose the culms are cut into short lengths, flattened out and laid on as shingles. These are said to be very durable and to make perfectly watertight roofs.

The cultivated crops are buckwheat, millet and a little maize. After the grain is sown no care is taken to keep fields in proper cultivation. One enclosed plot was full of ganja plants (*Cannabis indica*) in splended condition.

From Yoksun I marched to Tumlong through tropical and sub-tropical vegetation similar in all respects to that of the Darjeeling district.

By camparison with the drier regions of Upper Sikkim which I afterwards visited, I considered that the main characteristic of the vegetation along the Singalelah Range is its poverty in variety of forms and its superabundant wealth in individual species of Rhododendrons. I only collected about 200 species of plants in flower and fruit. There was, however, evidence to prove that the floral harvest would have been more remunerative later in the season. Sir J. D. Hooker, in his appendix on the Physical Geography of Sikkim, states: "The banks (of rivers) between 8,000 and 14,000 feet are generally covered with Rhododendrons, sometimes to the total exclusion of other wooded vegetation, especially near a snowy mountain, a cool temperature and great humidity being the most favourable conditions for the luxuriant growth of this genus." Such conditions prevailing throughout the Singalelah Ranges due to its proximity to Kinchinjunga, account for the overwhelming abundance of Rhododendrons, and may also be accepted as probable reasons for the comparative absence of herbaceous plants (in ordinal and generic forms) which are unable to maintain a struggle for existence in such an adverse climate and against such formidable competitors.

Second Tour.—The Lachung Valley.—I arrived at Tumlong on the 7th July, and was detained there until the 24th waiting for supplies which where delayed by the break of communications caused by the excessive rains.

Immediately on their receipt I commenced my second excursion and marched through the hot tropical valley of the Teesta, arriving at Choongtam, at the junction of the Lachen and Lachung rivers, on the 28th. Near Choongtam a remarkable transition from tropical to temperate vegetation takes place with no palpable increase of elevation. *Cnicus involucratus, Astragalus pyonorhizus, Eupatorium cannabinum, Anemone vitifolia*, and a few other plants served to accentuate the change. *Leptocodon gracilis*, a fragile climber with blue flowers rambled over bushes everywhere. I collected many specimens of *Pleopeltis rhynchophylla* from a tree at the end of the Lachung cane bridge.

The hill above Choongtam ascends abruptly to 10,000 feet, and is almost entirely clad with grass alone. It forms the termination of a lofty range running southwards from Kinchinjhow, and divides the Lachen and Lachung valleys. The Tibetans aver that this long spur possesses but one practicable pass, namely, the Sebo La between Momay Samdong and Tungu; but by dint of persistent enquiry I discovered that there are at least two more—one from Lachung to somewhere near Latong, the other from Yeumtong to Tallum Samdong. I was informed that they are rarely used, a fact explained by the lack of the necessity of frequent intercourse between the inhabitants of the two valleys.

From Choongtam we marched to the village of Lachung in one day. As far as Keadom the valley is narrow, and the path runs along the river bank for most of the way. Here the valley expands into a large flat, with an elevation of 6,600 feet, which enjoys such a warm and sunny climate that maize, millets and other tropical crops are successfully cultivated. Onwards the valley again becomes narrow, but two or three miles below Lachung it broadens considerably and remains open for some miles above the village.

A large proportion of sub-tropical trees and plants ascend to a short distance above Keadom. These are succeeded by a dense shrubby vegetation of *Hydrangea*, *Rosa macrophylla*, and *R. sericea*, *Prinsepia utilis*, *Pyrus*, *Pieris ovalifolia* and *P. formosa*, *Zanthoxylum*, *Rhododendron arboreum*, *R. ciliatum*, and Maples, &c. Other plants are *Leycesteria formosa*, *Buddleia macrostachya* and *B. Colvillei*, *Berberis*, and *Rubus niveus* with palatable fruits. *Roscœa alpina*, the Box-like *Sarcococca pruniformis* are in great quantity. The handsome fern, *Osmunda Claytoniana*, overruns large areas in the manner of Bracken at lower elevations. Two species of *Leucostegia*, *L. Hookeri* and *L. membranulosa*, with sweetly hay-scented foliage, and a large stipitate form of *Pleopeltis simplex* grow in a wood at about 8,000 feet. *Goniophlebium ebenipes* was in dense clusters on the tops of many of the numerous rocks.

This locality is eminently distinguished by its variety of Coniferous trees, *Abies Webbiana*, the dominant species on the humid mountains of the Singalelah and Chola Ranges, even here maintains its supremacy in numbers. It ranges from 9 to 13,000 feet. Up to 11,000 feet it grows intermingled with the other lighter-foliaged pines, but from that elevation to its highest limit, it exists alone or associated with the equally dark coloured *Juniperus pseudo-sabina*, so that nothing breaks the monotony of their sombre aspect on the slopes which they clothe with their lofty forests. *Juniperus pseudo-sabina* and *J. recurva* are the two last representatives of arboreal vegetation, both attaining 15,000 feet, the former as a small, stunted, weather-worn tree, the latter as a prostrate intricately-branched shrub. Large quantities of planks cut exclusively from *Abies Webbiana*, are annually exported to Tibet. Their preparation is an important industry of the inhabitants of Lachung, who shape the timber with no other appliances than the axe and wedge.

Picea Morinda and *Tsuga Brunoniana* are found between 8 and 11,000 feet. The former is a tall, conical tree with thick trunk and dark green pendulous branches, the latter has spreading branches drooping at the extremities and bears very small cones. *Larix Griffithii*, the only Himalayan Larch, is restricted in its distribution to Eastern Nepal, Sikkim and Bhutan ; and, previous to its re-discovery by Sir J. D. Hooker, its existence was only known from a notice in Griffith's journals. It is pyramidal in outline and attains a height of sixty feet. The branches are long and pendulous and support erect, cylindrical cones closely resembling those of *Picea Morinda*. It first appears at 8,000 feet, becomes plentiful at 9,500 feet, and ascends to 12,000 feet. It is the only

decidous Conifer in Sikkim, the leaves falling in autumn to be renewed in the beginning of the following summer.

The peach and apricot, introduced from Tibet, are cultivated by the villagers at Lachung, but in no great quantity. I was informed that the fruits of both ripen in the end of September. *Pyrus sikkimensis*, a wild Crab-apple tree, is common, but its austere fruit is only pleasantly edible when stewed with sugar. A little barley is reared with radishes and turnips, and these were the only vegetables I could obtain worth eating ; the scanty yield of potatoes consisted of wretchedly small tubers, so waxy as to be nauseating when cooked.

The Tankra Mountain was within easy distance of Lachung, and as it promised a quick introduction to the Apline Flora which I was so anxious to see, I determined to visit it at once. We crossed the Lachung Rivers threaded our way through the narrow, dirty lanes of the village, and immediately climbed up the grassy slope above it. For about a mile the path runs through a dense, herbaceous vegetation composed of the plants I formerly enumerated at Lachung. A beautiful small pink lily—*Lilium roseum*—grew profusely on banks associated with *Roscœa alpina* and *Drosera peltata*. At 9,500 feet we passed through a fine grove of small trees of Rhododendrons, Maples, Roses, *Lindera*, *Neesiana*, *Betula utilis*, and the laurel-like *Daphniphyllum himalayense*. In a mossy hollow within this wood, I found a large quantity of the delicate little fern, *Polypodium trichomanoides*. *Goniophlebium subamœnum* depends from the trunks of Silver Fir ; and *Goniophlebium erythrocarpum*, another epiphytic fern, accompanies arboreal vegetation to the end. Passing the grove we entered the magnificent forest of pines which extends without a break to 12,500 feet. We marched to its upper skirts, where we camped after clearing a sufficiently large plot of ground near a stream winding through an expanse of Rhododendrons. Two species of *Cremanthodium*, *Polygonum vaccinifolium*, *Oxyria digyna*, *Pedicularis* of various species, *Potentilla fruticosa*, beautiful yellow and white Saxifrages, *Epilobiums*, *Lactuca macrantha*, *Parnassia* and Aconites were the commonest plants observed.

The following day we held on our course upwards. The region of trees was soon left in the rear, and a low growth of *Rhododendron campanulatum* succeeded, showing the dark glaucous tints of its unfolding leaves. The bladder-headed *Saussurea* (*S. obvallata*) thrives on the damp margins of water-courses, and bumble bees were busy amongst its fœtid flower heads. These are in clusters of a dark brown colour, enclosed in inflated white papery bracts forming an ovate head, and yielding sufficiently to allow insects to insinuate themselves with ease. The woolly-headed *Saussurea* (*S. gossypiphora*) delighting to grow in sandy debris appeared at first sight to be only a ball of white, fleecy wool. The flower heads when young are completely enveloped ; but on the approach of maturity a ring opens on the top disclosing the inflorescence inside. Another remarkable plant, in similar situations, is *Crepis glomerata*, whose carrot-like stem buried in the ground is flattened on a level with its surface, and bears a broad head of yellow flowers, surrounded by small

radiating leaves pressed closely to the soil. *Rheum nobile* is visible on the faces of all the cliffs around, and ascends to 17,000 feet.

Our third day's camp was pitched below the ascent to Kanko La, which passes at the gorge, cut by the river through a low line of cliffs, forming a barrier across the head of the Tankra Choo Valley.

The next day we crossed this by the frequented path, and followed the track to the Tankra Pass, which is at an elevation of 16,000 feet. The terminal valley slopes gently to the pass, is exceedingly rocky, and is bounded by snowy ridges; and much snow lay in its hollows. The rounded surface of the pass is a conglomeration of sand and boulders which are constantly sliding down from the crags on either side.

On the Tibetan side, a narrow grassed valley descends steeply. Fog effectually prevented a more extended view. Between the Kanko La and the barren glacier below Tankra La there was a multitude of bright-hued flowering plants. Brown and yellow *Chrysosplenium*, yellow Saxifrages, blue and yellow forms of *Corydalis*, a few species of *Pedicularis*, beautiful small primroses—*P. uniflora*, *P. muscoides* and *P. soldanelloides*—*Ligularia*, *Rheum nobile*, some blue Gentians, and the bladder-headed *Saussurea* were the most notable. The plants I found on the pass are those enumerated by Sir J. D. Hooker. In addition to his list, I may state that *Meconepsis horridula*, a lovely plant affecting only the most inclement situations, was collected in full bloom from under the shelter of rocks. I stayed for two hours at the pass in the vain hope of the fog lifting to give me a better view. During this time the continuous winds were most variable, and the variability was rendered more obvious by the way in which vapour was deposited by different currents. The wind which blew from the Tankra Valley on the south-west brought hail and snow, that from the south-east in Tibet precipitated rain. The same meteorological conditions prevailed during Sir J. D. Hooker's visit. The Tankra La lies south of the summit of Tankra Mountain, to the east is a long rocky ridge cleft by the minor pass of Kanko La; and between this and the culminating peaks is a large, shallow basin with undulating surface through which flow the headwaters of the Tankra River. Those on the north spring from many points under snow fields, that on the south-east rises below the pass and is immediately lost in the great central moraine, re-appearing at its lower end as a large and swiftly-flowing torrent. It is joined near the Kanko La by the united streams from Tankra; after effecting the junction, the river turns sharply to the west through the deep and narrow defile of the pass and hastens precipitately downwards for some miles until it debouches in the Lachung River, a little south of the village of that name. From the Kanko spur to the limit of Pines at 13,000 feet, the valley is broad and shallow; here it suddenly narrows and remains so to its termination. During the week I spent on this excursion, the weather was uniformly boisterous and wet, while those of my party who remained below at Lachung asserted that they had enjoyed calm sunny days and clear nights.

The fragrant spikenard (*Nardostachys Jatamansi*) is plentiful on Tankra, and the Scrophularineous plant, *Picrorhiza Kurrooa*, intensely bitter when chewed, is abundant about 14,000 feet, and is held in much repute as a febrifuge and tonic. The only woody plant above 15,000 feet is the humble *Diplarche pauciflora*.

I returned to Lachung, where I halted for a week to dry the numerous specimens collected during the excursion to Tankra La, and also to make preparations for a journey to the Donkia Pass at the head of the Lachung Valley, and the most northern point I could reach in Sikkim.

We started on the 13th August, and arrived at Yeumtong the same day. The path runs close to the west bank of the Lachung River the whole distance. About half way we crossed an enormous landslip which had partly buried a large forest of *Abies Webbiana* and Larch.

The interesting feature of this day's journey was the extensive Pine woods through which we travelled. On the western slopes they grew down to the verge of the stream, and every tree was festooned with long gray streamers of the Lichen, *Usnea barbata*. I was told that, when reduced to great straits, the Tibetans made use of this unpromising plant as food ; when boiled it was said to be gelatinous and palatable, and as nourishing and life-sustaining as beef.

We saw many tailless rats, but I was prevented from procuring specimens by my desire to respect the superstitious notions of the Tibetans and Lepchas regarding them. I was told, with every appearance of belief on the part of my informants, that the killing of one of these animals was certain to be followed by storms of snow or rain according to the season of the year, and many instances of personal experience were related to me in corroboration of the fact. The Tibetans are reminded of the near approach of winter when they observe these rats busy themselves in preparing their winter quarters.

The valley is wide as far as Yakcha ; it there narrows for a considerable distance, broadening into large swampy flats intersected with streams towards Yeumtong. The spurs on the western flank are precipitous, rocky and sterile, supporting vegetation only at their sheltered bases, but forests clothe the opposite side with their verdure. Every mountain mass in this region facing a southerly direction in the least degree is, in summer, exposed to the full force of the damp southerly winds laden with mist which blow with increasing violence as the day advances, to die away only at night. These continuous currents rapidly disintegrate the surface, washing down the superincumbent earth and wearing away rocks which become precipices or crags of fantastic shapes. Vegetation, therefore, cannot find permanent foot-hold under such circumstances, and its abundance is confined to the sheltered flanks where a copious rainfall is absorbed by the deep and fertile soil.

The increase of 3,000 feet in elevation between Lachung Village and Yeumtong causes the appearance of many new plants along the route. Composites become more numerous and gregarious. *Inula Hookeri* beautifies dry knolls with its densely leafy stems and large heads of yellow flowers. *Erigeron*

multiradiatus, some species of *Senecio*, *Anaphalis* and *Aster* are equally plentiful. Various *Thalictrums* and *Halenia elliptica*, all with blue and white flowers, grow in the grass and low thickets. Orchids are well represented by many *Habenarias*, *Satyrium*, and the small purple *Orchis Chusua* (allied to the common *O. latifolia* of England). The monkshood was flowering and attained a height of 6 feet in flat grassy fields. Cattle and horses are allowed to graze at large in places infested with this plant, but sheep and goats do not possess the same instinctive knowledge of its poisonous properties, and great care has to be exercised by the shepherds when driving them through these localities.

Myricaria germanica, *Allium*, *Meconopsis simplicifolia*, whose spikes 3 feet in height greatly excel the stunted specimens seen on Singalelah, the large wild Rose (*Rosa macrophylla*) with bright red fruits, and shrubby Berberies, were all common.

The following day was Sunday, so I halted at Yeumtong. The tents were pitched between the huts and the river which flows tranquilly in a broad shallow bed down the whole length of the flat. Opposite is the snowy mountain with a glacier reaching a lower level than any other in Sikkim as Sir J. D. Hooker mentions; a thick turf of grass covered the surface of the flat. A yellow anemone (*A. obtusiloba*) with leaves appressed to the ground, a surculose Saxifrage, the Dandelion, *Taraxacum officinale*, the aromatic yellow *Elsholtzia eriostachya*, and groups of brilliantly yellow-flowered *Senecio diversifolius*, gave colour to the scene. A small swamp north of the camping ground was brightened by the yellow flowers of *Pedicularis tubiflora*, and a small floating *Ranunculus*, and beyond, in a small wood of Silver fir, I found many specimens of *Meconopsis simplicifolia* and *M. nepalensis* in fruit. I collected a large supply of seed from the former, but nearly every capsule of the latter had been destroyed by a small white caterpillar. Neither species ever grows in the open, both preferring the shelter afforded by rocks or small bushes on the skirts of the thickets. The commonest plant was *Cnicus eriophoroides* with strongly spinose leaves which penetrate the thickest cloth, and cause a smarting sensation in the skin. Other plants were *Salvia glutinosa*, *Lychnis nutans*, *Cucabalus baccifer* and *Asarum himalaicum*.

Aroids of the genus *Arisæma* are common. In early summer their tuberous roots are prepared and used for food according to the method described by Sir J. D. Hooker. I was presented with a few glutinous cakes made in the most approved style, but the taste was so peculiarly disagreeable that I could not persuade myself to eat more than one mouthful.

Yeumtong is a large cattle-grazing station and depôt for Tibetan exports and imports. Communication thus far from the lower valleys is kept open by the people of Lachung who carry loads of planks, bamboo, rice, dye-stuffs, such as the leaves of *Symplocos* and the roots of *Rubia cordifolia*, which are transported by yaks to Tibet. In exchange the Tibetans bring down loads of salt, barley, blankets and other commodities for the inhabitants of Lower Sikkim.

I could not ascertain how many yak-loads of merchandise are carried annually over the Donkia Pass, but every day during my stay in this part I saw herds of at least 10 or 12 yaks, and often many more either going or returning. Looking northwards from Yeumtong, the slope of the valley to an elevation of 13,000 feet is easy and is black with pine forests. Above, the land is red and sterile. On the west a tributary stream flows from behind Changokhang along the base of a long declivity of sand. The view higher up is cut off by jutting spurs below Momay Samdong.

The following morning we marched to Momay Samdong, elevation 15,300 feet. The first and the last two miles of the path are easy, but the intervening portion is steep. A forest of Silver Fir, Maple, Birch, Pyrus, Rhododendron and other trees extends to 13,000 feet; for a few hundred feet further some scattered black Juniper trees occur; an equal distance is occupied by Rhododendrons and Willows, and passing the spurs which terminated the view from Yeumtong, the valley is broad with enormous rocks on its surface, and the surrounding hills are rocky. I have nothing to add to the excellent description of this spot by Sir J. D. Hooker, but a place with more inhospitable surroundings can scarcely be imagined. A few yaks were grazing, the sole survivors of large herds almost annihilated by an epidemic of rinderpest which raged during the previous year.

This great calamity had impoverished the inhabitants of the valley, as for the greater part of the year they depend for sustenance on the curds and cheese made from the milk yielded by their flocks.

As the morning of 10th August was bright and sunny, holding out hopes of a fine day, a promise unfortunately not fulfilled, I set out for the Donkia Pass, seven miles from Momay, and the most northerly point I could reach in Sikkim. The tracks lead through a waste of stupendous rocks, and the stream becomes divided into many channels. The hills rising around it are masses of rock and rubble, forming a most forbidding landscape in the aggregate. The shallow waters support an abundance of reddish *Sedum* and *Rheum nobile*. Myriads of the blue Gentians unfolded in the brief glimpse of sunshine we enjoyed, and *Allardia glabra* grew in low, dense tufts, bearing large sessile flowers with yellow disks and purple rays. The musk-scented *Delphinum glaciale* ascends to 17,500 feet accompanied by *Aconitum Napellus* reduced in size to a small plant with two or three leaves bearing but one short pedicelled flower. Other plants were *Ranunculus lœtus*, *Cyananthus*, of two species, the Edelweiss (*Leontopidium alpinum*), *Erigeron*, *Cremanthodium reniforme*, *Lactuca Dubyœa*, *Crepis glomerata*, *Saussurea*, and the curious lichen-like *Antennaria muscoides*. *Rhododendron nivale* and *Ephedra vulgaris* were the only woody plants. The feature of the vegetation from 17,000 feet upwards is the prevalence of plants growing in dense, hard hemispheric tufts such as *Arenaria*, *Saxifraga*, *Saussurea*, *Astragalus*, and *Myosotis Hookeri*. The last steep ascent to the pass, 18,100 feet elevation, is devoid of vegetation. The view across Cholamoo to the Kambajong Mountains was clear, and we were able

to appreciate fully the graphic account of this wonderful region which Sir J. D. Hooker gives in such perfect detail.

My orders forbade the crossing of the Donkia, so I returned to Momay in the evening through a blinding storm of snow and rain.

As I was anxious to penetrate to the Lachen Valley through the Sebo La, I waited at Momay for a week in order to obtain good weather for the attempt, but the cold south wind drove a thick mist and drizzling rain without intermission, and I was compelled to relinquish the idea. One day I went eastwards to the great glacier of Kinchinjhow. Passing the hot springs noted by Sir J. D. Hooker, and climbing to the crest of the terminal moraine, we walked along the top of a lateral one leading far into the snowy billowy mass of the glacier. I was surprised to find many plants flourishing in such a bleak place. *Eriophyton himalaicum* was common. It is a white, woolly *Labiate* with bright blue flowers peeping from under the leaves ; I have never observed it but on dry sandy slopes. The other plants were a minute *Saxifraga* with extensive runners, a small *Gentian*, *Pedicularis* of three species, *Festuca* and *Carex*. *Rhododendron nivale* was dead and withered, having probably been killed by the severity of the previous winter, but, strange to say, *Potentilla fruticosa*, in its largest and most developed form, and not the creeping variety we should expect to find here, was covered with flowers and foliage and was as much at home amongst ice and snow as it is at the more temperate elevation of 10,000 feet. From Momay Samdong I returned to Yeumtong and halted there a few days. I ascended to the glacier on the opposite side, which Sir J. D Hooker failed to reach through the gorge. Now-a-days there is a cattle-track leading to the high pastures, so that progress is easy. *Rosa sericea* is the commonest shrub in the pine forest, and *Salix Wallichiana* and *Pyrus microphylla* are abundant. Between the summit of the first ridge and the glacier, the path runs along the side of the stream, the rest of the area is too encumbered with boulders to be walked on with safety. Above 13,000 feet the forest of Silver Fir is replaced by impenetrable Rhododendrons and a few stunted trees of black Juniper. There is little variety in the herbaceous vegetation, the biting air radiating from the glacier being too chilly to suit even cold-loving plants. *Podophyllum Emodi* yielding red fruits eaten by the Tibetans, *Swertia Hookeri*, *Rheum accuminatum* and *Cnicus eriophoroides* were conspicuous by their abundance and size.

The weather at Yeumtong was also uniformly wet and miserable, so I started for Lachung on the 20th August. Arriving the same day I stayed to dry my collections and to make arrangements for an excursion through the Sebu Valley to Ghora La ; a part as yet unvisited by any naturalist to my knowledge.

In his "Himalayan Journals" Sir J. D. Hooker notes "about five miles above Lachung the valley forks, the eastern valley leads to lofty, snowed regions, and is said to be impracticable." A lofty precipice at the immediate entrance to this valley, and on its northern flank, attracted my attention. On enquiry, I discovered that one of my men had ascended to Ghora La, the first

pass from the northern end of the longitudinal range which extends from Donkia to Gipmoochi, and forms the eastern boundary of Sikkim. From a distance the forbidding aspect of this valley would naturally lead one to conclude that to explore it would be a matter of great difficulty and danger. It is almost useless to interrogate the Tibetans as to the feasibility or otherwise of ascending any comparatively unfrequented valley, as their jealous exclusiveness prompts them to overrate natural difficulties in the hope of deterring Europeans and other strangers from exploring the various practicable routes to Tibet. The path to Ghora La runs up the valley of the Sebu River, a large and turbulent stream. I was informed that this valley is held in considerable veneration by the Tibetans on account of the lofty and unique precipice guarding its entrance, for the sacred mountain of Donkia at its head, and also for the sacred inscriptions which were carved on the face of a cliff half way up the ascent to Ghora La ; but this last feature is now completely obliterated, as the whole face of the rock has fallen down. At the summit of the pass, and visible from a considerable distance, is an irregular pillar-like rock, which I was told is a figure of a god, but its real character was apparent on closer inspection.

Leaving Lachung on the morning of the 3rd September, I took the following route. The Lachung Valley path was taken for three miles to the village of Yakcha. Here the track to Ghora La breaks off abruptly to the north-west, a direction which is pursued more or less the whole way. A short walk through a forest, containing beautiful Conifers, *Picea Morindà*, *Tsuga Brunoniana*, *Larix Griffithii*, brought us to the Lachung, which is crossed by a good wooden bridge. On the other side it is steep for a short distance, and afterwards the path runs almost level over somewhat swampy ground. The river Sebu, which from its source downwards, is a swiftly-flowing torrent coursing through a boulder-strewn channel, here becomes broader, shallower and more tranquil. Small willow-trees fringe its banks, with *Euonymus* and *Ilex intricata*, while *Thalictrum* is specially abundant. Beyond this, a sudden ascent is made along the base of a stony precipice with *Woodsia lanosa* growing in its clefts ; and a little further on I found its allied species, *Woodsia elongata*, the only occasion I recollect of their association, as the former affects a more alpine elevation as a rule. The remainder of the day's march was steep through a large forest of Silver Fir, until we arrived at the first convenient camping ground, a cattle station, named Sebu, artificially formed by a clearance in the forest. Here *Ainsliœa pteropoda*, *Heracleum*, and *Galeopsis Tetrahit* monopolized spots untrodden by cattle.

The northern side of the valley is enclosed by a continuous precipitous spur, broken in one place only by a deep forest-clad depression. At the foot of the chief one at the commencement of the valley, is a small temple where services are held on certain days of the year. The range on the other side being more gently sloped, is covered with forest and succeeding smaller vegetation, and is more diversified by ravines.

Of trees which do not extend above 10,500 feet in this valley, are *Picea Morinda, Tsuga Brunoniana, Larix Griffithii, Prunus Padus, Pyrus lanatus, Pyrus sikkimensis, Hydrangea, Ilex dipyrena.* Above this elevation to 13,000 feet is a continuous forest of *Abies Webbiana* associated with Maples, Birch, *Viburnum, Berberis,* and *Rhododendron* ; *Aconitum Napellus* grows luxuriantly on the grazing ground at Sebu.

At 11,000 feet large trees of *Juniperus recurvus* appear, and at 13,000 feet (the upper limit of *Abies Webbiana*) and for a short distance above it they form the only arboreal vegetation.

From 13 to 15,000 feet there is an impenetrable growth of Rhododendrons and Willows, with numerous small trees of *Pyrus foliolosa*, and *P. microphylla*; and, intermingled with grass underneath these bushes, is an equal luxuriance of herbs, such as *Aconites, Senecios, Saxifrages, Primulas, Potentillas, Polygonums* and *Thistles. Cnicus eriophoroides,* which is moderately common in most valleys, is so abundant here as to be a perfect pest.

From Sebu (12,500 feet) the next march was to a yak-grazing station, named Sethang, at an elevation of about 15,000 feet. Up to 14,000 feet the floor of the valley is very steep, but about 1,000 feet below the level of Sethang we emerged on a swampy flat, through which the Sebu flows in several channels. Its surface is covered with grass, and its borders are cumbered with *Rhododendron Anthopogon.* A tributary from the west pours over the hollow of a precipice in a magnificient waterfall. Above the plain is a steep rocky barrier thrown transversely across the valley. On reaching its summit we arrived at the camping ground. The coolies took up their quarters in the deserted huts, and my tent was pitched near an accumulation of enormous boulders. A small muddy pond lies at the upper end of the flat.

Here the two branches of the river Sebu unite—one rising in Donkia, the other in the nameless snowy mass south of Ghora La. The former is seen flowing in a deep and narrow gorge ; the latter rushes down a steep rocky transverse slope similar to that which we ascended below Sethang. These slopes run parallel to each other, and are probably the terminal moraines of the glacier, which is now confined to the head of the valley. *Rhodedendron companulatum* is the common shrub. *Primula Stuartii, Meconopsis nepalensis, Geranium collinum,* all in fruit, abound on the flat.

On the following morning I walked to Ghora La, elevation 17,000 feet. The path descended into the stream from the Donkia, the ascent beyond winding amongst gigantic boulders on the western side of the slope. At the top is another small plain, and the remaining portion of the valley becomes broader and ascends by a long easy gradient to 16,500 feet.

The valley from this point onwards to near its head is bounded by even ridges and unbroken slopes which are possibly the lateral moraines of the ancient glacier terminating below Sethang.

Both seemed to be elevated 500 feet above the river. A broad terrace runs along the base of the eastern one for some distance. Higher up, the valley

expands and the stream again divides. The eye following the course of the western branch, is carried to the snowy mountain of Forked Donkia from whose feet a glacier spreads out over a large area.

There is an accumulation of rocks and sand at the eastern termination of the glacier, and its waters feed a lake white with suspended silt. This mountain is an object of worship and veneration, and votive offerings of prayer-printed cloths fluttered on the banks of the lake. Between Forked Donkia and the pass is a shivered line of crags devoid of snow ; the pass itself is an extremely narrow gap with sheer rocks rising sharply on either side. Its final ascent is occupied by a glacier which widens out eastwards into an enormous field of ice under another snowy mountain. The actual ascent of the pass is commenced at a small pool at the end of the glacier. There is no permanent path amongst the shifting mass of rocks, so we had to make our way as best we could up the lateral moraine of loosely poised boulders. Half way up we took advantage of a small snowfield. The last hundred yards was over the grassy surface of the ice in which we cut steps as we advanced.

The available standing room on the pass would scarcely suffice for ten men, and the descent on the Tibetan side is startling in its steepness. Its surface was covered with a shoot of stones. This pass is not practicable for the passage of yaks, and is seldom used by foot travellers. On the north a high, naked hill projected eastwards, appearing as a huge pile of stony debris ; on the south a large glacier descended. Below lay the broad, open, grassy valley of the Ridu Chu ; beyond were a few isolated, rounded peaks surrounding elevated plateaux of large extent, and further back still were mountains of the same dull red colour running east and west, while over them hung heavy masses of clouds which obscured more distant views. The lower part of a snowy mountain, said to be Chumulhari, was seen in the far east.

The district we overlooked is called Kamboo. Medicinal hot springs of great repute occur in it. Phari is to the south-east of Ghora La, but is hidden behind intervening ranges.

The vegetation above 15,000 feet in the Sebu Valley is very scanty. *Sedum* of two or three species, *Saxifraga, Allardia, Meconopsis horlidula, Cyananthus, Gentiana, Saussurea* of three species, *Ephedra, Rhododendron nivale*, and a few other plants, principally grasses and sedges, form the bulk of the vegetation. *Rheum nobile* grows on the surrounding otherwise sterile heights, reaching to an elevation of 17,000 feet.

We found a woolly *Saussurea* (*S. tridactyla*) at the foot of the ascent to the pass, but from thence upwards not even a lichen was visible. This *Saussurea* and *Antennaria muscoides* are supposed by the Tibetans to be the most esteemed of their gods as incense. The plants used in temples are *Rhododendron Anthopogon* and *R. setosum* and a Juniper. I could not obtain definite information as to the derivation of the name "Ghora." I was first told that the sacred pictures carved near it suggested its name, and I concluded that the

same was a contracted form of Gorucknath ; afterwards it was explained that the meaning was " winding " in allusion to the winding route to the pass.

Yaks are grazed from 14 up to 17,000 feet in this valley during the summer, and at Sebu I found a large herd of cattle.

From Sethang I returned to Lachung in two marches, arriving on the 8th September.

The time until the 14th was devoted to arranging and packing my collections and luggage. We returned to Tumlong by the Teesta Valley path and arrived there on the 20th September.

Third Tour.—The Chola Range.—I left Tumlong on the 22nd September for my third and last excursion. The first march was to Rungpo, elevation 6,000 feet, a halting stage of the Sikkim Rajas during their journeys to and from the Chumbi Valley, their favourite summer resort. The path descends through cultivated fields to the beds of two arms of the Ryott River which unite a little further down. They are crossed by cane suspension bridges. The succeeding ascent is steep, and passes through many fields of dry-ground rice and millet. An edible variety of Job's tears (*Coix lachryma*) is grown near water-courses. The whole valley is thickly populated, and the inhabitants practise a careful system of cultivation.

An oak (*Quercus semecarpifolia*) is common at Rungpo, but the rest of the vegetation is of the usual type at this elevation.

Onwards to Chola Pass the marches were made eastwards up a continuously steep ridge. The second day's journey brought us to Laghep (10,400 feet), a small cattle station with a camping ground on a projecting knoll covered thickly with *Iris nepalensis*. This locality is celebrated for its variety of Rhododendrons, every species existing in Sikkim, excepting *R. nivale*, being found within a distance of two days' short marches. It was too early in the season to obtain seeds, as they do not ripen until November.

The plants of *Decaisnea insignis* which Sir J. D. Hooker observed at 7,000 feet still grow abundantly there.

The next day's march was a short one to Pheyeunggong, 12,400 feet, a large flat-topped peak where the *Abies Webbiana* is first seen. Beyond Pheyeunggong we descended to the Rutto River, where we found quantities of *Cathcartia villosa* in fruit. This plant is extremely local in its distribution, being found only in this small valley and in one small area near the summit of Lingtu. The ascent continues along the broad valley of Rutto, which becomes bleak upwards. *Abies Webbiana*, however, attains an elevation of 12,600 feet at Chamanako, where we halted.

The first part of the ascent to the Chola Pass is very steep ; an easy path then leads to the next ridge, beyond which is a small and pretty lake. A second slight ascent brought us to another small lake, and a pond lies immediately beneath the pass. The summit of the pass is rounded, and its surroundings are barren rocks. On the Tibetan side a narrow gorge-like valley descends sharply. Snow

had fallen the previous night, descending to 13,000 feet. We left Chamanako on the 28th, and resumed our journey along the Chola Range. The path follows the course of the Rutto for half a mile, then crosses it, and an ascent to 14,000 feet follows, through a scrub of Rhododendrons. At 14,000 feet there is a large hollow covered with Rhododendrons, containing two lakes, the larger ovoid in shape, the smaller long and narrow. Attaining the ridge beyond we descended to the river Rungpo, passing through on the way a narrow defile walled with rock. Another ascent through small Rhododendrons again followed, after which we descended and struck a path from Guntok. We walked along this for a mile, and reached the camping ground, named Buthan, a large expanse of green turf closed in on the east by a barrier-like cliff.

During this march we found specimens of *Chrysanthemum Atkinsoni*, the only example of the genus occurring in Sikkim, some small *Saussureas* with fern-like leaves, Primroses, *Parnassia*, the bladder-headed *Saussurea*, *Senecio amplexicaulis*, and the small Rhubarb, *Rheum acuminatum*.

The following day we marched to Kapup, a small plateau under Zeylap La. We ascended to the top of the rocky barrier east of the camp. From here we obtained a magnificent view of a long trough-like valley terminated by a ridge beyond Kapup. The whole scene was of a warm brown colour from the herbaceous vegetation killed by the late autumn frosts. This valley, which runs southwards, is bounded on the north by the main Chola ridge which forms the political boundary between Sikkim and Tibet. There was a long gradual descent down this remarkable valley, in which are two marshy lakes of considerable extent. Beyond the second lake a deep narrow gorge intervenes. This is clothed with Pine forest, and at the end of the valley the meeting of two opposite spurs holds back the stream so as to form a large lake reflecting the pine woods on its dark-tinted surface. Surmounting the ascent from the stream, we emerged on the grassy flat of Kapup with a few scattered Silver Fir trees, small Rhododendrons and shrubby *Berberis* in its sheltered parts. The Spikenard, *Nardostachys Jatamansi*, was common, but few plants grew in the closely-cropped herbage.

On the 30th September I walked to the pass, and returned through Kapup to Gnatong. No vegetation exists at the pass itself, and that below it was fast withering. At Gnatong the plants still in flower were *Onosma*, *Senecio*, and a few species of *Saussurea*, *Swertia* and *Saxifraga*. From Gnatong I travelled by the military road to the Teesta Bridge, arriving at Mongpoo on the 5th October.

During the whole of this excursion I had only one fine day, namely, the 28th September. A dense fog with drizzling rain prevailed to my disappointment during the rest of the time, which prevented me from noting the details of the scenery I passed through.

EXTRACTS FROM AN ACCOUNT OF TOURS ALONG THE MALABAR COAST.

By Edgar Thurston, C.M.Z.S.,

Superintendent, Madras Government Museum.

Soon after my arrival in India, in 1886, accompanied by my staff of taxidermists, who excel in fish-stuffing, I made a short tour on the western coast of the Madras Presidency, from Cochin southwards by the system of backwaters—the home of otters and crocodiles—to Trivandrum, the capital of the Máharája of Travancore. The object of this tour was the making of an initial collection of the fishes of Malabar for the Madras museum, and the greater part of the time was spent at Cochin, which affords abundant natural facilities for fish capture. More recently, in 1894, a tour was made from Cochin northward to Cannanore, with halts at Calicut and Tellicherry, with a view to making a survey of the littoral fauna of the Madras coast of the Indian Ocean with the assistance of the dredge.

The work of the tours commenced on each occasion at Trichúr, a large town twenty miles from the station of Shoranúr on the Madras Railway, from which place Trichúr is easily reached, by a well-avenued road, in bullock cart or pony transit. Between Shoranúr and Trichúr is the village of Vadakanchéri, where the best Trichúr mats are made. At Trichúr fishing is actively carried on with nets from boats in the fine open sheet of water, which extends for some miles south of the town. The fish market contained an abundant supply of fish caught locally, as well as fish sent from Cochin by backwater.

At the time of my visit in 1886, the phenomenon of phosphorescence was extremely brilliant on the first night spent on the backwater ; the fishes, as they darted to and fro, being so brilliantly illuminated that I at first thought that it must be caused by *Micrococcus phlügeri*, a microscopic luminous organism which grows in colonies on the skin of fishes. But, on collecting some of the water in a tumbler, I discovered that the phosphorescence was really produced by myriads of small *Medusæ*, many of which contained tiny crustacea imbedded in their gelatinous substance. Phosphorescence in all its brilliancy I have, in the course of many wanderings along the coast of Southern India, only seen on one other occasion, *viz.*, on the Pulicat Lake, north of Madras ; and, in this instance, it was produced by hosts of *copepods*.

The natives who live along the backwater between Trichúr and Cochin, and rely largely on the products thereof for physiological sustentation, are able to obtain not only an abundance of a bivalve mollusc (*Velorita cyprinoides*), whose shells are collected together and burned into chunám (lime), but also of fish, which they capture with line or net, or, more simply, by wading in the shallow water and picking the fish out of the muddy bottom with their hands. Fish and shell fish, as captured, are cleaned from the adhering mud and placed in chatties attached to a string held between the teeth, and floating on the surface

of the water. The fish which I saw captured in greatest abundance were *Etroplus suratensis*, *Etroplus maculatus*, and *Gobius giuris*.

The town of Cochin is situated on the south side of the entrance of the most considerable river in Malabar. This river opens into the sea out of a broad lagoon with a dense background of cocoanuts, which, with the distant line of hills, wrapped in a grey haze in the spring months, form the leading characteristic of the scenery throughout the whole length of the backwater.

The Cochin backwater abounds in oysters (*Ostrea*, sp.), which live in clumps on the stone and woodwork (freely bored by an isopod crustacean), and have their shells encrusted with anemones, barnacles, and mussels. The oysters, though eaten by the European community, occasionally give rise to an acute intestinal crisis.

The north bank of the Cochin river is formed by the island of Vypeen, which is said to have been created in 1341 A.D. by a cyclone or earthquake. Climbing up the gneiss and conglomerate boulders, which are piled up as groynes at Vypeen point, where the river enters the sea, and serve as an abode for the mollusc *Littorina undulata*, were the crustacea *Grapsus strigosus* and *Metagrapsus messor*.

The shells on the Vypeen shore, used for the manufacture of chunam, belong to coarse species of *Venus*, *Arca*, *Tapes*, &c., evidently rolled in from a distance and worn or broken by wave action ; whereas those on the south shore are more delicate, and suited for museum exhibition. The south shore is riddled with the burrows of giant ocypods (*Ocypoda platytarsis*), the smaller *Ocypoda cordimana*, and the " calling crab," *Gelsimus forceps* (?), which emerge from their hiding places in the morning and evening, and are difficult to catch as they scamper along the sand.

To travellers Cochin is best known as the home of the Jews, black, white, and half-caste, concerning whose history and customs a great deal of interesting information is contained in Days' *Land of the Permauls* ; *or, Cochin Past and Present*. But it is, from a commercial standpoint, a very important centre of trade in coir fibre, cordage, kopra (dried cocoanut kernels), cocoanut oil, ginger, &c.

My camp at Cochin was pitched in the " compound " of a travellers' bungalow facing the tidal river which affords anchorage, in seven to nine fathoms, for craft of light draft, such as can pass over the sandy bar, and load and discharge cargo in smooth water. The bungalow is a noted resort of thieves, and was, during my stay there in 1886, guarded at night by a constable armed with the saw of a young saw fish (*Pristis*), with the base cut away so as to form a handle.

From the bungalow a scene of busy activity can be witnessed from early morning until sunset. The large open " compound "—the resort of stray cattle and goats, which caused endless annoyance by rubbing their noses into and licking up my specimens drying in the sun—forms a convenient spot for fishermen to spin the cotton thread for their nets by a simple contrivance con-

sisting of a stick weighted at the end to which the thread is attached, and deftly swung round the head. Visitors to the bungalow are beset by professional mendicants making an income out of the prevalent elephantiasis (Cochin leg), which attacks young and old alike ; and vendors of stuffed crocodiles with flat glass panes for eyes, and mouths lined with red or yellow flannel, and jewellery of local manufacture made from the small silver coins (*puttans*) of the Native State of Cochin.

Stored in the bungalow "compound" are casks of fresh water, brought daily from the sanitarium of Alwayi, about twenty miles from Cochin. The water of the Alwayi river, from which I obtained a unique dredging consisting of stone gods, has a good reputation, and on it the European community of Cochin depends largely for its supply of wholesome water.

Lining the Cochin river on both the north and south banks are rows of Chinese or parallelogram dip-nets, about sixteen feet square, which are let down into the water, and, after a few minutes, drawn up again. These nets afford an easy and certain source of income, and, like other fixed engines, "produce an 'unearned increment' to the owner, irrespective of his skill, or of his being a member of the fishing community proper."* The men who work the nets stand protected from the sun within a cadjan shed or beneath the shade of a portia† or "tulip tree" (*Thespesia populnea*), whence they emerge to pick the fish out of the net (the apex or bottom of which is brought within reach by a long rope) with a hand-net. When the fishes are small and few in number, the fishermen are defeated by the ever-watchful crows who in company with pariah kites (*Milvus Govinda*) sit perched on the wooden framework of the net, waiting anxiously for it to be hoisted up out of the water.

In March, 1886, enormous quantities of mullet (*Mugil pœcilus*), characterised by a deep black spot in the centre of the scales, were being caught daily in the parallelogram nets. This fish is used extensively as food, and the roe is considered a great delicacy. Another species of mullet (*M. cunnesius*) was also caught, but in far smaller quantities.

Placed across the Cochin backwater, in which long-nosed dolphins (*Delphinus dussumieri*) may frequently be seen disporting themselves, are bamboo labyrinths and rows of bamboo stakes with nets affixed thereto at flood-tide. These bamboo stakes serve as convenient perches for hosts of the smaller sea tern (*Thalasseus bengalensis*), on the look-out for food. Fishermen, simply clad in a loin-cloth and widespreading circular hat made of palmyra leaves, may constantly be seen fishing in the river or backwater from canoes ("dug-outs") with lines or nets ; fishing with bait from the jetties ; or, in the cold season, trolling at the mouth of the river for bá-min (*Polynemus tetradactylus*), a specimen of which, estimated as weighing over 300 lbs., and

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* F. J. Talfourd Chater, Prize Essay. *Fisheries Exhibition, London*, 1883.

† "The word portia is a corruption of Tamil pu-arassu, flower-king." *Hobson-Jobson.*

a load for six men, was recorded by Buchanan Hamilton ("Fish-Ganges") from the Gangetic estuary.

The deep-sea boats (*i.e.*, the boats which fish outside the shallow waters of the littoral zone) secured daily, in March, 1886, large hauls of *Engraulis malabaricus, Engraulis indicus* ("anchovy"), and *Dussumieria acuta*, known all along the Malabar coast as the sardine. These fishes are salted and dried for food, and the surplus is used for the extraction of fish-oil. Also brought in by the deep-sea boats for sale in the fish bazaar, were the common crustacea *Neptunus pelagicus, Neptunus sanguinolentus, Thalamita prymna*, and *Squilla nepa*.

During my stay at Cochin a journey was made by backwater to the mud-bank of Narrakal, which, like that of Alleppy, affords smooth water anchorage for big ships during the boisterous weather of the south-west monsoon. The mode of formation of these mud-banks, which has given rise to much speculation, has been most recently dealt with by Mr. P. Lake,* of the Geological Survey of India, who states his opinion that "the Narrakal mud-bank is very probably, to a large extent, formed of the silt carried down by the Cranganore river. It does not appear to be very much affected by the rise of the backwaters."

The surface of the vast liquid mud-flats of the backwater between Cochin and Narrakal, through which our boat was laboriously propelled, is covered with a dense mass of a mollusc (*Telescopium fuscum*), which produces a curious appearance as of the spikes of the helmets of a submerged army. On the sandy shore at Narrakal great quantities of the mollusc *Dactylina orientalis* were being washed up by the in-flowing tide; and the neighbouring muddy shore was strewed with full-grown shells of the pearl-oyster, *Avicula fucata*. These pearl-oyster shells were not worn, and must have been rolled in by the sea from a bank at no great distance from the shore. Of the existence of such a bank I can find no record; but, in the event of the shells being recognised hereafter, it would be worth while to have an inspection made on the chance of discovering a bank which might yield material for a fishery on a small scale by the Tuticorin divers.

A single night's journey by British India coasting steamer brought me from Cochin to Calicut, the chief town of the Malabar district. Landing was possible from a wherry at the sandy beach, on which except during the south-west monsoon storms, the waves flow with a gentle ripple, affording a strong contrast to the surf-beaten shore at Cochin.

A cursory examination of "specimens" washed on shore showed at a glance that the littoral fauna of Calicut differs in a very marked degree from that of Cochin, and demonstrated the necessity of detailed examination of the entire coast line, if any semblance of an approach to an accurate knowledge and

* See Lake, *Rec. Geol. Surv. Ind.*, Vol. XXIII, 1890; and King, *Rec. Geol. Surv. Ind.*, Vol. XVII, 1884.

museum record of the nature and distribution of the littoral fauna of Southern India (with which alone I am concerned) is to be acquired.

For the great mass of visitors to museums in India, who come under the heading of sight-seers, and who regard museums as *tamasha* or wonder houses, it matters but little what exhibits are displayed, or how they are displayed, provided only that they are attractive. I am myself repeatedly amused by seeing visitors to the Madras museum pass hurriedly and silently through the arranged galleries, and linger long and noisily over a heterogeneous collection of native figures, toys, painted models of fruits, &c. But, in addition to the sight-seers, those have to be considered who regard museums in the light of institutions where they should be able to acquire solid information ; and our Indian museums would be fulfilling a very useful function if, in the capital city of each province, collections were brought together and properly exhibited illustrating and forming a classified index to the natural history, ethnology, arts, archæology, economic resources, &c., of the province concerned.

To return, however, to Calicut. Not only do many of the delicate mollusca washed on shore belong to different genera to those at Cochin, but very conspicuous by their abundance were the siphonophora *Velella* and *Physalia* (Portuguese man-of-war) ; the shells of an edible mollusc (*Mytilus viridis*) ; the young of the cirrhiped *Balanus tintinnabulum*, the carapaces of the crustacean *Matuta miersii*,* the burrowing crustacean *Hippa asiatica*, swarms of which are destroyed by fishermen with each cast of their shore nets and heaped upon shore ; sharks' vertebræ, teeth, and egg-cases attached to drift coir fibre ; worn madreporarian coral fragments, doubtless carried across by currents from the Laccadive Islands ; and a pennatulid (*Cavernularia malabarica*, sp. n., Fowler). This pennatulid was being cast ashore in large numbers at the time of a visit to Calicut during the south-west monsoon, 1893, with the object of ascertaining whether Calicut could serve as a source of supply of cowry shells (*Cypræa moneta*) for the Belgian Congo State.†

The crustacean *Hippa asiatica*, which lies buried between tide-marks on the Calicut beach, is collected by digging with the hands, roasted with medicinal herbs purchased in the bazaar, and applied as a fomentation to sore legs.

After some days spent in dredging at Calicut, the journey was continued by road to Tellicherry, one of the most delightful drives in the plains of Southern India. Conspicuous by their abundance were the cocoanut and betel palm (*Areca catechu*) ; the deciduous silk-cotton tree (*Bombax malabaricum*) in full flower ; black pepper vines (*Piper nigrum*) twining up the trunks, and sheltered by the branches of the coral tree (*Erythrina indica*) ; the cashew (*Anacardium occidentale*) laden with ripening nuts ; and jack-fruit trees (*Artocarpus integrifolia*) with the young fruits protected by wicker baskets from the attacks of predatory birds.

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* J. R. Henderson, *Journ., Mad. Lit. Soc.*, 1887.

† The supply was eventually arranged for by a Bombay firm.

The transfer of the pony carts to the ferry boats, by which the passage of the three rivers opening into the sea between Calicut and Tellicherry is effected, afforded an opportunity of studying the habits of the "calling" or "dhobi" crabs (*Gelasimus annulipes*), which abound in the mud between tide-marks. These crabs were hard at work with their young families making the burrows which serve as their dwelling places; the adults bringing up between their feet from the bottom of the burrows in course of construction mud rolled into pellets, which they pushed with their feet to a distance of several inches from the mouth of the burrow; cleaning the feet from adherent particles of mud, and again descending into the burrow, remaining under ground from ten to twenty seconds. In the work of removing the mud pellets from the mouths of the burrows the adults were zealously assisted by the young.

In the city of Madras, the "microscopic minority" of Europeans, who are regular fish-eaters, will go on year after year without seeing at the table any other fish, out of the large variety which is sold in the fish bazaar, than seir (several species of *Cybium guttatum*); pomphret, white, silver, grey,* or black (*Stromateus sinensis*, *S. cinereus* and *S. niger*); the so-called "whiting" (*Sillago sihama*); and perhaps an occasional flat-fish (*Psettodes erumei*), which is a poor substitute for the British sole. During three years in Calcutta I only saw served up *hilsa* (*Clupea ilisha*), which, though bony, is excellent when smoked; *begti* (*Lates calcarifer*) and the mango-fish or *tupsee muchee* (*Polynemus paradiseus*), which comes up the Hooghly river for spawning purposes in very large numbers. Again, at Cochin, out of about forty different kinds of fish classed as edible by natives, which were being caught at the time of my visit, only four were considered fit to place before me, *viz.*, seir, "whiting," mullet, and sardines.

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* Silver pomphret is the immature, and grey pomphret the adult *Stromateus cinereus*.

MISCELLANEOUS NOTES.

No. I—HYBRID FRANCOLINS.

In 1876 Captain (now Lieutenant-Colonel) E. A. Butler, 83rd Regiment, while stationed at Deesa, shot six or seven specimens of Francolins which were apparently hybrids between *Francolinus vulgaris*, the northern form or Black partridge, and *F. pictus*, the Painted partridge and southern form.

These hybrids have been described in volume II, page 26, of Hume and Marshall's "Game Birds of India," and one has been figured in the same plate as the Eastern Francolin.

Both species, *F. vulgaris* and *F. pictus*, are known to occur near Deesa, and I shall be glad if any member of the Society can kindly assist me in getting authentic information as to whether hybrids of the above species are now met with at Deesa or elsewhere, and, if possible, in procuring specimens of the same. Any information on the subject later than Colonel Butler's record will be gratefully received.

G. W. VIDAL, I.C.S.

POONA, 10*th October*, 1894.

No. II.—NESTING OF THE BROWN FLY-CATCHER.

I am forwarding to you to-day by rail a nest and four eggs of the brown fly-catcher (*Alseonax latirostris*) as I understand that the eggs of this bird have not hitherto been recorded. These eggs I obtained near here on the ghauts. The first nests were taken by Sergt. Kemp, of the Barrack Department, and myself on the 17th ultimo, on which occasion the eggs were perfectly fresh; the last were taken on the 30th, when fresh and hard set eggs and young birds were met with, from which I infer that the period of incubation lasts about a fortnight. With one exception all the nests have been found on the dwarf teak trees, which grow so plentifully on the ghauts. They are, as a rule, built on thick bare horizontal branches, at some little distance from the trunk and, on an average, eighteen feet from the ground. The bird seems to prefer the more secluded nullahs to breed in, generally selecting for this purpose a tree close to the bank. The nest, as you will see, is rather a large one for so small a bird, and, except for being so high, would not be difficult to find. Four seems to be the full complement of eggs, though three hard set eggs have been found.

I also enclose a skin of a bird shot from the nest; the bird was only shot for purposes of identification and the skin was unfortunately spoilt.

I trust you will receive the eggs safely.

BERTRAM A. G. SHELLEY, LIEUT., R.E.

MHOW, C. I., 1*st July*, 1894.

P. S.—The eggs were taken on the 30th, not the 29th. Three were obtained from one nest, and the other, the dark specimen, was obtained from a second nest. I regret I could not send you a complete clutch as I have only one.

B. A. G. S.

No. III.—NOTES AS TO HOW TIGERS KILL.

Perusing the interesting notes on the tiger by Mr. J. D. Inverarity, published at page 143, Vol. III, No. 3, of the Society's Journal, on the points as to how tigers kill their prey, I beg to add my experiences on this subject.

I have on several occasions sat over the live bait, a young buffalo, and seen the tiger kill.

I will give two instances. In each case the tiger rushed and sprang with a roar, in broad daylight ; one paw was brought down on the snout and up went the horns, and the other paw over the humps, and with the mouth the back of the neck was seized. In each case I was too excited to wait longer, and I fired at the head. The tiger was with his back towards me. In one case I killed, in the other I missed, and could not account for it. I found my shell in the buffalo's skull between the horns.

In another case when it was too dark to see what actually occurred, I have heard and indistinctly seen the same process, and then all was quiet for about ten minutes ; I presume the tiger was sucking the blood. He then walked off without eating at all. Later on he returned to make a meal. The moon was up ; I shot the tiger ; the kill was untouched. Tigers always begin feeding at the rump.

FRED. WRIGHT.

ELLICHPUR, 28*th June*, 1894.

No. IV.—A CURIOUS INSTANCE OF MELANISM.

I send you the following note regarding a specimen of the common Madras bulbul (*Pycnonotus hæmorrhous*), now in my possession, as it may not be uninteresting to some of the members of the Society.

At the beginning of March this year a bulbul was found in the fernery of my garden which, it was noticed, differed somewhat from the ordinary Madras bulbul in its plumage. The bird appeared to be a young one, and the plumage resembled that of a young bulbul, except in being several shades darker and in having no red or crimson feathers in the under tail-coverts, these being glossy-black. The black of the head and face shaded into very dark brown on the neck, and the white feathers on the rump and vent were replaced by brown ones, so that the bird on the whole looked almost black.

The bird has now almost completed moulting and the new plumage resembles that of an adult bird, the feathers on the rump and vent being white and the black of the head and face more defined, but the under tail-coverts are still glossy-black. I have two other specimens of this bulbul, and on comparing it with them find it still looks slightly darker than they do. I have not been able to ascertain if this peculiarity of the plumage has been noticed before, but some members of the Society may perhaps be able to throw some light on the subject.

MADRAS, 8*th August*, 1894. P. BERRY.

No. V.—MEASUREMENTS OF TIGERS' SKULLS.

Apropos of the article in No. 4, Vol. VIII, on "Horns and Skull Measurements," by Capt. St. John Richardson, I have carefully measured, between uprights, the skulls of two large tigers shot by me in Canara.

The dimensions are $11\frac{1}{4}$" by $10\frac{1}{2}$" and $14\frac{7}{8}$" by $10\frac{3}{8}$". The former belonged to a tiger measuring 9'-$7\frac{1}{2}$", as it lay on the ground;* the latter to one considerably larger, but unfortunately I omitted to measure it.

HUGH MURRAY,

BELGAUM, 18*th June*, 1894. Divisional Forest Officer.

No. VI.— SAMBHUR HORNS EATEN BY PORCUPINES.

I have frequently been told by "Gonds" and other jungle inhabitants that porcupines (*Hystrix leucura*) are in the habit of eating stag horns which have been shed. I do not know whether this fact is generally known and I certainly did not believe it until I stumbled across undeniable evidence of it.

Whilst in camp in this district of Nagpur, in some out-of-the-way forest on the Seoni border, during the month of June, 1893, I found many shed Sambhur horns, and on picking up one I found it had been gnawed in many places. On asking the "Gonds" with me what animal had done this, they said that it was done by porcupines, and on investigating the spot I found that it was lying near a porcupine's burrow, with a regular "run" leading from the burrow to the horn, and there were fresh tracks on the run.

It would be interesting to know whether porcupines eat horns in this way for food, as the "Gonds" say, or only for wearing down and sharpening their teeth, in the same way that rats and rabbits are known to gnaw wood.

P. H. CLUTTERBUCK,

Assistant Conservator of Forests.

NAGPUR, *August*, 1894.

No. VII.—CANNIBAL DRAGON FLIES.

Walking among the Trimulgherry Rocks a little before sunset on the 10th September, I noticed a couple of dragon flies flying in an unusual manner and followed them up to where they fell among the grass.

The larger one which was uppermost, with his wings at rest, seemed to have a hold of the smaller one who was on his back by the throat, if a dragon fly can be said to possess one, and I could distinctly hear a grinding snip-snip going on. In a few seconds the under one's head dropped off. More snip-snipping. After a while I disturbed them, and the larger one flew away. I picked up the body

* Mr. Murray since writes:—"The measurements of the 9'-$7\frac{1}{2}$" tiger were not taken between "uprights, nor were they taken altogether along the curves. I always make one man hold "the tape on the point of the nose and another man on the very end of the tail; then I press "the tape down into the hollow of the back, thereby increasing the length by an inch or an "inch and a half."

and head of the other. One front leg was attached to the body. Two or three more legs had been cut off, which probably accounted for the further snipping I heard after the head was off, and a good deal of the body was eaten. The head held on to a bit of grass that I put into its mouth ; and the body wriggled and the wings fluttered several minutes after they were separated.

The larger fly was about three inches and a half long, the other scarcely a quarter of an inch shorter. Both were of the same kind with transparent wings, body darkish-brown, with a bright steel-blue patch of a light shade in rear of the wings—more of it on the under than the upper side. The tail part had a pale yellow ring at the point of each section, the rest brownish.

Speaking of this to a friend, he said that he had seen a similar case, only that the larger fly had attacked the other one's back and went on eating him even after being picked up and laid on the open hand.

I knew that dragon flies were voracious, but not that they had cannibalistic tastes.

RICHARD ROBERTS.

SECUNDERABAD, *September*, 1894.

No. VIII—A BISON CALF.

(*With a Plate.*)

The Bison Calf whose photograph is given in this number of the Journal was captured during a shooting expedition to the Neilampathy hills in the Native State of Cochin, Southern India, in August, 1892. One afternoon towards the close of the monsoon, I was out looking for Ibex which frequent some high cliffs at the head of a fine open grassy down ; the day had been very misty, at times one could not see two yards ahead, but every now and then the fog would roll away, and the fine open downs—high picturesque cliffs with the sunny plains stretching away below the hills—would appear for a short time. A bison was sighted some 400 yards off lying down near the edge of an open grass slope near the cliffs and a very considerable distance from cover. From its position and large size I took it for a solitary bull and began to consider the best way to approach for a shot, when it suddenly got up and moved slowly away uphill, stopping every now and then to look back. One of the shikarees declared he saw a small calf lying down close to the place where the bison had been lying. I followed the cow, the shikaree going down after the calf. The cow trotted away when she saw me coming, and after a time passed through a small wood. I fired to frighten her when some distance away. She broke at once into a gallop, and disappeared over a hill. I then returned to where I left the shikaree ; he, in the meantime, had gone down and caught the calf, tied his turban round its neck and hauled it up the hillside, it being far too heavy to carry on his back. It proved to be a bull-calf scarcely a week old. It was, of course, in a terrible state of alarm, and I had great trouble in getting



Mintern Bros. Photo. imp. London.

CALF OF INDIAN BISON.

Bos gaurus.

the poor little creature to my shooting hut over a mile away, and during the long time it took to get it there I expected its mother would appear and attempt a rescue. Next day I made up a hammock and had it carried by four coolies some six miles over very rough and hilly ground to a cattle-shed belonging to a friend and at once got it fed on cow's milk by means of a feeding bottle made from a joint of bamboo. It took its nourishment very well from the first and became much quieter. There were a lot of small calves in the shed to keep it company. After a couple of days' rest I again had it placed in the hammock, tying all its legs together, and, with four coolies carrying it, started on an 18-mile march for the foot of the hills to Wallenghary. I reached Wallenghary public bungalow late in the evening and stabled my calf in one of the rooms, tying it to a very heavy washing-stand. While having my dinner in the next room, I heard a great noise and was much surprised at seeing the calf suddenly appear, dragging the stand after him. He did not like being left alone. Next morning I sent him off in a cart for Palghat and had him railed from there to Mettapolliam, at the foot of the Nilgiri Hills. and, again putting him in a cart, had him taken up to Wellington, where my regiment was stationed. He stood the long journey extremely well. I kept a lot of milk in bottles for him, getting it fresh at the various places we stopped, and fed him by means of the bamboo bottle nurse. Shortly after reaching Wellington I measured the calf and found as follows :—Height to top of ridge on back, 2 ft. 10 in.; girth, 2 ft. 9 in.; length of head, 10½ in.; general colour, a dark rufous-brown. I obtained a cow for his sole use. This cow had a small calf of her own, and at first she showed the greatest possible dislike to the young bison, so much so that, before I brought the bison near to get milk, I was obliged to have her hind legs securely tied. After some five weeks the cow began to show a strong friendship for the bison, constantly licking it all over, and would not permit her own calf to come near, kicking at the little creature whenever it approached. Besides its foster-mother, the bison struck up a close friendship with two small fox-terriers. These dogs took to sleeping beside it every night, and one or the other closely attended it during the day in order, apparently, to keep flies away from annoying it. In return the bison often licked the dogs' faces ; it has now grown considerably and has a pair of small horns ; its colour has become a dark brown and it has four yellowish-white stockings. It is still extremely tame and full of spirits, at times racing at a tremendous pace with its tail in the air all round the compound. Its foster-mother still shows great affection for it. It eats grass, bamboo leaves, bread, gram, oats, carrots, sugar-cane, well for a time, but appears soon to tire of any one food.

G. S. RODON, MAJOR,
Royal Scots.

BELGAUM, *4th April*, 1894.

No. IX.—EGGS OF THE BUSTARD.

It is, I think, worthy of record that I recently obtained two bustard's eggs from the same nest. Both eggs were of a peculiar colour, exactly alike, and equally hard set.

H. BULKLEY.

KHARAGHORA, 27*th October*, 1894.

No. X.—A BLACK BUCK WITH ONE HORN.

On the 17th instant I shot a black buck with one horn.

The antelope was in good condition and bore no marks of fighting; it was not so black as some I have shot, but still a very respectable black; and I should say it was rather a small animal.

The head bore one horn 17½" long, thinnish but perfect; the place where the other horn should have been showed a small wart-like excresence about ½" diameter, merely a skin-deep thing, for it moved about on being touched and came off as part of the skin; the skull merely showed a lump about ½" at most in the centre. There is actually no appearance whatever of a horn ever having existed, though, if it did, it must have been broken off very early.

My shikari, Abdul Karim, formerly with Mr. Hughes, of the Geological Survey, and Mr. Hobson, Mr. Fraser, &c., whom doubtless you know by reputation, says he has never seen one like it.

I am sending the specimen to you for your museum where such abnormalities are of interest.

J. SEWELL,
District Supt. of Police.

BULDANA, BERAR, 27*th October*, 1894.

No. XI.—DEPOSITS MADE BY WHITE ANTS.

Two years ago I wrote to the *Asian* on the subject of a vegetable substance which the white ants appear to deposit on the surface of the ground here. I asked for information, but no one responded, nor does any one here seem to know what it is. Natives told me that it was a deposit made by white ants, and, on turning over a piece or two of the deposit, I found white ants underneath. The natives then astonished me by saying that if I let the deposit alone, it would next morning be turned into fungi, and, sure enough, all the little egg-like particles became small fungi an inch high with heads up to the size of a four-anna bit. I ate some and they had all the flavour of mushrooms, but are of a waxy white colour all through. I have sent you in a small box a specimen of the deposit. I have put a wet sponge in with it so that it may keep moist on the journey and perhaps some of the eggs will have turned into

small fungi by the time it reaches you. The deposit is flat and generally circular, some patches only the size of a rupee, others about four inches in diameter. Those I saw this morning are on a well-frequented road, on the road itself and a few patches on the bank at the side. I have only native authority for it that the deposit is the work of white ants, corroborated by my finding white ants under the patches and in one case by the deposits occurring where I knew white ants to be. Here the white ants do not seem to betray their presence by throwing up earth as in Northern India.

C. F. SHARPE, GENERAL.

COONOOR, 28*th October*, 1894.

No. XII.—THE MUSK-RAT AND ITS YOUNG.

The following curious incident happened to some friends in Nagpur. One evening after dinner the lady of the house was startled at seeing what she supposed was a cobra which took refuge under the piano. On investigation, however, it was found that it was only a female musk-rat with six or seven young ones. Apparently their method of progression was for them to go in single file, the mother leading the way and the young ones following, each holding on to the tail of the one in front, thus giving to the whole a regular snake-like motion. As I cannot find this habit mentioned in Blanford, Sterndale, or any other books, I thought it might be worth while to mention it, and perhaps some other members will be kind enough to say if they have noticed the same thing.°

P. H. CLUTTERBUCK,
Assistant Conservator of Forests.

NAGPUR, *August*, 1894.

NOTE.—Since writing the above, another friend has informed me that he has also noticed this habit of the musk-rat.

P. H. C.

No. XIII.—A TIGER KILLING A BEAR.

In the Chanda district last year I heard of a bear (*Melursus ursinus*) being killed by a tiger and partly eaten, but had no chance of investigating the facts. I was transferred in June, and in July the following incidents happened to my successor, Mr. R. Thompson (junior), and thinking them interesting, I am sending this account to you.

On going along a *nala*, he came upon the fresh track of a large bear, and on following it found the track of a tiger who had apparently followed the bear. The bear, finding itself chased by the tiger, bolted along the *nala* a short

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[° An amusing account of this occurrence will be found in Mr. E. H. Aitkin's book "The Tribes on my Frontier."—ED.]

way and then tried to climb an "Unjun" tree (*Terminalia urjuna*). This could be plainly seen from the tracks. The bear had almost climbed out of the reach of the tiger when the latter must have seized the bear and pulled him down. This could be perceived by the huge vertical scratches on the bark of the tree. Once down, however, the bear must have stood up to the tiger, and the state of the ground testified that they had fought for some time. The tiger managed in the end to kill the bear and then ate a part of him. It was thus that my successor found the "gara," and thinking that the tiger would very likely come back soon (it being the rainy season), he sent the "Gonds" with him to a little distance to cut wood for a "machan." While they did this, he waited near, but, finding the smell from the "gara" too strong, he retired a short distance. When the men returned and were approaching the "gara," they found the tiger already there. The latter slunk away and did not return that day. It was shot, however, some few days afterwards by Mr. Thompson, and it was then found that the whole of his chest and belly had been ripped up by the bear's claws.

I do not know whether it is a common occurrence for tigers to kill bears, and these are the only instances I have ever heard of.° Probably a tiger would only attack a bear when being hard pressed for food.

P. H. CLUTTERBUCK.
Assistant Conservator of Forests.

NAGPUR, *August*, 1894.

[° A similar instance was recorded by Mr. T. J. Campbell on page 101 of this Volume.—ED.]

No. XIV.—THE BARKING DEER.

(*Cervulus muntjac.*)

When down in the southern part of the Chanda district in March, 1892, I shot three muntjacs and (although two of them were full grown) none of them had any horns above the hair. The pedicles were from 3" to 4" long and covered with hair, the tips being rounded off and also so covered. They apparently had never supported horns, for, if so, either scars would have existed on the spots whence the horns were shed, or horns in some stage of growth would have been seen.

This year Mr. R. Thompson (junior), the officer who relieved me, also shot several in the same district and found the same peculiarity. He has promised me a skull, and, when I get it, I will send it to the Bombay Natural History Society's museum.

P. H. CLUTTERBUCK,
Assistant Conservator of Forests.

NAGPUR, C. P., *August*, 1894.

PROCEEDINGS

OF THE MEETING HELD ON JULY 10TH, 1894.

A meeting of the members took place at the Society's Rooms on Tuesday, the 10th July, a large number being present. Brigade-Surgeon-Lieutenant-Colonel G. A. Maconochie, M.D., presided.

NEW MEMBERS.

The election of the following new members was announced:—

LIFE MEMBERS.—The Curator, Baroda State Museum; Baron Ed. de Poncins, (France); His Highness Kumar Shri Juswant Singhji, (Jamnagar).

MEMBERS.—The Curator and Secretary, Provincial Museum, Lucknow; Mr. Kaliandas Keshavdas, (Bombay); Mr. R. E. Enthoven, I.C.S., (Bombay); Mr. J. McNeil, I.C.S., (North Canara); Mr. Bhugwandas Narotumdas, (Bombay); Mr. E. Clements, I.C.S., (Tanna); Surgeon-Captain J. Girvin, A.M.S., (Kamptee); Mr. W. H. Dawson, I.C.S., (Rangoon); Mr. B. B. Osmaston, (Chakrata); Captain A. Jennings, (s.s. Iran, Liverpool); Lieutenant James M. Burn, R.E., (Mussoorie); Mrs. Phillips, (London); Mr. H. J. McIntosh, I.C.S., (Simla); Lieutenant A. J. Pilcher, R.E., (Upper Burma); Mr. Lionel S. Osmaston, (Poona); Professor R. M. Dixon, B.A., (Bombay); Mrs. Buren, (Broadstairs, Kent); Mr. R. Thurlow Baker, (London); Captain W. Prior, (Lucknow); Mr. J. Brandenburgh, (Bombay); Mr. C. E. Low, I. C. S., (Khandwa); Rev. G. Fitzgerald Windover, (Indore); Mr. Fazulbhoy Meheralli Chinoy, (Bombay); and Mr. D. M. Dalal, (Bombay).

CONTRIBUTIONS.

The Honorary Secretary acknowledged the receipt of the following contributions since the last meeting:—

Contribution.	Description.	Contributor.
1 Snake (alive)	Typhlops brahminus	Mr. A. D. Stewart.
1 pair of Swamp Deer Horns	Cervus duvauceli	Anonymous.
1 Trap-door Spider's Nest	.....	Surgn.-Major Lowdell.
1 Panther's Skin	Felis pardus	Mr. W. F. Sinclair, I.C.S.
1 Baillon's Crake (alive)	Porzana bailloni	Mr. A. Otto.
A number of Fish from Aden.	.....	Capt. E. L. Shopland.
1 White-eyed Buzzard	Butastur teesa	Col. K. Mackenzie.
1 Snake	Zamenis ventrimaculatus	Mr. H. E. M. James, I.C.S.
1 Dolphin's Skull	Steno plumbeus	Mr. W. F. Sinclair, I.C.S.
1 Lizard (alive)	Eumeces punctatus	Mr. A. D. Stewart.
1 Painted Bat (alive)	Kerivula picta	Dr. deMonte.
A number of Sand Lizards from Sind.	Ophiomorus tridactylus	Mr. H. E. M. James, I.C.S.
36 Crocodiles' Eggs	Crocodilus palustris	Mr. S. Tomlinson.
1 Tree Snake	Trimeresurus anamallensis	Mr. G. P. Millett.
2 Birds' Nests	Hyphantornis galbula	Mr. C. E. Tooth.
1 White-tailed Porcupine (alive).	Hystrix leucura	Mr. B. A. Gupte.

Contribution.	Description.	Contributor.
A number of Lizards (alive)	Sitana ponticeriana	Surgn.-Capt. J. Girvin.
Some Black Rock Scorpions (alive).	Scorpio swammerdami	Do.
A quantity of Tree Lizards (alive).	Calotes rouxii	Rev. F. Dreckmann, S.J.
1 Cobra (Juv.)	Naja tripudians	Mr. C. E. Kane.
1 Earth Snake	Silibura brevis	Do.
1 Stone Plover (alive)	Œdichemus scolopax	Mrs. N. C. Pearson.
Skull and Horns of Wild Sheep.	Ovis poli	Baron Ed. de Poncins.
1 Skin of Tibetan Marmot.	Arctomys himalayanus	Do.
6 Eggs of the Indian Cliff Swallow.	Hirundo fluvicola	Mr. E. C. Tooth.
1 Indian Palm Civet (alive)	Paradoxurus niger	Mr. W. M. Sterling.
1 Egg of the White-backed Vulture.	Pseudogyps bengalensis	Anonymous.
4 Eggs of Striated Bush Babbler.	Chatarrhæa caudata	Do.
4 Eggs of Plain Brown Munia.	Amadina malabarica	Do.
1 Pied Cuckoo (alive)	Coccystes jacobinus	Mr. N. Melling.
1 Dhaman (alive)	Zamenis mucosus	Dr. K. R. Kirtikar.
1 Indian Koel (alive)	Eudynamis honorata	Mr. N. S. Symons.
1 Krait	Bungarus cæruleus	Mr. E. Milch.
2 Rufous-backed Sparrows	Passer pyrrnonotus	Mr. S. B. Doig.
1 Indian Pangolin	Manis pentadactyla	Mr. B. A. Gupte.
2 Eggs of the White-browed Bulbul,	Pycnonotus tuteolus	Miss M. Hide.
2 Indian Vampire Bats	Megaderma iyra	Mr. W. George.
1 Snake	Simotes arnensis	Mr. J. Bradenburg.
1 Lynx Skin	Felis lynx	Lt. E.G. Farquharson,R.E.
1 Tibetan Marmot's Skin	Arctomys himalayanus	Do.
Nest and Eggs of the Brown Flycatcher.	Alsconax latirostris	Lieut. B.A. G. Shelley, R.E.
1 Snake	Lycodon striatus	Capt. R. H. Light.
1 Photograph of Bison	Bos gaurus	Major Rodon.
2 Snakes	Zamenis diadema and Dipsas trigonata	Surg-Capt. R. S. F. Henderson.
1 Chameleon (alive)	Chamæleon calcaratus	Mr. P. J. Tonkin.
Some Australian Minerals.		Mr. R. E. Enthoven, I.C.S.
1 Skin of Wild Dog	Cyon dukhunensis	Mr. G. P. Millett.
1 Panther's Skull	Felis pardus	Do.
1 Large piece of Teak Wood, measuring 5ft. 4in. by 3ft. 3in. from the N. Kanara Forests.	Tectona grandis	Mr. Haripad Mitra (thro' Mr. W. F. Sinclair, I.C.S.)
2 Jerboas (alive)	Alactaga indica	Born in the Society's Room.

MINOR CONTRIBUTIONS FROM

Mr. H. Bicknell, Captain Finny, Mrs. B. Smith, Mr. B. Ferozeshah, Mr. R. C. Dyson, Mr. A. Foulkes, Captain Shopland, Mr. W. F. Sinclair, I. C. S., Mr. R. M. Myer, Mr. J. Tate, Surgeon-Captain Wade-Brown, Mr. R. Cashel, Mr. Dajee Abajee Khare, Mr. J. Stiven, Mr. C. E. Kane, Mr. R. E. Enthoven, I. C. S., Mr. B. A. Gupte, Mr. J. Adam, the Hon'ble Mr. Justice Starling, Mrs. T. Gray Hill, Master G. Gordon, Mr. C. Hudson, I. C. S., and Mr. R. C. Wroughton.

CONTRIBUTIONS TO THE LIBRARY.

Transactions of the Entomological Society of London, for 1893; in exchange.

A set of back numbers of the Bombay Natural History Society's Journal; by Mr. J. P. Cornforth.

Records of the Geological Survey of India, Vol. XXVII, Parts 1 and 2; in exchange.

The Fauna of British India, Moths (Hampson); by Mr. W. F. Sinclair, I.C.S.

Proceedings of the Royal Society of Victoria, Vol. VII ; in exchange.

Proceedings of the Linnæan Society of N. S. W., Parts 3 and 4, Vol. VIII ; in exchange.

Indian Museum Notes, Vol. III, No. 3; the Trustees of the Indian Museum.

Les Formicides de la Province d'Oran (Algerie), by A. Forel; from the Author.

Actes de la Société Scientifique du Chili, Vol. III ; in exchange.

The Canadian Entomologist, Vol. XXVI, No. 5; in exchange.

Report of the Council of the Zoological Society for 1893; by Mr. W. F. Sinclair, I. C. S.

The Indian Forester, Vol. XX, Nos. 5 and 6; in exchange.

The Victorian Naturalist, Vol. XI, Nos. 1 and 2 ; in exchange.

The Journal of the Asiatic Society of Bengal, Vol. LXII, Part I, No. 4; in exchange.

The Journal of the Asiatic Society of Bengal, Vol. LXIII, Part II, No. 1 ; in exchange.

The Flora of British India, Part XX, by Sir J. D. Hooker ; in exchange.

Annual Report of the Secretary for Mines, Victoria, N. S. W., 1893; in exchange.

Bulletin of the American Museum of Natural History, Vol. IV, 1892; Smithsonian Institution.

Proceedings of the Academy of Natural Science of Philadelphia, Part II, 1892 ; Smithsonian Institution.

Scientific Taxidermy for Museums by R. W. Shufeldt, M. D.; Smithsonian Institution.

The Memoirs and Proceedings of the Manchester Library and Philosophical Society, 1893-94; in exchange.

A VALUABLE CONTRIBUTION.

A special vote of thanks was passed to Baron Ed. de Poncins for his valuable contribution to the Society's collection of the skull and horns of a female *Ovis poli*.

PAPERS READ.

The following papers were then read :—" Man-eating Panthers," by Mr. J. D. Inverarity ; " Wounded Tigers, &c., how should they be killed " ? by Mr. Regd. Gilbert ; and " Some Indian Stalking and Shooting," by Mr. A. M. Markham, I.C.S., all of which will appear in the Society's Journal.

A vote of thanks having been passed to these gentlemen for their interesting papers, the meeting then terminated.



Jessie Benjamin del. Bombay Nat. Hist. Soc. Bruno Grimm lith. London.

THE POISONOUS PLANTS OF BOMBAY.

Semecarpus Anacardium Linn.

¼ Natural size.

JOURNAL

OF THE

BOMBAY

Natural History Society.

Vol. IX.] BOMBAY. [No. 3.

THE POISONOUS PLANTS OF BOMBAY.

By Surgeon-Major K. R. Kirtikar, I.M.S., F.L.S.,

Civil Surgeon, Thana.

PART XI.

(*With Plates M and Supplementary M.*)

(*Continued from Vol. IX, page* 176.)

SEMECARPUS ANACARDIUM—(*Linn.*)

Natural Order—Anacardiaceæ.

MARATHI बिबा (Bibâ); भिलावा (Bhilâwâ.)

(*Read before the Bombay Natural History Society on 28th January* 1895.)

This is the marking-nut tree of English writers.

A deciduous forest-tree common in several parts of India and other tropical countries, varying in height from 20 to 40 feet, very showy when in full blossom and full fruit. Very common in the jungles of Thana. Old leaves shed in January and February. New leaves appear in April and May. The tree blossoms soon after the new leaves are thrown out. The flowering time lasts from May to August. The seed is ripe in January and February. (Roxburgh).

BRANCHES—Numerous, spreading.

TRUNK—Straight; covered with grey, scabrous bark, which is often brown. Girth 4 to 6 feet.

BARK—"1 inch thick, dusky grey, blackish with irregularly quadrangular plates, separated by narrow longitudinal and shallow, irregular cross furrows or wrinkles, in old trees rough with exfoliating scales." (Brandis' Forest Flora of N. W. and C. India, page 125.) "The inner substance of the bark contains," says Roxburgh, "in crevices, a quantity of *white*,* soft, almost insipid gum." He further adds that "from wounds made in the bark, a dirty looking *brownish** soft gum is procured, which dissolves slowly in the mouth." The latter remark is nearer the truth, according to my experience. The resinous exudation from the young fruit, however, is milk-white or cream-coloured as it escapes ; it soon turns jet-black on exposure.

THE WOOD, says Brandis, "is ash-coloured, reddish-white or brown, even but open-grained." It is full of acrid juice which causes swelling and irritation. "Timber-cutters," says Brandis, "object to felling it unless it has been ringed for some time." It cracks in seasoning ; is not durable and not much used. Weight, 42 lbs. per cubic foot. Sap-wood and heart-wood not distinct (Brandis). I find that under an ordinary magnifying glass the medullary rays are fairly well distinct. Kurz observes that the wood is grey or reddish-white, soft and useless. (Forest Flora of Burma, Vol. I, pp. 311—312.)

LEAVES—Generally closely arranged at the extremities of the branchlets ; simple, alternate, very coriaceous and flat ; very large, 9 to 30 inches long, 5 to 12 inches broad ; cuneate, oblong or obovate-oblong, rarely linear-oblong. Margin quite entire ; cartilaginous ; usually contracted below the middle, not unoften also above the middle, giving the whole leaf a wavy appearance slightly. Apex rounded, "blunt or mucronate," says Kurz. Base rounded, cordate or cuneate. The surface is opaque above, and slightly pubescent, especially when young ; whitish or glaucous and thickly pubescent beneath. Hooker says that the leaves are brown beneath. This is not the case in the Konkan at any rate. Kurz observes that the leaves of the shoots or young trees are not seldom elongate, and cuneate-obovate with a sharp point. *Nerves* 16 to 25 pairs; stout, slightly arched, pale white. The entire net-venation is boldly prominent and very coarse, especially on the under-surface, giving the leaves a notably harsh feel. It is difficult to examine the

* The italics are mine.—K. R. K.

stomata under the microscope on account of this prominent network of veins or nerves. Kurz agrees with me in the view that the venation is markedly coarse on the under-surface. Dalzell and Gibson, who were particularly familiar with the Bombay specimens also say that the leaves are whitish and tomentose beneath.

PETIOLE—Short, varying in length from 1 to 2 inches, rounded or half-rounded, stout, not winged, densely puberulous.

FLOWERS—Polygamous or dicecious ; small, $\frac{1}{4}$ to $\frac{1}{3}$ inch in diameter ; subsessile, fascicled ; the fascicles arranged in erect compound terminal panicles.

INFLORESCENCE—In large terminal tomentose panicles ; the lower branches of the panicles issuing from the axils of terminal leaves. The panicles are stout, equalling or shorter than the leaves, branching into numerous spikes. The panicles of the male tree much more slender.

BRACTS—Many, small, lanceolate, fugacious.

BRACTEOLES—Present but fugacious.

ÆSTIVATION—Imbricate.

The above is a description of the flowers generally. It would be useful to note the differences in the male, female and hermaphrodite flowers individually.

FEMALE AND HERMAPHRODITE FLOWERS, says Kurz, "are 1 to 3 lines long, racemulose and nearly twice longer than the clustered, almost sessile, male flowers. Pedicels very thick and tomentose." He further adds that both male and female flowers form a terminal ample robust tomentose panicle of the length of the leaves or shorter.

CALYX—5-fid ; segments deciduous.

COROLLA—Greenish-white, or "greenish-yellow." (Brandis.)

PETALS—Five ; "valvate-imbricate" (Kurz). 3 to 4 times the length of the calyx ; oblong, slightly pointed at the apex, inserted under the margin of the disk ; sessile, glabrous, very spreading.

DISK—Broad, annular, between stamens and ovary.

STAMENS—5, alternate with the petals ; inserted on the margin of the disk ; imperfect or sterile in female flowers ; equal ; distinct.

FILAMENTS—Subulate from a somewhat dilated base ; of the length of the petals.

ANTHERS—Yellow ; ovoid or elliptical.

OVARY—Free, sessile, 1-celled. "Densely appressed, tawny, hispid," says Kurz.

STYLES—Three, from the apex of the ovary; divergent, incrassate.

STIGMA—Sub-clavate, shortly two-lobed or retuse.

OVULES—Inserted at the apex of the cell; pendulous from a basal funicle.

MALE FLOWERS—Usually smaller than the hermaphrodite; often on a separate tree. Calyx and corolla as in the hermaphrodite flower. Petals "about a line long; oblong-lanceolate" (Kurz).

FILAMENTS—Five, of the length of the petals.

ANTHERS—Much larger than in the hermaphrodites.

PISTIL—Absent, or small, and abortive, and in the form of a semi-globular hairy glandular body (Roxburgh).

FRUIT—A drupe, 1 inch long and about as broad, often less; ovoid, obliquely ovoid or cordate-ovate, with a slight obtuse notch on either side under the apex; unequally compressed; slightly convex in some parts, and quite plain in others; seated at the summit of, or more or less immersed in a fleshy receptacle formed of the thickened disk and accrescent calyx-base termed the *Hypocarp*.

CUP—Fleshy, orange-red, smooth, about the size of the nut, sometimes a little larger.

PERICARP—Smooth, shining black, thick; containing between the outer and inner laminæ roundish or oblong cells full of corrosive resinous juice. This juice is white when the fruit is young, darkening on exposure to the air. In the mature fruit it is brownish or perfectly black. The inner lamina is hard and rugose; the outer smooth, leathery and less hard.

SEED—Pendulous, "with a swollen or umbilicate funicle." (Lubbock.)

TESTA—Coriaceous; inner coat somewhat fleshy.

EMBRYO—Thick, milk-white. Plumule "ovate-leaved, veined, conduplicate, very thin." (Gaertner).

COTYLEDONS—Fleshy, thick, white, irregularly plano-convex.

ALBUMEN—Absent.

RADICLE—Superior, minute, concealed within the apex of the cotyledons; "always directed to the hilum." (Lindley's Vegetable Kingdom, p. 465, 1847.)

REMARKS.

I have said on the authority of Hooker and Kurz that this tree is deciduous. I can also add my own humble testimony to that effect. In Paxton's Botanical Dictionary, however, and in Johnson's Gardener's Dictionary, the plant is said to be an evergreen. I presume that this description is taken from the stove-plants of the marking-nut that are reared in the English nurseries. I think it requires the tropical heat and open air jungle-life to give it its full character of a deciduous tree. Balfour observes that the natural order *Anacardiaceæ* is unknown in Australia (Manual of Botany, p. 473, 1875). Hooker, however, notes that the *Semecarpus anacardium* is to be found in North Australia. Baillon also says that the representatives of the genus *Semecarpus* are to be seen in the Oceania, which of course includes Australia. Among introduced plants belonging to the Natural Order *Anacardiaceæ* I have seen the mango grow in the beautiful Government Gardens of Sydney. There are several species of the genus *Rhus* (Sumach) also growing there. The mango does not evidently thrive there, and bears very poor fruit, if at all. But several of the American species of *Rhus* seemed to me to be in very good condition, as if born to the soil. The northern part of Australia would not be unnatural soil for the growth of the different species and genera of the Natural Order *Anacardiaceæ*. It is therefore difficult to understand how Professor Balfour made such a wholesale statement as to say that the Natural Order *Anacardiaceæ* is unknown in Australia. Perhaps the information we now possess was not available when he wrote his work.

The following are the synonyms as given in Part I of the *Index Kewensis* compiled by B. Daydon Jackson at the expense of the late Charles Robert Darwin of sacred memory, under the direction of Sir Joseph Hooker (p. 115) :—

Anacardium latifolium.—Lam. Encyc., I., 139 (*Ill.* t. 208).

A. longifolium.—Lam. l. c.

A. officinale.—Pritz. Ind. Ic., 59.

A. orientale.—Auct. Ex Steud. Nom., Ed. II., i. 82.

A. officinarum.—Gaertn. Fruct., i., 192, t. 40.

A. solitarium.—Stokes, Bot. Mat. Med., II., 159.

In "Johnson's Gardener's Dictionary" edited by Wight and Dewar (1894, p. 892), *Cassuvium longifolium* is also mentioned as a synonym of *Semecarpus anacardium*. Referring to the *Index Kewensis* under the head *Cassuvium* I find that this last synonym is not mentioned. It appears, however, that according to Rottböll *Cassuvium* and *Anacardium* are synonymous.

Sir Joseph Hooker also mentions *Semecarpus latifolius* Pers. (ex Marchand), as a synonym of *Semecarpus anacardium*. (Flora Br. Ind., Vol. II., p. 31).

With regard to the habitat of the plant, Dr. Gregg says that it is a native of the mountainous parts of India. Dalzell and Gibson, who knew the Bombay Flora well, say that it is common in the Dekkan and the Konkan, which latter includes the Waree country (Sâwant Wâdi). Contrast with this the observation of the Rev. Mr. Nairne. He says: "*Semecarpus anacardium* is said to be common in the Dekkan, Konkan and Gujrat, but I should scarcely call it so" (p. 69, The Flowering Plants of Western India). So far as the Thana district is concerned, it is very commonly seen in the jungles. Mr. Govindji Narayan, an able indigenous writer, in his Marâthi work entitled "*Vriksh-varnan*," observes that the *Khârvis* of Damaun and Surat use the marking-nut for nearly every kind of ailment.

In describing the *Semecarpus anacardium* of the Colonies in his "*Fragmenta Phytographiæ Australiæ*," Baron Sir Ferdinand von Mueller observes that "the tree grows to a height of even 50 ft.; and that the fruit is known as the cashew-nut of the Colonies" (p. 23, Vol. VII, 1869-71). It may be observed that the cashew-nut of this country is the Kâju plant (*Anacardium occidentale*).

The *Anacardiaceæ* were formerly classed as a sub-division or sub-order, by Kunth, Wight and Arnott, and DeCandolle, under the Natural Order *Terebintaceæ* of Jussieu. In the *Genera Plantarum*, the Natural Order *Anacardiaceæ* is synonymous with *Terebinthaceæ*. "The Anacards," says Lindley, "are distinctly known by the seeds hanging from the end of a thread, which rises up from the base of the carpels, which in general are solitary, or at least quite distinct, and are sometimes, when quite ripe, placed at the end of an excessively enlarged disk as in the cashew-nut itself"—(Vegetable Kingdom, p. 465,1847). "As an ornamental tree, either in full foliage or before the fall of the

leaf," says Surgeon-General Balfour, "the marking-nut tree merits observation." He says that the *mature corolla* and receptacle are fleshy and sweetish-sour. As against this, I may observe that the receptacle is fleshy; and not the *corolla*, but the *calyx-base*. The corolla is distinctly deciduous; so is the upper part of the calyx where the sepals are distinct. "The marking-nut is well described by the Arabs," says Dr. Dymock in one of his earlier notes on this plant, "as resembling the heart of an animal, the torus representing the auricles and the fruit the ventricles."—(Pharmaceut. Journal, p. 1003, Vol. VIII, 1877-78, 3rd Ser.)

"The bark of the younger parts," says Roxburgh, "is smooth;" but from an examination of the plants growing in and around Thana, I find that the younger parts are invariably covered with a light ash-coloured or brownish pubescence. Brandis fully bears me out in this assertion when he says that "young branches, inflorescence, petiole, and underside of leaves are clothed with a short, somewhat harsh tomentum of simple hairs." The simple hairs, as seen by me under the microscope, magnified about two hundred times, are unicellular. Their shape varies much; some are straight and blunt, or sharp-pointed; others wavy and sharp-pointed. These forms are figured under No. 5 in the supplementary Plate M. "The bark is astringent and used in dyeing," says Brandis.

Wight and Arnott say that the under-surface of the leaves is "scarcely downy." This is not the case so far as the Thana plants are concerned. If anything, the under-surface is distinctly downy. The tomentum is apparent even to the naked eye. Kurz agrees with me in this, for he says, "the under-surface is covered with a thick grey velvetty tomentum."

Katâ Bhat of Junagadh says that the flowers are red (p. 285, *Nighant-Sangraha*). All the previous writers are unanimous in describing the colour of the flowers as greenish-yellow or whitish-green. The stigma is sometimes tinged brownish.

With regard to the one-celled nature of the ovary in *Semecarpus anacardium* I have this to observe. In the tribe *Spondiæ*, of the Natural Order *Anacardiaceæ*, the ovary is syncarpous, consisting of 2 to 5 carpels and containing as many cells. From this occurrence of several distinct carpels in one flower among the *Spondiæ*, the one-

celled ovary of the *Semecarpus anacardium* "may be considered," says Sir John Lubbock, "as reduced types." (Seedlings, Vol. I., p. 369.)

Baillon observes that the cup-shaped fleshy orange-red enlargement, more or less high round the pericarp, and encircling the base of the drupe, is a peduncular swelling. I think it is something more than that. It contains in addition to the peduncular enlargement, the base of an accrescent calyx. Baillon says that fermented drinks and conserves are made from this very showy cup. It has an agreeably acid taste, and is perfectly harmless. In speaking of the edible nature of the friut of a congener of *Semecarpus anacardium*, namely, the elm-leaved Sumach of America (*Rhus coriaria*), Mr. Nuttall observes that "the pulp of the drupes of several species affords an agreeable acid similar to that of wood-sorrel, either oxalic or tartaric" (p. 122, Vol. II., "North American Sylva). It would be interesting to know to what particular acid the sour taste of the bright orange cups of the marking-nut is due. Mr. Wasudev Chintâman Bâpat of Nâringre (Ratnagiri district) says that the orange cups are dried and eaten like figs under the name of *Bipti*. The ripe fruits are strung together on a piece of twine and hung up to dry in the sun before being so used. It is stated in Lindley and Moore's "Treasury of Botany" that the *unripe fruit* is employed for making a kind of ink (Vol. II, p. 1047). I may observe that even the ripe and dried fruit is similarly used, I should even say *principally* used. The dried flat cotyledons are used in this country under the name of *godambi*. Though some consider the taste of the fruit agreeable, Brandis is of opinion that the fruit, when fresh, is "acrid and astringent; roasted, it is said to taste somewhat like roasted apples, and when dry, somewhat like dates." Roxburgh says that before being roasted, the fruit leaves sometimes a painful sensation on the tongue. The roasting is usually done in hot ashes. Masters, who writes the article on *Semecarpus anacardium* in the "Treasury of Botany" just referred to, says that "the seeds called Malacca-beans or marsh-nuts are eaten, and are said to stimulate the mental powers and especially the memory." I know a case of leprosy complicated with loss of memory, in which the nut was used by a Hindu Vaidya with the special object of curing the latter affection.

I may add here that, although on the authority of Mr. Masters I have ventured to state that the seeds of the marking-nut tree are called Malacca-beans, the plant known in American works as the Malacca-bean plant should not be confounded with the marking-nut tree. The former is the *Avicennia tomentosa*, Jacquin, of the Natural Order *Myoporinæ*, R. Brown. It is now classed under the Natural Order *Verbenaceæ* by Bentham and Hooker, and is also known under the name Linnæus originally gave it, namely, *Avicennia officinalis*. It grows abundantly as a straggling shrub on the entire Bombay and Salsette Coasts in their widely extending marshes. This Malacca-bean plant of the American Botanists, essentially ripal in its habitat, is an entirely distinct plant from the inland and jungle-loving marking-nut tree. The Malacca-bean plant is known to, and described by, American Botanists as the Soft-leaved *Avicennia*. Witness the following observations of Mr. Thomas Nuttall, F. L. S.:—"The *Avicennia* or Malacca-bean, according to Rheed, becomes a tall and graceful tree on the coast of India, rising to the height of 70 feet, with a trunk of 16 feet in circumference, sustaining a pyramidal and somewhat orbicular summit of dense and dark verdure. The wood is whitish, covered with a grey bark, and is employed for many economical purposes. The kernels, naturally bitter, deprived of this quality by steeping and boiling in water, are then sufficiently edible, and known to the Hindus by the name of *Caril*; an oil may also be expressed from them as from the nuts of the *Anacardium*." (Nuttall's North American Sylva, Vol. III, p. 79). In reading the above account in Mr. Nuttall's work, what puzzles me most is, why Mr. Nuttall gives *Anacardium* (*Bauhin*, Pinax, p. 511; *Oepata. Rheed*, Malab. Vol. 4, p. 95, tab. 45) as one of the synonyms of *Avicennia tomentosa*. The two natural orders, namely, *Anacardiaceæ* and *Verbenaceæ* to which *Anacardium* and *Avicennia* respectively belong, are as far removed from each other as they possibly can be among the Flowering plants. To sum up, it is necessary to remember that the Malacca-bean plant is entirely different from the marking-nut tree producing the so-called Malacca-beans of Masters.

The cotyledons of the marking-nut, when mature, yield a bland sweet oil, which is entirely free from acrid property. That the pericarp should contain a highly acrid and corrosive oil, nay, indeed,

the whole plant should be more or less acrid, and that the oil of the cotyledons, on the other hand, should be perfectly harmless, is not without a parallel in the vegetable kingdom, as will be seen from my remarks on the oil obtained from the seeds of the *Moringa pterygosperma* in my last contribution to this Journal, describing that plant.

I may add one more instance of this strange botanical fact recently gathered from the writings of an Amrican Botanist—Mr. Thomas Nuttall, F. L. S. He says that the leaves of the Western Yew tree (*Taxus occidentalis*), which is the same as the *Taxus brevifolia* of the Americans and the *Taxus baccata* of Hooker (in part Flor. Bor. Amer. 2, p. 167) "are poisonous to horned cattle and horses, though the berries are inoffensive. Cattle so affected run about in fury and delirium, and at length drop down dead. Three children, according to Dr. Percival of Manchester, were poisoned dead in a few hours by taking a small dose of the green leaves as a remedy for worms, but they appear to have suffered no pain, and after death looked as though they were in a placid sleep. The best antidotes to this poison are oily substances." (Nuttall's North American Sylva, Vol. III, p. 89).

Other instances are not wanting in the Natural Order *Anacardiaceæ* itself where the cotyledons are perfectly harmless, though the other parts of the plant contain an acrid juice, as for instance the kâju-nut (cashew-nut). The oil obtained from the cotyledons of this nut is bland, and free from acridity, whereas the pericarp contains an acrid oil. Baillon mentions another plant, the *Semecarpus atra* (*Rhus atra*, Forst.) of a similar nature. The roasted seeds of this tree are eaten in New Caledonia ; but the juice of the stalk, or *Nolé* resin, as it is called, is caustic and poisonous. The apple of it, besides, known as the *Nolé apple*, which is merely the fleshy peduncle, is used to prepare a fermented drink.

The most interesting part of the marking-nut tree is the pericarp of the fruit. "The pericarp contains," says J. Lapire, "32 per cent. of a vesicating oil of specific gravity 0·991, easily soluble in ether."* This volatile oil is the ingredient which gives the resinous fluid its acrid, and corrosive, escharotic, or caustic property. The acrid juice

* [Journal Pharm. (3) XL., 16]—Quoted from Henry Watt's Dictionary of Chemistry, Vol. V., 1869.

of the pericarp contains *anacardic acid* and *cardol*. Besides being soluble in ether as noted by Lapire, it is soluble in alcohol and vegetable oils. *Anacardic acid* and *cardol* are readily decomposed by heat. Exposure to them produces irritant effects even from a distance in some constitutions, particularly in those which are predisposed to irritation by virtue of their tender cutaneous system. It is impossible to know beforehand which constitution might suffer and which escape. When, however, it is once found out that a particular constitution does suffer from near or from afar, it were best for such a constitution to keep aloof from the marking-nut, or its operations, when other persons are using the nut. "According to Basiner," says Dr. Lyon, "when subcutaneously injected in large doses, the yellow oily liquid known as *cardol* causes in warm-blooded animals stupor and paralysis." Medicinally given, the juice, as a whole, acts as a stimulant and narcotic. Surgeon-General Balfour notes that the juice is much administered internally to elephants. "Given in large doses," says he, "it renders these animals furious."

The volatile nature of the oil of some of the members of the *Anacardiaceæ* is very striking. Thus, for instance, referring to *Schinus molle* (false pepper), Sir Joseph Hooker, in editing Mrs. Hooker's translation of LeMaout and Decaisne's "Descriptive and Analytical Botany," adds a note that "fragments of the leaf of this plant floated on water move about by jerks owing to the discharge of a volatile oil from the tissues." Let me add that this false pepper plant is a small tree of tropical America, with a sugary edible drupe and a mastic with a slight odour of pepper (LeMaout and Decaisne, p. 363, 1873). Balfour says that the torn leaves of this plant send out the resinous matter with so great a force "as to cause a sort of spontaneous motion by the recoil." Another congener of the marking-nut known as *Melanorrhœa usitatissima* (or *usitata* as Dr. Gregg calls it), which yields the so-called Martaban varnish, possesses a thick viscid greyish fluid, assuming a black colour on exposure. It constitutes the black varnish of the Burmese, and is extensively used by them. The point I wish to notice about this fluid black varnish is, that it has a distinctly terebinthinate smell. Ordinarily the black oleo-resinous fluid from the pericarp of the marking-nut is without any smell. "It is known

as the black varnish of Sylhet" (Birdwood's Economic Products of the Bombay Presidency, p. 261). When a dried nut is held over the flame of a candle, it burns beautifully, throwing out spirts of lit volatile oil which appear in succession like bright stringed beads, dropping down copious dark thick varnish-like juice. Around the flames there is a bluish halo. As the dried fruit burns, it emits a faint smell not unlike that produced at the time of baking the cashew nut. In referring to the volatile nature of the oil issuing from other parts of the marking-nut-tree, Col. Drury and Surgeon-General Balfour, in their respective works cited in this paper, make the following common remarks :—" Even the farina of the anthers of the flowers is very narcotic and irritating ; people of a peculiar habit, accidentally sleeping under the tree when in blossom or even going near the flowers, are stupefied and have their faces and limbs swollen." O'Shaughnessy says that " the vapours arising from the nuts during roasting have been often known to occasion erysipelatous inflammation" (Bengal Dispensatory, p. 280). Instances of the volatile nature of the oil found in the plants of the genus *Rhus* belonging to the Natural Order *Anacardiaceæ* are to be seen in *Rhus toxicodendron* and *R. radicans*, which have an extremely dangerous milky juice. "It is capable of poisoning persons who approach such plants in hot weather" (Lindley). " It is said," notes Wight, " that merely handling the leaves of *Rhus toxicodendron* is sufficient to cause a crop of vesicles, and exposure to the volatile emanations from *R. toxicodendron* and *R. venenata* has been known to excite in susceptible persons severe indisposition, or they have had their bodies covered with a crop of pustules. The two Indian species of *Rhus*, he says, are not endowed with these acrid properties (Illustrations of Botany, Vol. I, p. 183, 1840.) It may be observed here that Hooker (Br. Flora, Vol. II, p. 9) says the genus *Rhus* often contains an acrid juice. He does not, however, specify which of the 12 species he describes have it. " Dr. Bigelow mentions," says Beck, " that he has known individuals badly poisoned in winter from the wood of *Rhus vernix* accidentally burnt on the fire" (Medical Jurisprudence, p. 837, 1836.) It will thus be clear that it is the volatile nature of the oil which renders it dangerous even from a distance.

It will be evident from the foregoing remarks that the genus *Semecarpus* is not the only one belonging to the Natural Order *Anacardiaceæ*, which is known to affect some individuals even from a distance. Mr. Thomas Nuttall, F.L.S., an American Botanist, in his "North American Sylva" (Vol. II, pp. 121-123, 1852), mentions several other American species of the genus *Rhus* which, besides those I have mentioned, are topically poisonous. In speaking of the "Coral Sumach" (*Rhus metopium*) he makes the following remark :— "Like several other native species of the genus (*Rhus*), this stately species of Sumach, a native of Jamaica, Cuba and Key West, is to some individuals poisonous to the touch. This, and the Mountain Sumach, are called in St. Domingo 'Mountain Manchiniel,' from the poisonous qualities of the juice they exude." Referring to another species, the *Rhus vernix*, to which I have just referred, he says that it "affords the Japan varnish, which oozes from incisions made in the tree, and grows thick and black when exposed to the air. It is so transparent, that when laid pure upon boxes or furniture every vein of the wood may be clearly seen. With it the Japanese varnish most of their household furniture made of wood. The milky juice of the plant stains linen a dark brown ; the whole shrub like our Poison Ash (*R. venenata*), to which it is nearly allied, is in a high degree poisonous ; and the poison is communicated by touching or smelling any part of it. Inflammations appear on the skin in large blotches, succeeded by pustules which rise in the inflamed parts, and filled with watery matter, attended with burning and itching, which continues for several days, after which the inflammation subsides. The extremities and glandular parts of the body are those which are most affected. Our *Rhus radicans* and *Rhus toxicodendron* (Poison Vines) operate nearly in the same way, though in a less degree than the Poison Ash or *Rhus vernix*. Many persons, however, can approach and handle these deleterious plants with impunity. One of the most dangerous species in America is the *Rhus pumila*, of Michaux, a native of North Carolina. Mr. Lyons, a well-known and assiduous collector of rare and ornamental plants, suffered extremely from its venom by merely collecting the seeds ; it produced a general fever, and affected the use of his limbs for several years." Lindley

observes that the *Stageneria vernicifera* of the Indian Archipelago, another member of the Anacardiaceous family which yields the black varnish called Japan lacquer, contains a resin which is extremely acrid, causing excoriations and blisters if applied to the skin. The people of Sumatra consider it dangerous even to sit or sleep beneath its shade.

It is not that every member of the Anacardiaceous family contains an acrid resinous fluid. Ondaatje, of Ceylon, for instance, says, that the resin yielded by *Semecarpus Gardneri*, a native of Ceylon, is free from acridity (Pharmac. Journal, p. 819, Vol. XIII, 1882-83, 3rd Ser.).

The dirty brown soft gummy exudation from incisions made in the bark is notably tasteless and free from acrid properties ; it dissolves slowly in the mouth (Brandis). This freedom of the gum from acridity is not unlike that of the pinkish gum of *Moringa pterygosperma*, nearly every part of which plant partakes of the odour of the true horse-radish or of mustard oil. It must be noted that a distinction should be made between the pure gum and the gum-resin or oleo-resin which respectively exude from different parts of the plants belonging to the Anacardiaceous family. The one is a pure gum in solid masses or tears, whereas the other is a resinous tarry oily-looking fluid, generally white in the tender parts of the *Semecarpus anacardium* plant and its young fruit.

The resinous juice of the pericarp is much used medicinally by the natives of this country. It may be named, without fear of contradiction, as the Indian *panacea* for all sorts of complaints from the mildest to the gravest. In fact, there is no affection which the Indian flesh is heir to in which it is not, almost instinctively, used. It is often used externally with marked relief, barring individual idiosyncrasy, which renders some constitutions readily susceptible to its poisonous effects ; it is not less often productive of dangerous results in other instances, the remedy proving worse than the disease itself for the cure of which it was originally used, and producing large sloughs, far beyond expectation. Internally, the juice acts as a tonic, though at times it produces violent gastric inflammation. When administered by the mouth, the resinous juice is well dissolved in vegetable oils, milk, curds, or whey.

As an article of domestic economy the resinous juice is extremely valuable. It is commonly used by the natives for marking linen and

cotton fabrics, the marks thus produced being indelible, leaving the fabric perfectly uninjured at the same time. Hence it is that the fruit comes to be named the *Indian marking-nut*. Ashes or quick-lime and water are used to fix the black colour. "The green nuts," says Roxburgh, "well pounded into a pulp, makes good lime." "The resinous juice is insoluble in water and is only diffusible in spirits of wine," adds Roxburgh, "for it soon falls to the bottom, unless the menstruum be previously alkalized ; the solution then is pretty complete, and of deep colour. It sinks in, but soon unites perfectly with, expressed oils." Hence it is that the natives use cocoanut, *teel*, or ground-nut oil to wipe off the skin recent stains of the resinous fluid, or to reduce the acridity of its poisons. Brandis says that the oil of the seeds of the marking-nut mixed with the milk of *Euphorbia* (which species, he does not mention—K.R.K.) is made into bird-lime by the wild tribes of the Satpura range in the Central Provinces.

POISONOUS PROPERTIES.

The marking-nut is a distinct vesicant of the skin, if it were nothing more. But it is even worse, as will have been gathered from the foregoing remarks. It only remains to look at its properties from the clinical point of view. Some escape its action beyond a slight irritation where the nut is locally applied. Others suffer from irritation of even untouched parts, while some others suffer violently even from a distance, though not themselves the users of the irritant fluid. Their face, their eyes, their ears become rapidly swollen, not unoften with great constitutional disturbance, followed by much prostration. The fruit is seldom, if ever, used internally for the purpose of poisoning. Jail-convicts and malingerers sometimes use it for producing blisters and ulceration of the skin, to avoid work. Dr. Norman Chevers bears me out in this assertion. "Dr. Hornigberger notes," says this experienced veteran Medico-Jurist, "that at Lahore he discovered that some of the prisoners rubbed the juice of this nut on their eyes ; others had rubbed it on their bodies. The former were apparently suffering from incurable ophthalmia, the latter from a kind of ring-worm. By this means they continued to remain on the sick-list, eating and drinking without being necessitated

to work." Superintendents and Medical Officers of Jails beware! Udoy Chandra Dutt also notes a similar experience as regards the jail-birds of Bengal. "It is often employed by natives," says he, "especially jail-convicts in India, to produce irritation and fictitious marks of bruises." (Materia Medica of the Hindus, p. 141, 1877.) Such has been my experience in the Thana prison.

Two cases came under my observation in the Thana Civil Hospital in 1893. In one of these cases, the deliberate application of the resinous fluid on several parts of the body produced violent symptoms; in the other case, mere pounding of the seeds on a stone was enough to cause irritation of several parts of the body. It would be useful to give briefly the notes of these cases.* They are as follow :—

1ST CASE.—A female, aged 20, married, was sent to the Civil Hospital, Thana, by the Chief Constable of Salsette, on 24th April, 1893. A number of black-nut marks were found on both breasts, thighs and genitals. She stated that the marks were made by her husband by way of punishment. The parts mentioned were all swollen on the day of her admission. On the third day of the application large blisters appeared on the painted parts. Under prompt application, first of sweet oil (*teel*), then of a lotion of acetate of lead and opium, and subsequently of vaseline, the parts recovered, and the patient was discharged cured, but not before three weeks.

2ND CASE.—In this the whole face and ears were much swollen, and there were large vesicles on both the forearms, chest and abdomen. The following are brief notes of this case :—The patient is a young Hindu, male, aged 24; admitted into the Civil Hospital, Thana, on 24th June, 1893. States that he had a swelling on his right forearm, for which he was recommended the external application of the marking-nut. He pounded a few nuts and used the resinous fluid on the affected part. The following day large vesicles appeared on it, as also redness and swelling on the face and ears, though they were not painted over. There was violent itching and much constitutional disturbance. The chest, abdomen, and left forearm were also swollen and red. Pus-

* The notes of these cases are recorded by my Assistants, Rajanna Lokaji and Madhavrao Shankar Sowani.—K. R. K.

tules formed on these parts on the third day ; the right forearm, over which the fluid was actually used, suffered most. It was considerably swollen. Within two days, under the same plan of treatment as followed in the first case, coupled with suitable constitutional treatment, the swelling of the ears, face, chest and abdomen subsided ; the parts over which pustules had appeared healed up, and the man was discharged cured within ten days of the application.

The first case mentioned here is not the only one of its kind where the marking-nut is used by a cruel husband to punish a helpless wife. Dr. Lyon mentions a case (Med. Jurisprudence, p. 190,) in which a man was tried before the Bombay High Court, and "convicted of causing hurt to his wife by throwing marking-nut juice over her face, blistering of the skin and severe ophthalmia of one eye lasting for several days being the result." Dr. Wellington Gray, when acting Chemical Analyser of Bombay, came across a case where a man introduced three marking-nuts into the genitals of his wife.

It is not uncommon to find persons painting their skins over to support false charges of assault. Dr. Newton mentions that the bruised nut applied locally to the *os uteri* is often in use amongst the native women for procuring abortion.

Dr. A. Gibson records a case in the Transactions of the Bombay Medical and Physical Society, in which a singular vesicular eruption was produced by the external application of the juice of the marking-nut (p. 117, Vol. for 1841). At page 271 of the same volume, is recorded a case in which the juice of the marking-nut was used mixed with *Nereum odorum* (Marâthi—*Kanher*), *Plumbago zeylanica* (Marâthi—*Chitrak*), sulphate of copper, beetles (genus *Mylabris*) and a snake to boot. No wonder such a diabolical combination, as virulent in effect as it was disgusting in conception and practice, produced a fatal result!

Dr. O'Shaughnessy records his experience of the deleterious nature of the resinous juice of the marking-nut with the true spirit of a pharmacological martyr, in his Bengal Dispensatory (page 280, Ed. 1841). A minute drop of the juice placed by himself on the back of his hand occasioned "the eruption of an herpetic blotch, intensely itchy and scaling from the centre to the circumference, which did not disappear for eight months, and left a scar like that of a burn. Dr. O'Shaughnessy

says that "by *boiling the nut* (the italics are mine, K.R.K.), an oil is prepared, which, when undiluted, acts as a blister." The common experience is that the process of boiling the nut is hardly necessary to bring out the blistering property. The crude juice, even as it escapes from the pericarp, rapidly produces a blister. In some constitutions the blister appears after 24 or even 48 hours, and not unfrequently, even a pustule. It is the crude juice that is generally used for medicinal or criminal purposes. The process of boiling the nut therefore, may be deemed superfluous.

Mr. C. Duran reports in the *Medical Times and Gazette* (p. 519, Vol. II, 1875), a case treated under the care of Dr. Frederick Taylor in Guy's Hospital, London, for poisoning by the Indian marking-nut. The symptoms are briefly as follow :—A European school-boy, aged 13, was admitted into Guy's Hospital on 18th May, 1874. He stated that he had painted the figure of an anchor on his left arm with the juice of the marking-nut *nine days* previous to admission into the hospital. The seed was given to him by a soldier returning to England from India. The juice "was not pricked in as in tattooing," but merely rubbed on. When the juice dried, it left a black stain which could not be rubbed off. During the week it caused some smarting. A full week after, the boy noticed that the painted arm was red, and that a number of small pimples had appeared. In the night his face became red and swollen, and the next day he went to the hospital. During the first night of his admission into the hospital, he rested his arm, which was covered with lint, on the abdomen and thighs. The following morning both the abdomen and thighs were red. This shows how long the acrid properties of the juice remain, and how indestructible it is even when mixed with the serum of the blood for a whole week, and how it affects adjacent parts by means of such serum even when they are protected by a thick piece of lint. The boy suffered from no constitutional disturbance. The redness of the affected parts resembled that of erysipelas. Although it was the *left* forearm that was painted over with an anchor, the back of the *right* hand and front of the wrist "were covered with a few red spots, surmounted with minute white pustules." The face also presented a similar inflammatory condition ; "the redness and swelling affected both eyes (the left

being quite closed), as well as the upper lip, chin, and the back of the right cheek, where there were a few isolated, raised red spots. The colour was sharply defined, and on the chin was a yellow crust resembling the crusts of eczema. On the inner side of each thigh at the upper part was a large red, less sharply-defined patch, with one or two transparent vesicles; and on the lower part of the abdomen were a few spots resembling those on the right hand and wrist. The eruption caused considerable itching." This, and numerous other cases which have come under my observation amply illustrate the erratic nature of the poisonous volatile principle which renders the resinous juice of the marking-nut so harmful, and at times even dangerous. The boy recovered under suitable treatment and left the hospital in a fortnight. The point noticeable about this case is that a playmate of the above patient was painted with the juice at the same time, and in consequence suffered from symptoms which Mr. J. D. Roberts, under whose care he was placed, describes as being similar to those of the cases I have cited. Mr. Duran notes that Dr. White of Harvard University characterizes the eruption as eczematous, and states that he has never seen it take on a really erysipelatous type. The duration of the disturbances generally varies from five to six weeks. (*Opus cit.*, page 520.) "These cases show," observes Mr. Duran, "that the period of time which may elapse between the application of the irritant and the development of the symptoms" may be so great as to render it difficult to trace the latter and "connect them with their real cause." Dr. White is said by Mr. Duran to observe, with reference to a similar peculiarity of the American genera of the *Anacardiaceæ*, that "the time required for the development of the visible manifestations of the poison upon the skin after contact with the *Rhus** or its emanations seems to vary greatly; for he found that, though shorter periods might occur, three, four, and five days were repeatedly given, by patients especially susceptible to its action as the interval between contact and the appearance of the eruption."

In the papers published under the head of "Indian Museum at South Kensington" in the "London Pharmaceutical Journal" (p. 181,

* *Rhus toxicodendron* and *R. venenata*, already referred to in this paper.

Vol. VI, 1875-76, 3rd Series), I find the following remarks which are well worth quoting :—" The marking-nuts which often come to this country mixed with the myrobolans, contain between the inner and outer layers of the shell or pericarp a remarkably caustic blackish oily fluid *which is apt to blister or greatly inflame the lips of those who attempt to crack the nuts.** In persons of erysipelatous tendency, the inflammation is often considerable and even dangerous." In one of his earlier papers contributed to the " London Pharmaceutical Journal" so far back as 1878 (p. 1003, Vol. VIII, 3rd Series), Dr. Dymock observes as follows :—" Garcia d'Orta remarks that the poisonous properties of the marking-nut have been much exaggerated by Serapion, and goes on to say that in Goa it is administered internally *after having been steeped in butter-milk*,* and is also given as a vermifuge ; and, moreover, says he, we (the Portuguese) salt the young green fruit and use them like olives." I have this to observe regarding the remarks of Garcia d'Orta. I have not the means of knowing at the present moment to what extent and where Serapion has exaggerated the poisonous properties of the marking-nut. All I can say is that those poisonous properties are very grave indeed topically in many men. If the oil of the seed is administered in Goa internally for asthma, and for the matter of that for any other complaint, or no complaint whatsoever after the seeds are steeped in butter-milk, I can safely say that the oleaginous or fatty principle of the butter-milk well-nigh renders the poisonous property of the resinous juice harmless by dissolving it out, inasmuch as it is now well established that the volatile oil parts from its host (*the seed*), and leaves it harmless when much diluted in oil. Moreover, I do not believe that the Portuguese stomach is in any way different from the ordinary human stomach if it can digest without suffering the salted young green fruit of the marking-nut as a substitute for olives, with the prior aid of common salt, which possibly renders the acrid properties of the seed inert, by dissolving out the poisonous element and changing it chemically. During the process of salting probably the volatile principle escapes. There is no reason why the chlorine of the chloride of sodium should not act upon the constituent elements of the marking-nut.

* The italics are mine.—K. R. K.

In my humble opinion the "Pharmacopœia of India" in no way exaggerates the deleterious properties of the marking-nut. It is safer to emphasize them in the present state of our knowledge as derived from books and from practical experience. Dr. Dymock distinctly says that when the nut is given internally "the juice of the pericarp is mixed with oil or melted butter." This is his last utteranee on the subject ("Pharmacographia Indica," Vol. I, page 390. "In the Concan," says he, "a single fruit is heated in the flame of a lamp and the oil allowed to drop in a quarter seer of milk." This drawing of the bare black juice, deprived of its obnoxious, volatile, poisonous element, removes a great deal of the sting of the poison if not the whole of it. The poisonous element lies in the volatile oil, which, like all other volatile substances, is dispersed by means of actual heat, or when exposed to air.

ADDENDUM.—While the first proofs of the above contribution were being examined by me, with the assistance of Mr. Mahadeo Shankar Sowani, my Civil Hospital Assistant, he told me that Dr. Ganesh Krishna Garde, L.M. & S., of Poona, could supply me with some important notes of cases of poisoning by marking-nut which he had met with in his practice. I have known Dr. Garde by reputation and by personal acquaintance as a medical man of great research and possessing extensive knowledge of Indian drugs. He is well read in ancient Hindu medicine. His experience therefore is worth recording. On application he has promptly supplied me with the following information which I produce *in extenso* in his own words :—

"Marking-nut has a special affinity for the skin, and its action on it must be looked upon as specific, as it invariably affects that tissue whether applied externally, taken internally or in whatever way absorbed into the blood. I quote below one or two of several cases that have come under my observation.

"Case No. 1.—A Parsee gentleman came to me one morning complaining of big swellings on the face, forearms, the back of the wrists and chest. There was no tingling or itching, but a slight dull tensive pain on tender parts like cheeks and alæ of the nose, &c. Some of the swellings had a reddish discoloration but others were of the

natural hue. My former experience at once suggested to me the idea that these swellings might be due to marking-nut in some way absorbed into the blood ; and so I questioned the patient whether he had ever come in contact with marking-nut in some way or other. After repeated questionings the patient recollected that he was lately using for some time a tooth-powder which contained a charcoal of these nuts. On learning this history I told him to stop using that tooth-powder and gave him one of my usual antidotes for application to the swellings which gradually disappeared in a few days. *Lininentum calcis* or a weak ointment of Bicarbonate of Soda are generally serviceable when these swellings are fresh, but when they get older I generally prefer an ointment of *Rhus toxicodendron* on Homœopathic principles, for *Rhus toxicodendron* has a similar action on the skin and a weak ointment of its tincture very rapidly disperses all anacardium irritation and swellings and ulcerations (caused by local application of the nut). I have lately learnt that the ashes of the bark of the marking-nut tree is a good application for all the cutaneous lesions caused by the nut.

"Case No. 2.—A few months ago a man came to me from Kolhapur with a hard, reddish and slightly painful swelling on the tip and alæ of the nose, a part of the cheeks and upper lip. It had remained persistently, shifting its place a little now and then, and becoming aggravated or ameliorated by various external applications prescribed by Doctors and Vaidyas but never disappearing altogether. As it had remained nearly two years so obstinately he was alarmed and came here for consultation. He told me that the hard, reddish swelling on the nose and surrounding parts was diagnosed as lupus by a renowned medical man but his treatment had failed. In investigating the causes of the swelling I happened to ask him, among other questions, whether he had ever used marking-nut internally. To this he answered affirmatively, and said that he had on several occasions consumed a nostrum containing these nuts prescribed for dyspepsia, constipation and general debility. This at once put me on the right track and my diagnosis of the case was Anacardium rash. But I regret to say that the diagnosis of the case was not completed by treatment as the patient did not remain here any longer.

"I have had several opportunities of observing the effects of marking-nuts and my long observation leads me to believe that *Anacardium orientale* is a specific dermato-irritant, its special affinity being for the skin of the face, alæ nasi, lobes of the ear, and lips and to some extent the trunk and upper extremities. Of course locally applied it may affect any part of the skin. The swellings over the nose, &c., have a striking resemblance to leprosy, and this may account for its recommendation for that disease in native medicine. Indeed modern Homœopathic therapeutics recommend it against leprosy on account of its homœopathicity to that disease. It is said also that long continued internal use of the drug causes failure of memory and some forms of unsoundness of mind."

In a further note Dr. Garde adds the following remarks :— "Marking-nut is one of those drugs like Quinine, Nux-Vomica, Ipecacuanha for which certain individuals show a great idiosyncrasy. I have seen people eating these nuts with cocoanut kernel without any harm, and many have used a decoction of about a dozen nuts quite safely. There are, on the other hand, some people, especially children who get their face swollen simply by being exposed to the effluvia of the nut, evolved when it is being broken for external application. These effluvia have been known to affect this way even from a considerable distance. The people of Gujrat and Kathyawar are more sensitive to its action than the Dekkanees. Darker races seem to resist its action ; and people of fair complexion are very sensitive to its action."

I am all the more grateful to Dr. Garde for these interesting remarks, especially as he is convalescent from a serious illness, and has promptly complied with my request in a very trying condition. Although I am not prepared to accept his Homœopathic views, I have let him speak in his own way *in extenso*. There is one remark I would make, and that is with reference to his observation that the long continued internal use of the nut causes failure of memory, and brings on some forms of unsoundness of mind. In the body of the paper I have already observed that I have seen it used in a case of leprosy for improving lost memory. I have also quoted from Masters the view that it stimulates the mental powers, and especially the memory.

DESCRIPTION OF PLATE M.

1. The fruit-bearing top of a sprig ; ¼ natural size, showing the fruit in varying stages of development.

2. The mature fruit with the orange cup-shaped torus (natural size).

3. A vertical section of the mature nut, after the torus has dried up and fallen ; showing the pericarp with its outer and inner laminæ, and the intervening space occupied by the dark resinous juice (natural size). The white portion shows the cotyledon of one side.

4. A terminal raceme bearing hermaphrodite flowers (half the natural size).

5. A hermaphrodite flower looked at from above (natural size).

6. A hermaphrodite flower looked at sideways (natural size) ; shows the position of the accrescent calyx.

7. Part of a panicle bearing male flowers only (half the natural size).

8. A male flower looked at from above (natural size).

DESCRIPTION OF SUPPLEMENTARY PLATE M.

1. Male flower looked at from above (after Wight, much magnified).

2. Hermaphrodite flower (modified after Wight, much magnified) ; × showing the stamen slightly drawn down to expose fully the ovary, and the three styles with their stigmata (front view).

3. Hermaphrodite flower (after Wight, much magnified) ; back view showing the relative size of the sepals and petals, and the position of the accrescent calyx, with a curved dark line.

4. Transverse section of the nut, about the middle diagrammatically showing the cellular receptacles of the acrid resinous fluid between the outer and inner laminæ of the pericarp, in a young fruit before the cotyledons are fully formed (natural size).

5. Hairs forming the *tomentum* of leaves and fruit in various shapes described in the text, as seen under the microscope (magnified 200 times).

6. Vertical section of the fruit and accrescent calyx and disk (diagrammatic and modified after Roxburgh, showing the receptacles of the acrid oily fluid ; the pendulous cotyledons ; and the position of the embryo. The asterisk at the top shows the position of the insertion of the styles (natural size).

7. Cotyledons separated and in juxtaposition (after Roxburgh ; natural size).

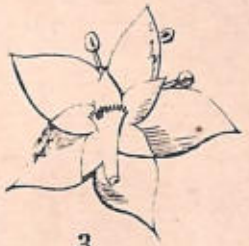
8. Plumule (much magnified, after Roxburgh).



1



2



3









H.L. Dos del. West, Newman chromo.

INDO-MALAYAN BUTTERFLIES.



INDO-MALAYAN BUTTERFLIES.



H. L. Dos del.

West, Newman, chromo.

INDO-MALAYAN BUTTERFLIES.



L. Dee del.

West, Newman, chromo.

INDO-MALAYAN BUTTERFLIES.

ON NEW AND LITTLE-KNOWN BUTTERFLIES FROM THE INDO-MALAYAN REGION.

By Lionel de Nicéville, F.E.S., C.M.Z.S., &c.

(*With Plates N, O, P, and Q.*)

(*Read before the Bombay Natural History Society on 28th January*, 1895.)

Family NYMPHALIDÆ.

Subfamily Satyrinæ.

1. LETHE (*Rangbia*) GULNIHAL, de Nicéville, Pl. N, Fig. 1, ♀.

L. gulnihal, de Nicéville, Proc. Zool. Soc. Lond., 1887, p. 450, pl. xxxix, fig. 7, *male*; id., Elwes, Trans. Ent. Soc. Lond., 1888, p. 308; id., Manders, Trans. Ent. Soc. Lond., 1890, p. 518, n. 18; *L. gulnihal*, var., Elwes, Proc. Zool. Soc. Lond., 1891, p. 263; *Rangbia gulnihal*, Moore, Lep. Ind., vol. i, p. 234, pl. lxxvi, fig. 2, *male* (1892); *R. peguana*, id., l. c., p. 235.

Habitat: Bhutan (*de Nicéville* and *Elwes*); Bernardmyo, Shan States (*Manders*); Karen Hills, 2,000 to 5,000 feet (*Elwes*); Sikkim; Manipur; Saipha, 3,500 feet, Katha District, Upper Burma (*coll. de Nicéville*).

Lieutenants James M. Burn, R.E., and A. J. Pilcher, R.E., have lately obtained a considerable number of male specimens of this species at Saipha in March. I have compared them carefully with my Manipur and Bhutan specimens, and am unable to find that any of the characters given by Mr. Moore to distinguish between *L. gulnihal* and *L. peguana* are constant. The best character, as far as my specimens go, is the size of the ocelli on the underside of the hindwing; but this is very variable too, they are large in Bhutan specimens, still larger in Manipur ones, medium and small in the Upper Burma examples. I have here figured a female example from Saipha, as that sex, though described by Mr. Elwes, has not so far been portrayed. It is useless figuring a male from Burma, as the figure could not be made to disclose any real differences between Bhutan and Burma specimens; the Bhutan form has already been twice well figured.

Subfamily Amathusiinæ.

2. MELANOCYMA FAUNULOIDES, n. sp., Pl. N, Fig. 2, ♀.

Habitat: North Chin Hills, Upper Burma.

Expanse: ♀, 4·5 inches.

Description: Female. Upperside, *both wings* very pale fuscous or French-grey, all the black markings of the underside showing through faintly by transparency. *Forewing* with the veins slightly

infuscated. *Hindwing* with the outer two-thirds of the abdominal margin, and the anal region widely as far as the inter-nervular fold in the first median interspace, ochreous-yellow, this colour being carried narrowly along the outer margin as far as the second median nervule. UNDERSIDE, *both wings* slightly paler than above, especially the hindwing. *Forewing* with a large round black spot near the middle of the discoidal cell; a broad black line across the cell beyond its middle, joined to two similar lines running along the subcostal and median nervures from the base of the wing, the latter broadening out towards the base of the submedian interspace; the anterior half of the discocellular nervules black, fining away to nothing posteriorly; two broad slightly irregular nearly parallel black lines commencing at the subcostal and ending at the submedian nervure, the inner line somewhat lunulated between the median nervules; a very fine obscure submarginal blackish line; with an extremely fine black line on the margin. *Hindwing* with the abdominal margin ochreous-yellow of a paler shade than on the upperside, this colour becoming entirely lost towards the middle of the submedian interspace, extending narrowly along the outer margin as far as the first median inter-nervular fold; the wing is crossed by four broad parallel more or less irregular black bands, all commencing close to the costa; the first band is nearly straight and is quite close to the base of the wing and ends on the submedian nervure; the second band is also nearly straight and ends on the internal inter-nervular fold; the third band is highly irregular and lunulated, the concavity of each lunulated portion directed towards the outer margin, it ends in a somewhat faint detached spot on the internal inter-nervular fold, anteriorly it is joined to the second band by a thin black line running along the costa; the fourth band is also highly irregular and lunulated, the concavity of each lunulated portion directed towards the base of the wing, it commences on the first subcostal nervule and ends on the submedian nervure; a somewhat broad submarginal fuscous line, posteriorly becoming lost in the ochreous anal area; a very fine black line on the margin ending posteriorly on the first median internervular fold. *Cilia* throughout very short and cinereous. *Antennæ* black. *Thorax* in front ochreous, posteriorly and *abdomen* pale fuscous.

A reference to Hewitson's, Westwood's, and Distant's figures of *Melanocyma faunula*, Westwood, all taken from female specimens, will at once reveal the many important characters in which that species differs from the present one, which characters are also borne out by the numerous specimens of *M. faunula* I possess from several localities in the Malay Peninsula and from Chentaboon in Siam. The ground-colour in *M. faunula* is almost white on the upperside of the hind-wing, instead of being concolorous with the forewing; the yellow colour is more extensive also, reaching to the second median nervule, in *M. faunuloides* it ends midway between the first and second median nervules; on the underside of the forewing the black discal bands are highly lunulated, and the points of the lunules almost meet in *M. faunula*, while in *M. faunuloides* the bands are nearly straight, and the inner one is only slightly lunulated; this character is even more strongly pronounced on the hindwing, as in *M. faunula* anterior to the third median nervule these bands entirely join, enclosing two large oval spots of the ground-colour; lastly, the yellow colour is much duller and does not extend half as far on to the disc in *M. faunuloides*.

Described from two specimens kindly given to me by Capt. E. Y. Watson, which were captured in June, 1893, at Number Three Stockade, in the North Chin Hills, at 3,500 feet elevation above the sea.

Subfamily NYMPHALINÆ.

3. APATURA (*Rohana*) ARTAXES, n. sp., Pl. N, Figs. 3, ♂; 4, ♀.

HABITAT: Battak Mountains, N.-E. Sumatra.

EXPANSE: ♂, 1·6; ♀, 1·8 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* deep velvety-black. *Forewing* with three subapical white dots placed one above the other, the middle one rather nearer to the base of the wing than the other two; a short oblique shining ferruginous fascia is placed outwardly against the three dots. *Hindwing* with the abdominal margin broadly pale. UNDERSIDE, *both wings* pale dull brown; a common discal narrow macular violet-whitish fascia, in the forewing commencing at the sub-costal nervure, where it is narrowest, ending on the submedian nervure, where it is broadest, the fascia outwardly bowed, its inner edge

even ; in the hindwing it commences on the costal nervure, ends on the submedian nervure, the band is sinuous or recurved, of about the same width throughout ; the usual two annular spots, one above the other, across the middle of the discoidal cell ; a reniform spot at the end of the cell ; a very indistinct submarginal whitish fascia. *Forewing* with an additional minute subapical dot placed posteriorly to the three dots of the upperside ; a small round black ocellus in the middle of the first median interspace. *Hindwing* with a very small oval black ocellus placed in the middle of the first median interspace. FEMALE. UPPERSIDE, *both wings* dark hair-brown or fuscous, with many of the markings of the underside showing through by transparency, including the markings in the discoidal cell, and the two ocelli in the first median interspaces, only on the upperside these latter are blind ; a prominent, broad, dazzlingly-white discal band, more or less divided by the dark veins, in the forewing commencing at the costal nervure, where it is narrowest, ending on the inner margin, the band curved outwardly in the middle, both its edges rather irregular, in the hindwing commencing on the costal nervure, ending on the submedian nervure, of nearly equal breadth throughout, its inner edge very straight and even, indented only at the forking of the second and third median nervules in one specimen, the outer edge lunulated ; a common submarginal waved whitish line. *Forewing* with five subapical white dots, the two posteriormost minute ones in a line with the middle dot ; a round black spot placed against the outer edge of the discal white band in the first median interspace, outwardly faintly defined by a pale line. *Hindwing* with an exactly similar spot, but its outer bounding line is rather more prominent. UNDERSIDE, *both wings* pale brown, somewhat tinged with ochreous, marked similarly to the male, except that the discal band is broad and pure white as on its own upperside.

I am greatly indebted to Heer P. C. T. Snellen for a very perfect coloured drawing of a single male example of *A. nakula*, Moore, in his own collection, here given on plate N, fig. 5, and through the courtesy of Mr. Francis A. Heron of the entomological department of the British Museum (Natural History) I have been furnished by Mr. H. Knight with a very beautiful coloured drawing of the unique

type female specimen of *A. nakula*, Moore,* here reproduced on plate N, fig. 6, which is certainly the nearest ally to *A. artaxes*, and occurs in Java. From these drawings the male of my species appears to be much more scantily marked on the upperside than in *A. nakula*, being furnished with three instead of five subapical white dots to the forewing only, and with no trace of discal and submarginal bands except the short ferruginous fascia beyond the white dots on the forewing. On the underside also all the markings appear to be less prominent, and the discal common fascia is quite different in character. The females of the two species differ much more than the males do. *A. artaxes* has the ground-colour of the upperside fuscous, *A. nakula* has it "dull pale reddish-brown;" the former has the discal band of both wings intensely white, while *A. nakula* has it "whitish" in the forewing; the band in *A. artaxes* is very much broader also; the black spots in the first median interspaces of both wings touching the outer edge of, instead of being well removed from, the discal band; again the submarginal markings greatly differ, and the forewing in *A. artaxes* is truncated at the apex in both sexes, which is not the case in *A. nakula*. On the underside the discal white band in the forewing in the female increases in width from the costa to the third portion, in *A. nakula* the third portion is the smallest of the three; and in that species the discal band on the hindwing is much narrower than in *A. artaxes*; besides many minor differences.

The following species of the subgenus *Rohana* of the genus *Apatura* have been described :—

1. *A. parysatis*, Westwood, Kumaon, Sikkim, Bhutan, Assam, Burma, Jelebu in the Malay Peninsula, Upper Tonkin, Hongkong. (Recorded also from S.-W. Celebes by Heer Snellen, but either *A. athalia*, Butler, or *A. macar*, Wallace, is probably the species intended).

1*a*. *A. parysatis*, var. *sumatrensis*, Staudinger, Sumatra.

1*b*. *A. parysatis*, var. *nana*, Staudinger, Palawan in the Philippine Isles.

2. *A. camiba*, Moore, South India, Ceylon, Java. (*A. parysatis* has been recorded from Java by Mr. Moore before he described *A. camiba*; the latter is probably the species intended).

3. *A. macar*, Wallace, Macassar in Celebes.

4. *A. rhea*, Felder, Babuyanes, Luzon, Bohol, Leyte, Siargao, North and East Mindanao—all in the Philippine Isles.

4*a*. *A. rhea*, var. *rana*, Staudinger, Palawan in the Philippine Isles.

5. *A. athalia*, Butler, Celebes.

6. *A. nakula*, Moore, Java.

7. *A. artaxes*, de Nicéville, N.-E. Sumatra.

* Horsfield and Moore, Cat. Lep. Mus. E. I. C., p. 203, n. 414 (1857).

A. artaxes has been described from one male in Hofrath Dr. L. Martin's collection and one in my own, and several females also in his collection and my own, some of which were taken in October. Strangely enough the latter sex appears to be the more common, but this is probably not really the case, the male of this species is so like the common *A. parysatis* that it is passed over by the native collectors for that species, while every specimen of the conspicuously-different female that is seen is captured.

4. EUTHALIA BINGHAMII, n. sp., Pl. N, Figs. 7, ♂; 8, ♀.

HABITAT: Daunat Range, Tenasserim, Burma.

EXPANSE: ♂, 2·5; ♀, 2·7 to 3·0 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* deep shining fuscous. *Forewing* with the following bronzy-fuscous markings :—two rounded spots in the discoidal cell, one in the middle, one at the end; a subapical triangular patch, its base resting on the costa, its apex on the lower discoidal nervule; a broad marginal band, broadest on the inner margin, fining away to nothing before reaching the apex, the band at the anal angle bearing a small patch of greenish scales. *Hindwing* with the costa and outer margin broadly bronzy-fuscous, its inner edge on the disc regularly scolloped, bearing a series of five small oval black spots, one in each interspace from the first subcostal to the first median nervule; the outer margin broadly greenish-blue, broadest at the anal angle, fining away to nothing at the second subcostal nervule; the abdominal margin pale. UNDERSIDE, *both wings* light ochreous-brown, outwardly somewhat darker; the usual linear black markings in and about the discoidal cells. *Forewing* with an inner discal black band from near the costal nervure to the first median nervule, anteriorly wide and somewhat diffused, posteriorly narrower; also an outer discal somewhat macular black band, increasing in width towards the anal angle, ending in the submedian interspace in a large round spot, anteriorly continued to the extreme apex of the wing by a prominent pale greenish-blue elongated spot. *Hindwing* with the outer margin from the second subcostal nervule to the submedian nervure broadly pale metallic greenish-blue, which colour extends on to the disc anterior to the inner discal fascia and into the discoidal cell; the inner discal fascia somewhat diffused; the outer discal

fascia of the forewing reduced to a series of seven black dots between the veins in the hindwing. FEMALE. UPPERSIDE, *both wings* shining pale brown, with the usual narrow black markings in and about the discoidal cells. *Forewing* with a discal broad band somewhat paler than the ground-colour from the costa to the inner margin, its inner edge highly irregular, its outer edge bounded by a nearly evenly disposed series of blackish lunulated spots ; a discal series of five more or less rounded sullied whitish spots placed three and two ; these spots are variable in size, being larger in some specimens than in others, but are always rather small ; the three anterior ones are close together, divided only by the veins, the fourth and fifth spots in the median interspaces further apart, the anterior one of these the larger. *Hindwing* with an even inner discal fascia, its inner edge diffused, its outer edge regularly scolloped; an outer discal series of small round black spots. UNDERSIDE, *forewing* pale ochreous-brown ; the five discal spots of the upperside clear white (not sullied), more prominent than above, and placed on a dark brown fascia ; the usual discoidal markings ; an outer discal series of round black spots, the posteriormost one much larger than the others ; the disc more or less washed with bluish-purple, but this is variable in extent. *Hindwing* with the usual discoidal black markings ; a prominent outer discal series of eight small round black spots ; almost the entire surface of the wing shining pale bluish-green, what may be considered to be the pale brown ground-colour being reduced to an inner discal fascia from the costal nervure to the first median nervule, broader in some specimens than in others, and a marginal band, also variable in width, from the costa (where it is widest) to the anal angle (where it is reduced to a point). *Body* of the male black above, pale brown beneath ; of the female pale brown above, whitish beneath. *Antennæ* black above, the club and shaft beneath ferruginous.

This species is evidently very close to *E. zichri*, Butler,* from Sarawak, Borneo, from which it differs, as far as the description goes, in the male sex, in having on the upperside of the hindwing five instead of three black spots on the outer bronzy portion, and on the underside in having a prominent green spot at the apex of the forewing and a large area in the hindwing (fully one-third of the surface)

* *Adolias zichri*, Butler, Cist. Ent., vol. i, p. 6 (1869).

metallic greenish-blue, that colour being apparently entirely absent from *E. zichri*. The female of *E. zichri* does not appear to have ever been described. Mr. Distant describes * and figures *E. zichri* from Malacca in the Malay Peninsula; that specimen differs from Mr. Butler's description of the species, but agrees with *E. binghamii*, in having five black spots on the upperside of the hindwing, but differs from *E. binghamii* and also from the Bornean type of the species in having the underside entirely ochreous-brown without any bluish coloration whatever. I am not quite sure that I have correctly sexed *E. binghamii*. In all cases in which the sexes differ as greatly as they do in the present species, there is, when the species is newly discovered and not much is known about it, a little uncertainty regarding the correct pairing. Should it be hereafter discovered that the opposite sexes belong to different species, I would prefer the name *E. binghamii* to be applied to the male. The female of *E. binghamii* is not at all unlike on the upperside some specimens of *E. garuda*, Moore, but the great extent of the blue coloration on the underside will instantly distinguish it. The latter feature is characteristic of *E. xiphiones*, Butler, which is a local race of *E. appiades*, Ménétriès, but the acuminate apex to the forewing will at once separate *E. binghamii* from the females of all the various forms of *E. appiades*.

Described from a single male and five females in my collection. I name the species in honour of my friend Lt.-Col. C. T. Bingham, Conservator of Forests, Tenasserim Circle, who has done so much good work amongst the *Aves*, *Lepidoptera*, and *Hymenoptera* of Burma.

Family LEMONIIDÆ.

Subfamily NEMEOBIINÆ.

5. TAXILA BURNII, n. sp., Pl. N, Fig. 9, ♀.

HABITAT: Loi Maw, 5,000 feet, Katha District, Upper Burma.

EXPANSE: ♀, 1·9 inches.

DESCRIPTION: FEMALE. UPPERSIDE, *both wings* light ferruginous, with all the markings of the underside showing through more or less by transparency. *Forewing* with an outer discal or submarginal series of diffused or irrorated rounded whitish spots arranged in a slightly outwardly-curved line across the wing from the costa to the first

* *Euthalia zichri*, Distant, Rhop. Malay., p. 438, n. 20, pl. xliii, fig. 6, *male* (1886).

median nervule, more prominent anteriorly, obsolete posteriorly; a similar marginal linear series, each spot on both sides outwardly defined with black. *Hindwing* with the marginal series of spots as in the forewing, but the two anteriormost spots divided by the discoidal nervule larger than the others. UNDERSIDE, *both wings* a little paler than above, rather more ochreous in shade. *Forewing* with the inner margin as far as the submedian nervure whitish; the discocellular nervules narrowly defined by a dark ferruginous line; an inner discal macular white fascia, the anterior portion of which from the costa to the third median nervule is formed of spots divided only by the crossing veins and arranged in one straight line, followed by three spots placed in echelon in the median and submedian interspaces, these three spots forming an inwardly oblique straight line; an outer discal curved series of white spots arranged regularly across the wing from the third subcostal nervule to the submedian nervure; a marginal, narrow, almost continuous, series of white spots, prominently defined on both sides by a fine black line. *Hindwing* with an inner discal series of white spots very similar to that on the forewing, but the anterior portion ending on the third median nervule is wider; followed by an indistinct castaneous macular fascia, which is continued somewhat indistinctly on to the disc of the forewing; two marginal apical large rounded black spots divided by the discoidal nervule, each spot bears outwardly a large white area, inwardly each spot bears a few white scales; in the median, submedian, and internal interspaces are large conical outline silvery-white spots, the base of the cone is on the margin, the apex is towards the base of the wing, the spot in the internal interspace the smallest and oval in shape. *Cilia* of both wings dusky, just touched inwardly with whitish. *Antennæ* above black, beneath prominently annulated with white, the base of the club also white. *Thorax* and *abdomen* above concolorous with the wings, beneath white. *Legs* with the femur white, the tibia and tarsi ochreous.

T. burnii is a very aberrant species, and seems to form a link, as far as the markings go, between the known species of the genus *Taxila* and the typical group of the genus *Abisara* (*A. echerius*, Stoll). *T. burnii* has the more or less silvery macular markings on the underside of *T. haquinus*, Fabricius; *T. thuisto*, Hewitson; *T. fasciata*, Moore; and *T. zemara*, Butler, which are lacking in the *echerius* group of *Abisara*;

but it possesses the two prominent apical black spots on the underside of the hindwing, which are characteristic of all the species of *Abisara*, but are lacking in *Taxila*. The coloration and markings of *T. burnii* are entirely different from those of any known species of *Taxila*.

Described from a single example taken in April by Lieut. James M. Burn, R. E., who has generously presented the specimen to me, and after whom I have much pleasure in naming the species.

6. ABISARA ATLAS, n. sp., Pl. N, Figs. 10, ♂ ; 11, ♀.

HABITAT : Java.

EXPANSE : ♂, ♀, 2·1 to 2·2 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* dark castaneous. *Forewing* crossed by two oblique pale discal bands ; the inner one is the broader, straight, of nearly equal breadth throughout, commencing on the costa and ending on the submedian nervure, posteriorly it is a little narrower and curved inwardly slightly towards the base of the wing ; the outer band is not quite so prominent, more blurred, commencing on the costa broadly, posteriorly ending at the anal angle in a fine line ; a fine anteciliary pale line from the anal angle to about the middle of the wing. *Hindwing* with a broad curved discal pale band, prominent and whitish on the costa, becoming darker on the disc, ending about the submedian nervure, its inner edge sharply defined, even, its outer edge blurred ; two large oval marginal deep black spots in the lower subcostal and discoidal interspaces, each outwardly bearing a fine pure white line, inwardly defined by a narrow pale line ; two twinned small similar spots in the submedian interspace ; two pale submarginal lunules in the median interspaces ; an anteciliary ochreous line, defined on both sides by a fine black line, and again inwardly between the veins by a white line, this ochreous line is continued from the margin on to the disc some distance along the third median, discoidal, and second subcostal nervules ; *tail* short, just tipped with whitish. UNDERSIDE, *both wings* with the basal half rather paler than on the upperside, the outer half dark. *Forewing* with the inner discal pale band much more prominent than above and nearly pure white ; the outer band greatly broadened out anteriorly, posteriorly reduced to a fine line as on the upperside. *Hindwing* marked as on the upperside, but the discal band whiter and

more prominent than above, with an additional minute oval spot in the upper subcostal interspace. *Body* concolorous with the wings. *Eyes* with a prominent white line on each side. *Antennæ* above black faintly annulated with white, beneath entirely white; club black, tipped with ferruginous. FEMALE. Differs from the male in the ground-colour being paler throughout; the discal bands rather more prominent; the tail considerably longer.

Nearest to *A. savitri*, Felder, described from the Malay Peninsula, recorded by Mr. Distant from Province Wellesley, Malacca, Ayer Panas, and Singapore, all in the Malay Peninsula, and from Borneo; in my collection from Rawan and Perak in the Malay Peninsula, North-East Sumatra and South-East Borneo, which is the same species as *A. susa*, Hewitson, described from "India," from which it differs in the ground-colour being a rich chestnut instead of ochreous-brown; the discal bands are more prominent and whiter, that on the hindwing with a regularly curved even inner edge, in *A. savitri* the inner edge of the band is very irregular; and, most important of all, the tail in *A. savitri* is long and pure white, in *A. atlas* it is short, ferruginous, and just tipped with white only.

Described from three males and one female kindly sent to me by Mr. H. Fruhstorfer from Java, but without precise locality.

Family LYCÆNIDÆ.

7. PARAGERYDUS PÆTUS, n. sp., Pl. O, Fig. 12, ♂.

HABITAT: N.-E. Sumatra.

EXPANSE: ♂, 1·7; ♀, 1·5 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* shining plumbeous-black. *Forewing* with the usual sexual elongated pale oval patch on either side of the naked and swollen basal portion of the third median nervule. *Cilia* fuscous. *Hindwing* unmarked. *Cilia* cinereous. UNDERSIDE, *both wings* pure white, rather thickly and evenly scattered all over with small and large sepia-coloured spots. *Forewing* with the inner margin as far as the submedian nervure free from sepia spotting; with the following more distinct and larger spots:—One at the base, two in the middle one above the other, and a very large one closing the discoidal cell; an outer discal or submarginal series of six, the series dislocated, the two posterior spots placed nearer the base of the

wings than the others; a not very distinct marginal series. *Hindwing* with several large spots at the base, a very large one at the end of the cell, a very irregular discal series, and a marginal series as in the forewing. *Antennæ*, *head*, and *body* fuscous. FEMALE. Much as in the male, except that the third median nervule of the forewing is not basally swollen, and the hindwing is highly scalloped instead of being almost entire.

An apparently quite distinct species. It is, perhaps, nearest to the common *P. horsfieldi*, Moore, which also occurs in North-East Sumatra, but the coloration of the upperside is darker, and the ground-colour and shade of the spots of the underside are very different, the former being pure white, the latter sepia, while in *P. horsfieldi* the former is pale ferruginous,* the latter dark ferruginous. The hindwing in the male of *P. pætus* is but very slightly scolloped, but this is a most remarkably inconstant character, especially in the females, of *P. horsfieldi*. The upper discoidal nervule is given off from the subcostal nervure far beyond the apex of the cell in the male, at the apex in the female. *P. panormis*, Elwes,† described from Burma and Perak, also occurs in North-East Sumatra, but it is a very distinct species.

Described from two males and a female in my collection, captured at Bekantschan in March and November, and numerous examples in the collection of Hofrath Dr. L. Martin.

8. SIMISKINA PHALENA, Hewitson, Pl. O, Fig. 13, ♀.

Poritia phalena, Hewitson, Trans. Ent. Soc. Lond., 1874, p. 344; idem, id., Ill. Diurn. Lep., p. 216, n. 8, pl. lxxxix, figs. 14, 15, *male* (1878); id., Distant, Rhop. Malay., p. 200, n. 4, pl. xxii, fig. 8, *male* (1884); id., Hartert, Proc. A. S. B., 1890, p. 204; *Massaga hartertii*, Doherty, Journ. A. S. B., vol. lviii, pt. 2, p. 128, pl. x, fig. 1, *male* (1889); *Poritia hartertii*, de Nicéville, Butt. of India, vol. III, p. 43, n. 635 (1890).

HABITAT: Singapore (*Hewitson*); N.-E. Sumatra (*Hartert*); Patkoi Hills, Upper Assam (*Doherty*); Katha district, Upper Burma (*coll. de Nicéville*).

EXPANSE: ♀, 1·4 to 1·6 inches.

DESCRIPTION: FEMALE. UPPERSIDE, *both wings* shining purplish-fuscous. *Forewing* with an oval discal pure white spot beyond the

* "Creamy-white" and "brown" respectively in typical Javan specimens.

† Proc. Zool. Soc. Lond., 1892, p. 619, pl. xliii, figs. 8, *male*; 9, *female*.

discoidal cell, anteriorly bounded by the third median nervule, posteriorly extending slightly beyond the first median nervule. *Hindwing* much broader than in the male, the outer margin between the terminations of the second and third median nervules produced into a blunt tail-like projection bearing a black spot on the underside ; with faint traces of a series of submarginal bluish-white lunules, and a marginal very fine white line. UNDERSIDE, *both wings* much as in the male, except that the discal white band on the *forewing* is posteriorly much wider. *Cilia* white, here and there touched with fuscous, almost entirely fuscous on the anal half of the hindwing.

The female is here described for the first time. Its nearest ally is probably my *S. solyma* from Perak,* which, however, has the white spot on the upperside of the forewing bordered with rich iridescent emerald-green, and in some lights is suffused throughout with this beautiful colour, thereby greatly differing from the present species. The markings of the underside, however, are entirely different.

I am indebted to Lieutenant James M. Burn, R. E., for the gift of specimens of both sexes of this species taken in the Katha district of Upper Burma at 800 feet elevation above the sea in March and November.

9. CYANIRIS COSSÆA, n. sp., Pl. O, Figs. 14, ♂ ; 15, ♀.

HABITAT : N.-E. Sumatra ; W. Java.

EXPANSE : ♂, ♀, 1·2 to 1·4 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* shining somewhat iridescent bluish-purple of exactly the same shade as in the common *C. puspa*, Horsfield. *Forewing* with the costa as far as (or even a little beyond) the subcostal nervure, the apex widely, the outer margin less widely, black. *Cilia* fuscous, barely tipped with white. *Hindwing* with the costa broadly, the outer margin broadly, but slightly decreasingly, black ; an oblique powdery white fascia divided by the black veins commences at the apex of the wing and ends about the termination of the discoidal cell ; this fascia is more prominent in some specimens than in others ; the upper disco-cellular nervule marked with a black line. *Cilia* rather more prominently

* Journ. A. S. B., vol. lxiii, pt. 2, p. 29, n. 25, pl. iv, fig. 10, *female* (1894).

white than on the forewing. UNDERSIDE, *both wings* creamy-white, all the markings deep black and prominent; a series of submarginal lunules, six on the forewing, seven on the hindwing; beyond which is a marginal series of six and seven black spots respectively, those on the forewing oval, on the hindwing round. *Forewing* with a line on the disco-cellular nervules; a slightly irregularly-curved discal series of six spots. *Hindwing* with four rather large spots towards the base of the wing, the costal one the largest; a fine line on the disco-cellular nervules; a very large round spot on the middle of the costa; the usual irregular discal series of spots. FEMALE. UPPERSIDE, *both wings* deep black. *Forewing* with a large round pure white patch in the middle of the wing, in certain lights glossed with beautiful pale metallic blue, especially so at its outer edge; the base of the wing from the middle of the discoidal cell to the inner margin, and extending along the inner margin to near the outer angle, rich light metallic blue. *Hindwing* with the costa narrowly white; a large oval pure white patch in the middle of the wing; the abdominal margin white; the base of the wing glossed with rich light metallic blue. UNDERSIDE, *both wings* precisely as in the male.

Near to *C. marginata*, de Nicéville, but the black margins on the upperside of the male are not quite so broad as in the rainy-season form of that species. The creamy-white ground-colour of the underside is, as far as I know, found in no other species in the genus, nor do I know any species which has so large a spot on the middle of the costa of the hindwing on the underside as *C. cossæa*. If the *Cyaniris* sp. (?) mentioned from Malacca by Mr. Distant (Rhop. Malay., p. 453, n. 5, pl. xliv, fig. 10, *female* (1886), is really a female (the blue coloration of the upperside is much darker than is usually found in that sex), it is allied to *C. cossæa*. The markings and colour of the ground of the underside as pictured agree almost exactly with my examples. But my belief is that the specimen figured is a male.

Described from numerous males and females in my collection, and many others in Dr. Martin's, from N.-E. Sumatra (one taken at Namoe Oekor on 17th November, 1892), and one from Pengalengan, West Java, 4,000 feet, by Mr. H. Fruhstorfer.

10. CYANIRIS CORYTHUS, n. sp., Pl. O, Figs. 16, ♂ ; 17, ♀.

HABITAT : Battak Mountains, N.-E. Sumatra.

EXPANSE : ♂, 1·40 to 1·50 ; ♀, 1·45 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* pale shining blue. *Forewing*, the costa with a black marginal thread, the outer margin narrowly black, the inner angle white ; a large discal oval white area crossed by the blue veins occupying the lower outer end of the discoidal cell, the lower discoidal, both median, and part of the submedian interspaces. *Hindwing* with the discal half of the wing white crossed by the blue veins ; a fine anteciliary black thread. *Cilia* of the hindwing broad, white ; of the forewing white at the inner angle, becoming black towards the apex. UNDERSIDE, *both wings* white faintly tinted with blue ; all the markings small, black, prominent ; the usual marginal series of black dots, with a more or less incomplete series of lunules within. *Forewing* with a fine disco-cellular line ; a discal series of three, four, or five small spots. *Hindwing* with three or four basal dots, a fine disco-cellular line, the usual irregular discal series of spots, but all of them small. FEMALE. UPPERSIDE, *forewing* dull black, the base very faintly glossed with metallic blue ; a very large oval pure white patch occupies the middle of the wing. *Hindwing* with the costa as far as the subcostal nervure and its first branch and a very small area at the base dull black, the rest of the wing pure white ; a very fine black anteciliary thread, just within which is a series of six lengthened oval black spots, the four towards the anal angle crowned with a fine black lunule, which is continued along the veins till it unites with the anteciliary thread. *Cilia* of the hindwing pure white, of the forewing white posteriorly, fuscous anteriorly. UNDERSIDE, *both wings* coloured and marked precisely as in the male.

This is a very lovely and distinct species, with no near ally. The male is a little like *C. ceyx*, de Nicéville,* from Java, but is much larger ; the upperside is of a different shade of colour, more blue ; the white area on the forewing is larger, that on the hindwing smaller,

* Journ. Bomb. Nat. Hist. Soc., vol. vii, p. 328, n. 5, pl. H, figs. 6, *male* ; 7, *female* (1892).

not nearly reaching the outer margin except at the apex of the wing, the marginal dots barely present, with other slight but well-marked differences on the underside.

Described from numerous male and one female specimen in my collection from the Battak Mountains taken in September and December. It is a fairly common species, and Dr. L. Martin possesses many examples of it.

11. CYANIRIS CARNA, n. sp., Pl. O, Fig. 18, ♂.

HABITAT : N.-E. Sumatra.

EXPANSE : ♂, 1·3 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* shining bright blue of a slightly violet tint in some lights. *Forewing* with the costa very narrowly, the apex broadly, the outer margin dwindling away to nothing at the inner angle, black; a large white discal patch beyond the discoidal cell filling the basal halves of the two median and lower discoidal interspaces exactly as in *C. albidisca*, Moore. *Hindwing* with the costa rather broadly fuscous, the apical half of the wing fining away to nothing about the first median nervule white, the rest of the wing blue; a series of six round fuscous spots on the margin, inwardly with a series of indistinct blackish lunules; a fine black anteciliary thread. UNDERSIDE, *both wings* white, all the markings pale fuscous or brownish, none prominent; the usual marginal series of lunules enclosing black spots beyond. *Forewing* with the costa and apex widely infuscated; the discocellular nervules defined with a dark mark; an irregular discal series of four spots. *Hindwing* with the usual basal, discoidal, and discal spots.

Nearest to *C. albidisca*, Moore, from South India, differing in the broader black apex to the forewing on the upperside, the larger white area on the hindwing, and the infuscation of the costa and apex of the forewing on the underside.

Described from a single example in my collection from N.-E. Sumatra.

12. CYANIRIS MUSINA, Snellen, Pl. O, Fig. 19, ♂.

Lycæna musina, Snellen, Tijd. voor Ent., vol. xxxv, p. 145, n. 8 (1892); *Cyaniris jynteana*, var., Distant (*nec* de Nicéville), Rhop. Malay., p. 452, n. 3, pl. xliv, fig. 6, *male* (1886).

HABITAT : West Java (*Snellen*) ; Perak, Malay Peninsula ; N.-E. Sumatra.

EXPANSE ; ♂, ·95 of an inch to 1·15 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* dark plumbeous-blue, gradually slightly darkening to the outer margins, with hardly any gloss ; an anteciliary black thread. *Cilia* of the hindwing whitish ; of the forewing whitish at the anal angle, becoming black towards the apex. UNDERSIDE, *both wings* French-grey, of a very dark shade for a species of this genus ; the majority of the markings fuscous (not black), outwardly defined with whitish ; a marginal series of fuscous spots ; a submarginal prominent lunular line ; the disco-cellular nervules marked by a fine line, the line defined on both sides by whitish. *Forewing* with a discal series of five or six spots, the anteriormost of these nearer the base of the wing than the others, these latter placed somewhat in echelon. *Hindwing* with three basal spots ; the usual irregular discal series of spots, the anteriormost spot much more prominent than the rest and deep black.

This very distinct species is probably the smallest in the genus. It seems to be nearest to *C. placida*, de Nicéville, which is found from Sikkim, through Bhutan, Assam, Burma, and the Malay Peninsula to Sumatra and Java ; differing therefrom in its smaller size, darker (more plumbeous) coloration on the upperside, and much narrower black border to both wings. The markings of the underside are almost identical. I have but little doubt that this is the species figured by Mr. Distant as *C. jynteana*, var., in spite of his utterly unrecognisable figure of the upperside (for which he apologises) and Mr. Moore's identification of the specimen, as the size agrees with my larger examples, and the underside appears to be correctly delineated, but the species is certainly closely allied to *C. placida*, and very distantly to *C. jynteana*, de Nicéville. Mr. Doherty identifies this figure with his *C. melæna*,* described from the Tenasserim Valley, and occurs also in North-East Sumatra.

* Journ. A. S. B., vol. lviii, pt. 2, p. 434, n. 88, pl. xxiii, fig. 13, *male* (1889).

Appears to be common in the mountains of Perak and N.-E. Sumatra, and I have described it from a long suite of specimens in Dr. Martin's and my own collection.

P. S.—Since the above was written, I have sent all the original drawings of the species of *Cyaniris* described in this paper to Heer P. C. T. Snellen of Rotterdam, who has done such excellent work in elucidating the *Lepidoptera* of Malayana. He informs me that the species above described which I had named *C. candaules* is his "*Lycæna*" *musina*, so I have adopted his name for it. Should, however, the species ultimately prove to be distinct (I possess no specimens from Java to compare with my series from the Malay Peninsula and Sumatra), I would propose the name *C. candaules* for it.

13. CYANIRIS CATREUS, n. sp., Pl. O, Figs. 20, ♂; 21, ♀.

HABITAT: W. Java.

EXPANSE: ♂, 1·3 to 1·5; ♀, 1·6 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* lavender-blue of about the same shade as in Javan specimens of *C. huegelii*, Moore. *Forewing* with a discal white powdering faintly present in some specimens, absent in others; a narrow costal black thread; the outer margin with a narrow black border about 1 mm. wide at the costa, fining away to nothing at the anal angle; the tips of all the veins ending on the outer margin black in some specimens. *Hindwing*, costa dusky; the apical area sprinkled with white in some specimens; a very narrow outer black border, broader at the apex of the wing, reduced posteriorly to a mere thread. *Cilia* of the hindwing white, of the forewing white at the anal angle, becoming dusky towards the apex. UNDERSIDE, *both wings* white with a bluish tinge; a marginal series of small round black spots, more prominent on the hindwing; a submarginal lunular dusky line. *Forewing* with a very faint (almost obsolete) dusky line defining the disco-cellular nervules; a discal series of from three to five small black spots, the anteriormost one nearer the base of the wing than the others. *Hindwing* with three subbasal black spots; a very faint disco-cellular line; the usual discal irregular series of eight black spots reduced in this species to from three to six. FEMALE. UPPERSIDE,

both wings fuliginous-black, without any blue gloss whatever. *Forewing* with a round white area in the middle of the wing, entering the discoidal cell at its lower end, anteriorly bounded by the upper discoidal, posteriorly by the first median nervule. *Hindwing* with a large discal pure white area, broadest on the abdominal margin, leaving the costa and outer margin with a broad even black border. UNDERSIDE, *both wings* pure white, a black anteciliary thread. *Forewing* with the costa narrowly, the apex broadly, the outer margin as far as the submarginal lunular line decreasingly infuscated ; the disco-cellular nervules marked with a rather prominent dusky line ; a curved discal series of five dusky spots darker than the infuscated area on which they are placed ; the submarginal lunular line forming the outer boundary of the infuscated area ; five marginal oval black spots. *Hindwing* with the costa and base somewhat broadly faintly powdered with fuscous ; the usual three subbasal spots, the anteriormost one on the costa with an outer whitish ring ; an obsolete disco-cellular line ; the usual discal series of spots reduced in number to five, all small but prominent, the anteriormost one on the costa with an outer whitish ring ; a prominent submarginal continuous broad lunular line ; a prominent marginal series of eight spots, the three analmost ones small and contiguous.

This species belongs to the " Holly-Blue " section of the genus, which contains the British *C. argiolus*, Linnæus, and the Northern Indian species, *C. celestina*, Kollar, *C. huegelii*, Moore, &c. From the latter the male may be known by its unusually lengthened and narrow forewing ; also by the markings of the hindwing on the underside, the discal series of spots being reduced in number, and the submarginal lunular line and marginal spots being much more prominent. The female is entirely different from the same sex of *C. huegelii*, on the upperside it has no blue coloration whatever, and one-half the total area is black, the other half pure white. The infuscation of the costa and apical region of the forewing on the underside is a quite unique character.

Described from four males and one female kindly sent to me by Mr. H. Fruhstorfer, who captured them at Pengalengan, 4,000 feet, West Java, in 1893.

14. CYANIRIS CAMENÆ, n. sp., Pl. O, Fig. 22, ♂.

HABITAT ; Perak, Malay Peninsula ; N.-E. Sumatra.

EXPANSE : ♂, 1·1 to 1·6 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* rather pale shining blue, of a rather more purple shade than in *C. corythus*, de Nicéville (*ante*, No. 10). *Forewing* with a narrow outer black border, about 1 mm. broad at the apex, fining away to almost nothing at the anal angle ; the middle of the disc in some specimens with a sprinkling of white scales. *Hindwing* with the costa white, spreading more or less on to the disc, sometimes reaching the second median nervule, sometimes ending about the discoidal nervule ; an anteciliary black thread. *Cilia* of the hindwing broad and pure white ; of the forewing narrower, white at the anal angle, becoming dusky towards the apex. UNDERSIDE, *both wings* white faintly tinted with blue ; all the spots small, prominent, and fuscous ; an anteciliary black thread. *Forewing* with a fine line on the disco-cellular nervules ; a discal series of six spots, usually placed somewhat in echelon, sometimes forming a straight line divided only by the veins, the anteriormost spot shifted inwardly towards the base of the wing ; a marginal series of six linear spots. *Hindwing* with a basal series of three spots ; a fine disco-cellular line ; the usual irregular discal series of spots ; and a marginal series of eight spots, the three at the anal angle smaller than the rest and placed very close together.

Nearest to *C. lanka*, Moore, from Ceylon, with which it agrees absolutely on the underside. On the upperside it differs in its much lighter (more blue, less purple) coloration, in having always more or less white irroration apically on the hindwing, usually on the disc of the forewing, and the forewing having a distinct black border, in *C. lanka* there is an anteciliary thread only.

This species appears to be the commonest of the genus occurring in the mountains of N.-E. Sumatra, being found also in the Malay Peninsula. I have diagnosed it from a very large series. It is probably a local race of *C. cœlestina*, Kollar, from the Western Himalayas.

My collection contains the following ten species of *Cyaniris* from Sumatra and nine from Java : four species only are common to both islands :—

Sumatra.	Java.
1. *C. akasa*, Horsfield.	1. *C. akasa*, Horsfield.
2. *C. cossæa*, de Nicéville.	2. *C. cossæa*, de Nicéville.
3. *C. corythus*, de Nicéville.	
	3. *C. ceyx*, de Nicéville.
4. *C. puspa*, Horsfield.	4. *C. puspa*, Horsfield.
5. *C. carna*, de Nicéville.	
6. *C. musina*, Snellen.	
7. *C. placida*, de Nicéville.	5. *C. placida*, de Nicéville.
	6. *C. cœlestina*, Kollar.
	7. *C. coalita*, de Nicéville.
	8. *C. huegelii*, Moore.
	9. *C. catreus*, de Nicéville.
8. *C. camenæ*, de Nicéville.	
9. *C. limbatus*, Moore.	
10. *C. melæna*, Doherty.	

15. SURENDRA STIMULA, n. sp., Pl. O, Fig. 23, ♂.

Habitat : Java.

Expanse : ♂, 1·65 inches.

Description : Male. Upperside, *both wings* very deep rich blue. *Forewing* with the costa up to the subcostal nervure, the apex broadly, the outer margin broadly but decreasingly black, the black margin at the inner angle nearly 3 mm. wide. *Hindwing* with no anal lobe or tail, but the outer margin slightly projecting at the termination of the second median nervule ; with the costa widely black, that colour reaching almost to the discoidal nervule ; the outer margin with a narrow black thread ; the abdominal margin broadly outwardly black, inwardly becoming whitish. *Cilia* black throughout. Underside,

both wings very dark, almost black, without distinct markings. *Forewing* with an apical triangular pale patch ; the inner margin as far as the submedian nervure whitish ; a submarginal indistinct series of five linear black spots. *Hindwing* with indistinct traces of a broad dark discal and submarginal band.

Quite distinct from the same sex of the Javan *S. vivarna*, Horsfield, which has a tail and anal lobe to the hindwing, and has the blue coloration on the upperside of the hindwing further removed from the outer margin than in that species. Nearest to *S. florimel*, Doherty,* from the Tavoy district, Burma, differing therefrom in its larger size, much darker coloration on the underside, without distinct markings of any kind. Perhaps nearest of all to "*Amblypodia*" *palowna*, Staudinger,† from Palawan in the Philippines, apparently differing in its larger size, and the black costal and outer margins to the forewing on the upperside broader.

Described from a single example sent to me by Mr. H. Fruhstorfer without any precise locality.

16. NACADUBA NELIDES, n. sp., Pl. O, Fig. 24, ♂.

HABITAT : N.-E. Sumatra ; W. Java.

EXPANSE : ♂, 1·2 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* shining violet-blue of almost exactly the same shade found in typical specimens of *N. atrata*, Horsfield, from Java ; the margins (as seen under a magnifying glass) narrowly black. *Cilia* black, tipped with white. *Tail* black, short, tipped with white. UNDERSIDE, *both wings* French-grey, all the markings of a slightly darker shade than the ground, outwardly defined by whitish ; a double series of marginal lunules, and a very fine anteciliary black thread. *Forewing* with a spot across the middle of the discoidal cell, with a faint one posterior to it in the submedian interspace ; a spot closing the cell ; a discal chain-like series of seven spots, the five anterior ones in a curved series, conjoined,

* *S. florimel*, Doherty, Journ. A. S. B., vol. lviii, pt. 2, p. 424, n. 30, pl. xxiii, figs. 17 *male* ; 4, *female* (1889).

† Iris, vol. ii, p. 131, pl. ii, fig. 3, *male* (1889).

the two posterior ones separated, out of the line with the others, shifted inwards towards the base of the wing. *Hindwing* with the usual basal, discoidal, and discal markings ; a prominent round black spot on the margin in the first median interspace.

This is a very distinct species, though it is difficult in words to make plain the points of difference between it and its nearest allies. It is perhaps nearest to *N. noreia*, Felder = *N. ardates*, Moore, tailed form, from which it differs in its larger size (in size it is intermediate between *N. noreia* and *N. atrata*), in the different shade of violet-blue of the upperside, the colour of the ground of the underside, the reduced prominence of all the markings, and the subanal black spot to the hindwing lacking the turquoise-blue line of scales outwardly placed upon it, and the anterior outer orange line, found in *N. noreia*.

Mr. H. Fruhstorfer has sent me a single male specimen of what appears to me to be this species from Mount Gede, West Java, 4,000 feet, taken in August, 1892. It differs from the specimens above described from Sumatra in having no tail, and the markings of the underside are a little less prominent. At the extreme anal angle of the hindwing on the underside is a most minute black dot bearing a few turquoise-blue scales. This dot is just traceable in some of my specimens of this species from Sumatra, but they bear no blue scales.

Described from four male specimens from North-East Sumatra in my own and numerous others in Dr. Martin's collection, and one male from East Java.

17. ARHOPALA ABOË, n. sp., Pl. O, Fig. 26, ♂.

HABITAT : Daunat Range, Tenasserim, Burma.

EXPANSE : ♂, 1·9 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* rich shining purple ; no outer black margin ; *cilia* black. UNDERSIDE, *both wings* glossy lilac-brown, all the spots darker, dull reddish-brown without purple gloss, outwardly defined by a fine pale violet line. *Forewing* with the inner margin broadly up to the median nervure and first median nervule whitish ; a small oval spot towards the base, a larger oval one at the middle, and a still larger quadrate one closing the discoidal cell ; a rather large spot in the submedian interspace

placed at the point where the first median nervule arises ; another spot at the base of the first median interspace ; a discal increasing outwardly-curved continuous chain of seven spots ; a rather prominent submarginal fascia ; a marginal indistinct fascia. *Hindwing* with the usual four round spots across the base ; a subcostal spot ; a spot posterior to the last in the middle of the cell ; a large spot posterior to the latter ; an elongated spot at the end of the cell ; a small spot posterior to the latter ; the discal band much dislocated, the two anteriormost spots well separated and shifted inwardly from the four spots which follow, these again are partially dislocated from the next spot, which is an elongated one, the latter again quite separated from the last quadrate spot of the discal band which is placed on the abdominal margin ; a rather prominent lunulated submarginal band ; a marginal series of oval dark spots ; the anal lobe very small, black, crowned with a few metallic-green scales.

Appears to be nearest to "*Amblypodia*" *arvina*, Hewitson,* from Java, but of which I possess a rather small male specimen from the Daunat Range, figured herewith on plate O, fig. 25 ; differing from Hewitson's figure and description in having the discal band of the forewing on the underside continuous, instead of the penultimate spot being projected inwardly ; and in possessing a small but distinct anal lobe, a feature which appears to be entirely absent from *A. arvina*. Except in its superior size, discal band slightly differing, and presence of an anal lobe, *A. aboë* seems to be identical with *A. arvina*.

Described from a single example in my collection.

18. ARHOPALA ADALA, n. sp., Pl. O, Fig. 27, ♂.

HABITAT : Daunat Range and Ataran Valley, Tenasserim, Burma.

EXPANSE : ♂, ♀, 1·7 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* rich shining deep blue, distinctly turning to purple in some lights. *Forewing* with the costa up to the costal nervure, the apex widely, the outer margin somewhat widely and decreasingly black, the inner edge of this black area is irregular as it is penetrated by the blue ground-colour beyond the end of the discoidal cell and again towards the apex of the wing.

* Ill. Diurn. Lep., p. 12, n. 54, pl. ii, figs. 16, 17, *male* (1863).

Hindwing with the costa, outer, and abdominal margins broadly black. UNDERSIDE, *both wings* glossy reddish-lilac-brown, all the spots darker, dull reddish-brown, outwardly defined by a fine pale violet line. *Forewing* with the inner margin broadly up to the submedian fold and the first median nervule whitish; a small oval spot towards the base, a larger one at the middle, and a still larger quadrate one closing the discoidal cell; a costal spot; a rather large spot in the submedian interspace placed at the point where the first median nervule arises; another oblique spot at the base of the first median interspace; a discal outwardly-curved continuous chain of seven spots, the spots slightly and gradually increasing in size from the anteriormost one on the costa to the fourth, the fifth and sixth the same size as the fourth, the seventh a mere dot; a prominent submarginal fascia divided from a marginal series of oval spots by a pale broken line. *Hindwing* with the usual four small round spots across the base; a subcostal spot; a spot posterior to the last in the middle of the cell; a large spot posterior again to the latter; an elongated spot at the end of the cell; a small spot posterior to this; the discal band much dislocated, the two anteriormost spots well separated and shifted inwardly from the six spots which follow, touching the elongated spot at the end of the cell; the second portion of the discal band consists of six spots, which are all conjoined, but are placed in pairs somewhat, the posteriormost of these just touches the last spot of the discal series, which is placed on the abdominal margin; a rather prominent lunulated submarginal band; a marginal series of oval dark spots; the anal angle produced but hardly forming an anal lobe. FEMALE. UPPERSIDE, *both wings* with the blue areas smaller than in the male. *Forewing* with the costal black border reaching to the subcostal nervure, and closing the cell with a wedge-shaped projection; the outer margin of the blue area quite regular; the outer margin of the wing nearly twice as broadly black as in the male. *Hindwing* has the blue colour confined to a much smaller area on the middle of the disc; the disco-cellular nervules marked with a black line. UNDERSIDE, *both wings* as in the male, except that the ground-colour is slightly paler.

This species is a little like *A. asopia*, Hewitson,* from Maulmain, which is still unknown to me except from Hewitson's description and

* Ill. Diurn. Lep., p. 14 *f*, n. 90, pl. iii *c*, figs. 50, 51 (1869).

figure, but the blue coloration of the male on the forewing is less extensive and darker, and has anteriorly an irregular edge ; the shape of the hindwing is also different, in *A. asopia* the anal angle is quite round, in *A. adala* it is produced to a point so that the abdominal and outer margins together form an exact right angle. The markings and coloration of the underside are very close indeed to *A. arvina*, Hewitson, and *A. aboë*, de Nicéville (*ante*, No. 17).

Described from a single pair in my collection, the male from the Ataran Valley, the female from the Daunat Range.

19. ARHOPALA ADULANS, n. sp., Pl. O, Figs. 28, ♂ ; 29, ♀.

HABITAT : Ataran Valley, Tenasserim, Burma.

EXPANSE : ♂, 1·5 to 1·6 ; ♀, 1·7 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* rich shining deep blue, distinctly turning to purple in some lights. *Forewing* with the costa up to the costal nervure, the apex widely, the outer margin somewhat widely and decreasingly black, the inner edge of this black area is irregular as it is penetrated by the blue ground-colour beyond the end of the discoidal cell and again towards the apex of the wing. *Hindwing* with the costa, outer, and abdominal margins broadly black. UNDERSIDE, *both wings* glossy dark lilac-brown, all the spots darker, dull reddish-brown, outwardly defined by a fine pale violet line. *Forewing* with the inner margin broadly up to the median nervure and first median nervule whitish ; a small oval spot towards the base, a larger one at the middle, and a still larger elongated one closing the discoidal cell ; a rather large transverse spot in the submedian interspace placed at the point where the first median nervule arises ; another oblique spot at the base of the first median interspace ; a discal outwardly curved continuous unbroken chain of seven spots, the anteriormost and posteriormost of these spots of equal size, smaller than the rest ; a prominent submarginal fascia divided by a pale broken line from a marginal series of oval spots. *Hindwing* with four small round spots across the base ; a subcostal spot ; a spot posterior to the last in the middle of the cell ; a large spot posterior again to the latter ; an elongated spot at the end of the cell ; a small spot posterior to this ; the discal band much dislocated, the two anteriormost spots shifted inwardly

from the six spots which follow, touching the elongated spot at the end of the cell and the third spot of the discal series; the second portion of the discal band consists of six spots which are all conjoined, but are placed in pairs somewhat, the posteriormost of these just touches the last spot of the discal series, which spot is placed on the abdominal margin; a rather prominent lunulated submarginal band; a marginal series of oval dark spots; the anal angle produced, but hardly forming an anal lobe. FEMALE. UPPERSIDE, *both wings* differ from the male only in having the black margins throughout almost twice as broad. UNDERSIDE, *both wings* as in the male.

On the upperside both sexes of this species agree almost precisely with *A. adala*, de Nicéville, described above (*ante*, No. 18). On the underside, however, the ground-colour of *A. adulans* is distinctly darker and less reddish; the pale inner marginal area of the forewing is more extensive, reaching to the median nervure instead of to the submedian fold; and *A. adala* possesses in the forewing a small costal spot placed midway between the end of the cell and the discal band, which is wanting in *A. adulans*. The female of *A. adala* (which I have not thought it necessary to figure) has the blue coloration of the upperside considerably less extensive than in the same sex of *A. adulans*, so that in the forewing the black area broadly covers the disco-cellular nervules, and in the hindwing occupies about half the surface; in *A. adulans* the black colour occupies the outer third of the wing only.

Described from three males and one female in my collection.

20. ARHOPALA ARAMA, n. sp., Pl. O, Fig. 30, ♂.

HABITAT: Sikkim; Burma.

EXPANSE: ♂, 1·9 to 2·1 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* rich shining deep bluish-purple. *Forewing* with the costa narrowly and the outer margin somewhat widely black. *Hindwing* with the costa widely, the outer margin as wide as in the forewing, black; the abdominal margin broadly pale fuscous; anal lobe black, bearing anteriorly a few white scales. UNDERSIDE, *both wings* shining pale ochreous-brown, all the markings of the colour of the ground, and standing out prominently, bordered widely with dark brown (almost fuscous), with a fine

outermost pale line; a submarginal fuscous fascia, continuous, increasing, rather prominent in the forewing, macular and obsolete in the hindwing. *Forewing* with the inner margin up to the first median nervule pale; a small oval spot towards the base, a larger oval one at the middle, and a still larger quadrate one at the end of the discoidal cell; above the latter is a prominent costal spot; a large spot in the submedian interspace at the point where the first median nervule arises; a smaller one at the base of the first median interspace; the discal band twice dislocated, consisting of four, then two, then a single spot. *Hindwing* with the usual four small round spots across the base; a subcostal spot; a round spot in the middle, and an oblong one closing the cell; the latter followed by a small spot near the base of the first median interspace, and then by a large one across the middle of the submedian interspace; the discal band highly dislocated, the anterior pair of spots far removed from the pair next to it, touching and placed almost in a line with the terminal spot in the cell, the second and third pairs of spots touching each other, the seventh spot V-shaped, the eighth elongated, touching the internal nervure, both these latter spots standing alone; anal lobe large, bearing a deep black spot, anteriorly with a few metallic green scales; a few similar scales on the margin between the anal lobe and the base of the tail; anterior to the anal lobe is a lengthened obscure irrorated fascia composed of black and white scales; *tail* black tipped with white.

This species belongs to a large and difficult group of the genus *Arhopala*. It is near to fig. 29, pl. iv, of Hewitson's Cat. *Lycænidæ* Brit. Mus. (1862), named "*Amblypodia*" *adatha* on the plate, from Singapore probably, but differs in the ground-colour of the underside being pale ochreous-brown instead of rufous, and in having an additional spot on the costa of the forewing on the underside. It is also very near to *A. silhetensis*, Hewitson, figs. 27, 28 of the same plate, from Sylhet, but if I have correctly identified that species the shape of the wings is different, as is also the shade of blue of the upperside, *A. silhetensis* being of a much lighter colour. It is also near to *A. adorea*, de Nicéville,* the types of which are now in the

* Butt. of India, Burma and Ceylon, vol. iii, p. 238, n. 789, pl. Frontispiece, fig. 189, *male* (1890).

Raffles Museum, Singapore, but the two male "co-types" are in my collection. Besides these two specimens I possess a very extensive series of *A. adorea* from Java, North-East Sumatra, numerous localities in the Malay Peninsula and Burma, and the Khasi Hills, from all of these examples it differs in all the spots of the underside being much smaller and consequently better separated from one another; and in having far less metallic green irroration at the anal angle of the hindwing on the underside. *Arhopala ace*, de Nicéville,* from Perak and North-East Sumatra, is another allied species, but the blue coloration of the upperside is much bluer in that species, there is practically no black border, and the coloration and markings of the underside are quite different also. It is also allied to *A. acestes*,† de Nicéville, from Penang and Perak, but the coloration of the upperside in that species is very dark purple, and there are no black borders to the wings; on the underside all the markings are very much larger, and the ground-colour is glossed with purple. Lastly, the underside is very similar to that of *A. bupola*, Hewitson, as figured by Hewitson on plate Supplement vii, fig. 64, Ill. Diurn. Lep., *Lycænidæ*, which species I identify to be the female of *A. eumolphus*, Cramer, but *A. arama* has the additional costal spot above-named, the ground-colour of the underside is different, and all the markings are much smaller.

Described from two examples from Sikkim,‡ one of which was taken at about 4,700 feet near Kalimpong by Lieutenant-Colonel C. T. Bingham; one from Loi Maw, Katha District, Upper Burma, and one from the Ataran Valley, Tenasserim, all males, in my collection. They are quite constant in coloration and markings, and are readily distinguishable from their allies.

21. ARHOPALA APHA, n. sp., Pl. O, Fig. 31, ♂.

HABITAT: Martaban, Maulmain, and Ataran Valley, all in Tenasserim, Burma.

EXPANSE: ♂, 1·8 to 2·1; ♀, 1·8 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* rich shining deep bluish-purple. *Forewing* with the costa narrowly and the outer

* Journ. Bomb. Nat. Hist. Soc., vol. vii, p. 329, n. 6, pl. H, fig. 13, *male* (1892).

† Journ. Bomb. Nat. Hist. Soc., vol. vii, p. 330, n. 7, pl. H, fig. 14, *male* (1892).

‡ One of these I recorded as *A. adorea* in Butt. of India, Burmah and Ceylon, vol. iii, p. 238. Now that I have large series of true *A. adorea*, I see that that species is not represented in my collection from Sikkim.

margin somewhat widely black. *Hindwing* with the costa widely, the outer margin of the same width as in the forewing, black ; the abdominal margin broadly pale fuscous ; the anal lobe black, just touched outwardly with a few white scales. UNDERSIDE, *both wings* shining vinous, all the markings large and prominent, pale fuscous, outwardly bounded by a fine pale line ; a submarginal fuscous fascia ; a very indistinct marginal fascia. *Forewing* with the inner margin prominently and widely pale ochreous, reaching up to the second median nervule ; a small oval spot towards the base, a larger oval one at the middle, and a still larger quadrate one at the end of the discoidal cell ; above the latter is a prominent small costal spot ; a large spot in the submedian interspace at the point where the first median nervule arises ; a similar spot at the base of the first median interspace ; the discal band nearly straight and even, slightly dislocated only between the fourth and fifth, sixth, and seventh spots ; the latter very variable in size, very small in the type specimen, twice as large in another specimen, still larger and shaped like a figure 8 in a third example. *Hindwing* with the four basal round spots as usual ; an oval spot at the middle of the cell, with a subcostal spot anterior to it, and another spot posterior to it in the submedian interspace ; a large spot at the end of the cell, with a small spot below it at the base of the first median interspace ; the discal band greatly dislocated, the two anterior spots strongly shifted inwardly from the rest, touching the spot at the end of the cell ; the next four spots nearly in a straight line ; the seventh spot V-shaped ; the eighth spot elongated, ending on the internal nervure ; the anal lobe large, jet-black, anterior to which is a large area reaching from the abdominal margin to the second median nervule of metallic green scales ; an oblong black spot on the margin on either side of the base of the tail. FEMALE. UPPERSIDE, *both wings* differ from the male only in the black borders being very much broader, in the forewing reaching the subcostal nervure, and extending over the disco-cellular nervules. UNDERSIDE, *both wings* as in the male.

This species is closely allied to *A. arama*, de Nicéville (*ante*, No. 20), and to all the species cited in the description of that species above, but it is distinguished from all of them by the very rich vinous-red coloration of the underside, in this respect reminding one of *A. acestes*,

de Nicéville, but the colour in *A. apha* is still richer; in markings it differs from that species in having an additional costal spot, and all the spots are much smaller.

Described from three males and one female in my collection.

22. ARHOPALA ANELLA, n. sp., Pl. P, Fig. 32, ♀.

HABITAT: Perak, Malay Peninsula.

EXPANSE: ♀, 2·0 inches.

DESCRIPTION: FEMALE. UPPERSIDE, *forewing* with the costa somewhat widely, the apex widely, and the outer margin widely and evenly shining fuscous; a narrow fuscous anteciliary line inwardly defined by an equally fine whitish line; the disco-cellular nervules defined by a fuscous bar; all the rest of the wing shining bluish-purple. *Hindwing* with the costa, outer, and abdominal margins broadly shining fuscous; the outer margin bearing a well-marked series of black lunules, one in each interspace, outwardly defined by a narrow whitish anteciliary line; the upper disco-cellular nervule marked by a black bar; the rest of the wing shining bluish-purple. *Tails* three, fuscous tipped with white, a short one at the termination of the second, a long one at the termination of the first median nervule, and a short one (the shortest of all) at the termination of the submedian nervure. UNDERSIDE, *both wings* brown with a slight vinous suffusion, all the spots of a darker shade of brown than the ground-colour, each outwardly defined by a prominent narrow brown line of a much lighter shade of brown than the ground-colour. *Forewing* with an oval spot towards the base, a larger oval spot across the middle, and a still larger somewhat quadrate-shaped spot closing the discoidal cell; a costal spot above the middle spot in the cell; a large oval spot at the base of the first median interspace, posterior to which in the submedian interspace is a large quadrate pale spot or area, which outwardly bears a pair of geminated spots of the usual description; a discal series of six spots, the four anterior ones in a straight line, placed strongly outwardly obliquely, the two posteriormost ones of the discal series strongly shifted inwardly, placed one beneath the other in the median interspaces,

the anteriormost of all small, the others of nearly equal size ; a prominent submarginal dark brown fascia defined with paler on both sides ; a narrow dark brown marginal line ; an anteciliary pale line. *Hindwing* with the usual four small round spots across the base of the wing ; followed by three others placed one above the other, the anterior one round, placed in the costal interspace, the middle one oval, placed in the middle of the cell, the posterior one round, placed in the submedian interspace ; a large oblong geminated spot at the end of the cell ; a small one immediately below this at the base of the first median interspace ; a discal series of eight spots placed in pairs, the lower spot of the anteriormost pair touching the upper outer corner of the spot at the end of the cell and the upper inner corner of the anterior spot of the next pair of spots of the discal series, the next two pairs of spots of about equal size, the posteriormost pair of spots very elongated and recurved to the abdominal margin ; the outer margin bears first a pale lunular line, then a dark brown lunular line, then another pale lunular line, then a series of black lunules, then a straight anteciliary fine pale line ; the two black lunules towards the anal angle larger than the others, very deep black, and crowned broadly with rich iridescent metallic-green ; anal lobe rather large and deep black. *Cilia* of both wings cinereous outwardly, inwardly fuscous.

A very distinct species, which has no near ally as far as I know. The markings of the underside are particularly prominent and are all well defined, somewhat reminding one of those of *A. ovomaculata*, Hewitson, from Sumatra. The presence of three tails to the hindwing is a very rare feature in the genus. In India, *A. abseus*, Hewitson, alone possesses three tails (*A. amphea*, Felder, from the Philippine Isles and N.-E. Sumatra, is a local race of *A. abseus*), though some specimens of *A. amantes*, Hewitson, may almost be said to possess that number. *A. aglais*, Felder, from the Philippines, may also possess three tails. But there is no species known to me with three such well-marked tails as are possessed by *A. anella*, as a rule the two outer tails are mere teeth, and are hardly better than slight prolongations of the cilia.

Described from a single example in my collection.

23. ZEPHYRUS ABSOLON, Hewitson, Pl. P, Figs. 33, ♂; 34, ♀.

Dipsas absolon, Hewitson, Ill. Diurn. Lep., *Lycænidæ*, p. 65, n. 3, pl. xxx, figs. 11, 12 male (1865); *Zephyrus absolon*, de Nicéville, Butt. of India, vol. iii, p. 304, n. 867 (1890).

HABITAT: India (*Hewitson*); West Java.

EXPANSE: ♂, ♀, 1·6 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* black. *Forewing* with rather more than the basal half brilliant metallic dark green crossed by the black veins, this green area reaches from the base of the wing to the middle of the costa, occupies the whole of the discoidal cell, reaches the inner margin, and stops about 2 mms. short of the anal angle. *Hindwing* with the basal two-thirds of the same green colour as the forewing, leaving the costa, outer, and abdominal margins about equally broadly black. UNDERSIDE, *both wings* pale brown slightly washed with vinous. *Forewing* with a pair of curved fine dark brown lines at the end of the cell; a discal dark brown fascia from the costa to the first median nervule, its inner edge lost in the ground-colour, its outer edge sharply defined by a narrow pure white line from the costa to the second median nervule; a submarginal series of five quadrate dark brown spots, smallest and palest at the costa, largest and darkest in the first median interspace, where the series ends; a large quadrate orange patch on the disc, posteriorly bounded by the submedian nervure, anteriorly reaching the lower end of the cell, its inner edge somewhat irregular, bounded by an imaginary line from the disco-cellular nervules to the inner margin, its outer edge bounded by the submarginal macular fascia, anteriorly this orange patch is broken into by the discal fascia. *Hindwing* with a pair of fine dark lines defining the disco-cellular nervules; a narrow discal white line from the costa to the submedian nervure above the anal angle, where it is recurved to the abdominal margin, its general direction very straight, but the line itself a little irregular, inwardly defined by the ground-colour being slightly darker at that point; a pair of lunulated narrow macular pale violet fasciæ, the outer the broader and formed of deeper lunules, the ground-colour between these fasciæ rather dark; a narrow white anteciliary thread; a round black spot in the first median interspace well removed from the margin, outwardly bounded by a narrow deep orange (almost vermillion-coloured) ring; the small anal lobe deep black; anterior to which is a small quadrate deep

orange patch, which is continued for some little distance along the abdominal margin. FEMALE. UPPERSIDE, *both wings* shining dark hair-brown. *Forewing* with the apical area bounded anteriorly by the costa, posteriorly by the first median nervule, inwardly by the disco-cellular nervules, darker than the rest of the wing; two triangular discal orange spots placed obliquely, the one nearest the base of the wing in the lower discoidal interspace, its base placed against the disco-cellular nervules, its apex directed to the outer margin of the wing, the other is placed in the middle of the second median interspace. *Hindwing* unmarked. *Cilia* of both wings cinereous. UNDERSIDE, *forewing* pale brown, the inner margin whitish; the disco-cellular nervules faintly defined on both sides by a dark line; the orange spots of the upperside faintly visible, with an additional small and indistinct one placed against the middle of the first median nervule in the first median interspace; three prominent discal bands, all commencing on the costa, the first and second ending at the first median nervule, the third extending a little below it, all of them nearly straight, slightly outwardly bowed only, and of nearly equal width; the band nearest the base of the wing is dark brown, its outer edge sharply defined, its inner edge lost in the ground-colour; the second band is white just tinted with violet; the third band is dark brown. *Hindwing* pale violet-brown; the disco-cellular nervules defined by a narrow whitish and a narrow brown line; a broad discal white band, posteriorly more or less marked with violet, its inner edge quite straight, its outer edge outwardly bowed, the band commences at the costa, where it is broad, it is still broader in the middle, it becomes quite narrow posteriorly, and at the submedian nervure is recurved to the abdominal margin; a highly lunulated submarginal pale violet line; a narrow white anteciliary thread; an oval black spot in the first median interspace outwardly surrounded by an orange ring, placed between the discal and submarginal bands; a small black spot on the anal lobe inwardly broadly crowned with orange, with an orange line anterior to this on the abdominal margin. *Cilia* cinereous throughout. *Thorax* and *body* above dark brown; *abdomen* beneath and *legs* whitish. *Antennæ* black, the club beneath, the tip of the club throughout, ferruginous.

Apparently nearest to *Z. katura*, Hewitson, which is almost certainly the female of *Z. ataxus*, Doubleday and Hewitson, from the Western Himalayas and Western China,* the male differing therefrom on the upperside in the darker and less bronzy shade of the green colour, which also is of far less extent, especially on the forewing. The underside is totally different. The female differs on the upperside of the forewing in having the base of the wing dark brown instead of "pale blue"; the markings of the hindwing on the underside are very different, in *Z. katura* the inner edge of the discal band is highly irregular and broken, in *Z. absolon* it is quite straight, unbroken, and regular. The occurrence of a species of so purely palæarctic a genus as *Zephyrus* in the mountains of Java is highly interesting, the furthest southward point where any *Zephyrus* has been found is in the Khasi Hills of Assam, from whence I described *Z. khasia*, and where *Z. duma*, Hewitson, is also found, though *Z. letha*, Watson, from the North Chin Hills, Burma, 5,000 feet, is from a still more southerly locality.

Described from a single male taken on 26th August, 1892, on Mount Gede, 4,000 feet, Western Java; the female figured from Sukabumi, 2,000 feet, Western Java, taken in 1893; and a second female taken at the same place as the male, but on 30th June, 1892, all captured by Herr H. Fruhstorfer, and given to me. The second female mentioned above differs from the type in the entire absence of the broad pure white discal band on the underside of both wings, the band being replaced by a pale violet band. Mr. Hewitson described the species from "India" from a specimen in Dr. Boisduval's collection. There is little doubt, I think, that it does not occur in India, and that it is probably restricted to the mountains of Western Java, where it is very rare, as Mr. Fruhstorfer informs me that he captured only six or seven specimens in all.

* Mr. J. H. Leech in Butt. from China, Japan, and Corea, p. 375, says that the two names represent sexes of one species, and he figures both sexes from Moupin in Western China (pl. xxvii, figs. 5, *male*; 6, *female*). On the other hand Dr. C. Fixsen in Romanoff's Mémoires sur les Lépidoptères, vol. iii, pp. 268 and 269, places *Thecla katura* in the *Dipsas* group, and *Thecla ataxus* in the *Zephyrus* group. He divides the genus *Thecla* into eleven groups, and in these mixes up the genera, species and sexes in the most comic manner.

24. CAMENA CRETHEUS, n. sp., Pl. P, Fig. 35, ♂.

HABITAT: W. Java; N.-E. Sumatra.

EXPANSE: ♂, 1·35 to 1·45 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* rich shining deep blue of about the same shade as in *C. icetas*, Hewitson. *Forewing* with the costa as far as the subcostal nervure black (except a few blue scales placed between the costal and subcostal nervures towards the base of the wing); the apex broadly black, the inner edge of the black area evenly curved; the outer margin narrowly and decreasingly black, about 2 mms. broad at the inner angle. *Hindwing* with the costa and abdominal margins broadly black, the latter internally becoming whitish; the basal two-thirds of the discoidal cell shining fuscous; the apex rather broadly black; the outer margin with an anteciliary black thread; a small submarginal black spot in the first median interspace in one specimen; the anal lobe black, bearing outwardly a few turquoise-blue scales and then a few white scales, anteriorly marked with a ferruginous line; *tails* black, tipped with white. *Cilia* of the forewing black, of the hindwing whitish. UNDERSIDE, *both wings* pale leaden-colour, slightly shining, of a little lighter shade than in *Tajuria mantra*, Felder; a prominent very narrow outer discal dark line, outwardly narrowly defined with whitish, in the forewing a little outwardly bowed, commencing at the subcostal and ending on the submedian nervure, in the hindwing straight from the costa to the third median nervule, thence highly zigzag, and at the submedian nervure recurved to the abdominal margin; an obsolete darker submarginal fascia. *Forewing* with a short broad prominent orange band at the extreme base of the costa, very conspicuous in unset specimens; the usual tuft of pale ochreous hairs attached to the outwardly-bowed middle portion of the inner margin and turned under and forwards. *Hindwing* with an oval submarginal black spot in the first median interspace, inwardly very broadly (almost up to the outer discal dark line) surrounded with orange, this orange colour being continued to the abdominal margin in a narrow line, beyond which latter is a white line of the same breadth; the anal lobe bears an oval deep black spot, outwardly bounded by a line of brilliant metallic torquoise-blue scales, these scales being continued into the interspace beyond, that

interspace bearing marginally and outwardly some grey sprinklings; a prominent anteciliary black thread, which is continued very narrowly on to the forewing, but is there inconspicuous and pale fuscous, inwardly defined in the hindwing by a pure white thread, anteriorly becoming obsolete. *Palpi* whitish below, black above; *face* with two white lines; *thorax* and *abdomen* above black, beneath pale leaden-coloured. *Antennæ* above black, beneath dotted with white, the club beneath dull ferruginous towards the apex.

This species is nearest to *C. carmentalis*, de Nicéville,* from the Khasi Hills, differing on the upperside in the more blue, less purple ground-colour, which colour also is of greater extent in both wings. On the underside *C. carmentalis* lacks the yellow base to the costa of the forewing. It is remarkably similar on the upperside to *Camena cippus*, Fabricius, which I possess from Assam, Bhutan, Kalar in the Nilgiri Hills, and Karwar in North Kanara (the two latter localities are here recorded for the first time), and Dr. L. Martin has it from North-East Sumatra, caught by myself at Selesseh. It has been recorded from Nepal, East Pegu, the Shan States, the Garo Hills, and Borneo, and doubtfully from Simla and Ceylon. *C. cretheus* differs on the underside, however, in not having a brilliantly-shining silvery ground-colour. It is also near to "*Iolaus*" *ister*, Hewitson, as figured, but that species does not appear to possess secondary male sexual characters, and the orange areas on the underside of the hindwing are much smaller. It is not unlike the figure† of the male of "*Iolaus*" *isæus*, Hewitson, (= "*Tajuria*" *relata*, Distant, *teste* Elwes in Proc. Zool. Soc. Lond., 1892, p. 637), but the discal line on the underside of both wings is much nearer the outer margin in *C. cretheus*. It is probably nearest of all to "*Camena*" *icetoides*, Elwes,‡ from the Karen Hills, Burma, differing therefrom apparently in having a large tuft of hairs attached to the inner margin of the forewing, this tuft in *C. icetoides* being said to be "absent or very much reduced;" in the present species it is large and whitish; further, the orange costal streak to the forewing

* *Camena carmentalis*, de Nicéville, Journ. Bomb. Nat. Hist. Soc., vol. vii, p. 335, n. 12, pl. H, fig. 10, *male* (1892).

† *Iolaus isæus*, Hewitson, Ill. Diurn. Lep., *Lycænidæ*, p. 44, n. 15, pl. xix, figs. 13, 14, *male* (1865), from Sarawak, Borneo.

‡ Proc. Zool. Soc. Lond., 1892, p. 636, pl. xliv, fig. 3, *male*.

on the underside appears to be entirely absent in that species, and the orange areas on the hindwing are also smaller in *C. icetoides.*

Described from two male specimens kindly sent to me by Mr. H. Fruhstorfer and taken by himself at Sukabumi, W. Java, 2,000 feet, in 1893, and from a single male in the collection of Hofrath Dr. L. Martin, taken in the Battak mountains of North-East Sumatra in March.

Genus OPS, nov.

MALE. FOREWING, ample ; *costa* regularly arched throughout its length ; *apex* rather acute ; *outer margin* convex ; *inner angle* rounded ; *inner margin* nearly straight, slightly concave in the middle ; *costal nervure* terminating on the costa about opposite the apex of the discoidal cell ; *first subcostal nervule* arising nearer to the apex of the cell than to the base of the wing, near its origin slightly bent towards the costal nervure ; *second* subcostal arising nearer to the origin of the first subcostal than to the upper disco-cellular nervule ; *third* subcostal arising nearer to the apex of the wing than to the apex of the cell ; *upper disco-cellular* nervule minute, outwardly oblique ; *middle* and *lower* disco-cellulars upright, in one straight line, the middle shorter than the lower ; *second median* nervule arising well before the lower end of the cell ; *first* median arising rather less than twice as far from the second as the second does from the third ; *submedian nervure* slightly sinuous ; a large round discal patch of *androconia* on the upperside of the wing occupying the outer end of the cell, anteriorly bounded by the second subcostal, posteriorly reaching to the middle of the first median interspace. HINDWING, with the *costa* greatly arched at the base, regularly arched to the apex ; *apex* well rounded ; *outer margin* straight as far as the second median nervule when it is suddenly angled, from this tooth-like projection the outer margin is sinuated as far as the anal lobe ; anterior to the anal lobe is an excavation ; *abdominal* margin convex ; *tails* two, of nearly equal length, the inner rather the longer perhaps, arising from the terminations of the submedian nervure and first median nervule ; *costal nervure* much arched at the base, regularly arched to the apex of the wing ; *first subcostal nervule* also arched at the base, arising well before the apex of the cell ;

disco-cellular nervules straight, strongly outwardly oblique, the upper a little shorter than the lower; *second median* nervule arising close to the lower end of the cell; *first* median arising much nearer the end of the cell than the base of the wing; *submedian* and *internal nervures* nearly straight. *Palpi*, long, naked, porrect, in the same straight line as the axis of the body. *Eyes* naked. *Antennæ* short, about half as long, or a little less, than the costa of the forewing; with a long very slightly swollen club. FEMALE, differs from the male in both wings being broader, and in the absence of the "male-mark" in the forewing. Type, *Ops ogyges*, de Nicéville.

This genus is certainly allied to those which are clustered around *Camena*, Hewitson, and *Tajuria*, Moore. It is, however, unique as far as Indian genera go—at any rate in the group which has two short tails to the hindwing in both sexes arising from the submedian nervure and first median nervule, and three subcostal nervules to the forewing—in the secondary sexual characters of the male. The genera *Arrhenothrix*, de Nicéville, and *Camena* have tufts of hair on the inner margin of the forewing towards the base of the wing turned under and forwards, which is entirely wanting in the genus *Ops*; nor does it possess the glandular patch of scales on the hindwing towards the base of the costa found in those two genera and also in *Maneca*, de Nicéville; but instead, it possesses a large round patch of androconia on the upperside of the forewing near the middle. As regards "male-marks" it is nearest to *Maneca*, but that genus has it on the hindwing instead of on the forewing. From *Maneca* it differs considerably in the outline of the wings, the forewing has the costa much more convex, in *Maneca* it is nearly straight, and the hindwing is produced outwardly tooth-like at the termination of the second median nervule, which is not the case in *Maneca*. In neuration and outline it agrees very closely with *Tajuria*, especially with *Tajuria jalindra*, Horsfield, and its local races, *T. indra*, Moore, *T. tarpina*, Hewitson, and *T. burbona*, Hewitson (="*Charana*" *datoe*, Martin, MS.); but the presence of the "male-mark" separates the species of *Ops* from all those of *Tajuria*.

25. (1) OPS OGYGES, n. sp., Pl. P, Figs. 36, ♂; 37, ♀.

HABITAT : Maulmain, Tenasserim, Burma.

EXPANSE : ♂, 1·6 to 1·8 ; ♀, 1·9 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* iridescent pale cerulean-blue in some lights, iridescent emerald-green in other lights. *Forewing* with the base of the costa pale ochreous ; the outer half of the discoidal cell, the apex very broadly, and the outer margin decreasingly black ; in certain lights the large circular patch of shining fuscous androconia is very prominent. *Hindwing* with the costa broadly black, the abdominal margin broadly whitish, the outer margin with an anteciliary black thread ; the anal lobe black, powdered over with white scales, and bearing inwardly a small ferruginous patch ; *tails* black, tipped with white ; *cilia* of both wings black. UNDERSIDE, *both wings* dull brownish-fuscous, of almost the same shade as in *Camena cleobis*, Godart ; an outer discal or submarginal prominent narrow dark fuscous line ; a very indistinct marginal fascia. *Forewing* with the discal line nearly straight, only slightly outwardly curved, commencing on the subcostal nervure beyond the point where the third subcostal nervule arises, ending on the submedian nervure. *Hindwing* has the discal line quite straight from the costa to the third median nervule, afterwards to the abdominal margin it is regularly zigzagged ; a small round black spot in the first median interspace well removed from the outer margin, inwardly crowned narrowly with orange, outwardly bearing some metallic turquoise-blue scales ; the next interspace bears on the margin a few turquoise-blue scales touching the submedian nervure ; the anal lobe bears a moderately-sized round black spot, narrowly anteriorly crowned with orange, outwardly with some metallic turquoise-blue scales ; a narrow black anteciliary line ; *cilia* of both wings of the colour of the ground of the wings. *Body* above throughout very hairy, pale blue, the abdomen beneath ochreous. FEMALE. UPPERSIDE, *both wings* pale dull blue without any metallic lustre whatever. *Forewing* with the blue coloration of much greater extent than in the male, owing to the absence of the "male-mark," and occupying the whole of the discoidal cell. *Hindwing* with traces of a submarginal black band ; an indistinct round black spot in the first median interspace. Otherwise as in the male.

The female of this species appears to be nearest to the same sex of *Tajuria mantra*, Felder, of which there is a single example in the collection of the Indian Museum, Calcutta, from Mergui, taken in March by Dr. J. Anderson. It differs from this specimen, as also from Felder's description and figure, in the small extent of the yellow coloration at the anal angle of the hindwing on the underside. In this respect also it agrees with Hewitson's figure of "*Iolaus*" *mantra* in Ill. Diurn. Lep., *Lycænidæ*, pl. xx, fig. 24, *female* (1865), which figure appears to have been taken from what Hewitson on page 46, n. 20, calls a "var." from Macassar in Celebes, and is said to have the hindwing on the upperside "all brown," in *O. ogyges* it is nearly all blue. Mr. Distant has evidently figured a female from Malacca of the true *T. mantra* in Rhop. Malay., p. 245, n. 2, pl. xxi, fig. 11 (1884). *Tajuria relata*, Distant, l. c., p. 246, n. 3, pl. xxi, fig. 12, *female* (1884), is perhaps still more nearly allied to *O. ogyges* than is *T. mantra*, but that species differs from the same sex of *O. ogyges* in its smaller size, and the greatly curved form of the discal line on the underside of the forewing; in *O. ogyges* it is almost straight. Mr. Elwes says that *T. relata* is the same species as "*Iolaus*" *isæus*, Hewitson, and in this I think he is right.

Described from five males and a female in my collection.

26. (2) OPS ŒTA, n. sp., Pl. P, Fig. 38, ♂.

HABITAT: Maulmain and Daunat Range, Tenasserim, Burma.

EXPANSE: ♂, 1·65 and 1·85; ♀, 1·80 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* pale shining (but not iridescent) cerulean-blue. *Forewing* with the base of the costa pale ochreous, the rest of the costa, the apex very broadly, and the outer margin decreasingly, black; the large round discal patch of black androconia is not very distinct, but can be seen in some lights as a darker shade. *Hindwing* with the costa very broadly black, extending as far as the second subcostal nervule; the outer margin decreasingly black, reduced to a fine anteciliary thread at the third median nervule; anal lobe black, anteriorly obscurely crowned with ferruginous, sprinkled throughout thickly with white scales; *tails* black, edged and tipped with white; *cilia* of both wings fuscous. UNDERSIDE,

both wings pale reddish-brown, outwardly becoming whitish ; the disco-cellular nervules marked with a dark brown line, a dark brown discal line, and an obscure submarginal fascia. *Forewing* has the discal line gently outwardly curved, formed of outwardly-curved lunules, each lunule crossing an interspace, the line commences on the subcostal nervure just within the point where the third subcostal nervule originates, and ends on the submedian nervure ; the inner margin up to the submedian fold white. *Hindwing* with the discal line throughout its length highly irregular, posteriorly it is zigzagged and recurved to the abdominal margin ; a minute black spot surrounded by a narrow ferruginous ring in the first median interspace ; between this spot and the outer margin and the next two interspaces towards the anal angle black thickly sprinkled over with white scales ; the anal lobe bears a small round deep black spot, crowned with ferruginous. *Body* above very pilose, pale blue ; beneath ochreous. FEMALE. UPPERSIDE, *both wings* pale blue, of a lighter and duller shade than in the male, with no iridescence. *Forewing* with the blue coloration of greater extent than in the male owing to the absence of the " male-mark." *Hindwing* has the outer black margin reduced owing to the greater extent of the blue ground-colour; the black anteciliary thread inwardly defined by an equally fine white thread. Otherwise as in the male.

O. æta is near to *O. ogyges*, de Nicéville, but differs in many important particulars. The coloration of the upperside is different, it is not iridescent, and is never emerald-green in any light ; in the forewing there is less blue on the inner margin, the black area on the outer margin being broader, and there is more blue in the discoidal cell ; the " male-mark " is less prominent. On the hindwing the outer margin is more broadly black, in *O. ogyges* it bears a black anteciliary thread only. On the underside the ground-colour of both wings is redder, the disco-cellular nervules are marked with a dark line, the discal line is more irregular, and is further removed from the outer margin. It appears to be allied to " *Myrina*" *deudorix*, Hewitson,* from Mindanao in the Philippines (*Hewitson* and *Semper*), but

* Ill. Diurn. Lep., *Lycænidæ*, p. Supplement 2, n. 43, pl. Supplement ii, figs. 64, 65, *male* (1869).

that species has the discal line on the underside of both wings "white bordered inwardly with brown." On the upperside the two species hardly differ.

Described from two male and one female example in my collection.

(3) OPS MELASTIGMA, de Nicéville.

Tajuria melastigma, de Nicéville, Proc. Zool. Soc. Lond., 1887, p. 460, pl. xl, fig. 1, *male*; idem, id., Butt. of India, vol. iii, p. 379, n. 935 (1890).

HABITAT: Sikkim; Khasi Hills; Burma; North Kanara; Nilgiri Hills.

Very near to *O. ogyges*, de Nicéville, but in the male on the upperside the blue coloration is different, of a darker shade, and never iridescent emerald-green in any light. The "male-mark" is still more prominent than in *O. ogyges*, is more quadrate in form, does not extend into the discoidal cell, and posteriorly reaches the first median nervule only instead of ending midway between the first and second median nervules.

27. TAJURIA TURA, n. sp., Pl. P, Fig. 39, ♂.

HABITAT: Battak Mountains, N.-E. Sumatra; W. Java.

EXPANSE: ♂, 1·6 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* rich shining blue. *Cilia* cinereous. *Forewing* with the costa up to the subcostal nervure, the apex very widely (its inner edge very irregular), the outer margin decreasingly black, at the anal angle the black colour is reduced to a mere thread. *Hindwing* with the costa and apex somewhat broadly fuscous; an anteciliary black thread; the anal lobe small and black, with a few turquoise-blue scales posteriorly, and a dull ferruginous line anteriorly; abdominal margin broadly whitish; *tails* black tipped with white. UNDERSIDE, *both wings* pale French-grey; a fine darker line closing the discoidal cells; a similar discal line, on the forewing commencing at the costa, ending on the submedian nervure, approaching the outer margin posteriorly, slightly outwardly curved, in the hindwing anteriorly straight, posteriorly zigzag and recurved to the abdominal margin. *Hindwing* with an oval deep black spot in the first median interspace close to the margin, anteriorly with a large patch of clear yellow; the anal lobe bearing an oval deep black

spot, anteriorly with a small patch of clear yellow; the submedian interspace between the discal line and the outer margin heavily sprinkled with (as seen under a magnifying glass) dull blue scales on a black ground; an anteciliary black thread. *Cilia* whitish at the anal angle, anteriorly black.

Near to "*Iolaus*" *ister*, Hewitson,* from India, but that species is smaller, apparently of a lighter shade of blue on the upperside, the apical area of the hindwing more widely fuscous, and the yellow patch crowning the black spot in the first median interspace of the hindwing on the underside much smaller. Also near to *T. thyia*, de Nicéville,† from the Khasi Hills, Assam, but that species is smaller, with the black coloration on the upperside of both wings more extensive, with a very narrow ferruginous ring surrounding the subanal black spot on the hindwing below. Also near to *T. albiplaga*, de Nicéville,‡ from Sikkim, but that species in the male has the blue coloration of the upperside of both wings much paler, and also differs a good deal in the details of the markings of the underside.

Described from a single example (the type) obtained at Sukabumi, 2,000 ft., Western Java, during 1893, by Mr. H. Fruhstorfer; and another specimen taken in August in the Battak Mountains of North-East Sumatra and kindly given to me by Hofrath Dr. L. Martin.

28. TAJURIA TYRO, n. sp., Pl. P, Fig. 40, ♀.

HABITAT: Ataran Valley, Tenasserim, Burma; N.-E. Sumatra.

EXPANSE: ♀, 1·25 to 1·35 inches.

DESCRIPTION: FEMALE. UPPERSIDE, *both wings* pale cerulean-blue. *Forewing* with the costa as far as the subcostal nervure, the apex widely, and the outer margin decreasingly black. *Hindwing* with

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* Ill. Diurn. Lep., *Lycænidæ*, p. 43, n. 13, pl. xix, figs. 15, 16, *female* (1865). Mr. G. F. Hampson has kindly examined the type specimen in the British Museum collection, and informs me that it is from Moulmein, Burma, Archdeacon Clerk's collection, that it may be a male, but the legs are wanting and the apex of the abdomen has been destroyed by mites, so that the sex is a little uncertain. It has three subcostal nervules to the forewing. It has no secondary sexual characters.

† *Tajuria thyia*, de Nicéville, Journ. Bomb. Nat. Hist. Soc., vol. vii, p. 336, n. 13, pl. H, fig. 11, *male* (1892).

‡ *Tajuria albiplaga*, de Nicéville, Proc. Zool. Soc. Lond., 1887, p. 459, pl. xxxix, figs. 1, *male*; 2, *female*.

the costa and abdominal margin whitish ; a narrow anteciliary black line which widens out at the apex and is continued some distance along the costa ; anal lobe entirely black ; *tails* black, tipped and edged with white. UNDERSIDE, *both wings* pale French-grey ; a very indistinct submarginal darker fascia. *Forewing* with a discal, somewhat irregular, slightly outwardly curved, dark French-grey band or line, outwardly defined with white, commencing at the second subcostal nervule, ending on the submedian nervure. *Hindwing* with a similar discal line but much more irregular throughout its length than on the forewing, posteriorly highly zigzagged and recurved to the abdominal margin ; a large round black spot on the margin in the first median interspace, prominently anteriorly crowned with yellow ; the submedian interspace on the margin white sprinkled with black scales ; the anal lobe bearing a small deep black spot, which bears outwardly some metallic green scales ; anterior to this spot is a short yellow fascia reaching the abdominal margin, well separated from the yellow patch in the first median interspace ; a fine black anteciliary thread, inwardly defined by an equally fine white thread. *Face* white in front. *Palpi* with the first and second joints white, the third black. *Eyes* surrounded by a white line. *Antennæ* black, the shaft finely annulated with white. *Body* above blue, beneath whitish. *Legs* white, prominently ringed with black.

In general appearance this species very closely resembles *Britomartis cleoboides*, Elwes, and *B. buto*, de Nicéville, differing structurally, however, in possessing three instead of two subcostal nervules to the forewing. From the female of *B. cleoboides* it differs on the upperside of the forewing in having the blue area of greater extent, thereby reducing the black apical area by about one-half ; the anal lobe of the hindwing is entirely black, in *B. cleoboides* it is crowned with ochreous, and bears some metallic blue scales. On the underside of both wings the discal line in *B. cleoboides* is distinctly deep ochreous, almost ferruginous (Elwes calls it " pale yellow," but viewed under a strong magnifying glass it is really dark yellow) instead of dark French-grey, it is also outwardly curved, in *B. cleoboides* it is very straight in all my twenty specimens (seventeen males and three females), on the hindwing also the discal line is very much more irregular ; the two yellow anal areas do not meet as they do in *B. cleoboides* ; and the

space between them on the margin does not bear metallic blue scales. From *B. buto* it differs on the upperside in the different shade of the ground-colour, being a paler blue and not iridescent green in any light; the blue colour also is far more extensive in the forewing; and the same differences hold good on the underside as regards the discal band as obtain between it and *B. cleoboides*, but it agrees with *B. buto* in the complete separation of the yellow patches on the hindwing. From "*Iolaus*" *ister*, Hewitson, of which I possess a female from Maulmain, Burma, and another from Borneo, it differs in the greater extent of the blue coloration of the forewing on the upperside, and in the outline of the hindwing, in *T. tyro* the outer margin is well rounded, making the wing broader, in "*Iolaus*" *ister* the outer margin is straight, thereby making the wing much narrower. Colonel Swinhoe* suggests that "*Iolaus*" *ister* is the female and *Camena carmentalis*† the male of one and the same species. I made the same remark when describing the latter, but now that I possess specimens of "*Iolaus*" *ister*, I think it improbable that this is so, as the coloration of my species on the upperside is of a distinctly purple shade, while "*Iolaus*" *ister* is pale "cerulean-blue," as Hewitson quite correctly describes it. *Tajuria relata*, Distant,‡ is another allied but quite distinct species, which is said by Mr. H. J. Elwes to be the same as *T. isæus*, Hewitson, see *ante* p. 295. It is very unfortunate that the female sex of so many allied species should alone be known. It may be, however, that the sexes of several of the known species of *Tajuria* have been incorrectly diagnosed; the males are often very difficult to determine, having no "male-marks" or distinctive coloration, and it is more than probable, I think, that male specimens are often recorded as female and *vice versa* in this genus.

Described from two examples from Tenasserim and three from N.-E. Sumatra in my collection.

Genus BRITOMARTIS, nov.

MALE. FOREWING, short, broad; *costa* regularly and evenly somewhat strongly arched; *apex* rounded; *outer margin* regularly convex; *inner angle* rounded; *inner margin* slightly concave, longer than the

* Trans. Ent. Soc. Lond., 1893, p. 302, n. 289.

† Journ. Bomb. Nat. Hist. Soc., vol. vii, p. 335, n. 12, pl. H, fig. 10, *male* (1892).

‡ Rhopalocera Malayana, pp. 246 and 460, n. 3, pl. xxi, fig. 12, *female* (1884-86), from Province Wellesley and Malacca (*Distant*), Perak (*coll. de Nicéville*).

outer margin ; *costal nervure* ending opposite the apex of the discoidal cell; *first subcostal nervule* emitted nearer the apex of the cell than the base of the wing, bowed upwards near its origin and almost touching the costal nervure ; *second* subcostal arising twice as far from the first subcostal as it does from the upper disco-cellular nervule ; *discoidal cell* somewhat broad, reaching to the middle of the wing ; *upper disco-cellular nervule* stout, long, strongly outwardly oblique ; *middle* disco-cellular long, upright, concave ; *lower* disco-cellular longer than the middle one, slightly inwardly oblique, concave ; *second median* nervule arising well before the lower end of the cell ; *first* median arising twice as far from the second as the second does from the third ; *submedian nervure* straight ; a large *patch of androconia* on the upperside of the wing occupies the outer three-fourths of the cell, and extends into the discoidal and median interspaces. HINDWING, much longer than broad ; *costa* arched at the base, thence to apex slightly curved only ; *apex* well rounded ; *outer margin* anteriorly straight, somewhat produced like the teeth of a saw at the terminations of the second and first median nervules ; *tails* two, short, the outer arising at the termination of the first median nervule, rather longer than the inner at the termination of the submedian nervure ; *anal lobe* small ; *abdominal margin* excavated above the anal lobe, then convex ; *costal nervure* strongly curved at the base, then slightly curved, ending at the apex of the wing ; *first subcostal nervule* arising well before the apex of the cell, curved at the base, then nearly straight ; *upper disco-cellular* nervule outwardly oblique, slightly concave ; *lower* disco-cellular nearly upright (only slightly outwardly oblique), slightly concave, a little longer than the upper disco-cellular ; *second median* nervule arising quite close to the lower end of the cell; *first* median arising somewhat nearer to the lower end of the cell than to the base of the wing ; *submedian nervure* straight ; *internal* nervure straight at the base, lying close to the submedian nervure, then curved towards the abdominal margin. *Antennæ* short, about half the length of the costa of the forewing, with an elongated, rather slender club. *Palpi* porrect, naked, third joint long. *Eyes* naked. FEMALE. BOTH WINGS, somewhat broader than in the male. FOREWING, lacks the patch of androconia on the upperside. Otherwise as in the male. Type, " *Camena* " *cleoboides*, Elwes.

Of the Indian genera with two subcostal nervules only to the forewing, *Britomartis* seems to be nearest allied to *Hypolycæna*, Felder, of which *H. tmolus*, Felder, from the Philippines, is the type. Herr Georg Semper considers *H. tmolus* to be a "Variety" only, or more properly a "Local race" of *H. erylus*, Godart. From the latter species *B. cleoboides* differs in the forewing being shorter; the "male-mark" somewhat differently placed, occupying a much larger area in the cell; the second subcostal nervule arises twice as far from the base of the first subcostal as from the origin of the upper disco-cellular nervule,* in *H. erylus* the exact opposite obtains; the second median nervule arising further from the lower end of the cell; and the eyes being apparently naked instead of hairy. From the genus *Chliaria*, Moore, of which "*Hypolycæna*" *othona*, Hewitson, is the type, it may be known by the naked eyes, and by the second subcostal nervule of the forewing being far removed from, instead of close to, the first subcostal at its origin; the hindwing, also, is longer and narrower. *Britomartis* has male secondary sexual characters, which *Chliaria* entirely lacks.

(1). BRITOMARTIS CLEOBOIDES, Elwes.

Camena cleoboides, Elwes, Proc. Zool. Soc. Lond., 1892, p. 637, pl. xliv, figs. 4, *male*; 5, *female*; *Iolaus isæus*, Hewitson, Ill. Diurn. Lep., *Lycænidæ*, Supplement p. 10, Supplement pl. iv, figs. 35, 36, *male* (1869), (*nec* idem, id., l. c., p. 44, n. 15, pl. xix, figs. 13, 14, *female* (1865); *Tajuria mantra*, part (*nec* Felder), Moore, Journ. Linn. Soc. Lond., Zoology, vol. xxi, p. 44 (1886); id., de Nicéville, Butt. of India, vol. iii, p. 380, n. 936 (1890).

HABITAT: Karen Hills, Burma (*Elwes*); Sarawak, Borneo (*Hewitson*); Owen Island, Mergui Archipelago, January, captured by Dr. J. Anderson (*Moore*); Méple, Middle Tenasserim, Burma, captured by de Nicéville in October, 1892; Ataran Valley, Tenasserim, Burma; N.-E. Sumatra, captured by Hofrath Dr. L. Martin; Sukabumi, Western Java, 2,000 feet, captured by Herr H. Fruhstorfer in 1893—all in coll. de Nicéville.

Mr. Elwes says of this species that it has "A large round velvet patch free from blue scales in the cell of the forewing and with raised

* Actually there is no upper disco-cellular nervule in this genus, what I have described above as that veinlet being the basal portion of the upper discoidal veinlet, the middle disco-cellular veinlet arising from the upper discoidal some distance from the base of the latter.

androconia." This hardly expresses the facts of the case, as will be at once seen by a reference to Mr. Elwes' figure 4. The "male-mark" is not "free from blue scales," but is composed of blue scales, but they appear to be placed at a different angle to the other blue scales on the wing, and they are not of the same shade of blue, being, indeed, quite purple in some lights. Mr. Elwes quite correctly points out (probably from a note of the capturer of the type specimens, Mr. W. Doherty), that it has only two branches to the subcostal nervure in the forewing. In the male the blue coloration of the forewing on the upperside is somewhat variable, in specimens from the same locality it is more extensive in some than in others, sometimes almost reaching the anal angle, sometimes far removed from it.

On a closer examination of the pair of specimens of *Tajuria mantra*, Felder, *teste* Moore, taken by Dr. John Anderson in the Mergui Archipelago, Lower Burma, in the cold weather of 1881-82, and now deposited in the Indian Museum, Calcutta, I find that one specimen only (the female) is true *T. mantra*, the other (the male) being *B. cleoboides*. *T. mantra* is a much larger species, has a much darker ground-colour on the underside, and the discal linear fascia is placed much nearer the outer margin than in *B. cleoboides*.

Mr. G. F. Hampson writes to me as follows regarding the type specimen of "*Iolaus*" *isæus*, Hewitson,* from Sarawak, Borneo :— "The figure should be of a darker shade of blue, as in the male of *Tajuria longinus*, Fabricius ; the discal line on the underside of both wings should be more continuous, broader, and fulvous ; reduced to obliquely-placed fulvous streaks above the anal yellow patch in the hindwing. The 'male-mark' consists of a large patch of roughened scales filling the whole outer part of the discoidal cell of the forewing on the upperside, and extending rather beyond its limits. There are no tufts of hairs between the wings. The forewing has only two subcostal nervules." This note and a study of the figure leads me to believe that this specimen is the same species as the *B. cleoboides* of Elwes ; Hewitson's name *isæus* will however stand, as the female specimen he first figured as that species is of a different genus to the male specimen he subsequently figured as the opposite sex of his

* Ill. Diurn. Lep. *Lycænidæ*, Supplement, p. 10, Supplement pl. iv, figs, 35, 36, *male* (1869).

"*Iolaus*" *isæus*. I am inclined to agree with Mr. Elwes that the *Tajuria relata* of Distant from Province Wellesey and Malacca is the female of *T. isæus*, as I possess a female specimen of *T. relata* from Perak, which agrees exactly in the coloration and markings of the underside with Mr. Hewitson's figure, pl. xix, fig. 14, in which case Hewitson was correct in the first instance in calling his original type example a male : subsequently he corrected himself, and said it was a female.

29. (2) BRITOMARTIS BUTO, n. sp., Pl. P, Fig. 41, ♀.

HABITAT : Ataran Valley, Tenasserim, Burma ; N.-E. Sumatra.

EXPANSE : ♀, 1·2 inches.

DESCRIPTION : FEMALE. UPPERSIDE, *both wings* iridescent cerulean-blue in some lights (of the exact shade found in the common *Camena cleobis*, Godart), emerald-green in others. *Forewing*, with the apical half black, the blue or green coloration being confined to the basal half of the discoidal cell, a small patch in the middle of the first median interspace, the whole of the submedian interspace except an oblique portion on the outer margin, and the sutural area except the extreme outer margin. *Hindwing* with the costa and abdominal margin whitish ; a very narrow anteciliary black line, towards the anal angle inwardly defined by an equally fine white line ; anal lobe black, anteriorly just touched with dark ochreous, outwardly bearing a few turquoise-blue scales ; *tails* black, edged and tipped with white. UNDERSIDE, *both wings* pale French-grey. *Forewing* with a narrow discal macular dark ochreous band or line outwardly defined with white, it commences on the second subcostal nervule, and ends on the submedian nervure, the band is slightly outwardly curved ; a very indistinct submarginal darker fascia. *Hindwing* has the discal band as on the forewing, but posteriorly it is highly zigzagged and recurved to the abdominal margin ; a very indistinct submarginal darker fascia ; an oval rather large deep black spot in the first median interspace broadly crowned with yellow ; the next posterior interspace on the margin is white, heavily irrorated with black scales, and bearing inwardly some brilliant metallic-green scales ; anal lobe black, outwardly bearing some brilliant metallic-green scales ; above the anal lobe is a short band of yellow colour ending inwardly on the abdominal

margin, outwardly not reaching the patch of the same colour crowning the black spot in the first median interspace ; a fine black anteciliary line inwardly defined by a similar white line; *cilia* throughout cinereous. *Face* white in front. *Palpi* white, the third joint black. *Eyes* surrounded by a white line. *Antennæ* black with very small white annulations. *Body* blue above, whitish beneath. *Legs* white, prominently ringed with black.

On the upperside *B. buto* differs from the same sex of *B. cleoboides*, Elwes, in the colour of the ground, being distinctly of a lighter shade and emerald-green in some lights, instead of being of the same shade of blue in all lights ; the blue area on the upperside of the forewing is of considerable less extent, as will be at once observed by consulting Mr. Elwes' excellent figure 5 of the female of *B. cleoboides* ; on the underside of the forewing in *B. cleoboides* the discal band is straight from the costa to the submedian fold, posterior to which it is directed inwardly slightly, in *B. buto* it is distinctly outwardly curved, and is, moreover, placed considerably nearer the outer margin ; on the hindwing the black spot in the first median interspace is twice as large, and the yellow area crowning that spot is well separated from the yellow fascia placed interior to it, while in *B. cleoboides* these two yellow areas are conjoined. There is a slight difference in outline also—*B. cleoboides* is a more "chubby" or truncated insect, the costa of the forewing being short, while the forewing of *B. buto* is more produced at the apex, and the costa consequently longer. It has two subcostal nervules only in the forewing. From the figure of "*Iolaus*" *ister*, Hewitson, the present species may be known by the blue coloration of the forewing on the upperside being of much less extent.

Described from two examples in my collection, one each from Tenasserim and N.-E. Sumatra.

30. CHLIARIA AMABILIS, Martin, Pl. P, Fig. 42, ♂.

HABITAT : N.-E. Sumatra; Java.

EXPANSE : ♂, 1·0 inch.

DESCRIPTION: MALE. UPPERSIDE, *both wings* rich dark ultramarine-blue visible in all lights, but distinctly iridescent, so that the colour is much brighter and more prominent in some lights than in others.

Forewing with the costa up to the subcostal nervure, the apex somewhat broadly, the outer margin decreasingly black. *Cilia* black. *Hindwing* with the costa and apex black ; a fine white and then a fine black anteciliary thread, both prominent at the anal angle, obsolete before reaching the apex of the wing ; three round equal-sized black spots at the anal angle ; the two innermost ones with a patch of pure white anterior to them ; abdominal margin dusky ; *tails* short, the outer one rather the longer, white centred with black. *Cilia* white. UNDERSIDE, *both wings* bluish-white ; the disc crossed by a narrow ochreous band, straight in the forewing from the second subcostal to the first median nervule, then slightly deflected towards the base of the wing and ending on the submedian nervure ; on the hindwing the band is straight from the costa to the third median nervule, the portion from the third to the first median nervule is also straight, but is shifted inwardly towards the base of the wing, then there is a perfect V-shaped portion in the submedian interspace ; lastly there are two parallel portions extending obliquely forwards from the internal nervure to the abdominal margin. *Forewing* with the apex broadly, the outer margin decreasingly, brownish-ochreous. *Cilia* black. *Hindwing* with a highly irregular macular black band beyond the discal ochreous band ; a marginal series of six rounded black spots, the anal one large, the one in the first median interspace still larger, the four remaining spots small, the fourth from the anal angle the smallest of all ; a fine anteciliary black thread. *Cilia* white. *Thorax* and *abdomen* above blue, beneath white. *Antennæ* black, the shaft narrowly annulated with white.

Nearest to *Chliaria merguia*, Doherty,* from Mergui, of which I possess a specimen from the Mibbu Pass, Tenasserim, Burma, captured by Colonel C. T. Bingham in January, and another from the Katha district of Upper Burma ; Mr. H. J. Elwes records it from Perak; and I have both sexes from Bekantschan taken in March and the Battak Mountains taken in March and December—both in North-East Sumatra. *C. amabilis* differs from that species in being a little smaller, the apex of the forewing is less acute, the coloration of the upperside

* *Chliaria merguia*, Doherty, Journ. A. S. B., vol. lviii, pt. 2, p. 427, n. 47, pl. xxiii, fig. 2, *male* (1889).

rich dark iridescent ultramarine-blue instead of "dull indigo-blue," and the marginal spots of the hindwing on the underside larger and more intensely black. The two species are abundantly distinct, the coloration of the upperside alone will instantly distinguish between them, besides many small differences in the details of the markings. The figure of *C. merguia* is not very good, the underside is mostly "pearl-grey," it is shown of a dull ochreous tint almost throughout.

Described from a single example (the specimen described and figured) from Java without precise locality, kindly sent to me by Mr. H. Fruhstorfer, and another male from N.-E. Sumatra sent to me by Hofrath Dr. L. Martin, who has other examples in his own collection. He informs me that he has recently described this species, but the description has not as yet reached me. However, I have adopted his name for it.

31. CHLIARIA TORA, Kheil, Pl. P, Fig. 43, ♀.

Hypolycæna tora, Kheil, Rhop. Nias, p. 31, n. 99, pl. v, fig. 40, *male* (1884); *Chliaria tora*, Elwes, Proc. Zool. Soc. Lond., 1892, p. 639.

HABITAT: Nias (*Kheil*); Perak (*Elwes*; *coll. de Nicéville*); N.-E. Sumatra (*coll. Martin* and *de Nicéville*); Borneo (*coll. de Nicéville*).

EXPANSE: ♀, ·9 of an inch.

DESCRIPTION: FEMALE. UPPERSIDE, *both wings* dull leaden-fuscous, with a slight gloss in some lights. *Forewing* immaculate. *Cilia* grey. *Hindwing* with four slightly decreasing conjoined marginal round black spots from the anal lobe, one in each interspace, inwardly defined by a pure white band, the inner edge of the band lunular; a fine white, then a fine black, anteciliary thread, from the anal angle not quite reaching the apex of the wing. *Cilia* and *tails* white. UNDERSIDE, *both wings* bluish-white; crossed by a narrow discal bright ochreous band, in the forewing straight, anteriorly lost in the apical ochreous area, posteriorly ending on the submedian nervure, in the hindwing anteriorly straight, posteriorly zigzag and recurved to the abdominal margin. *Forewing* with the apical half bright ochreous; two fine bright ochreous lines at the end of the descoidal cell. *Cilia* black. *Hindwing* with a highly irregular macular black band beyond the discal ochreous band; a marginal series of rounded black spots, the anal one large, the one

in the first median interspace still larger, the other four small, the anteriormost spot ochreous ; an anteciliary black thread. *Cilia* white. *Body* above fuscous, beneath whitish.

The female of this species has not hitherto been described. I possess a single example taken at Bekantschan at the foot of the Battak Mountains in N.-E. Sumatra by Dr. L. Martin in July, and two males taken at Selesseh also in N.-E. Sumatra in May and August, as well as a very worn specimen from Borneo and one from Perak. The description above would apply almost word for word to the same sex of *C. merguia*, Doherty ; the best character I can find to separate them is the colour of the ground on the underside, *C. tora* having it of a purer white. The disco-cellular nervules of the hindwing below are not defined on both sides by a fine ochreous line in *C. tora* as they are in *C. merguia*.

Genus MANTO, nov.

MALE. FOREWING, *costa* regularly but slightly arched ; *apex* rather rounded ; *outer margin* nearly straight ; *inner angle* rounded ; *inner margin* greatly bowed outwardly in the middle ; *costal nervure* ending opposite to the apex of the discoidal cell ; *first subcostal nervule* arising nearer the apex of the cell than the base of the wing, slightly bowed forwards near its base, but well separated from the costal nervure ; *second* subcostal arising much nearer to the first than to the upper disco-cellular ; *third* subcostal arising nearer to the apex of the wing than to the apex of the cell ; *subcostal nervure* terminating at the apex of the wing ; *upper disco-cellular nervule** stout, rather long, strongly outwardly oblique ; *middle* disco-cellular straight, upright ; *lower* disco-cellular also straight, upright, not quite twice as long as the middle disco-cellular ; *second median* nervule arising well before the lower end of the cell (the distance between the origins of the third and second median nervules about equals or is a little less than the length of the middle disco-cellular nervule) ; *first* median arises about twice as far from the second as the second does from the third ; *submedian nervure* sinuous, strongly bowed posteriorly at its middle. HINDWING, *costa* greatly arched throughout its length ; *apex* well rounded ; *outer margin* at first straight and even in the type species, very convex in *M. martina*, Hewitson, angled at the termina-

* There is actually no upper disco-cellular nervule, what passes as such being the true basal portion of the upper discoidal nervule.

tions of the second and first median nervules ; *tails*, two—a short one from the termination of the first median nervule (·15 of an inch or 3·5 mms. in length); a long one at the termination of the submedian nervure (·4 of an inch or 9 mms. in length in the type species, considerably longer in *M. martina*, Hewitson); *anal lobe* small; *abdominal margin* excavated above the anal lobe, then straight to near the base, when it is inwardly curved ; *costal nervure* curved throughout its length, greatly so towards the base ; *first subcostal nervule* arising well before the apex of the cell, slightly curved ; *upper disco-cellular* nervule straight, outwardly oblique ; *lower* disco-cellular also straight, outwardly oblique, but not so much so as the upper disco-cellular, a little longer than that veinlet ; *third* and *second median* nervules arising together at the lower end of the cell; *first* median arising at a distance from the second equal to the length of the lower disco-cellular nervule ; *submedian nervure* straight ; *internal* nervure at first straight, its basal portion lying close to the basal portion of the submedian nervure, then greatly bowed outwardly ; *male secondary sexual characters* consist of a large oval patch of black androconia placed in the costal interspace extending beyond the origin of the first subcostal nervule, but not extending into the cell in the type species, across which lies a thick tuft of black hairs turned forwards across the androconal glandular patch, the roots of the hairs being just within the cell.* *Antennæ* exactly half the length of the costa of the forewing, with a thin elongated club. *Palpi* rather long, porrect, scaly, the third joint long. *Thorax* rather robust. *Abdomen* not nearly reaching to the anal angle of the hindwing. FEMALE. FOREWING, has the *inner margin* straight, not outwardly bowed as in the male, the *submedian nervure* consequently straight also. HINDWING with no androconal patch. Otherwise as in the male Type, "*Myrina*" *hypoleuca*, Hewitson.

This genus comes into the seventh division of the Indian *Lycænidæ* as proposed by me in "The Butterflies of India, Burmah and Ceylon," vol. iii, p. 398, which contains eleven Oriental genera. These eleven genera can be split up into two subdivisions according to the position

* In *M. martina*, Hewitson, the androconal patch is larger than in the type, and extends into the discoidal cell, the roots of the hairs being in the cell. Mr. W. Doherty in Journ. A. S. B., vol. lviii, pt. 2, p. 417 (1889), records the following note:—"Some rare species of *Neocheritra* are green above in some lights, especially *N. martina*, a Bornean species. The allied *N. hypoleuca* was also figured by Hewitson as green, apparently by mistake." The males of both species are of course green on the upperside.

occupied by the longer of the two tails. *Manto* comes into the first of these which has the inner tail the longer, and contains five other eastern genera—*Zeltus*, de Nicéville; *Charana*, de Nicéville; *Neocheritra*, Distant; *Jacoona*, Distant; and *Thrix*, Doherty. Of these, *Neocheritra* and *Thrix* have four subcostal nervules to the forewing in the male; *Zeltus* has only two; while the other two and *Manto* have three. There remain then only two genera—*Charana* and *Jacoona*,—from both of which *Manto* differs in possessing secondary male sexual characters. It is nearest of all to *Charana*, but the inner margin of the forewing in the male is straight in that genus, greatly bowed outwardly in *Manto*; in *Charana* the hindwing is about as broad as it is long, in *Manto* it is much longer than broad; the costa of *Charana* is slightly arched only, in *Manto* it is greatly arched; and in *Charana* the second median nervule arises well before, in *Manto* at, the lower end of the cell.

(1) MANTO HYPOLEUCA, Hewitson.

Myrina hypoleuca, Hewitson, Ill. Diurn. Lep., p. 38, n. 40, pl. xvii, figs. 54, 55, *male* (1865).

HABITAT: Java (*Hewitson*); Central Java, 1,500 feet (*Fruhstorfer, coll. de Nicéville*); Eastern Java (*coll. de Nicéville*).

The anal tail in the type specimen of this species was lost on both sides, so in drawing it Mr. Hewitson had to guess it. It is not drawn quite long enough, while the outer tail is shown a little too long in the lower figure (No. 54), of the right length in the upper (No. 55). Mr. Hewitson omitted to describe the male secondary sexual characters, but I have supplied the omission in the generic diagnosis above. Dr. A. Pagenstecher, in Jahr. des Nass. Ver. fur Natur., vol. xliii, p. 98, n. 93 (1890), places "*Sithon*" *hypoleuca* as a synonym of "*S.*" *martina* in recording the species from East Java. The two species are I believe distinct, and it is not apparent, even if they should be one and the same species, why the older name of the two should be sunk as a synonym of the later name.

32. (2) MANTO MARTINA, Hewitson, Pl. P, Fig. 44, ♀.

Myrina martina, Hewitson, Ill. Diurn. Lep., Suppl., p. 3, n. 46, pl. ii, figs. 70, 71, *male* (1869).

HABITAT: Borneo (*Hewitson*); Ataran Valley, Tenasserim, Burma; Penang, Malay Peninsula (*coll. de Nicéville*).

EXPANSE: ♀, 1·6 inches.

DESCRIPTION : FEMALE. UPPERSIDE, *both wings* dull fuscous, with a slight gloss in some lights. *Forewing* unmarked. *Hindwing* with the costa broadly whitish ; a large anal pure white patch, crossed by the fuscous veins, commencing at the third median nervule, ending on the abdominal margin, bearing three rounded black spots, the first in the first median interspace close to the outer margin, the second, the largest of the three, in the submedian interspace well removed from the margin, the third on the anal lobe ; an anteciliary black line extends from the anal lobe to the third median nervule and runs down the tails. UNDERSIDE, *both wings* a little paler than in the male. *Forewing* with the inner margin whitish, but this pale area is much smaller than in the male. *Hindwing* as in the male. *Cilia* of the forewing cinereous, of the hindwing pure white posteriorly, cinereous anteriorly.

The male of this species differs from *M. hypoleuca*, Hewitson, in having the metallic-green scales (which, by-the-bye, are highly deciduous) on the upperside of the forewing considerably less extensive; the hindwing has the outer margin very convex instead of straight, the anal tail much broader throughout its length and longer also (·5 of an inch or 13 mms.), the outer black margin on the upperside broader, and on the underside of the same wing there is a submarginal broken black line from the abdominal margin to the third median nervule, besides a marginal black spot in the submedian interspace which are absent in *M. hypoleuca* ; there are also some additional marginal black spots on the upperside of the hindwing in *M. martina*. The "male-mark" is larger, and extends into the discoidal cell in this species.

(3) MANTO INOPINATA, Butler.

Myrina inopinata, Butler, Ann. and Mag. of Nat. Hist., fifth series, vol. xii, p. 159, n. 2 (1883); *Sithon inopinata*, Kheil, Rhop. Nias, p. 32, n. 106 (1884).

HABITAT : Nias Island (*Butler* and *Kheil*).

I have not seen this species. As far as the description goes it does not appear to differ from *M. martina*, Hewitson, with which Mr. Butler should have compared it instead of with "*Myrina*" *timon*, Fabricius, a three-tailed African species. Herr Kheil places *M. martina* as a synonym of *M. inopinata* ; he should have given the former precedence, as it is the older name.

33. NEOCHERITRA NISIBIS, n. sp., Pl. P, Fig. 45, ♀.

HABITAT: Kwala Lampur, Selangore, Malay Peninsula; N.-E. Sumatra.

EXPANSE: ♀, 1·5 inches.

DESCRIPTION: FEMALE. UPPERSIDE, *both wings* dull hair-brown, outwardly rather darker. *Forewing* unmarked. *Cilia* cinereous. *Hindwing* with the anal third pure white, this white area reaching from the abdominal margin (where it is widest) to just beyond the third median nervule (where it is narrowest, dying away to nothing), its inner edge irregular, arranged step-like, coincident with an outer discal series of black spots on the underside; this white area bears a rounded deep black spot on the incision in the abdominal margin anterior to the anal lobe; a larger round similar spot in the submedian interspace well removed from the outer margin; an exactly similar spot in the first median interspace close to the margin; a narrow black streak close to the margin in the second median interspace; a similar streak on the abdominal margin above the incision; an anteciliary fine black thread from the anal black spot to the third median nervule. *Cilia* pure white. *Tails* two, pure white, faintly at the base centred with black; the external one at the end of the first median nervule short (3 mm. in length); the internal one at the end of the submedian nervure rather long (9 mm. or ·4 of an inch in length). UNDERSIDE, *both wings* rather dull orange. *Forewing* with the ground-colour of the apical third becoming gradually darker towards the outer margin; the inner margin pale. *Cilia* dark grey, inwardly almost fuscous. *Hindwing* with the costal third of the wing only dull orange, gradually merging into the white colour of the rest of the surface; the three large spots towards the anal angle as on the upperside, also the blackish streak on the abdominal margin; the spot in the second median interspace smaller, better defined, and of a deeper black; with two smaller rather indistinct spots in the two interspaces beyond; an outer discal series of four black spots, arranged nearly in a straight line, the one nearest the abdominal margin shaped like a very broad V, reaching from the internal nervure to the first median nervule, the three others decreasing in size, somewhat reniform, the anteciliary black thread of the upperside reaching almost to the apex

of the wing. *Cilia* pure white. *Face* with two white streaks; *palpi* very long and porrect, above fuscous, beneath white, except the tips which are fuscous; *thorax* and *abdomen* above dull hair-brown; abdomen beneath dull orange.

Allied to *N. amrita*, Felder, female specimens of which I possess from Perak, Singapore, and N.-E. Sumatra, but differs from the same sex of that species in being smaller, the tails (especially the inner one) much shorter, the white area on the upperside of the hindwing larger, and the costal orange area on the underside of the hindwing much smaller. Nearer to *N. clœlla*, Weymer,* with which it agrees in size, extent of white area on the upperside of the hindwing, and in the length of the tails, but differs entirely in the ground-colour of the underside, *N. clœlla* having it dull ochreous instead of dull orange; the black anteciliary thread in the hindwing is also twice as prominent in *N. clœlla* as it is in *N. nisibis*. It may also be near to "*Sithon*" *pallida*, Druce, from Borneo,† of which the male only is known; but that species is said to have "a blue line" above the outer black spots on the underside of the hindwing, which is absent in the present species. It is near to "*Sithon*" *paluana*, Staudinger,‡ but appears to differ on the underside of the hindwing in having the outer discal macular straight black band considerably further removed from the series of black spots beyond. The tails appear to agree in length. "*Sithon*" *teunga*, Grose Smith,§ probably belongs to some other genus than *Neocheritra*. It is described from a male, and the secondary sexual characters appear to differ from those of *Neocheritra*. On the underside it is said to be "dull pale brown," while *N. nisibis* is orange, besides other differences. Lastly, it differs from *N. namoa*, de Nicéville,‖ in the tails being much shorter, and the ground-colour of the underside orange instead of "pale bluish-white." I do not think it is very closely allied to *Thrix gama*, Distant, described from Penang, and males in my collection from the Battak Mountains of

* *Hypolycæna clœlla*, Weymer, Stet. ent. Zeit., vol. xlviii, p. 10, n. 8, pl. ii, fig. 5, *female* (1887), from Nias Island.

† Proc. Zool. Soc. Lond., 1873, p. 352, n. 14, pl. xxxiii, fig. 3, *male*.

‡ Iris, vol. ii, p. 107, pl. i, fig. 9, *female* (1889), from Palawan in the Philippine Isles.

§ Ann. and Mag. of Nat. Hist., sixth series, vol. iii, p. 317 (1889), from Kina Balu Mountain, North Borneo.

‖ Journ. A. S. B., vol. lxiii, pt. 2, p. 41, n. 36, pl. v, fig. 9, *male* (1894), from the Battak Mountains, N.-E. Sumatra.

N.-E. Sumatra taken in March,* and one female from Selesseh, N.-E. Sumatra, taken in May, in the collection of Hofrath Dr. L. Martin, though the coloration on both sides appears to be much the same, but *T. gama* has a very much longer hindwing than *N. nisibis*, and the black spot in the submedian interspace and the black anal spot of the hindwing on both surfaces seem to be much nearer to the outer margin in *T. gama* than in *N. nisibis*.

Described from a single example (the type) in my collection from Kwala Lampur, Selangore, in the Malay Peninsula, and another from N.-E. Sumatra.

34. HYSUDRA (?) HADES, n. sp., Pl. P, Fig. 46, ♂.

HABITAT : Daunat Range, Tenasserim, Burma.

EXPANSE : ♂, 1·55 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* shining fuscous. *Forewing* with a large dull coppery-red area occupying the middle of the wing crossed by the black veins and bearing a black streak outwardly on the submedian fold ; this red area just enters the outer end of the discoidal cell and occupies the basal portions of the lower discoidal, median, and submedian interspaces. *Hindwing* streaked between the veins more or less by the same dull coppery-red colour as in the forewing ; anal lobe coppery-red. UNDERSIDE, *both wings* pale fawn-colour; the disco-cellular nervules marked by a rather broad and prominent paler line. *Forewing* with a macular outwardly curved discal fuscous band, commencing at the costa, ending close to the submedian nervure ; an obsolete marginal dark fascia. *Hindwing* with a discal fuscous band as on the forewing, but more prominent, outwardly defined with white, posteriorly somewhat ferruginous, and recurved to the abdominal margin in a W-shaped figure ; a marginal series of four dark lunules from the first subcostal to the second median nervule ; a marginal oval black spot faintly crowned with orange in the first median interspace ; a clump of black and white scales in the submedian interspace; the anal lobe black faintly crowned

* *Neocheritra gama*, Distant, Rhop. Malay., p. 462, n. 2, woodcut fig. 128, *female* (1886) ; *Thrix gama*, Doherty, Journ. A. S. B., vol. lx, pt. 2, p. 35, n. 7 (1891), from Padang Rengas, Malay Peninsula. The female has three subcostal nervules only to the forewing, while the male has four.

with orange ; with a narrow orange fascia running along the abdominal margin from above the anal lobe to the termination of the discal band ; *tail* black, tipped with white. *Antennæ* with the shaft black annulated with white, the club black, the tip ferruginous. *Body* black above, fawn-colour below.

I place this species in the genus *Hysudra* with considerable doubt, but do so because the coloration of the upperside is very similar to that of *H. selira*, Moore, from the Western Himalayas, but more especially because the coloration and markings of the underside are almost identical. The tail, however, is twice as long as in *H. selira*.* As far as I can see, however, by the application of benzine to my unique specimen, it does not possess the characteristic male "scale-mark" of the genus *Hysudra*, but instead has that portion of the subcostal nervure between the point where the first subcostal nervule arises and the apex of the discoidal cell distinctly swollen and free of scales, with a small oval area also apparently free of, or covered with, colourless scales in the subcostal interspace immediately anterior to the point where the first subcostal nervule arises. Without bleaching the wings of a specimen it is difficult to define these characters accurately. The species may be a *Deudorix* ; it is certainly not a *Rapala*, as it does not possess a tuft of hairs on the inner margin of the forewing or a "scale-mark" on the costa of the hindwing, which are characteristic features of that genus.

Described from a single example in my collection.

35. RAPALA RHŒCUS, n. sp., Pl. P, Fig. 47. ♂.

HABITAT : N.-E. Sumatra.

EXPANSE : ♂, 1·5 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* very rich and dark slightly iridescent ultramarine-blue of a little darker shade and less

* Is not the "*Thecla*" *micans* of Bremer and Grey, which occurs throughout Northern, Western, and Central China, a *Hysudra*? To judge from Mr. Leech's figure of "*Rapala*" *micans*, var. *betuloides*, Butler, in Butt. from China, Japan, and Corea, p. 414, pl. xxvii, fig. 18, *male* (1893), I should certainly guess it to be so. To me that figure has all the appearance of a large specimen of a female of *H. selira*, Moore, from the Western Himalayas, with the orange colour of the hindwing on the upperside confined to a patch at the anal angle instead of being continued along the outer margin of the wing towards the apex.

iridescence than in *R. sphinx*, Fabricius. *Cilia* black. *Forewing* with the costa up to the subcostal nervure, the apex widely, and the outer margin decreasingly, black ; the veins crossing the blue area also black ; a conspicuous silky shining black "male-mark" on the middle of the disc, placed at the bases of the median interspaces, very slightly extending anteriorly into the discoidal cell, posteriorly into the submedian interspace. *Hindwing* with the costa and abdominal margin broadly, the outer margin narrowly, black ; the anal lobe centred with a black spot crowned with dull orange ; the *tail* black with a white tip ; a fine white anteciliary thread extends from the anal lobe to the termination of the second median nervule ; the tuft of hairs attached to the middle of the inner margin and turned under and forwards, black. UNDERSIDE, *both wings* dark olive-green ; a pair of fuscous lines closing the discoidal cells ; a discal fuscous band ; a submarginal and marginal dark fascia, both indistinct, especially the outer one. *Forewing* has the discal band with very even edges, commencing at the costa, ending in a point just before reaching the submedian nervure, outwardly bowed ; the inner margin broadly paler than the rest of the wing. *Hindwing* has the discal band slightly wider than in the forewing, very straight from the costa to the first median nervule, thence to the abdominal margin zigzag, W-shaped ; this latter portion is finely more or less edged on both sides with very pale greenish-silvery scales ; the round marginal black spot in the first median interspace crowned with dull orange ; the interspace beyond thickly sprinkled with greenish-silvery scales over a black ground ; the black anal lobe crowned first with a line of greenish-silvery scales, then with dull orange ; a fine white anteciliary thread as on the upperside. *Head* and *body* above black, *abdomen* beneath dark ochreous.

This species is nearly allied to *R. tara*, de Nicéville, from the Himalayas and Khasi Hills ; but the blue coloration of the upperside is quite different, being darker and richer in shade, less iridescent, and in the forewing of greater extent ; the sexual patch is also smaller, barely extending into the submedian interspace, in *R. tara* it extends somewhat widely below the first median nervule ; the ground-colour of the underside is also quite different. It is also near to *Rapala elcia*, Hewitson, from East Luzon and Polillo in the Philippine Isles ; but

the "silky rufous spot at the centre of the wing" is not nearly as large, in *R. elcia* it appears to be even larger than in *R. tara*; the coloration of the upperside appears to be very similar, except that in *R. elcia* it is far more highly iridescent, nearly as much so as in *R. schistacea*, Moore, while in *R. rhœcus* it is slightly iridescent only. On the underside of the forewing the discal band is said by Hewitson, and is figured by him, to be "equal" (*i.e.*, of the same breadth throughout its length), in *R. rhœcus* this band tapers away to nothing posteriorly. More distantly-allied species are *R. orseis*, Hewitson, which has a somewhat different male-mark; *R. sphinx*, Fabricius (=*R. varuna*, Horsfield, and figured by Hewitson under that name), *R. phranga*, Hewitson, from Batchian; *R. chozeba*, Hewitson, from Sumatra (which I have not seen); and *R. manea*, Hewitson, from Celebes. These last four, however, do not appear to possess a male-mark on the disc of the forewing on the upperside.

Described from numerous examples in my collection obtained by Hofrath Dr. L. Martin, at Bekantschan, at the foot of the Battak Mountains in N.-E. Sumatra, one of them on 4th July, 1893, and others from the Battak Mountains themselves taken in May and July.

(*To be continued.*)

THE OORIAL.

By J. D. Inverarity.

(*With a Plate.*)

(*Read before the Bombay Natural History Society on 28th January*, 1895.)

My experience of this sheep is confined to the range of hills that divide Sind from Beluchistan, where it is fairly numerous on the lower slopes of the Khirtar Range and in the low stony hills that lie at the foot of, and run parallel to, the main hills. Where I shot them in Sind was from a few hundred feet to about 2,000 feet above sea-level. They are no doubt to be found at higher altitudes, as the hills extend to about 7,000 feet in height, but as one camps near the water at the foot of the hills, I never managed to get any higher than 2,000 feet. I generally kept to the low hills, as the stalking there was easier. The Sind Oorial is the same animal as is found in the salt hills of the Punjab, and used to rejoice in the name of *Ovis cycloceros*. Mr. Blanford, however, in the "Fauna of India (Mammalia)" considers it to be the same as the climatic variety known as *Ovis vignei* which inhabits the Himalayas, at an elevation of 15,000 feet. The differences or supposed differences between the two are set forth in the Badminton Library volume on Indian Game. The Sind name for the Oorial is "Gud." It is usually shot in Sind by driving the hills, but the best sport is to stalk it. It would be a fairly easy animal to stalk if it were not that the ground one has to get over is a mass of loose stones, which grate horribly against each other as you tread on them and slip away and roll down the hillside. The lower hills are of conical shape with steep sides covered with loose stone. There are a good many lumps of petrified wood in places and fossil shells. Here you see the Seesee partridge running about among the rocks, while overhead high in the air, in the month of October, are long flights of the "Cullum" on their annual migration to India. The best herd of Oorial I saw numbered fifteen with three good rams. I had carefully examined the slope of the opposite hill, 400 yards off, without seeing anything. I showed myself over the ridge and up got the herd from the hillside where they had been sitting undistinguishable by me, or my Beluchees, from the surrounding rocks. On another occasion I saw a fine ram



From a photograph by Mr J. D. Inverarity.

Mintern Bros. Photo imp. London.

THE URIAL, OR SHA.

Ovis vignei.

and three females lying under the shade of a large rock 400 yards below me, but, as there was no way of getting near them, I sat down and waited for them to move, occasionally peeping over the ridge to see what they were about. It being the middle of the day, I did not expect them to move for some time and was lying down, when I heard a rattle of stones, and a female topped the ridge within a few yards of me, saw me, and bolted. I made for my rifle which was lying a short way off. Another female followed the first, and a tremendous clatter of stones on the other side of the ridge greeted me as I reached the top. There was the ram and the remaining female galloping away along the hillside not more than 60 yards off. The rest is too painful to recall, suffice it to say that the ram's head, a remarkably fine one, is not in my collection. Early one morning I saw a single ram standing on the sky-line of a ridge of hills, and, making a long round, got to the spot and was standing on a rock looking about for him, when he suddenly started from under my feet; he was lying under the very stone I was standing on and went down the hill at a great pace. I missed him. Yet another day the fates were against me. I had been watching a ram by himself for some time, when he began to walk towards a gap in the hills. I hastened down to it to intercept him, and as I got to the far side of the gap, I heard the stones rattling as he came along about 100 yards off; on he came till he was within ten yards of me, though of course, I could not see him as he was the other side of the ridge, when a puff of wind blew through the gap in the wrong direction and he turned and fled. I rushed to the top of the ridge; he had stopped for a moment and presented an easy shot. My cartridge missed fire.

In most shikar stories "what is hit is history, what is missed is mystery." I have in this paper reversed the saying and refrain from expatiating on the successful days that fall to the lot of every one who perseveres and which fully compensate for the toil of many a blank day. The photograph was one of my early efforts in that line, and is by no means a good one. The head is fairly good, 26 inches long. Like all wild sheep the coat is of coarse hair. I find in England that people are generally under the impression, when you point to a head as that of a wild sheep, that you have massacred a woolly animal of a confiding disposition, whereas all wild sheep have the skin of a deer and are quite able to take care of themselves. A distinguish-

ing feature of the old ram Oorial is the long mane of hair that hangs down the whole length of his neck. The female has short horns, a few inches long, which stand almost straight up. I caught a young one, which refused to eat, though it was old enough to eat grass, having horns an inch long; I let it go, when I found it would starve if kept. A young Sind Ibex I had at the same time, ate greedily from the first day of capture. Mr. J. Strip, Assistant Collector of Customs, Kurrachee, writes to me :—"The Oorial, as far as my experience of the "animal in Sind extends, avoids the higher ranges of hills in which "Ibex is found. In Beluchistan, however, I met with them in "the higher ranges of the Pabb Hills as well as in the considerably "lower hills westward of the Pabb. There is no apparent difference "between the Sind and Beluchistan 'Gad' proper. The rams have a "sleek coat in summer, when the beard and throat-ruff is nearly absent." The Oorial, however, has no beard proper, *i.e.*, hair on the chin. The long hair begins at the throat and extends to the chest.

Mr. Strip has also kindly sent me some measurements of "Gud" heads shot by him in Sind and in Beluchistan. The measurements of those shot in Sind are—No. 1, 30 ; No. 2, 26 ; No. 3, 25¾ ; No. 4, 25½ ; No. 5, 25¼ inches. Of those shot in Beluchistan No. 1, 31⅜ ; No. 2, 31¼ ; No. 3, 27¼ ; No. 4, 26⅜ inches.

In each case I have given the measurement of the longest horns, as there is generally a slight difference of ¼ of an inch or so between the horns. Mr. Strip says the tip of the horn of 31⅜ inches was almost touching the eye. Its fellow had the tip broken and measured 31⅛. The circumference of these horns was 8¾ inches. The circumference of the horn of 30 inches was 10 inches.

AN ADDITION TO THE OPHIDIAN FAUNA OF INDIA.
(*TARBOPHIS RHINOPOMA*, BLANF.)

By G. A. Boulenger, F. R. S.

(*Read before the Bombay Natural History Society on 28th Jan.*, 1895.)

During a recent visit to London Mr. Phipson has submitted to me a young Dipsadine snake from Sind, which differs from any hitherto recorded from India. It belongs to a species discovered in Persia, at Karman, by Mr. Blanford, and described by him in his "Zoology of Persia" (p. 424, pl. xxviii, fig. 2) as *Dipsas rhinopoma*. Dr. Boettger (Radde's "Faun. Flor. Casp.-Geb.," p. 72, 1886) has already pointed out that this species is strictly a *Tarbophis*, which genus differs from *Dipsas* in the enlarged anterior maxillary teeth and in the absence of distinctly enlarged vertebral scales. The species should therefore bear the name *Tarbophis rhinopoma*.

The specimen which Mr. Phipson has kindly presented to the British Museum measures 485 millim., in which the tail enters for 75. It has nine upper labials, third, fourth, and fifth entering the eye ; 280 ventral shields, and 82 pairs of subcaudals.

I append a description of the species :—

Tarbophis rhinopoma.

Dipsas rhinopoma, Blanf. "Ann. and Mag. N. H.," xiv, 1874, p. 424, and "Zool. E. Pers.," p. 424, pl. xxviii, fig. 2. Head very distinct from neck ; snout broad, rounded ; eye moderate. Rostral broader than deep, just visible from above ; internasals broader than long, shorter than the præfrontals ; frontal slightly longer than broad, as long as its distance from the end of the snout, a little shorter than the parietals ; nasal semi-divided ; loreal twice to twice and-a-half as long as deep, entering the eye below the præocular, which is in contact with the frontal ; two postoculars ; temporals small, scale-like, 2 or 3 and 3 or 4; eight to ten upper labials, third, fourth, and fifth, or fourth and fifth, or fourth, fifth, and sixth entering the eye ; four or five lower labials in contact with the anterior chin-shields ; posterior chin-shields very small and widely separated from each other by scales. Body slightly compressed. Scales in 23 rows. Ventrals 268 to 280 ; anal entire ; subcaudals 76 to 82. Pale sandy-grey above, with a dorsal series of 65 to 85 brown square or transverse spots larger than the interspaces between them, and an alternating series of smaller spots on each side ; on the posterior part of the body the dorsal spots may split up into two alternating series ; head with small dark spots or specks ; labials dark-edged ; throat white ; ventrals dark brown.

The type specimen from Karman, South Persia, 5,000 ft., in the British Museum measures 990 millim. ; tail 155.

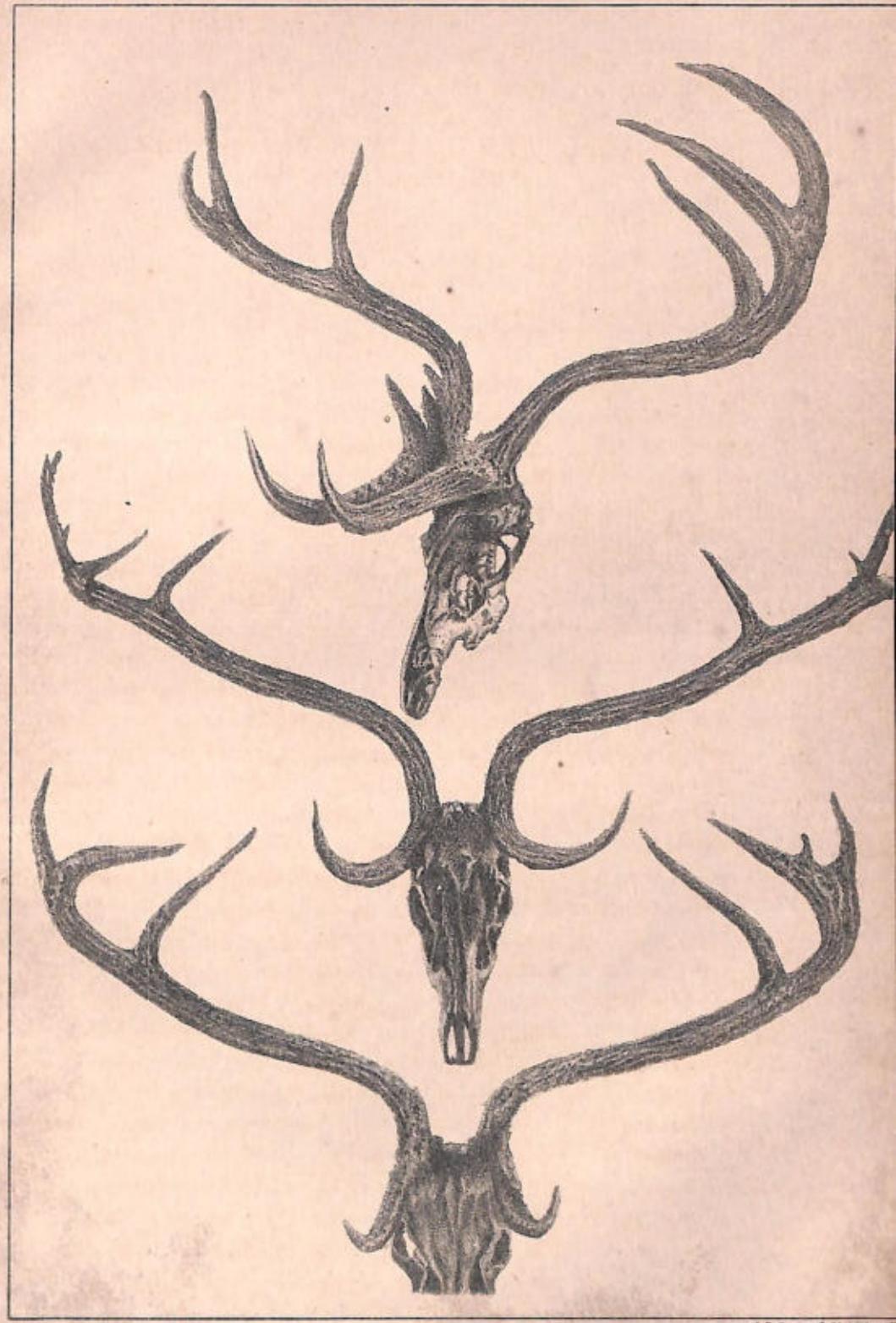
NOTES ON THE THAMIN OR BROW-ANTLERED DEER (*CERVUS ELDII*).

By Vet.-Capt. G. H. Evans.

(*With a Plate.*)

(*Read before the Bombay Natural History Society on 28th January*, 1895.)

These beautiful creatures are essentially a plains-loving species of deer, and are found in this country from the valley of the Chindwin River as far as Tenasserim. They may be seen in large numbers on the immense plains of Lower Burma, which lie between the hills and the sea. The chief characteristics of the forest on these plains are the dense, almost impenetrable, growth of elephant grass (called *Kaing* by the Burmese), and the remarkable scarcity of trees amongst it; the few that are seen usually grow at great distances from one another and are low, very often only slightly higher than the surrounding grass. The stems are short and the tops irregularly developed, which features are, no doubt, in a great measure, due to the injuries the trees suffer from fires during certain times of the year, and also to the fact that the roots are damaged by excess of moisture during the rains. Those most commonly met with are the *Butea frondosa*, *Zizyphus jujuba*, *Streblus asper*, *Nauclea sessifolia*, *Lagerstræmia flos-reginæ*, and the *Strychnos nux-vomica*. The soil appears to be perfect for elephant grasses, as in many places they attain an immense height, and the halms are frequently as thick and woody as those of certain small kinds of bamboos. A man standing on the rails of a high bullock-cart is easily concealed by these grasses. The more common varieties found are the *Saccharum spontaneum*, *Saccharum procerum*, *Polytoca heteroclita*, *Imperata cylindrica*, and several varieties of *Arundinaria*. Generally there is little or no scrub jungle about, but occasionally a few bushes of the *Hibiscus* order may be observed along the banks of a tidal creek. The plains, except where broken up by belts of jungle, or intersected by tidal creeks, extend for many miles along the coast, the fore-shore of which is, for a mile or two inland, covered with a belt of mangrove forest. As far as I am aware, Thamin never enter it, nor have I heard of them in the hills, or taking to heavy jungle, by which I mean jungle where the undergrowth is very dense and tangled.



A.P. Cortez & Co. Lithos.

From Photographs.

THE THÀMIN OR BROW-ANTLERED DEER.

(CERVUS ELDI.)

In Upper, as well as in Lower Burma, I have frequently found them in scrub and in open tree jungle (*Eng-daing*), which consists of *Dipterocarpus tuberculatis*, and other trees of this order which flourish on laterite soil. The animals resort to these places for shade, grasses, &c.

Thamin are gregarious in their habits, keep very much to themselves, and though Para (*Axis porcinus*) abound on the same grounds, I have never seen the two species grazing together. The herds usually number from eight to sixty, but the latter number is often exceeded. During the dry weather fires occur, the result being clearings large and small, and as at this time of year the dew is particularly heavy, it is not long before the young grass sprouts up. There are also open patches (called *kwins* by the Burmans)—low-lying grounds which are swampy during the rains, but which retain sufficient moisture in the dry season to maintain the growth of grasses, thus affording luxuriant pasturage. In these places Thamin may be found grazing in the early morning and evening. Other favourite resorts are the shallow Choungs or Nullas; and in such places, as soon as the water dries up, which is early in the hot weather, a very quick-growing leguminous plant springs up, of which these creatures, as well as Para, are very fond. The time for grazing is, off and on, between 3-30 p.m. and 9-30 a.m., after which hour they retire into the long grass to rest, and avoid the heat of the day. When it is exceedingly hot, and the flies very troublesome, the stags often come out for a short time to wallow in a bog-hole. There is a common belief, and, I think, an erroneous one, that Thamin rarely if ever drink during the dry season; this idea has probably arisen from the fact that fresh water is then uncommonly scarce, but I fancy if it were plentiful and more accessible, they would be more frequently observed partaking of it. During the rains, on certain low-lying grounds, large ponds are formed, which retain a good amount of water in the hot weather, but Thamin rarely have access to such spots, as they are invariably leased out for fishing purposes. However, a Burman, whom I know well, and who had the rights over one of these fisheries, informed me that Thamin came in late every evening to drink at a waste pool, about four hundred yards distant from his shed; at the same time he mentioned the case of a sporting Eurasian, who succeeded in killing a few animals by lying

up in the long grass alongside, and suggested, that if I only tried the same method I should certainly be well rewarded. Fortunately for the game, our ideas on sport differ from those of the Burmese. As a matter of fact, I expect these animals do go a long time without water as, the dew being so very heavy, a considerable amount of moisture must be taken in with the food.

Under ordinary circumstances, and when the usual precautions regarding wind, etc., are taken, they are not very wary or difficult to approach, but if the grounds have been disturbed, which is especially the case if dogs have been over them, the deer are very sharp and shy; the least thing alarms them. At first, they move off with a few big bounds, but before long settle down to a long swinging trot, which I should describe as their pace when alarmed. Strangely enough, when startled, they do not generally make for the nearest cover, but prefer to trot along in the open, halting, every now and then, to have a good look at the object which caused them fear. The case is different with wounded stags; they take to any cover fast enough, and to follow them into the grass would be almost as foolish as searching for the proverbial needle in a bundle of hay. One great blessing, however, is that the misery and annoyance of feeling that you have wounded a beast only to die a lingering death, can be avoided, as dogs are always procurable at any fishery, and if a stag is at all damaged, they are not long in running him down. A few shots daily do not disturb the ground much, neither do carts, as during the fair weather they are employed taking things to and from the fisheries, and bringing in thatch.

During the period when the Thamin stags are in velvet they do not appear to keep much with the herds, but mix more freely with the hinds when their horns are fully developed, which is at the end of February and beginning of March. The rutting season is April and May, when a certain amount of violent excitement is noticeable, but the stags are, when compared with those at home, wonderfully quiet about their hinds. Fights, of course, do take place occasionably, when the clashing of horns may be heard some distance off. The ruff, at this period, is seen to perfection.

Hinds go in calf from six and-a-half to seven months, the young ones being born in the long grass in October and November. The

young are pretty little creatures, and their coats frequently have white spots running through them, but these soon disappear. The hot weather is, undoubtedly, the correct time to shoot the Thamin, at least in Lower Burma, as the stags are all out of velvet in the early part of March. April and May are also good months, but a trifle warm; during the heat of the day a temperature of 109° Fahr. in the shade may be expected. Stags may be killed as late as the end of August, but to my mind there is no sport in these parts once the rain sets in. Early morning and the evening are the best times to find them. The best plan is to make head-quarters at, or rather near, a fishery, taking every precaution to have your shed or tent put up well to windward, otherwise you expose yourself to "olfactory inferno" and intense bodily discomfort, as the Burmans go in for making "*Ngapi*" at these places, which is with them a favourite and highly-esteemed condiment. Describing it in simple language, I should say that it consisted of small fish in the very last stages of putrefaction, with a minimum quantity of salt sprinkled over it.

Water is a serious difficulty, as arrangements must be made to obtain a daily supply for cooking, &c., but for drinking purposes sodawater should be carried. A large sola hat and a back protector will afford much comfort to the sportsman. Having attended to these details, two comfortable courses are open, *viz.*, to take a high bullock-cart, which enables him, when standing up, to see over the grass in many places and so get a view of a *kwin* with his glasses. (These *kwins* are well known to certain men.) If he happens to be fortunate enough to see a good stag, he can easily jump out and stalk it. It is also advisable to steer for a tree, old pagoda, or any other point of vantage whereby he can obtain a view of the country. The other plan is to get an elephant, which is perhaps the better method, as a more extensive view may be obtained than from a cart; moreover, it has this advantage that when returning to camp very close snap shots may be taken while passing through the long grass. Thamin are not much alarmed by the sight and smell of an elephant, as two or three herds of wild ones visit these plains each rainy season. I do not think that shots can often be obtained from a cart, but I cannot speak from experience on this point.

The track of a Thamin is very like an impression made on the ground by moderately separating the index and second finger, and it is anything but a neat track. I think the best weapon to use is an ordinary ·500 express, or better still, a magnum ·500. The great danger threatening the Thamin is the annual slaughter that takes place. During the early part of the rains, when the grounds are swampy, a number of men armed go out with spears, eight or ten feet long, and mounted on buffaloes, of course taking their dogs with them. A certain number of men surround a patch of *kaing*, the remainder go in with the dogs ; gradually the mounted men close in, and by this simple method Thamin stags, hinds and calves, as well as hog-deer, and pig come to an untimely end. When the rains are more advanced, and the plains in consequence flooded, the wretched beasts are forced to congregate on any pieces of high ground they can find, so a slightly different plan is adopted. Men armed with spears or *dahs* (rough swords) take their dogs and sally forth in canoes ; the strip or strips of land on which the poor beasts are taking refuge is surrounded ; some few men then go ashore with the dogs, and the Thamin are then hunted and mercilessly cut down. Some endeavour to escape by taking to the water, but the men in the canoes pursue them and kill them with spears. The flesh is distributed among those taking part in the hunt ; a certain amount is eaten, some is cut into strips and smoked for future consumption, and if there is any left, it is sold to the villagers. Very often many carcases are taken into the large towns where the meat is greatly prized, and good prices obtained for it. To such an extent is this system carried out that I, as well as others, have, during the last few years, noticed the annual decrease of these most lovely animals. Grounds where, only five years ago, herds of these deer were to be seen, are now almost deserted. I am of opinion that, before long, the Thamin will be very rare on these plains.

In Upper, and in some parts of Lower Burma, very good shooting may be had quite close to villages, as the Thamin come to feed on the crops.

In places where the slopes of the hill ranges sweep down out into the plains, by beating the grass in the vicinity with a line of elephants, other game may be found, such as gaur, sambar, bear, pig, and now and again a panther or tiger.

THAMIN.—General Description of the Colour.—This varies a great deal according to the age of the animal. Some sportsmen are of opinion that two kinds of Thamin exist, but up to the present I must say that I have failed to observe anything in the anatomy or habits of the dark and light-coloured Thamin to incline me to such a conclusion. Any difference there may be as regards colour is, in my opinion, due to age, season of year, and perhaps to some small extent to the locality in which they may be found. I should describe the colour of mature stags to be a dark russet-brown, which, when seen at some little distance off, conveys an impression that they are blackish. The coat is long, fairly thick, shaggy, especially down the course of the spine, and also about the neck. During the "rutting time," the hair in this region is from 4½ to 5 inches in length. The hair is coarse, rather easily removed, and is of a dark brown colour. Young stags vary much in colour; up to about the age of two years they are very like the hinds, requiring the aid of glasses to make out their "knobs;" but as they grow older the sides become darker in colour, and continue to deepen every year till the animal arrives at maturity. I have not yet seen a light-coloured stag carrying what would be termed a really good head. The hair surrounding the eyes, and infra-orbital sinuses, is of a darkish dun colour; that under the jaws is coarse, long and thick, shading off to a dirty white round the lower lip. The hair within the ears is also a dirty white, while that which covers the external meatus is long, and the colour at the base of the ears is lighter than the general colour of the body. The hair on the inside of the forearms and thighs, as also that on the under and posterior part of the abdomen, is a dirty white, and when washed with soap and water it is seen to be quite white. On the sternum the colour is generally dark, which, I think, is due to mud and dirt; but of course the underpart of the tail and dock are quite white.

The hinds are of a glossy brightish-chestnut, the underparts being light-coloured, and the hair is finer and much cleaner than is the case with the stags. The calves are pretty little creatures and are usually spotted (white).

Heads.—These vary immensely in shape, size, spread, number of points, etc., but they all possess the remarkable development of the

basal or brow antler, which, instead of pointing forwards, upwards, and outwards, as is generally the case with samber, cheetal, etc., those of the Thamin take a direction slightly downwards, forwards, upwards, and outwards, which difference gives the head its singular appearance. With reference to the development of the horns my observations have led me to the following conclusions, *viz.* :—That from a year to eighteen months after birth the young males may be distinguished from the hinds by the presence of very small protuberances or "knobs" on the skull, known, I believe, as "bossets;" shortly after this they become longer and pointed, and in the third year the brow antler appears, the beam or main horn taking a backward curve. After this period the horns, at each renewal, increase in length, thickness, and spread, till the animals reach their prime, when I am of opinion that the horns diminish in size at each renewal, as many aged stags carry most indifferent heads. The ages have been judged by the state of the teeth, allowance being made for the wild state.

The horns are cylindrical and grow from the pedestals or "bossets," which are from an inch and-a-half to two inches long. The basal antlers, as a rule, run out in a direction downwards and forwards for some few inches, then take an upward and outward sweep, but at times they run parallel to each other. The direction of the main horn varies very much, but generally speaking it runs backwards and upwards for several inches and then takes a somewhat sudden and sweeping curve, laterally outwards, upwards, and slightly inwards. The terminal portions of the main horns are slightly palmated. The heads I have shot in Upper Burma are nothing like as fine as many I have shot in the lower part of the Province; though the horns were long they were wanting in the lovely sweep which makes these heads so beautiful. Each horn is more or less semi-circular in shape. I should say the majority of good heads have ten distinct points inclusive of the brow antler, and they are disposed as follows :—An upright tine given off at the junction of the brow and beam; a second given off on the inside of the main horn about three-fourths of the way up and pointing inwards; and a third is given off on the upper surface of the horn a few inches from the terminal point. The greatest number I have observed on any head was fifteen—all well developed tines. I believe it is the custom at home to reckon any excrescence a point if

a wine glass can be hung on it, and counting in this way I have seen one head with seventeen. These secondary points are usually given off from the upper surface of the brow antler and from the latter portion of the main horn.

It is curious that, notwithstanding the fact that so many antlers must be shed annually, it is very seldom that a cast horn is picked up.

In size the Thamin resembles the red deer. As regards the ears and the fulness and brightness of the eyes, they are like other members of this family. The face is somewhat long and narrow, and the muzzle broad and full. Height varies from 10·3 to 11·1, and the girth round chest from 39 to 44 inches.

VOICE.—The "bell" of one of those beasts is difficult to describe, but it is a kind of gutteral ba-ah.

WEIGHT.—A good stag, cleaned, I should think, weighs from thirteen to fourteen stone.

I give below the measurement of an average-sized stag :—

Length of face from nose to crest of occiput	...Eleven and-a-half inches.
From pall to end of tail	...Sixty-one inches.
Length of tail	...Five inches.
Girth round neck behind jaws	...Twenty-one inches.
Round base of neck	...Thirty-one inches.
Girth round chest behind elbows	...Forty-two inches.
Round abdomen	...Thirty-eight inches.
Round forearm	...Eleven inches.
Under knee	...Four inches.
Height at withers	...Forty-four and-a-half inches.

This stag was shot early in the afternoon, the measurements were taken very carefully with a tape measure about two hours after death. He carried a very nice head.

The sight of a stag on the "qui vive" is one to be remembered ; the carriage of his beautiful head, crowned with the many-tined antlers, with the breeze just waving his 'ruff' to and fro, setting off his body to perfection, all reminds one of Landseer's famous picture, "The Monarch of the Glen."

MISCELLANEOUS NOTES.

No. I.—FOOD OF THE BULL-FROG.

I am very anxious to learn if it is a common thing for frogs to attack and eat other reptiles.

During the Pooja holidays I had occasion to go into the garden, at about 3 p.m., and on stepping out startled a lizard which ran across the path, when it was met half-way by a frog, who with one bound seized and swallowed it. I followed the frog and found him under a bush close by, with about an inch of the lizard's tail protruding from his mouth, and by the time I had caught him the lizard had quite disappeared, and the frog was apparently perfectly comfortable. I tried to force his mouth open to make him disgorge the lizard, but he kept his jaws clenched so tight that I was unable to do so, and not wishing to hurt him, I let him go. The frog was one of the ordinary dark green ones, with a yellow line right down the centre of his back, and the victim was a common garden lizard.

A few nights later, I was watching one of these frogs under a table in the drawing-room, when a toad, about half his size, hopped towards him, and was immediately disposed of in the same way as the lizard, but was apparently more restless and less tasty, and it struck me that the frog, on this occasion acting on impulse, had swallowed his plump little cousin by mistake. Immediately after swallowing the toad he began to show signs of great discomfort, and struggled hard to evict the unwelcome tenant, and after almost standing on his head, and pawing at his mouth for about a minute, his jaws suddenly seemed to spring open and out came the toad, covered with saliva (probably of his own production, and the cause of his eviction), and beyond the fact of his displaying more activity than is usual in toads, he seemed none the worse for his forced visit.

I shall be very glad to know if the food of the Bull-frog has been recorded, as, during the 14 years that I have spent in this country, I have never witnessed a case of this sort, and was under the impression that frogs fed entirely on insects.

I may mention that I forwarded a specimen of these frogs to the Superintendent of the Calcutta Museum, who informs me that it is the common Indian Bull-frog, *Rana tigrina*.

J. DUNDAS WHIFFIN.

ROURKELA, SINGBHOOM, B. N. R.

No. II.—MUSCULAR ACTION AFTER DEATH.

With reference to the curious instance described by Mr. E. J. Ebden, in No. 4, Vol. VIII of this Journal, I should like to mention a somewhat similar experience of my own.

In 1887, when on the march to Peshawur, I came across a large water snake about 40 yards, if I remember right, from a pool. I fired at it and cut it into two about the middle of the body. To my astonishment the halves of the snake, which were completely separated, made for the water, and, reaching it about the same time, disappeared. Finding that my veracity was liable to be called in question whenever I mentioned this incident, I have of late kept it to myself.

L. H. PARRY, Capt., R.A.

Hingoli, Deccan, *July*, 1894.

No. III.—THE EFFECT OF MUSIC ON ANIMALS.

Mr. C. K. Cornish has recently published the results of his experiments as to the effect produced by music on various animals at the Zoological Gardens in London, and it would be interesting if investigations of a similar character could be made in this country by those in a position to carry them out. Mr. Cornish says :—

"At the first sounds of the flute most of the monkeys ran away; and the piccolo excited loud and angry screams from all sides. Clearly in this case the violin was the favourite. We then decided to take the opinion of some of the largest and least vivacious animals, and selected the young African elephant for our next auditor. As this animal had shown the utmost dislike to the violin on a previous occasion, the flute was employed to open the concert, and with complete success. The elephant stood listening with deep attention, one foot raised from the ground, and its whole body still—a rare concession to the influence of music from one of the most restless of all animals. So long as the flute continued, it remained motionless and listening. But the change to the piccolo was resented. After the first bar, the elephant twisted round, and stood with its back to the performer, whistling and snorting and stamping its feet. The violin was less disliked, but the signs of disapproval were unmistakable. The deer, as before, were strangely attracted by the violin, and showed equal pleasure in the tones of the flute; the gemul deer, for instance, ran up at once to listen to the latter, their ears and tails being in constant movement at every change of tone or tune. Even the ostrich seemed to enjoy the violin and flute, though it showed marked signs of dislike at the piccolo, writhing its neck and walking uneasily up and down its enclosure. The ibexes were startled at the piccolo, first rushing forward to listen, and then taking refuge on a pile of rocks, from which, however, the softer music of the flute brought them down to listen at the railing. The wild asses and zebras left the hay with which their racks had just been filled; and even the tapir, which lives next door, got up to listen to the violin; while the flute set the Indian wild asses kicking with excitement. But the piccolo had no charms for any of them, and they all returned to their interrupted breakfasts."

No. IV.—A NEW GAZELLE.

When in Biskra, Algeria, some two years since, I was struck by the curious formation of a pair of Gazelle horns which was shown me. Having collected a series of these horns, it seemed to me that there could be little doubt of the animal being unknown to science, although the evidence of the horns was very slight, the skull and skin being then unobtainable.



Gazella loderi.

Sir Edmund G. Loder has been fortunate enough to shoot some specimens, a description of which now appears in the proceedings of the Zoological Society.

For the information of those of your readers to whom the Society's publications are not immediately available, I append an illustration of this new Gazelle now known as *Gazella loderi*.

The animal shot by Sir Edmund G. Loder stood about 2 feet 4 inches at shoulder and weighed about 34 lbs. It is interesting that this new Gazelle should be discovered within 7 days' journey of London.

The large game of the country consists of Boar, Lion, Wild Sheep (*Ovis tragelaphus*), two other varieties of Gazelles (*G. dorcas*, *G. cuvieri*), and *Addax*; the latter animal however is very little known to European sportsmen.

ROWLAND WARD.

166, PICCADILLY, LONDON,
9th October, 1894.

No. V.—A BIRD EATING A BUTTERFLY.

On the night of 30th April, 1894, I stayed at the Risoom dâk bungalow, 6,600 feet elevation, in the Kalimpong district of Darjiling, Sikhim. The next morning I was looking at the butterflies flying about, and amongst others saw some half a dozen males of *Teinopalpus imperialis*, Hope, circling round the top of a flowering tree about five or six yards from and below me. As I was observing a fine specimen as he flew past, a king-crow, *Dicrurus longicaudatus*, A. Hay, came down with a regular swoop, and carried off the butterfly. As but few have actually observed insectivorous birds eating butterflies, I think this observation is worthy of record.

G. C. DUDGEON.

Fagoo Tea Estate, Western Duars.
May 15th, 1894.

No. VI.—LIFE-HISTORY OF *RAPALA SCHISTACEA*, MOORE, A LYCÆNID BUTTERFLY.

Larva when full grown quite three-quarters of an inch in length; the anterior segment contractile; rather stout; of the usual onisciform shape, but much stouter than the larvæ of *Arrhopala rama*, Kollar, *A. dodonæa*, Moore, and *A. ganesa*, Moore, or of *Zephyrus birupa*, Moore, for example, being roughly cylindrical instead of flattened. Head globular, very small, retractile, and when protruded, singularly like that of a tortoise. Outline from above, a hexagonal cylinder (one visible side of which is dorsal, two subdorsal), very slightly narrowing towards the head; segmental folds deeply marked; the spiracular and subdorsal ridges very deeply serrated. The humps are sharply pyramidal. Of these, there are two unbroken series on each side, one subdorsal and one spiracular. The subdorsal series consists of eight humps, continuous from the third to the tenth segment. The spiracular series consists of eleven humps, continuous from the third to the thirteenth segment. Each hump bears two, three, or four short brown hairs. The texture of the skin is soft, smooth, and velvety. Ground-colour purple-brown; head dark brown, with a narrow white band across the face immediately over the mouth; on each side of this band is a small white spot. The brown colour of the head shades off into a dull yellow towards the neck. The subdorsal and spiracular humps are of a dull crimson, and are bordered laterally with white lines, which give them the shape of the teeth of a saw. The white spiracular line is continuous. Posterior to the white spiracular line there is a lunulated band of the ground-colour shading into pink above the claspers. Legs, claspers, and abdomen of a pale blue-grey. Larva feeds at Mussoorie in the Western Himalayas on *Spiræa sorbifolia*, Linnæus.

June 30th, 1894.—Larva pupated during the night. Pupa half-an-inch in length, stout, of a very dark brown colour. *July* 20.—Imago emerged to-day.

"Livelands," Mussoorie,
20th July, 1894.

Mrs. S. ROBSON.

No. VII.—LIFE-HISTORY OF *ATHYMA OPALINA*, KOLLAR, A NYMPHALINE BUTTERFLY.

May 13*th*, 1894.—I saw at Mussoorie, in the Western Himalayas, a female of *Athyma opalina*, Kollar, lay on the leaves of *Berberis aristata*, Hook. It fluttered over the leaves, and curled the apex of its abdomen under a leaf, depositing an egg on the underside. The egg is round, but is a little flattened at its base where it rests on the leaf. When first laid it is brown, and is covered with silvery dots which glisten in the sun. *May* 18*th*.—The ovum turned to a greenish-yellow with a brown crescent to be seen through its centre. *May* 20*th*.—This dark mark filled the anterior moiety of the egg, the posterior moiety being of a light dirty yellow. *May* 21*st*.—Larva emerged, but no trace of the egg-shell was to be seen, so probably its first meal was made off the shell. Larva a quarter of an inch long, of a dull green colour, with a very large brown head. *June* 5*th*.—Larva now about five-eighths of an inch in length, colour brown, with a bright green dorsal patch, and covered with small tufts. *June* 6*th*.—Larva changed its skin during the night, and is now much more bristly. *June* 9*th*.—Larva again changed its skin. The spines are now more prominent. *June* 13*th*.—Larva changed in the night from a dark brown to a beautiful green colour, very closely resembling the colour of its food-plant. There is a spiracular somewhat lunulated narrow yellow band. This band is whitish on the last three segments ; the underside is brown, merging into pale green on the last three segments. The legs and claspers are also brown, but of a darker shade. Head round, colour raw-sienna ; two A-shaped dark bars on the face are covered with minute white spines. Two black spines on the top of the head ; the rest of the head covered with raw-sienna-coloured spines. The third and fourth segments are each armed with a whorl of four branched raw-sienna-coloured spines. The fifth, seventh, eighth, ninth and tenth segments with smaller spines ; the twelfth segment with two branched spines ; the thirteenth segment with four simple anal spines, and two small branched spines just above them. The subdorsal series is very much the largest, particularly so on the fifth segment. All the branches are of a darker brown colour tipped with white. The larva is entirely covered with minute white spots. *June* 20*th*.—There is now a dorsal band, moss-green in colour, spotted with darker green ; a broad lateral blue band lined transversely with darker blue bars crossing the band obliquely ; a somewhat irregular narrow spiracular band extending from the sixth to the thirteenth segments, colour orange and pale ochreous alternately, the orange colour corresponding with the middle of each segment ; posterior to this is an interrupted brownish line. Legs black ; claspers and abdomen pale whitish-green. Length one inch and-a-half. *June* 21*st*.—Larva suspended itself by the anal claspers. Colour throughout yellowish-white. During the day from the head to about the middle the larva became much yellower, and the posterior half became almost quite white. *June* 22*nd*.—Pupa of a dingy white. *June* 23*rd*.—Pupa of

ERRATUM.

In Mr. P. W. Mackinnon's collection is a male specimen of *Tajuria diæus*, Hewitson, bred on 20th November, 1894, from a pupa given by Mrs. Robson to Mr. Mackinnon as a pupa of *Camena cleobis*, Godart. It appears, therefore, that Mrs. Robson incorrectly identified her specimens, and that the note No. viii, on page 339,—"Life History of *Camena cleobis*, Godart, a lycænid butterfly" should read "Life History of *Tajuria diæus*, Hewitson."

LIONEL DE NICÉVILLE.

MUSSOORIE, *October 8th*, 1895.

a brilliant metallic hue, and looks like burnished gold with burnished silver wing-cases. *July 6th.*—Imago emerged.

MRS. S. ROBSON.

"LIVELANDS," MUSSOORIE,
20th July, 1894.

VIII.—LIFE HISTORY OF *CAMENA CLEOBIS*, GODART, A LYCÆNID BUTTERFLY.

June 24th.—Found several eggs of *Camena cleobis*, Godart, on *Loranthus bicolor*, Linn. (vernacular name "Banda"), at Mussoorie, in the Western Himalayas. The eggs were laid either on the stems or on the underside of the leaves. In shape they are spherical, and covered with honeycomb-like indentations. The larva emerges either from the side or the top of the egg, and eats a small round hole in the shell to get out. It does not eat the shell after it emerges. At the same time was found a larva of a lycænid butterfly on the underside of a leaf, and it bore a striking protective resemblance to the pink and yellow shades of the edge of the leaf, on which it rested quite flat, with no legs or claspers visible. The larva was of the usual onisciform shape, except that it was a little stouter than usual posteriorly, and much stouter anteriorly, so that the outline was roughly that of a club. The whole larva was yellowish-green, except a faint pink patch on the anterior segments, beneath which the head is usually withdrawn. This larva changed its skin on the 26th, and died on the 29th.

July 7th.—On a quantity of "Banda" brought into the house, two lycænid eggs were found, and placed in a very small bottle. *July 13th.*—A very minute larva emerged from one of the eggs. Length one-sixteenth of an inch. It fed on one of the leaves, and was most difficult to distinguish from its food-plant, and would not have been discovered had I not seen the hole in the egg. *July 19th.*—The larva has changed its skin and is now a quarter of an inch long. Colour green. The larva is very depressed, with a pink spot on the "hood," by which is meant the anterior segments beneath which the head is hidden. The larva eats a small hole half-way through the leaf, and then moves to a fresh place. *July 30th.*—Larva now three-eighths of an inch long, somewhat fish-shaped. The "hood" is dented anteriorly, and when seen laterally reminds one of the mouth of a fish. On this day the head was first seen, it is light brown and shaped like that of a tortoise. A spiracular white line is now visible on each side of the larva. On the twelfth segment are two subdorsal white marks which slope from the dorsal line downwards and backwards. *August 2nd.*—Larva changed its skin. Its shape is now more accentuated, the anterior portion of the body is stouter and more club-like, the tenth and eleventh segments being also more constricted, the thirteenth segment more depressed and broader. On the tenth and eleventh segments are two small subdorsal dots. It is difficult to verify the segments, as the sides of the larva appear to adhere to the leaf. *August 6th.*—The larva is now three-quarters of an inch in length, and

seen either from the front or the side the "hump" or "hood" forms a most perfect fish's head with the mouth open, and two small black dots have appeared on the side of the hump about midway from its summit, which have the appearance of eyes and complete the resemblance. Laterally a black band has appeared in shape like a bow, extending from about the fifth segment, arching upwards just posterior to the subdorsal dots already mentioned on the narrow part of the back and descending again at the beginning of the flap-shaped thirteenth segment. On the ninth segment there is another pair of subdorsal dots, which dots at this date have turned dark brown. There is also a narrow dark green dorsal band, which darkens and widens out on the twelfth segment, and fades away to nothing on the thirteenth segment. The larva, which up to the present fed very daintily, now eats greedily, and appears to have almost doubled in bulk in the last few days. *August 8th.*—The eye-dots are now larger and quite black, and, in addition, there are two minute brown dots, one in front and one behind the eye-dot, forming a horizontal line of three spots. The arched line already described is now quite black and much broader. The subdorsal dots have merged into one dark patch. The larva when fully extended is now three-quarters of an inch in length. *August 9th.*—The larva has left its food-plant and looks like a bit of shrivelled leaf. The ground-colour has changed to a very dirty brown, and the dorsal patch is a dark brown colour. *August 11th.*—The larva still lying on the petiole end of the leaf head downwards. The "hump" is of a yellowish-brown colour, and the area on which were the dark marks is of a very pretty emerald-green colour with two dorsal white crescents, with a minute white spot in the space between the two points of each crescent. All the other markings have disappeared. The flattened anal segment is of a light yellowish-brown colour. *August 12th.*—The larva pupated, attached by the tail. The pupa is half an inch long, and resembles a small piece of dark brown dead stick.

It is most difficult to find the larvæ when they first emerge from the egg. Out of thirteen eggs only three larvæ were found. The food-plant rotted and had to be thrown away as it turned quite black; one dead larva was found on the rotten plant. The old food-plant was put into a bottle with fresh leaves, but no larvæ appeared. The best plan is to put one egg only in a very small bottle, when each larva emerges it can then be found without fail.

MRS. S. ROBSON.

"LIVELANDS," MUSSOORIE,
13th August, 1894.

NOTE BY MR. DE NICÉVILLE.

Mrs. S. Robson has very kindly sent me a live pupa of *Camena cleobis*, Godart, which I describe as follows:—Pupa attached to the underside of a leaf from which it hangs free, with no silk band across the middle as is usual in the *Lycænidæ*. It is fixed to the leaf by the anal segment, being attached to a

small pad of pure white silk. The anal segment where it touches the leaf is slightly widened out, thus forming a broad circular attaching base. The two following segments slightly decrease in width, beyond these the pupa is of the usual lycænid shape. The dorsal view of the pupa presents almost a right-angle, the apex of the angle being slightly rounded. The abdominal view presents an angle of about 45°, the short portion of this view consisting of the three basal segments, beyond which is the long portion which is composed of the wing-cases and the head. The head ends in two short conical blunt processes ; behind these there is on each side a slight depression which bears a pure white dot, and probably answers to the eyes of the imago. On each side running down to the apices of the cone-like processes is a pure white line. The dorsum is smooth and humped in the middle. The first abdominal segment is the widest, and is produced into a broad blunt process anteriorly, which slightly overhangs the dorsum. The abdominal segments somewhat rapidly decrease in width, but again, as said before, widen out slightly where the anal one joins the leaf. The coloration throughout is dark umber-brown, with a broad lighter brown band on each side of the abdominal segments above. Mrs. Robson informs me that in another pupa in her possession the top of the head-case is green with a green bar on each side ; the two conical head-processes are also green. Also that the whole pupa can move to the extent of one-eighth of an inch, the "hinge" being at the point where the abdominal segments meet the wing-cases in the dorsal line. The pupa on pressure being applied to the anterior thicker portion touches the leaf to which it is attached at the anterior or head end, but that it springs back to its normal position when the pressure is removed.

The fortunate discovery of the transformations of the species adds one more to the interesting list of lycænid pupæ which are abnormal in their mode of attachment, lacking a silken girdle entirely. Of these a somewhat similar pupa is figured in "A Catalogue of the Lepidopterous Insects in the Museum of the Hon. East-India Company," by Horsfield and Moore, vol. i, pl. xii, fig. 2*a* (1857), as *Dipsas biocellatus*, Grote, MS. This species does not appear to have ever been described, so I am unable to identify it. As Mr. Arthur Grote, F.Z.S., collected and made observations on *Lepidoptera* only, as far as I know, at Alipur, a suburb of Calcutta, it may be that the larva and pupa figured in this work are those of *Tajuria longinus*, Fabricius, or *Camena cleobis*, Godart, both of which occur not uncommonly in Calcutta. Another pupa is that figured in Mr. Moore's "Lepidoptera of Ceylon," vol. i, pl. xxxiv, fig. 1*b* (1881), as *Spalgis epius*, Westwood, but this identification is incorrect, the larva and pupa there given being probably that of *Horaga ciniata*, Hewitson, this name being subsequently changed to *H. cingalensis*, Moore. Still another pupa is that of *Tajuria longinus*, Fabricius, figured on pl. xlii, fig. 2*b*, of the last mentioned work. As the larva of *T. longinus* as figured by Mr. Moore does not agree at all with Grote's figure of the larva of "*Dipsas*

biocculatus," the latter is most probably that of *Camena cleobis*. The pupa of *Simiskina phalena*, Hewitson (=*Massaga hartertii*, Doherty), also hangs free, as does that of *Spalgis epius*, Westwood, as has recently been shewn in the pages of this Journal, vol. viii, p. 485, pl. A (1894), by Mr. E. H. Aitken.

C. cleobis is found at Masuri in the Western Himalayas, at Bolahât in the Malda district, at Dinajpur, Jalpaiguri, Calcutta, Sibsagar in Upper Assam, in the Chin-Lushai Hills, in the Ruby Mines district of Upper Burma, and in the Nilgiri Hills.

CALCUTTA, 20*th August*, 1894.

IX.—LIFE HISTORY OF *KALLIMA INACHUS*, BOISDUVAL, A NYMPHALINE BUTTERFLY.

August 22*nd*, 1894.—Saw seven ova laid in the Bhutan Hills at 1,800 feet elevation on the leaves of different plants of *Giradinia heteropheylla*, Ferns, *Polygonum orientalis*, and *Strobilanthes capitatus*, T. Anderson. Eggs not particularly large for so large a butterfly. Colour dark green, round, ribbed vertically with creamy-yellow. *August* 27*th*—29*th*. Larvæ emerged. The food-plant is like that of *Precis iphita*, Cramer. Head black and shining. Body dark brown, shiny, with two dorsal and two lateral rows of warts, each wart bearing a stiff black hair, the anterior warts bearing three hairs. These are real hairs not spines, as appears clearly under a microscope. Head not hairy. Larvæ grow very fast at this stage, and feed on the *Strobilanthes capitatus*.

31*st August*.—First moult. Verticillate spines now appear instead of hairs; also two long spines on the head, which did not exist in the first stage. Colour shiny black. Larva almost exactly resembles that of *Pareba vesta*, Fabricius, for which doubtless they have been taken, thereby remaining undiscovered until now.

3*rd September*.—Second moult. Spines on second segment very short and small; both subdorsal series of spines yellowish-buff at the base; a dorsal row of spines from the 5th segment, shorter than the subdorsal ones, not yellowish-buff at the base; two last segments with a transparent appearance.



8*th September*.—Third moult. Same as second. Spines long and eleven in number; bases of subdorsal spines orange-yellow; the second out of line; dorsal and two lateral rows of spines long, two small spines just above the legs on each side. When the skin is just shed, the spines are very short, and the larva combs them out with its mandibles and anterior legs. The long spines on the head are truncated, and grow in much the same way as do a butterfly's

wings when just emerged from the pupa. At first they are hardly apparent, but gradually they become first bumps, then short thick protuberances, until they are finally fully developed.

13*th September*.—Fourth and last moult. Larva velvety-black (the orange spots having disappeared), covered with rather long yellowish hair. All the spines reddish. General appearance that of a *Lasiocampa* or *Gastropacha* larva.

22*nd September*.—Three larvæ hung up for pupal change. Four pupated on 23rd. Pupal stage lasts about ten days.

G. C. DUDGEON.

FAGOO TEA ESTATE, WESTERN DUARS.
5*th October*, 1894.

Explanation of Wood-cut.

The wood-cut shews a section of the larva at the third moult at the segment which bears the second pair of prolegs, and shews the disposition of the spines. The base of the fifth spine on each side counting from a proleg is orange-yellow in colour.

No. X.—THE POWER OF MIMICRY IN CANARIES.

Last spring I was at home at Streatham, where there was a talking canary. I had heard of the bird's accomplishments, and being somewhat sceptical I noticed it particularly. The canary's cage was hanging in a window, and during the winter a parrot had been placed on a table close by. After some time it was noticed that the canary was repeating some of the parrot's sayings—"Pretty polly, pretty dear, polly wants a quart of beer."

I myself heard this many times, and was quite satisfied that it was the canary, as the parrot had been removed after the winter and no one in the house had any ventriloquial skill.

The articulation of the canary was to that of the parrot, as the parrot's is to the human voice, *i.e.*, rather worse, but still it was sufficiently clear and distinct to be intelligible and unmistakable.

There was a tendency to repeat words, *e.g.*, "Pretty *polly, polly, polly*, pretty dear, &c.," and sometimes to go off into a whistle without completing the sentence.

I am told talking canaries are not uncommon, but have never seen an instance recorded, so perhaps this may be worth noting in our Journal.

BOMBAY, 30*th December*, 1894. W. W. SQUIRE.

No. XI.—MEASUREMENTS OF TIGERS' SKULLS.

In my note on the measurement of tigers' skulls, which appeared in the last number of our Journal (page 225 of this Vol.), the dimension of the first skull are given as $11\frac{1}{4}''$ by $10\frac{1}{2}''$, but the figures which I wrote, or intended to write, were $14\frac{1}{4}''$ by $10\frac{1}{2}''$. Please make the correction.

HUGH MURRAY,
Divisional Forest Officer

BELGAUM, 6*th January*, 1895.



Isaac Benjamin del. Mintern Bros. Chromo-Lith. Bombay.

THE POISONOUS PLANTS OF BOMBAY.

Plumbago rosea Linn.

½ Natural size

JOURNAL

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Vol. IX.] BOMBAY. [No. 4.

THE POISONOUS PLANTS OF BOMBAY.

By Surgeon-Major K. R. Kirtikar, I.M.S., F.L.S.,

Civil Surgeon, Thana.

PART XII.

(*With plate N.*)

(*Continued from Vol. IX., page* 258.)

PLUMBAGO ROSEA—(*Linn*).

Natural Order—Plumbagineæ.

MARATHI—लाल चित्रक.

An evergreen perennial shrub, 2—4 feet high, "very rarely annual," (Boissier). The plant when grown in gardens and in conservatories is much more handsome than when it grows under a blazing sun, whereby its leaves invariably suffer in form and substance.

STEM.—Suffruticose, procumbent near the root, sometimes scandent, jointed where the leaves are inserted; woody below, herbaceous above; thin, long, roundish, longitudinally striated; near the joints the green colour of the stem is darker green, lined with red; usually not much branched. Sometimes instead of a single stem a number of branches shoot out direct from the tortuous roots. Some of these branches are erect, others procumbent, trailing along the ground.



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Usually however, especially in new plants, there is a single stem from which several branches arise. Young stems and branches contain pith in the centre.

BRANCHES.—Bifarious, diffuse ; striated longitudinally ; generally borne on the upper part of the stem, less numerous on the lower. Length of branches sometimes three to four feet at a stretch. The stem when in good condition bears leaves 1½—2¼ feet asunder. Each articulation bears a solitary leaf. The procumbent branches, when they reach the ground, bear fresh rootlets from the joints.

ROOT.—Fibrous, outwardly dusky yellow, or greenish according to Rumphius. On section it looks yellowish with a brown tinge in the line of the axis as seen in figure 5, of Plate N, accompanying this letter-press. The cross-section depicts the appearance of the root in its fresh condition; on drying it shrivels up. When mature it is woody and solid. Some say it has a disagreeable odour. As compared with the general size of the plant, the root is thick and strong ; nearer the stem it is nodose and sinuous, sending down into the ground many thick fibrillæ. Sometimes the root is two feet long ; sometimes it sinks much deeper into the soil, so much so that it is difficult to extirpate it.

LEAVES.—Entire ; alternate ; slightly drooping ; glabrous ; undulate or wavy ; elliptic, ovate, lanceolate, or oblong-rotund, as Rheede calls them ; striated by means of prominent ribs on the ventral surface ; midrib markedly reddish ; the principal nerves are similarly reddish or even faintly so on the ventral surface in tender leaves, they are greenish on the under or dorsal surface. The margin of tender leaves is distinctly tinged red all round. The leaves vary in colour from dark green to light green. The tender leaves are generally light green ; the older dark green. Leaves growing in shady places are of lighter green.

PETIOLES.—Very short ; channelled ; sometimes amplexicaul, sometimes absent ; margins tinged red. When the petiole is absent the leaves are sometimes amplexicaul or semi-amplexicaul.

The apex of young leaves is delicately mucronate. To see this, one has to examine the leaf buds as they expand at the growing point. The older leaves are obtuse at the apex. The under or dorsal surface of the leaves is generally of a lighter colour than the upper or ventral.

VERNATION.—Involute.

STIPULES.—Absent.

FLOWERS.—Usually about 1½—2 inches in length; not persistent; falling before the fruit is mature or even formed; situated on spikes.

INFLORESCENCE.—In terminal or axillary spikes (racemes). When the spikes are axillary, they arise from the upper axils of branches. Spikes usually simple, 1—2 feet long. Rachis of the spike glabrous. The flowers are arranged on the rachis alternately an inch or more apart, sometimes only on one side of the rachis,* thus forming unilateral spikes or racemes. The flowers are never crowded together. They are sometimes erect, sometimes transverse, and sometimes bent downward or slightly drooping.

ÆSTIVATION.—Of Calyx, plicate (Blume); of petals contorted; often sinistrorse, sometimes dextrorse.

The flowering time is said by Blume to be in May and June. On this side of India and in European conservatories the plant is well known to flower more than once a year. There is, however, a short resting period after the whole plant has once flowered. The blossom does not all appear at once on the whole plant, but branch after branch throws out spikes which bear flowers in due time. Rheede says that the plant flowers throughout the year, but especially in the rainy season.

BRACTS AND BRACTEOLES.—Shorter than the calyx.

BRACTS.—2, superior lateral; 3 says Roxburgh. Often scarious on the margin; ovate or ovate-oblong.

BRACTEOLES.—2, "conform with the bracts" (Kurz). Rheede describes 3 small bracteoles, glabrous foliaceous. Rheede's description seems to me to be more accurate; at any rate 3 bracteoles are more common. The bracteoles are persistent; even after the flowers have fallen, for a long time the bracteoles are to be seen intact, of reddish-brown colour. They are greenish when young. Each set of bracteoles, whether 2 or 3, contains a single flower. The flowers are without any odour.

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* "The flowers," says Sir William Hooker, "are remarkably *secund*, that is, *turned to one side*" (Curtis's Bot. Magazine, Tab. 5363). This is well illustrated in the plate given under that number in Curtis. Curtis's plate 230 in an earlier volume of his Bot. Magazine bears bilateral flowers like those in plate N of my series.'

CALYX.—Inferior ; gamosepalous, tubular; herbaceous, covered with stalked sticky scarlet glands throughout its length ; 5—10 ribbed ; often hyaline between the ribs. Mouth of the tube funnel-shaped, scarious, very slightly 5-dentate. Limb not persistent ; but more so than the corolla. Upper half bright red, often deep rose-coloured ; lower half brown-red, with just a shade of green near the insertion of the bracteoles. The calyx is distinctly non-accrescent, nearly always sessile. The pedicel if present is very short, oblong, and deeply imbedded in the bracteoles. The calyx of young buds is bright green ; the stipitate glands on it are also green. The viscid mucus secreted by the stalked glands, or glandular hairs as some call them, does not dry—(Boissier). Recent researches on these glands will be referred to under the heading of *Remarks* later on.

COROLLA.—Bright red, often deep rose-coloured ; hypogynous ; hypocrateriform ; tube long, slender, slightly angulate, generally lighter in colour than the lobes at its lower third. Lobes 5, patent, sometimes equal, sometimes slightly unequal. The form of the individual lobes varies much even in the same flower, being sometimes round, sometimes obovate, but usually obcordate. The midrib of the petals is distinctly paler and prominent on the under surface, ending sometimes in a sharp point. Hence Boissier calls the petals "unguiculate ;" sometimes the petal is blunt at the apex, hence assuming the obovate form ; sometimes it is distinctly notched, thus giving the petal an obcordate appearance. The petals are sometimes faintly striate. When fully open the corolla resembles that of the Jasmine. The circumference of the expanded petals taken together is an inch or even more. The corolla falls comparatively earlier than the calyx.

STAMENS.—5, opposite the petals ; free ; very fine and delicate ; pale rose-coloured, partly whitish ; slightly rising above the "throat" of the corolla-tube, and looking purplish.

FILAMENTS.—Filiform ; linear ; dilated at base and inserted at the base of the petals "into the tops of the 5 nectarial scales"—(Roxburgh).

ANTHERS.—Oblong ; introrse ; anther-cells separated at the base, and opening by longitudinal slits.

POLLEN-GRAINS.—Ovate.

HYPOGYNOUS DISK.—Absent.

PISTIL—

OVARY.—Free; sessile; superior; 1-celled; 5-angular above, or "5-gibbous" as Boissier terms it; narrowed at apex.

STYLE.—Single, slender, whitish; with 5 small segments, quite indiscernible and alternating with the stamens. Base of the style hairy. The union of the segments is a diagnostic character of this plant.

STIGMAS.—5, "capillary, furnished on their inner surface with several lines of glands" (La M. and Dec., Mrs. Hooker's Translation, page 525).

OVULE.—1 pendulous from a basal ascending funicle; anatropal.

FRUIT.—A membranous capsule, circumciss or rupturing near the apex; included in the tubular persistent calyx. Blume says that the dehiscence is valvate; others say that the pericarp of the fruit dehisces in a subvalvate manner.

SEED.—Cylindrical or oblong-rotund, with 5 longitudinal striæ; pendulous; "inverted sometimes, appearing erect by the union of the funicle with its integuments."—(La M. and Dec.) The seed is green when young, black when mature, adnate to the integument at its upper extremity.

INTEGUMENT.—Simple.

ALBUMEN.—Farinaceous; slight; separated into two parts by the embryo.

EMBRYO.—Within the albumen; straight.

RADICLE.—Superior; short.

COTYLEDONS.—Flat.

PLUMULE.—Slightly rough.

REMARKS.

The plant has the following synonyms :—

1. *Thela coccinea* (Loureiro, Flora Cochinchinensis, vol. I, p. 119, 1790).

2. *Thalia coccinea* (Loureiro, Flor. Cochin., Ed. Willd., vol. I, p. 147.)—Curtis Bot. Magazine, Tab. 5363, 1st February, 1863.

3. *Plumbago coccinea* (Boissier in D. C. Prodr., vol. 12, p. 693.)

4. *Plumbagidium roseum* (Spach. Veg. Phan., Vol. 10, p. 339.)

5. "*Radix vesicatoria*" (Rumphius Herb. Amboiensis, lib. IX, cap. 68, p. 453).

In writing the above description of this plant, I have mainly followed Rheede, Rumphius and Boissier, who show a very accurate knowledge of it. There are many points, however, in their remarks, as in those of other writers to be named hereafter, which require special notice; and I shall refer to them under this head as occasion requires. First then, with regard to its name, I have adhered to that given by Linnæus. Boissier observes that the specific name *Thela coccinea** had to be substituted by Loureiro for *Plumbago rosea* of Linnæus (*rosea* meaning rose-coloured, pink or rosy), because the colour of the species we are considering was deeper than that of the pinkest coloured rose. It was distinctly scarlet. For, says Boissier, "the corolla is never rosy in this plant."† To this, however, Sir William Hooker, presumably the writer of the letter-press accompanying the excellent plate in Curtis's Botanical Magazine under No. 5363, gives a very pertinent reply, albeit ingenious, in the following words:— "The flowers are one and a quarter inch long in the tube and more than an inch broad, remarkably secund, and the colour is bright brick-red, partaking of nothing of that purplish hue which induced Linnæus to call the species '*Rosea*'. Perhaps Loureiro and Boissier had this variety (or this coloured variety at least) in view when they gave it the name of *coccinea*, but the difference is hardly such as to justify the change of the old Linnæan and well-established name of *Plumbago rosea* to *P. coccinea* as Boissier has done. Popularly, too, the rose *is* red."

This reminds me of my school-days, when every class-book I bought I scribbled with the couplets:—

"The grass is green,
The rose is red,
This book is mine
Till I am dead;
Steal it not for fear of shame,
For under lies the owner's name."

Of the authorship of these lines I am still in the dark as much as I am with regard to their pretension to verse. The conclusion I draw,

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* *Thela*, from the Greek *Thelè* = *papilla*, so named from its papillose calyx (J. D. Loureiro); *Coccinea* meaning red or scarlet.

† To quote Boissier's own words—"Corolla numquam in hâc plantâ *rosea est*." D. C., Prodr., vol. xii, p. 693.

however, is the same as that drawn by Sir William Hooker, namely, that what is *rosy* may be considered *red*. Examining further the aptness of the synonyms mentioned above, I find in a recent edition of Johnson's Gardener's Dictionary (by Wright and Dewar, 1894, pp. 771-772) that, besides the species mentioned as *Plumbago rosea*, bearing red flowers, another distinct species is given under the name of *Plumbago rosea coccinea*, which has larger and brighter flowers than *P. rosea*, and which is said to be a native of the Neilgherries. This is evidently done on the authority of Sir William Hooker's letter-press accompanying plate 5363 again referred to later on. In Paxton's Botanical Dictionary (Hereman's edition, 1868), on the other hand, I find that *Plumbago rosea* and *Plumbago coccinea* are mentioned as two distinct species. The latter is said to be scarlet-flowered and a native of the Neilgherries, whereas the former is red-flowered and found throught the East Indies. On referring to the *Species Plantarum* of Linnæus (Willdenow's Edition, Berlin, 1797, vol. I, p. 838), I find that the species described by Burmann as *Plumbago zeylanica* is synonymous with *Plumbago rosea*. This *Plumbago zeylanica* of Burmann is a distinctly red-flowered plant. In the "Flora Zeylanica," which Linnæus published in 1747, the same statement is made (*vide* p. 30). I mention this here particularly, because I wish that the red-flowered *Plumbago zeylanica* of Burmann should not be confounded with what we now-a-days know as *Plumbago zeylanica*, Linn., which is a *white-flowered variety*. I presume that this white-flowered species is the *Plumbago zeylanensis* of Burmann. Asa Gray prefers to call the red-flowered plumbago of America *P. coccinea*.*

The plant we are considering is easy of propagation by means of cuttings. The cuttings root very readily in the rains. They evidently require much moisture and grow in almost any soil; they prefer, however, a sandy soil, and thrive, both as regards leaves and flowers, in cool and shady places. For I have observed that plants growing in the open suffer very much in foliage and blossom and never fruit on this side of India. Firminger observes that "the beauty of the plant is much impaired by many of the leaves appearing generally in a decayed condition; requires shade and moisture." (Manual of Gardening, 1890, p. 543.)

* Field, Forest, and Garden Botany of the United States, 1870, p. 222.

Next with regard to the habitat of the plant. So far as I know, it is not found in Bombay growing wild. It is essentially a garden variety on this side of India. The *Plumbagineæ* as a class are said by Mr. Clarke to grow mostly in maritime and saline places, and the genus *Plumbago* is distributed throughout the warm regions of both the hemispheres. But it is questionable whether *Plumbago rosea* grows wild extensively, if anywhere at all, in Western India. Kurz thinks it is not wild in Burma; Thwaites thinks it is not wild in Ceylon; so says Clarke. Loureiro says that both the species of *Plumbago*, *i.e.*, the red and the white, grow among the hedges of Indian bamboos, over which they climb as well in Cochin China as in China. Blume observes that the plant known as *Plumbago auriculata* (probably from its amplexicaul petiole), which is the same as *Plumbago zeylanica* of Linnæus, very largely grows in the marshes of Batavia (Bijdragen Flor. Nederland Indië, vol. III, p. 735, Buitenzorg). Kurz says that "*Plumbago rosea* is not unfrequent in the moister mixed forests of Pegu, Yomah, and the Martaban Hills down to Tenasserim; also Ava." He also adds that the plant is often cultivated and springs up "in *toungyas*,* along the river banks, &c." Rheede has noted that the plant grows in sandy places. In Bentham and Mueller's *Flora Australiensis* (vol. IV, p. 267), I find the following remark regarding *P. rosea* :—"Another Indian species, distinguished chiefly by its red flowers and more herbaceous stem, *P. rosea*, Linn., is said to have established itself near Rockhampton, in Queensland, as an escape from gardens." The question is whether this happens by means of cuttings or by the dissemination or actual planting of the seed. If the plant seeds in Australia at all, it is a remarkable fact—for in Bombay I have never known it to seed. There is this thing to be observed—that it is unquestionable it seeds on the Neilgherry Hills; for witness what is noted in Curtis' Botanical Magazine, plate 5363, letter-press. It is evident from this plate, depicting a very handsome and substantial blossom, that Sir William Hooker considers the plant depicted thereon is a variety, for he calls it "*variety coccinea*," of *Plumbago rosea*, which Johnson refers to in his dictionary, as quoted in the foregoing remarks:—"The plant," says Sir

* *Toung-ya* (Burmese)—a form of hill-cultivation carried on by burning the jungles—(Balfour).

Bombay Natural History Society.

NOTICE.

With reference to my Circular dated 1st October 1893, asking for specimens of the common Bandicoot-rat (*Nesocia bandicoota*), I have now been requested by Mr. Oldfield Thomas, of the British Museum of Natural History, London, to circulate the following directions for the benefit of those who are willing to assist in the collection of small mammals.

It is of course understood that Mr. Oldfield Thomas will describe in this Society's Journal any new forms which may be found by our members, and as the small mammals of India have never been thoroughly investigated, it is not at all improbable that new species may be discovered if a complete collection of skins be made in the manner described.

H. M. PHIPSON,
Honorary Secretary.

6, Apollo Street,
Bombay, 15*th May* 1895.

P. T. O.

Directions for Preparing Small Mammal Skins.

1.—With the freshly killed carcase before you, write the label. This should bear a number, locality, altitude above sea, sex, date, and the following measurements, in millimetres, taken in the flesh ; (1), length of head and body ; (2), of tail without end hairs ; and (3), hind-foot without claws. In the case of the first two measurements, the body should be straightened out as much as possible, and the tail bent upwards at a sharp angle, and the measurements should then be taken from a point in the angle. The label should also have on its back any notes that may strike you about the place where the specimen was caught.

Example of label :—

FRONT.

(Sex.)
(Space for scientific name.)
Nasik.
Deccan.
1,900 ft. H. M. Phipson.

BACK.

No. 51.
H. & B. 81 m. m. Trapped in field.
Tl..... 54 m. m.
Hf .... 22 m. m. Very common.

The positions of the different items should be as far as possible as in the example, so that skins from different sources may all be similarly labelled.

2.—Open the skin by cutting down the belly from the breast-bone to the anus ; first push one and then the other knee through the opening, and cut through the legs at the knee joints ; clear off the chief muscles of the leg-bones and separate away the skin from the body all round the tail ; then holding the skin at the base of the tail firmly between the finger and thumb nails, or in the fork of a cleft stick, pull out the vertebræ from inside with the forceps ; then gradually turning the skin inside out, skin it up over the body, shoulders, and head, separating the fore-limbs at the elbow joint, and taking great care not to cut it in passing over the eyes ; skin it entirely off over the mouth, cutting carefully round the lips. Throughout the operation plenty of fine sawdust will be found of great assistance in keeping the hands, and consequently the fur, dry and unsoiled.

3.—Clean the inside of the skin from blood, fat, &c., and then brush it all over with arsenical soap*, being especially careful that the insides of the limbs get some put on them.

4.—Turn the skin back right side out and fill the cavity of the body with cotton wool, putting it in as far as possible in one piece. (In tropical climates a few drops of carbolic acid or other disinfectant should be put on the wool to keep off insects.) Take care just to fill out the skin without overstretching it, and try to get all your skins filled out to about the same degree. Take a piece of straight wire long enough to extend from the front end of the belly opening to the tip of the tail, sharpen if necessary one end of it, and wind round it enough cotton wool to fill out the skin of the tail ; then brush it with arsenical soap and push the pointed end down to the extreme tip of the tail-skin, and fit the near end into the belly, packing it round with the wool of the body. Put a small piece of wool into the empty skin of the arms and legs. Then stitch or pin up the opening down the belly.

* In damp climates powdered oxide of arsenic should be used, as it helps to dry the skin, but caution should be exercised that it is not inhaled during the operation, or allowed to get under the nails.

NOTICE.

WITH a view of increasing still further the scope of the Journal, I beg to attach a form of application for membership, in the hope that you may be able to induce some of your friends to join the Society. Copies of the Rules, with a complete list of members, can be had on application.

H. M. PHIPSON,

Honorary Secretary,

BOMBAY NATURAL HISTORY SOCIETY.

BOMBAY NATURAL HISTORY SOCIETY.

APPLICATION FOR MEMBERSHIP.

Ladies and Gentlemen desirous of joining the Society are requested to fill in and sign this Form, and to forward it to the address of "The Honorary Secretary, Bombay Natural History Society, 6, Apollo Street, Bombay."

NAME, IN FULL.	ADDRESS.	NAME OF PROPOSER.

5.—If at all oily or greasy, the fur may be cleaned by being wiped with a rag dipped in benzine, and then having fine sawdust gently rubbed into it, this being afterwards brushed out when dry.

6.—Lay the skin on a board or piece of cork, draw out the fore paws forwards and pin them down to the board by a pin passed boldly through the middle of the paw. Take care that they are pinned as close in to the sides of the neck or head as they possibly can be, in order to prevent their claws catching in other skins when all are packed together in boxes. Similarly pin back, soles downwards, the hind feet close by the sides of the tail. It is of considerable importance that neither fore nor hind feet should project laterally outwards nor should curl up in drying.

7.—As the skin dries, try to get the face to assume as natural a shape as possible, and the ears to stand up in their natural position. Tie the label on to the ankle before pinning the skin down.

8.—Disarticulate skull from trunk, *roughly* clean it, but do not boil it or separate the lower jaw, and then let it dry. Be very careful not to cut or injure it in *any* way; if there is not time enough to get the brain out through the natural hole at the back, it must be left in to dry up. Label the skull with a corresponding number to that of the skin, and afterwards, when both are quite dry, it may be tied on to the leg of the skin, or the skulls may be packed and sent home separately if so labelled as to prevent any possible confusion.

9.—Pack the skins up carefully in small boxes when they are dry, with enough paper, or better still, wool, to prevent them shaking about; but if possible do not roll them up separately in paper *before they are dry*, as drying in paper gives the fur an unnaturally sleek appearance.

10.—Bats should have their wings closely folded up on each side of the body, but in such a way as not to hide the fur of the belly. The thumbs should be made to point inwards or downwards, not outwards.

The skinning of larger animals must necessarily be somewhat different to the above, but the make up of skins should be as described, except that when the combined lengths of body and tail exceed 30 inches, the tail should be bent up underneath the belly, while the fore as well as the hind feet should be directed backwards. The total length over all of middle-size skins, such as foxes, &c., should not if possible exceed 30 inches, any excess over this length being reduced by directing the hind feet forwards, or even by folding the skin up across the belly.

WANTED, generally, all small mammals, *however common*, so long as they are not domesticated or inhabitants of houses, *i. e.*, squirrels, rats, mice, shrews, moles, bats, weasels, stoats, &c., &c. Do not be afraid of sending too many of the same sort, if carefully prepared and labelled according to the directions. Series of skins representing the different seasons are always of interest.

Such animals are to be obtained chiefly by trapping, gins, break-back, or other traps being placed about in likely places, runs and mouse holes being specially looked for. Pitfall traps, made out of a glass or metal jar sunk in flush with the ground, are also very often successful.

William, "has long been *in cultivation* at Kew, and Messrs. Veitch have sent us *specimens raised from seeds received from the Neilgherries.*" The plant is such an exceptionally good illustration of stove-culture that few will fail to recognize the value and extreme beauty of *Plumbago rosea* as a garden ornament. Under the burning sun of India it can scarcely hope to bear leaves "measuring six inches in length and three in breadth," or panicles "two or more feet long" as depicted in plate 5363. The plant requires ample shade and moisture for healthy growth. Sir William's illustration is a vivid example of what the flower and foliage can be where the plant is not called upon to cope with the horrible heat and damaging dryness of the Indian sky.

It is difficult to understand the remark made by Mr. C. B. Clarke, the writer of the article *Plumbagineæ* in vol. III of Hooker's "Flora of British India" (*vide* p. 481) with reference to *P. rosea*. It runs as follows :—"Altogether resembling *P. zeylanica* and perhaps only a cultivated variety of it." To all appearance the plant I am describing is essentially a distinct species, in which the red colour is markedly prevalent, not only in the flowers and floral envelopes and their appendages, but even in the midrib and margin of the leaves and also in the leaf-appendages. The following *conspectus* of the two species given by Kurz* will show the differential characteristics of the two species :—

Spikes glandular, pubescent; corolla white, bract ovate, leafy; bractlets subulate ... ... *Plumbago zeylanica.*

Spikes glabrous or nearly so; corolla rose-coloured or scarlet; bract ovate, oblong, scarious, brown; bractlets conform with the bracts... *Plumbago rosea.*

Roxburgh has pointedly remarked that the specific distinguishing mark between *P. zeylanica* and *P. rosea*, according to his observation, depends on the racemes and bracts, *colour not being a specific mark.*†

"The bracts of *P. rosea*," says Roxburgh, "are three-fold, one-flowered, equal, smooth ; the inner or upper two united between the flower and rachis." The bracts of *P. zeylanica*, on the other hand, "are three-fold, one-flowered; the outer one is ten times larger than the lateral one ; they are covered with the same gluten as the peduncle of the raceme ; sometimes there is a fourth linear bract pressing the calyx."

* Contribution towards a knowledge of the Burmese Flora, pp. 217, 218, Journal As. Soc. Bengal, No. II, 1877.

† Roxburgh's Flora Indica, p. 155, Calcutta Edition, 1874.

With such distinctive specific differences which cannot be considered to be mere changes due to cultivation, it is somewhat puzzling to meet with the remark of Mr. Clarke in our standard work on Indian Botany.

In describing the root of *Plumbago rosea*, so far back as 1876,* Dr. Dymock says that "the root is reddish-brown externally, *transversely fissured, thick* and *suberous*; *internally* it is *white when first removed, but soon turns red upon exposure to air.*" (The italics are mine—K. R. K.) It will be seen from my transverse section of the root (Fig. 5, Plate N) that the color is yellow. It is only the central part that is brownish-red. This central portion consists of "a woody column," to use Dr. Dymock's own words, "with a very large vascular system surrounded by a bark almost entirely made up of thin-walled parenchymatous cells loaded with large oil-globules, and containing some starch." Jaikisson Indraji notes that "the roots when fresh exude a yellow juice." This would account for the yellow colour of the section of the fresh root depicted in my Plate N. Contrast with this the statement of Dr. Dymock † regarding *P. europæa* that Prof. Flückiger and Mr. Gerock found its root when freshly cut to be nearly devoid of colour, but on exposure it immediately assumed a yellow hue. I may add from personal observation that the root of *Plumbago rosea* is naturally yellow on section, even when taken fresh from the ground.

With regard to the habit of the plant, Asa Gray's *Plumbago coccinea* is a climber. The Indian variety is not always so, but can be trained as a climber if there is suitable trelliswork to support it.

The cotyledons, according to Gaertner, are foliaceous, and ovate-oblong; the embryo is slightly yellow; the albumen perfectly white; and the integument of the seed membranceous. (*De Fruct. et Semin.*, vol. I, p. 234.) Judging from the dehiscence of the fruit figured on Tab. 50 (Gaertner), it appears that the valves of the capsule begin separating at the apex.

With regard to the nature of the glands found on *Plumbago rosea*, I cannot do better than refer to the elaborate researches of Dr. John Wilson, Lecturer on Botany in the University of St. Andrews, published in the Annals of Botany.‡ As Dr. Wilson rightly observes, Boissier

* Pharmaceutical Journal and Transactions, vol. vii, 3rd series, 1876-77, page 190.

† Pharmacographia Indica, vol. ii, p. 333.

‡ Vol. iv, No. xiv, pp. 231—255, May, 1890.

does not touch the question of glands in his exhaustive monograph on the *Plumbaginaceæ* in De Candolle's Prodromus, freely utilized by me in compiling the foregoing remarks. No mention is made of the glands in Bentham and Hooker's *Genera Plantarum*. Nor is there in any author among the many that I have consulted any special mention of the structure and varieties of these glands. The contribution of Dr. Wilson, therefore, is a distinct advance upon the previous knowledge of the morphology of the *Plumbagineæ*; he therefore deserves the gratitude of every special student of this order for his elaborate researches. "The study of the vegetative organs of any member of the family" (*Plumbagineæ*), says he, "is not proceeded far when one finds studded over the leaves, stem, &c., sunk oval or circular glands with characteristically cruciform diametrical partitions." They possess, what Dr. Wilson calls the "*chalk-secreting*" function, to which are due the mineral substances known as "*chalk-scales*" secreted by certain species of the *Plumbagineæ*. Mettenius having described and figured these glands, Dr. Wilson calls them, for the sake of brevity, *Mettenian glands* (glands of Mettenius), and as such they will be referred to in the following observations. The structure of these glands may be given as follows, as described by Maury and quoted in the original French quotation cited by Dr. Wilson *:

"The *primitive* or *mother cell* is divided mainly into four simple cells each of which latter is a secretory cell. Their product (or secretion) is stored up in the intercellular space and is thrown out (or excreted) in consequence of the tension of the cells lying close to the lower part."

These glands, observes Dr. Wilson, in general "occur in longitudinal depressions on the stems of Plumbagos giving rise to a striated appearance when calcium carbonate is secreted." They are also present "on the leaves and bracts of all and sepals of many of the species of * * * *Plumbago* * * * examined." They also occur on the cotyledons of the genus *Plumbago*, besides those of several other genera of the *Plumbagineæ*, "even before the light is reached by the germinating seedlings." (Wilson, p. 240, *op. cit.*) I have often observed a

* Translated by me with the assistance of Mr. J. Mittra, Barrister-at-Law, Nagpore.

whitish crust on some of the leaves of *Plumbago rosea*. But I have never been able to account for its appearance there. Viewing the crust now in the light of Dr. Wilson's researches, I am able to attribute the occurrence of it to *Mittenian* glands. I may observe here that the critical eye of Mr. Jaikisson Indraji, of Porebundar, has not failed to notice this crust. In a Gujrati work, entitled Arya Aushadh, published in 1889 by Dr. Virji Jhinâ Râval, L. M. & S., in describing Chitrak, it is stated that in the space between the amplexicaul petiole and the stem a kind of saline substance is found which, he says, is used medicinally (p. 243). Mr. Jaikisson Indraji, in describing the leaves of *Plumbago rosea*, says that "they are covered with a white or brownish *bloom*." When I read this statement eight years ago, and observed later on for myself the white crust or *bloom* as he calls it, I was disposed to attribute it to external agencies. I thought that the saline deposit was due to salts contained in the water sprinkled over the plant in the process of watering. But, thanks to the researches of Dr. Wilson, this calcarious deposit has now a morphological interest, readily affording the happy solution of a question which has struck very few before, but which now appears to be a special phenomenon connected with the glandular appendages of the genus *Plumbago*. Were it not for the explanation given by Dr. Wilson, I should still have gone on imagining that the white crust-spots seen on many leaves in *Plumbago rosea* were merely due to the watering of the plants and to the deposit of the salines from the watering fluid rather than to the inherent power possessed by the glands of secreting saline ingredients by virtue of the chemical process going on in their ultimate cells. Dr. Wilson has now shown us that the so-called *Mittenian* glands which the Plumbagos contain in large numbers are the producers of the white saline crust, which consists of calcium carbonate.

The next set of glands seen in the Natural Order *Plumbagineæ* constitutes, what Dr. Wilson calls, "*mucilage-glands*." A few of them are seen in the leaf-axils of *Plumbago rosea*, the largest being ·38 mm. in diameter. The stalked glands on the exterior of the calyx of *Plumbago rosea* belong to this class. They are well known for the viscidity of their mucilaginous secretion. They are "spherical, bright red, and formed of very numerous polygonal cells. When fully

developed they are very opaque, and their whole structure remarkably tough. The stalk penetrates a considerable distance into the fully-formed head, so as to make the base of the gland dome-shaped or conical. Younger and smaller external glands are fairly translucent. The stalks of almost sessile glands are composed of a few comparatively large cells." Sessile glands are also to be seen in *Plumbago rosea* on the inner face of the sepals. Their basal cells are two. "Their homology with the stalked glands on the exterior of the calyx," says Dr. Wilson, "traced through the smaller and almost sessile ones there, cannot be doubted. Further, the sessile glands do not offer any point of material distinction from normal mucilage-glands of the leaves."

POISONOUS PROPERTIES.

The plant which Rumphius has described so graphically and fully under the name of *Radix vesicatorius** (the blistering root), is unmistakably the *Plumbago rosea* of Linnæus. That this name has not been given without reason will be apparent from the following observations. It is the root of the plant which is the most obnoxious of its entire organization. Its juice is very acridly pungent to taste, and produces in the tongue a severe lancinating pain. To do this it must be fresh. The juice distinctly blisters the skin and otherwise irritates it as violently and briskly as cantharides. Within six to eight hours, says Rumphius, the skin becomes red and covered with blebs. Rheede† observes that the leaves and stems are also pungent to taste, but are not so virulent as the root. More than one writer has said that the virulent effects are more marked when the juice is taken from a fresh root. Why is it so? Is it that the irritant property is due to an evanescent active principle, an essential oil or ether which deteriorates in course of time as the root dries up? Seventy years ago M. Dulong isolated an acrid active principle called *Plumbagin* from *Plumbago europæa*, the only European congener of *Plumbago rosea*. From the researches of O'Shaughnessy it appears that the same active principle is found in *Plumbago rosea*. It abounds chiefly in the bark of the root. "It occurs in brilliant yellow crystals, of

* Herb. Amb., Lib. ix, cap. 68, p. 453.

† Hortus Malabaricus, vol. x, t. 9, p. 17.

sweetish, but acrid and hot taste, easily fusible, partially volatile, scantily soluble in cold, freely in boiling water, very soluble in alcohol and ether, in the concentrated acids, and in alkaline solutions, with which it strikes a deep red colour; or with hydrate of alumina* or subacetate of lead a crimson-red coloured precipitate is formed, which constitutes a very valuable and delicate test, available in many medico-legal inquiries."† In the light of these researches of O'Shaughnessy it is important to remember that happily for toxicologists, *Plumbagin* is one of the few vegetable poisons which can be detected by chemical analysis as a matter of certainty. "Two grains of the powdered bark," says Dr. O'Shaughnessy, "may be detected in a pint of a mixture of milk, blood and various articles of food."

The careful researches of Dr. O'Shaughnessy are further emphasized by Dr. Dymock and his confrères‡ in describing the chemical composition of *Plumbago rosea*. They say that "the activity of the drug depends upon the presence of *Plumbagin*." It crystallizes, they add, "in delicate needles or prisms, often grouped in tufts; has a styptic saccharine taste; melts very easily, and partly volatalizes unaltered when heated. It is neutral, nearly insoluble in cold, more soluble in boiling water, very soluble in alcohol and ether. It dissolves with yellow colour in strong sulphuric acid, and fuming nitric acid, and is precipitated by water in yellow flocks. Alkalies change the colour of the solution to a fine cherry-red; acids restore the yellow colour." The extreme importance of these tests, from a toxicological point of view, is my only apology for thus extensively reproducing the remarks contained in the "Pharmacographia Indica" of Dr. Dymock and his colleagues. Dr. Lyon § makes a few remarks which may well be reproduced here :—"Plumbagin treated with caustic potash solution dissolves, forming a bright crimson liquid. Hydrochloric acid added to this changes the colour to yellow, and on standing the liquid deposits yellow flocculi of Plumbagin, which may be separated by shaking the

* According to modern chemical nomenclature Aluminium trihydrate and tribasic acetate of lead respectively.

† O'Shaughnessy's Bengal Dispensatory, p. 509, 1841.

‡ Pharmacographia Indica, vol. ii, p. 332, 1891.

§ Medical Jurisprudence for India, p. 219, 1889.

acidified fluid with ether. An alcoholic solution of Plumbagin gives a crimson precipitate with solution of basic acetate of lead." Dr. Lyon further adds an important note which is useful for analytical purposes :—"A colouring matter obtained from rhubarb root gives, with caustic potash solution, a crimson colour similar to that given by Plumbagin. An alcoholic solution of it, however, gives, with acetate of lead solution, an orange precipitate, not a crimson precipitate like Plumbagin."

There is yet another work, and a more recent one, I should like to refer to in connection with the active principle hitherto known as *Plumbagin*. It is the Dictionary of the Active Principles of Plants, compiled and published by Charles E. Sohn, F.I.C.,F.C.S., last year. At page 10 of this valuable work Dulong's *Plumbagin* is otherwise named *Ophioxylin* (C_{16} H_{13} O_6, or C_{48} H_{39} O_{18}). It is said by Sohn to resemble *Juglone*.* It is one of the active principles, found in some of the representatives of the Natural Order *Apocynaceæ*, as, for instance, *Rauwolfia* (*Ophioxylon*) *serpentina* and *trifoliata*. It is seen in the form of orange crystals of the tetragonal system, the melting point of which is 71·8°. No wonder, then, that in India the active principle contained in those roots is of an evanescent nature where the normal temperature is, as a rule, above the melting-point above indicated, except in the cold weather. This leads me to consider here the following remark made in the "Pharmacographia Indica" (pp. 332-333) by Dr. Dymock and his colleagues, namely :—"M. Greshoff, who has been investigating the chemistry of the medicinal plants of Java * * * , is of opinion that the roots (supposed to be from *Rauwolfia serpentina*) examined by Wefers Bettink * * * were really those of *Plumbago rosea*. Professor Bettink extracted with chloroform a yellow crystalline principle, apparently the Plumbagin of Dulong. Had M. Greshoff the benefit of Sohn's recent researches, I am positive he would have come to the conclusion that they both contain the same active principle ;

* *Note.*—"Vogel and Reischauer discovered a substance which crystallized in reddish-yellow needles in the green outer shell of the unripe walnut (*Juglans regia*), and gave to it the name of *nucine*, and afterwards changed to *juglone*. C. Reischauer then pointed out that this substance was probably identical with the *regianine* which had been prepared from the nutshells by Phipson, and this was confirmed by the latter chemist."—Treatise on Chemistry, Roscoe and Schorlemmer, vol. iii, Organic Chem., part vi, p. 137.

and perhaps would not have said that, because the roots of *Rauwolfia serpentina* contained the active principle known as Dulong's *Plumbagin*, they were the roots of *Plumbago rosea*. As a matter of fact, from the statement of Sohn we know now, in 1895, that they both contain Dulong's *Plumbagin* which Sohn calls *Ophioxylin*.

So far, for the active principle of *Plumbago rosea*. Let me now go back to the researches of O'Shaughnessy, the founder of our accurate toxicological knowledge regarding the plant we are considering. Although he avowedly speaks from a clinical experience of "from 300 to 400 cases," Dr. O'Shaughnessy is modest enough to say in the very next sentence as follows:—"Our experiments lead us to believe that the blistering quality resides in the Plumbagin, but on this we are as yet unable to speak in positive terms." This is truly characteristic of the humility of a thoroughly scientific mind. Dr. O'Shaughnessy was fully aware of the influence his conclusions would exercise for good or for evil on the readers of his words for countless generations yet to be. Had he been aware of what the ancient Hindu writers had said about the plant hundreds of years before him, I am sure he would have been more positive in his assertion regarding the blistering quality of *Plumbago rosea*. In the *Raj-Nighant* of Narhar Pandit, in the *Bhâv Prákash* of Bhâv Misra, in *Madanpal-Nighant* and in *Dhanvantari Nighant*, *Plumbago rosea* is spoken of as *Anal* or *Vanhi*, which means *fire* ; and we know that when fire is brought into contact with human skin, it either burns the skin or blisters it. It produces a blister where it does not burn. Even so it is with the root of *Plumbago rosea*. In Sanskrit it is also called *Chitrak*, from which we derive our *Marathi* name. Rendered into English *Chitrak* means the *marker*. It distinctly marks the skin.

The experiments which Dr. Dymock and his colleagues are reported to have made* with two cwts. of *bazar plumbago root* (the italics are mine—K. R. K.) are worthy of notice here. From these two cwts. was obtained half-a-fluid ounce of a deep yellow oily fluid having a peculiar penetrating odour. The effect of a few drops of this oil "smeared upon the upper part of the arm was not vesicating and occasioned no inconvenient symptoms." This points to one of two

* Pharmacographia Indica, vol. ii, p. 333.

things—either that (1) the vesicating principle is volatile and that it had disappeared from the roots before they were experimented on, they being bazar-bought, and consequently perhaps of old standing, at any rate not quite so fresh as required ; for all the previous writers have distinctly said that the vesicating property exists in the fresh root ; or (2) that the vesicating principle is decomposed or chemically altered during the process of experimentation. This may be supposed to be a mere conjecture on my part ; and so it is. It is only as such that I submit it for the consideration of the colleagues of Dr. Dymock—Dr. Warden and Mr. Hooper—who helped Dr. Dymock in bringing out the "Pharmacographia Indica," with the humble suggestion that in their future experiments fresh root of *Chitrak* may be tried. The bazar root though apparently fresh and moist, is necessarily old and, in consequence, worthless for the purpose of accurate analysis. It should be taken fresh from the ground. Besides I find that Dr. Dymock and his colleagues had "to dry the root before it could be powdered." ("Pharmacographia Indica," p. 334, vol. II.) It is necessary that further researches should be made without drying the root, for the blistering quality is supposed to exist in the roots of plants of the entire genus *Plumbago when they are fresh.* In quoting the researches made by Prof. Flückiger and Mr. T. E. Gerock on *P. europæa*, Dr. Dymock observes that the Plumbagin which it contains, or which is obtained therefrom, is "probably the product of a rapid oxidation of *some primary substance contained in the plant.*" (The italics are mine—K. R. K.) May not this "*primary substance,*" I ask, be the vesicating agent which in Dr. Dymock's experiments underwent rapid oxidation? May not the inertness of the oil he obtained from the root be due to such rapid oxidation as he conjectures? There is room for yet more accurate research in this direction. I have only to repeat what Dr. Dymock has himself said with regard to the action of the root of *Plumbago rosea* :—"Its action is well worthy of accurate scientific investigation." ("Pharmacographia Indica," vol. II., p. 331.) There is need for further observation as to what is the chemical constitution of the blistering agent in this root.

The root of *Plumbago europæa* has long been known in Europe, and is used for various purposes. It is employed by beggars, says Lindley ("Vegetable Kingdom," p. 641, 1847), "to raise ulcers upon

their bodies to excite pity; its root is so acrid that it is used in Roumelia for causing issues, and even as a vesicant." A young woman who had applied it is said to have affirmed "that the pain it occasioned was intolerable and that she felt as if being flayed alive." It is also said to be emetic. The blistering properties of the entire genus *Plumbago* were not unknown to Pliny, for he says, observes Loudon,* that this plant (I should rather say the genus *Plumbago*—K. R. K.) was so called "from *plumbum*, because it possessed the power of curing a disorder in the eyes called by that name, which appears to have been the same as cataract." There is also a modern reason for the application of the name to this genus. *P. europæa* is called toothwort and also *dentelaire*, Fr., from its curing the toothache, "for which purpose the bruised root is chewed, when it excites by its causticity a healthy salivation, but stains the teeth a lead colour." The "Pharmacopœia of India" notes that the Javanese apply the root of *P. rosea* topically for the cure of toothache. Here is additional testimony from authoritative writers† :—"The Plumbagos contain a very caustic colouring matter; the root of the European species contains a fatty substance which gives a leaden colour to fingers and paper." In referring to *Plumbago europæa*, Beck‡ remarks as follows:—"Suavages observes that the workmen who make use of the decoction of this plant for the purpose of obtaining a yellow dye, are tormented by a severe headache if they work longer than six hours." As a stainer of the skin of a leaden hue, I may confidently say that our *Plumbago rosea* has no such notoriety. Dr. Norman Chevers says that it is a very active but painful and a *very uncertain vesicatory*. (The italics are mine—K. R. K.)

The root is used in various forms in India for criminal purposes. So far back as 1837, Dr. O'Shaughnessy noted this fact and succeeded in detecting the poison by chemical analysis as indicated in the foregoing remarks. Apart from its blistering property when applied to the human skin, there is yet a more serious and dangerous use of the root of *Plumbago rosea* for criminal purposes which must seriously engage our attention. Dr. O'Shaughnessy says that it is very largely used as an irritant to occasion abortion. For this purpose "it is introduced

* Encyclopædia of Plants, pp. 118-119, 1829.

† E. Le Maout and Decaisne's system of Botany, translated by Mrs. Hooker, p. 528, 1873.

‡ Medical Jurisprudence, p. 838, 1836.

into the vagina and applied directly to the neck of the uterus." To this observation of Dr. O'Shaughnessy, Dr. Norman Chevers adds a note* that the root of *Plumbago rosea* is frequently used with far more violence than is described by Dr. O'Shaughnessy. Referring to Dr. Norman Chevers' remarks on criminal abortion,† I find that Rai Bahadur Kannya Lall Dey affords him valuable information regarding the use of *chitrak* (red variety) for the purpose of procuring abortion. In a document the Rai Bahadur handed over to Dr. Norman Chevers, as the doctor's work was going to press, the veteran Babu says in unmistakeable language that *lal chitra* (the Bengali name of *lâl chitrak* or *tâmbdâ chitrak* as called in Western India), "is very certain in its action; producing shivering almost immediately after the application, followed by abortion in two or three hours; and it may be used at all periods of pregnancy, still the fœtus is always expelled lifeless, and the woman is in great danger." Such is also the experience of Dr. Allen Webb. Apart from this directly local use of the root of *Plumbago rosea* on the generative organs, Dr. O'Shaughnessy has shown that it is administered internally, that is to say, by the stomach to cause abortion. In support of this Dr. Norman Chevers cites a fatal case mentioned to him by Kannya Lall Dey which occurred in 1857, and in which a mixture of *chitrak* root and some arsenic was administered to a girl for the purpose of making her abort.‡ The indigenous writers I have mentioned above, are totally silent as regards the abortifacient quality of the root of *chitrak*. Chakradatta, as quoted by Udoy Chandra Dutt,§ is the only ancient Hindu authority who states that *Plumbago rosea* has a specific action on the uterus. "The root of *Plumbago rosea*," says he, "taken internally, will expel the fœtus from the womb whether dead or alive." Dr. Lyon, as Chemical Analyser to Government, Bombay, refers‖ to a case from Sangamner, in which "some pieces of stick, stated to have been used for the purpose of procuring abortion, were found to be armed at the end with cotton covered with a paste in which, on chemical examination, *Plumbagin*,

* Medical Jurisprudence, p. 251, 1870.

† Medical Jurisprudence, pp. 712—19, 1870.

‡ Dr. Norman Chevers' Medical Jurisprudence, p. 116, 1870.

§ The Materia Medica of the Hindus, p. 187, 1877.

‖ Report for the year 1881-82, p. 11.

the characteristic principle of *Plumbago rosea* and *zeylanica*, was detected." In a subsequent annual report,* reference is made to another case of death after abortion which occurred at Satara, and in which *Plumbagin*, the characteristic principle of *Plumbago rosea* and *zeylanica* was detected in a lump of paste found lying in the vagina of the deceased. In this case arsenic also was detected in minute quantity in the liver." Among the modern Hindu writers who recognize the abortifacient properties of *chitrak*, are Dr. Sakharam Arjun and Mr. Jaikisson Indraji.

Taken internally, the root of *Plumbago rosea* acts as an irritant. Dr. Dymock states that when given internally in large doses, it acts as a narcotico-irritant poison. "In small doses it acts first as a powerful stimulant of the mucous membrane of the digestive organs, and after absorption, as a stimulant of the excretory glandular organs."† Colonel Drury observes that the root is not unfrequently used internally by the natives in Bengal for criminal purposes. "Taken internally," says he, "it is an acrid stimulant and in large doses acts as an acro-narcotic."‡ Dr. Norman Chevers says that the root is criminally used internally in poisoning *men*."§ He cites two well-recorded cases, from which I give the following extracts :—

(Case 1). In May, 1843, a woman living in Howrah, pounded a small piece of a reddish-coloured root which had been given to her, and having mixed it with milk, gave it to her husband. He was taken ill in about two hours after swallowing it, and died after having vomited ten times and being purged once. The Civil Assistant Surgeon observed a slight flush of inflammation on the surface of the stomach and small intestines. * * * The surface of the stomach was found by Dr. Mouat who examined it, to be much corrugated and covered with small patches of inflammatory blush. On analysing the contents of the stomach, some of the matter vomited, and the remains of the food said to have been taken by the deceased, Dr. Mouat could detect no trace of any mineral poison, but obtained the distinct evidence of the characteristic appearance produced by *lâl chitra*.

* Report of the Chemical Analyser to Government, Bombay, for the year 1885, p. 7.
† Pharmacographia Indica, vol. ii, p. 331.
‡ Useful Plants of India, 1873, p. 348.
§ Medical Jurisprudence, 1870, p. 252.

(Case 2). In October, 1853, the Civil Assistant Surgeon of Azimgur forwarded the stomach, with its contents, of a man supposed to have died by poison, together with a substance found near the body and supposed by the police to be poison. The stomach was received by Dr. Mouat in an advanced state of decomposition, but still exhibited traces of inflammation and was found to contain *lâl chitra*. The substance sent was also found to be a portion of the root of the *Plumbago rosea*.

Dr. T. D. C. Barry, Chemical Analyser to Government, Bombay, in his annual report for 1891, refers to a case of poisoning by *Plumbago rosea*. The details of this case are not before me, nor have I seen the report. I am writing from the Government resolution on that report as published in the newspapers. I therefore refer the reader to the report itself for further information.

The table given by Dr. Dymock (pp. 335-339) in vol. II. of the "Pharmacographia Indica" shows the particulars of Plumbago poisoning in India, and is well worthy of the perusal of those who are interested in the toxicology of this plant and its active principle *Plumbagin*.

To summarize briefly what I have stated above, the deleterious effects of *Plumbago rosea* may be classified under three heads :—

(1) Externally or locally in men and women as a blistering agent.

(2) Internally, *i.e.*, by the stomach in men and women as an acro-narcotic or narcotico-irritant poison.

(3) Internally, *i.e.*, by the stomach, and locally through the genital organs as an abortifacient.

ON NEW AND LITTLE-KNOWN BUTTERFLIES FROM THE INDO-MALAYAN REGION.

By Lionel de Nicéville, f.e.s., c.m.z.s., &c.

(*With Plates N, O, P, and Q.*)

(*Read before the Bombay Natural History Society on 28th January*, 1895.)

(*Continued from page* 321.)

Family PAPILIONIDÆ.

Subfamily Papilioninæ.

36. PAPILIO (*Euplœopsis*) DANISEPA, Butler, Pl. Q, Fig. 48, ♀

P. danisepa, Butler, Ann. and Mag. of Nat. Hist., fifth series, vol. xvi, p. 343, n. 109 (1885); *Isamiopsis danisepa*, Swinhoe, Trans. Ent. Soc. Lond., 1893, p. 314, n. 405.

Habitat: Near Assam; Sylhet (*Butler*); Cherra Punji (*Swinhoe*); Htaroony stream, Arracan Hills, March (*Adamson*); Sibsagar, Jorehât, both in Assam; Katha district, Upper Burma; Thaungyin Forests, Middle Tenasserim, Daunat Range, Burma (*coll. de Nicéville*).

Expanse: ♀, 5·2 inches.

Description: Female. Upperside, *forewing* with the basal third of the wing and the whole of the sutural area bronzy-brown, the outer two-thirds of the wing fuscous, in certain lights glossed with brilliant purple; the outer half of the discoidal cell occupied by a creamy-white patch, its inner edge irregular; a very narrow similar streak at the apex of, but immediately beyond, the cell; a very small irrorated white spot at the base of the subcostal interspace; a larger triangular one with its apex pointed outwards at the base of the upper discoidal interspace; a large creamy-white streak outwardly dusted with purple scales at the base of the lower discoidal interspace; a similar but narrower and longer streak dusted throughout with purple scales in the upper median interspace; a very faint purple irrorated streak in the lower median interspace; a submarginal series of nine rounded white spots outwardly edged with purple, the three anterior ones out of line with the rest, bent inwardly, one spot in each interspace save the submedian which has two, these latter are somewhat linear in shape, and the posterior of them reaches the anal angle of the wing. *Hindwing* with the costa as far as the costal

nervure, the outer half of the wing broadly and the abdominal margin fuscous; the whole of the discoidal cell and seven streaks beyond the cell creamy-white, the six anterior streaks are outwardly irrorated with purple scales, the outermost streaks at either end of the series are the largest, the series decreasing by pairs till the fourth or middle spot is reached, which is the smallest; a submarginal series of seven rounded creamy-white spots, the two anteriormost ones the largest. UNDERSIDE, *both wings* glossy bronzy-brown, without any purple gloss whatever. *Forewing* with the markings as on the upperside, but there is an additional pair of small indistinct irrorated white streaks in the middle of the submedian interspace; there is a short white streak at the base of the discoidal cell; and the basal third of the sutural area is also white. *Hindwing* marked as on the upperside, but the white streaks beyond the cell are wider, the submarginal spots are twice as large, and there is an additional round white spot at the extreme base of the wing. *Cilia* of both wings black, spotted with white (more prominently on the hindwing) at each interspace. *Head* with a white streak down the face on each side between the eyes and a white spot on each side of the vertex; *antennæ* black; *thoraæ* with two white spots on each side anteriorly above, and a white streak posteriorly above, spotted with white beneath; *abdomen* with three series of large white spots on each side, and a median series beneath.

P. danisepa is a local race of *P. caunus*, Westwood, from Borneo. Other local races are *P. ægialus*, Distant, from the Malay Peninsula, and *P. velutinus*, Butler, from Sumatra.* The Javan form has not been named, though it has been recorded from thence by Dr. Felder as *P. caunus*. Of all these, *P. danisepa* is the largest and most beautiful, in the same way that *P. telearchus*, Hewitson, is the largest and most beautiful species of the group of *P. paradoxa*, Zinken-Sommer. With regard to *P. telearchus*, of which I described and figured the female sex,† Colonel Swinhoe writes‡ :—"The female, which is now, I believe, in the collection of Messrs. Godman and Salvin, did not differ from the other sex; it certainly had no resemblance to the

* Ann. and Mag. of Nat. Hist., fifth series, vol. xvi, p. 343 (1885).

† Journ. Bomb. Nat. Hist. Soc., vol. iv, n. 169, n. 8, pl. A, fig. 5, *female* (1889).

‡ Trans. Ent. Soc. Lond., 1893, p. 514, n. 403.

insect described and figured by de Nicéville." I do not know why Colonel Swinhoe in one sentence refers to the Godman and Salvin female in both the past and present tenses. But I am quite sure that I have correctly sexed the species. Mr. W. Doherty has recorded the following note on this butterfly* :—"The undescribed female of this species appears to be dimorphic, one form resembling the male, and the other the female, of *Euplœa midamus*, Linnæus (*linnæi*, Moore)." It is probable that the Godman and Salvin female is the one which resembles the male, while the specimen I described and figured is the more aberrant form which mimics the female *Euplœa*. I observe, however, that on November 7th, 1894, Colonel Swinhoe (as recorded in the Proceedings) exhibited at the Entomological Society of London a female of *P. telearchus* from Cherra Punji. As he refers to the specimen I figured and described in speaking of his own example, it seems probable that he now admits that my identification is correct. I possess another female example taken at Fort Langleh on 29th September, 1890. *P. butleri*, Janson, from the Malay Peninsula and N.-E. Sumatra, which is a local race of *P. telearchus*, is also dimorphic in Sumatra, one of these forms of the female from the Malay Peninsula is figured by Mr. Distant in Rhop. Malay., pl. xxvii, fig. 6, which mimics a brown *Euplœa*, while that form and one mimicking the female of the local race of *Euplœa midamus* occurring in Sumatra is also found in that island. It is not known if both these dimorphic female forms occur also in the Malay Peninsula, but it is highly probable that they do.

P. danisepa is a beautiful mimic, except as regards its much superior size, of *Euplœa* (*Danisepa*) *diocletianus*, Fabricius, which occurs with it. The male is very rare ; I possess five specimens only. The female here described is probably the first ever obtained, and I am greatly indebted to Lieut. James M. Burn, R. E., for the gift of the specimen, which he obtained last March at Mawhun, 3,000 feet elevation, in the Katha District of Upper Burma. The female of the parent form, *P. caunus*, Westwood, has already been described† by the late Herr Eduard G. Honrath, who also remarks on the extraordinary

* Journ. A. S. B., vol. lviii, pt. 2, p. 130 (1889).

† Berliner Ent. Zeitsch., vol. xxxvi, p. x (1891).

rarity of that sex. Two specimens only were obtained by Baron Schönberg's collector Wahnes.

Family HESPERIIDÆ.

37. DAIMIO DIRÆ, n. sp., Pl. Q, Fig. 49, ♂.

HABITAT : Pulo Laut ; Java ; N.-E. Sumatra.

EXPANSE : ♂, 1·6 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* dark shining brown. *Cilia* cinereous. *Forewing* with the following hyaline whitish spots :—Five very small, apical, forming a sinuous line ; a comma-shaped one towards the end of the discoidal cell ; a small square one towards the base of the second median interspace ; another similar one, but four times as large as the one anterior to it, its outer edge concave, towards the base of the first median interspace : two pairs of indistinct sullied spots in the submedian interspace, the spots of each pair placed one above the other, the inner pair below the inner corner of the large quadrate spot in the interspace above, the outer pair in a line with the small quadrate spot in the second median interspace ; this latter pair of spots has other spots anterior to it on the disc, but highly indistinct. *Hindwing* with a large oval shining snow-white spot on the middle of the disc, neither reaching the abdominal margin nor the costa ; a rather prominent narrow submarginal macular sullied fascia. UNDERSIDE, *both wings* dull instead of shining brown as on the upperside. *Forewing* with the hyaline spots as on the upperside ; the two pairs of spots in the submedian interspace much purer white, larger, and more conspicuous than above. *Hindwing* has the large discal spot considerably larger than on the upperside, anteriorly it reaches midway between the costal nervure and the first subcostal nervule, posteriorly almost to the abdominal margin ; the submarginal fascia as on the upperside. *Antennæ*, *head*, *body*, and *legs* dark brown ; *palpi* with the third joint dark brown, the second chrome-yellow.

Nearest to *D. phisara*, Moore, a common species in Sikkim, the Khasi Hills, and Burma, and I have a single example from Perak in the Malay Peninsula ; differing therefrom on the upperside of the forewing in the spot towards the end of the discoidal cell being comma-shaped

and extending right across the cell, instead of being much smaller and round and placed against the median nervure ; and the snow-white (instead of pale-yellow) area on the hindwing being very much smaller, confined to the middle of the disc only instead of reaching the costal and abdominal margins. It is also allied to "*Satarupa*" *corona*, Staudinger,* from Alabat, Mindora, Camiguin de Mindanao, and Davao—all in the Philippine Isles, from which it appears to differ on the upperside of the hindwing in the discal spot being much smaller, and the submarginal fascia being sullied and more continuous, in *D. corona* it appears to be broken up into small white spots.

Described from a single example taken by Mr. W. Doherty in Pulo Laut, Borneo, in June, 1891, and deposited in Mr. H. J. Elwes' collection. Herr H. Fruhstorfer has sent me a second specimen, since the description above was written, from Java without any precise locality. It differs in some slight details from the type, more especially in having the discal white spot on the hindwing somewhat larger, and the submarginal line a little more prominent, but it is nevertheless obviously the same species. In the collection of Hofrath Dr. L. Martin are two more specimens of this species from N.-E. Sumatra, one taken at Selesseh on 13th May, the other in the Battak Mountains in July. They agree very closely with the type.

Genus SUADA, nov.

MALE. FOREWING, lengthened, narrow ; *costa* very nearly straight ; *apex* rather acute ; *outer margin* round at apex, then nearly straight (slightly convex only) to anal angle ; *anal angle* rounded ; *inner margin* straight, considerably longer than the outer margin ; *costal nervure* ending on the costa opposite the apex of the discoidal cell ; *first subcostal nervule* bent forwards soon after its origin and touching for some considerable distance, but not anastomosing with, the costal nervure ; *second* subcostal arising a little nearer to the first than to the third ; *third* subcostal arising near to the fourth ; *fourth* subcostal terminating at the apex of the wing ; *subcostal nervure* as usual ending on the outer margin well below the apex of the wing ; *discoidal cell*

* *Satarupa corona*, Semper, Schmett. Philip. Inseln, p. 306, n. 457, pl. xliv, fig. 2, *female* (1892). Dr. Staudinger's name appears to be a MS. one only ; I cannot find the species described by him anywhere.

long, reaching to two-thirds the length of the wing from the base; *upper disco-cellular nervule* long, strongly outwardly oblique; *middle* disco-cellular slightly longer than the lower disco-cellular, straight, inwardly oblique; *lower* disco-cellular upright, slightly anteriorly concave, posteriorly straight; *second median* nervule arising close to the lower end of the cell; *first* median arising about four times as far from the second as the second does from the third, arising much nearer to the lower end of the cell than to the base of the wing; *submedian nervure* sinuous. HINDWING, narrow, much broader than long; *costa* strongly arched at base, thence slightly arched to apex; *apex* rounded; *outer margin* distinctly excavated at the termination of the first median nervule; *anal angle* well rounded; *abdominal margin* slightly convex; *costal nervure* very straight, slightly curved at the base only; *first subcostal nervule* arising rather close to the apex of the cell; *disco-cellular* nervules concave, outwardly oblique; *discoidal* nervule wanting; *second median* nervule arising quite close to the lower end of the cell; *first* median arising much nearer the end of the cell than the base of the wing, arising at about three-fifths of the length of the cell from the base; *submedian* and *internal nervures* straight. ANTENNÆ long, more than half the length of the costa of the forewing, the club moderately stout, curved at the tip, the end of the club ending in a sharp point. PALPI erect; second joint broad, densely hairy; third joint long, naked, slender, acuminate, reaching well above the vertex of the head. LEGS very long and slender; foreleg, tibia with an epiphysis; hindleg, tibia with two pairs of spurs. THORAX small, weak. ABDOMEN, slender, long, reaching quite to the outer margin of the hindwing. FEMALE. Differs from the male only in the wings being somewhat broader. Type, "*Hesperia*" *swerga*, de Nicéville.

This genus comes into Capt. E. Y. Watson's subfamily *Pamphilinæ*, Section A (*vide* Proc. Zool. Soc. Lond., 1893, p. 71), and is allied to *Suastus*, Moore; *Acleros*, Mabille; *Iambrix*, Watson; *Koruthaialos*, Watson; *Oxypalpus*, Watson; and *Teinorhinus*, Watson, with all of which it agrees in the form of the palpi. It differs, however, from these genera in the shape of the wings, which are greatly lengthened, and the discoidal cell of the forewing being extremely narrow. It is perhaps nearest to *Koruthaialos*, from which it differs in neuration in that the second median nervule of the forewing arises nearer to the end of the

discoidal cell than it does in *K. hector*, Watson, the type of the genus, and the lower disco-cellular nervule is upright instead of inwardly oblique ; in the hindwing also the second median nervule arises nearer to the end of the cell; the disco-cellular nervules of *Suada* are outwardly oblique, in *Koruthaialos* they are upright.

(1.) SUADA SWERGA, de Nicéville.

Hesperia? swerga, de Nicéville, Journ. A. S. B., vol. lii, pt. 2, p. 89, n. 38, pl. x, fig. 12, *male* (1883) ; *Suastus swerga*, Elwes, Trans. Ent. Soc. Lond., 1888, p. 450, n. 475; *Suastus möllerii*, Moore, l.c., vol. liii, p. 49 (1884).

HABITAT : Sikkim ; Tenasserim (Beeling, Ataran Valley, Daunat Range) ; Malay Peninsula (Perak); N.-E. Sumatra ; Java.

38. SUASTUS ROBSONII, n. sp., Pl. Q, Fig. 50, ♂.

HABITAT : Masuri, Western Himalayas.

EXPANSE : ♂, 1·45 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* shining dark hair-brown. *Cilia* cinereous. *Forewing* with a very minute hyaline white spot in the middle of the outer end of the discoidal cell. *Hindwing* rather paler on the disc than elsewhere owing to the presence of some long dull ochreous hair-like scales. UNDERSIDE, *both wings* paler than above. *Forewing* with the inner half of the wing dark hair-brown as on the upperside ; the cell spot as above ; a pale streak in the middle of the submedian interspace. *Hindwing* (as seen under a strong magnifying glass) overlaid throughout with dull ochreous scales ; an elongated minute black spot at the end of the cell. *Abdomen* dark brown above, beneath each segment is ringed with whitish.

Nearest to *Suastus minuta*, Moore, from Ceylon, from which it differs in the cilia of the hindwing being less pure white, and on the underside in having the hindwing practically unmarked, *S. minuta* having its posterior two-thirds pure white, bearing three prominent dark brown spots. In Captain E. Y. Watson's revision of the genera of the *Hesperiidæ* in Proc. Zool. Soc. Lond., 1893, p. 76, there is a misprint bracketing *S. minuta* with *Suada swerga*, de Nicéville (= *S. möllerii*, Moore), but the two species are abundantly distinct and are given separate numbers. *S. swerga* has a much wider range

than was expected ; not only does it occur in Sikkim, Beeling in North Tenasserim, the Ataran Valley, and on the Daunat Range in Middle Tenasserim, but also in Perak in the Malay Peninsula, and in N.-E. Sumatra and Java.

Described from a single example obtained on the 12th July, 1892, by Mr. S. Robson, after whom I have much pleasure in naming the species.

Genus GE, nov.

MALE. FOREWING, *costa* regularly and slightly arched throughout its length ; *apex* rather rounded ; *outer margin* nearly straight, except from the apex of the wing to about the termination of the lower discoidal nervule where it is at right-angles to the costa ; *inner angle* rounded ; *inner margin* straight, as long as the outer margin ; *costal nervure* ending before the apex of the discoidal cell ; *subcostal nervules* arising at slightly decreasing distances apart ; *discoidal cell* narrow, extending to beyond the middle of the wing, not reaching to two-thirds the length of the wing from the base ; *upper disco-cellular nervule* rather long, strongly outwardly oblique ; *middle* disco-cellular straight, strongly inwardly oblique ; *lower* disco-cellular also straight, in the same straight line as the middle disco-cellular, of about the same length ; *second median* nervule arising well before the lower end of the cell ; *first* median arising nearer to the lower end of the cell than to the base of the wing ; *submedian nervure* straight ; a circular sexual dense *tuft of hairs* placed on the upperside of the wing towards the base of the first median interspace ; the area to which the bases of these hairs is attached shows prominently on the underside as a circular disc. HINDWING, longer than broad ; *costa* greatly arched at the base, less so to the apex of the wing ; *apex* rounded ; *outer margin* rounded, but considerably excised about the termination of the first median nervule ; *anal angle* rather acute ; *abdominal margin* straight ; *costal nervure* slightly curved only, terminating at the apex of the wing ; *first subcostal nervule* arising long before the apex of the cell ; *upper disco-cellular* straight, upright ; *lower* disco-cellular straight, outwardly oblique, longer than the upper ; *discoidal* nervule present ; *second median* nervule arising a little before the lower end of the cell ; *first median* arising about twice as far from the second as the second does

from the third ; *submedian* and *internal nervures* straight. ANTENNÆ long, more than two-thirds the length of the costa of the forewing, the club lengthened, very slender, the apex of the club long and thin. PALPI densely hairy, porrect, the third joint hidden beneath the second. THORAX small. ABDOMEN slender, a little longer than the anal angle of the hindwing. LEGS, foreleg, tibia with an epiphysis ; hindleg, femur thickly fringed, tibia with two pairs of spines. Type *Ge geta*, de Nicéville.

The genus appears to be nearest to *Matapa*, Moore, and *Sepa*,* de Nicéville, differing from both in the unique character of the "sex-mark" in the forewing. It differs from the former in having the antennæ perceptibly longer, with a much more slender club, with a longer and slenderer apical crook. The sexual tuft of hairs in the genus *Ge* reminds one of that in *Baoris oceia*, Hewitson, but in the former it is much smaller, circular, and placed on the upperside of the forewing ; while in the latter it is much larger, elongated, and placed in the middle of the cell and extending far beyond the cell, lying across the bases of the three median nervules, on the upperside of the hindwing. *B. oceia* has a glandular patch of scales placed on the middle of the submedian nervure of the forewing on the underside, and extending well beyond that vein on either side, which is wholly wanting in *Ge*. The pale patch in *Ge geta* on the disc of the hindwing on the upperside is almost certainly sexual, the scales being much modified ; there is also a tuft of long hairs attached along the subcostal nervure and partly covering the pale patch of modified scales, which also is almost certainly a male sexual character.

39. GE GETA, n. sp., Pl. Q, Fig. 51, ♂.

HABITAT : Penang ; N.-E. Sumatra.

EXPANSE : ♂, 1·5 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* shining dark brown, immaculate. *Cilia* cinereous. *Forewing* with the sexual small round dense raised tuft of hairs towards the base of the first median interspace jet-black. *Hindwing* with a large rounded space in the middle of.

* *Sepa*, de Nicéville, Journ. A. S. B., vol. lxiii, pt. 2, p. 49 (1894), from N.-E. Sumatra.

the wing paler than the rest of the surface composed of modified scales. UNDERSIDE, *both wings* coloured as on the upperside. *Forewing* with a broad dark ochreous fascia commencing on the inner margin extending on to the disc, and just enclosing the disc-like "male-mark" on its basal edge. *Hindwing* unmarked. *Cilia* of both wings pale ochreous. *Head, antennæ, palpi, body,* and *legs* dark brown.

Described from two examples in my collection—one from Penang, the other from N.-E. Sumatra; the latter kindly sent to me by Hofrath Dr. L. Martin, who has other specimens in his own collection.

Genus IDMON, nov.

MALE. FOREWING, triangular, rather short; *costa* nearly straight, only slightly arched; *apex* somewhat acute; *outer margin* regularly convex to the inner angle; *inner angle* rounded; *inner margin* straight; *costal nervure* short, ending just before the apex of the discoidal cell; *subcostal nervules* arising at progressively decreasing distances apart; *discoidal cell* narrow, rather short, not reaching to two-thirds the length of the wing from the base; *upper disco-cellular nervule* very short indeed, practically obsolete, outwardly oblique; *middle* and *lower* disco-cellular very upright, slightly inwardly oblique only, both slightly concave, the middle a very little longer than the lower; *second median* nervule arising close to the lower end of the cell; *first* median arising a little nearer to the base of the wing than to the lower end of the cell; *submedian nervure* straight; a *sexual brand* placed anterior to but against the submedian nervure towards its base, this brand is narrow and raised. HINDWING, almost circular, as broad as it is long; *costa* much arched at the base, thence slightly arched to the apex; *outer margin* evenly rounded to the anal angle; *anal angle* rounded; *abdominal margin* slightly convex; *costal nervure* rather arched, ending at the apex of the wing; *first subcostal nervule* arising rather near to the apex of the cell; *disco-cellular* nervules placed slightly obliquely outwardly, very concave; *discoidal* nervule wholly absent; *second median* nervule arising quite close to the lower end of the cell; *first* median arising much nearer to the lower end of the cell than to the base of the wing; *submedian* and *internal nervures* straight. ANTENNÆ

long, more than half the length of the costa of the forewing, with an elongated slender club, the terminal crook short. PALPI erect, second joint densely hairy ; third joint naked, bluntly conical, standing out prominently from the second joint. THORAX rather stout. ABDOMEN slender, reaching to the anal angle of the hindwing. LEGS, hindleg, femur fringed throughout its length, not tufted ; tibia with a tuft of hairs attached to its proximal and two pairs of spines on its distal end. FEMALE. Differs from the male only in the wings being broader, and lacking the sexual brand on the forewing. Type, "*Baoris*" *unicolor*, Distant.

Idmon is apparently nearest to *Arnetta*, Watson, but differs entirely in the male secondary sexual characters, the male of *A. atkinsoni*, Moore, the type of *Arnetta*, having the inner margin of the forewing lobed, with a tuft of long setæ attached to the lobed portion, while *I. unicolor*, Distant, has the inner margin to the forewing straight, with no tuft of hairs, but has instead a narrow raised brand of modified scales lying alongside a portion of the submedian nervure towards its base on the upperside of the forewing. The shape of the wings in the males of the two typical species of the two genera is very similar, but *Idmon* has the second median nervule of the forewing arising nearer to the lower end of the discoidal cell, while the first median nervule arises much nearer the base of the wing than in *Arnetta* ; and the discoidal nervule of the hindwing is quite wanting in *Idmon*, while it is present in *Arnetta*. *Idmon* is more distantly related to *Itys*, de Nicéville, but the shape of the wings and the palpi will readily distinguish between them. The male glandular streak on the upperside of the forewing is almost exactly similar to that found in some species of the otherwise very different genus *Padraona*, Moore. I am persuaded that the genus is a valid one, and can give no more convincing reason for the fact that it is quite distinct from *Arnetta* than the postulate laid down by Captain E. Y. Watson in Proc. Zool. Soc. Lond., 1893, p. 6, quoted below, with which I cordially agree :—"In any particular genus in which male secondary sexual characters are found, the particular male character (be it costal fold, discal stigma, or tuft of hairs) may be present or absent in different species of that same genus, but is never replaced by a character of different structure."

40. IDMON UNICOLOR, Distant, Pl. Q, Fig. 53, ♂.

Baoris unicolor, Distant, Rhop. Malay., p. 381, n. 5, pl. xxxv, fig. 11, *female* (1886).

HABITAT : Malacca (*Distant*) ; Perak.

EXPANSE : ♂, 1·35 ; ♀, 1·35 to 1·45 inches.

DESCRIPTION : "UPPERSIDE and UNDERSIDE, *both wings* unicolorous rufous-brown. *Body* dark brown. *Legs* pale brown."

"This obscure, and to me unique, *Baoris* is contained in the collection of Dr. Staudinger, to whom I am indebted for the opportunity of figuring and describing it." (*Distant*, l.c.)

Mr. Distant's choice of a name for this species was a little unfortunate, as in 1883 Mr. Moore had used the same for an extreme form of the very variable *Baoris oceia*, Hewitson. My identification of the species is also a little dubious ; all that Mr. Distant says about it is given above, and if my identification of the unique specimen he figured and described is correct, the sex of which is not even stated, it has nothing in common with the genus *Baoris*, Moore, as that genus comes into Section B, while my specimens come into Section A, of Captain Watson's subfamily *Pamphilinæ*. I possess a single male and two females, all from Perak, of *I. unicolor*, and find by comparing the female examples with Mr. Distant's figure of the species that they agree very closely.

Genus ITYS, nov.

MALE. FOREWING, triangular, rather lengthened; *costa* very straight; *apex* acute ; *outer margin* convex ; *inner angle* rather acute ; *inner margin* straight, considerably longer than the outer margin ; *costal nervure* terminating on the costa well before the apex of the discoidal cell ; *subcostal nervules* arising at decreasing distances apart ; *discoidal cell* long, more than half, less than two-thirds, the length of the wing; narrow ; *upper disco-cellular nervule* stout, short, strongly outwardly oblique ; *middle* and *lower* disco-cellulars sub-erect (slightly inwardly oblique), straight, thin, the middle rather longer than the lower ; *second median* nervule arising well before the lower end of the cell ; *first* median arising a little nearer to the lower end of the cell than to the base of the wing ; *submedian nervure* straight ; a long *sexual tuft of hairs* attached to the inner margin of the wing towards the base

and turned under and forwards. HINDWING, elongated, much longer than broad ; *costa* greatly arched at the base, convex to the apex ; *apex* much rounded ; *outer margin* regularly rounded to the anal angle ; *anal angle* somewhat acute ; *abdominal margin* straight ; *costal nervure* well arched, terminating at the apex of the wing ; *first subcostal nervule* arising long before the apex of the cell ; *disco-cellular* nervules almost erect, slightly only outwardly oblique, strongly concave ; *discoidal* nervule obsolete ; *second median* nervule arising a little before the lower end of the cell ; *first* median arising about twice as far from the second as the second does from the first ; *submedian* and *internal nervures* straight. ANTENNÆ long, more than half the length of the costa of the forewing, with an elongated slender club, the terminal crook short. PALPI porrect, densely hairy, third joint almost invisible, hidden amongst the hairs of the second joint. THORAX rather stout. ABDOMEN slender, reaching just to the anal angle of the hindwing. LEGS, foreleg with an epiphysis ; hindleg, femur fringed throughout its length, not tufted ; tibia with a single pair of long spines at its distal end. Type, *Itys iadera*, de Nicéville.

This genus may be nearest to *Isma*, Distant*, of which *I. obscura*, Distant, is the type, a species I have not seen, and which appears to be very badly figured (Rhop. Malay., p. 386, n. 1, pl. xxxv, fig. 19 (1886), nor is the sex stated of the specimen described. Captain Watson's diagnosis of the genus *Isma* was drawn up from "*Hesperia*" *cephala*, Hewitson, which may or may not be congeric with *Isma obscura*. *Itys* is certainly very near to the genus *Arnetta*, Watson, Proc. Zool. Soc. Lond., 1893, p. 81, of which "*Isoteinon*" *atkinsoni*, Moore, is the type. It differs from the male of that species in the forewing being more elongated, the inner margin being longer than (instead of the same length as) the outer margin ; the discoidal cell is longer and narrower, the second median nervule arises nearer the lower end of the cell, there is also a greater space between the origins of the first and second median nervules, the submedian nervure is straight instead of being greatly distorted in the middle ; the inner margin is straight, in *I. atkinsoni* it is lobed towards the base, the lobed portion being turned under ; the hindwing is more elongated, the disco-cellular

* Rhop. Malay., p. 386 (1886).

nervules are very concave instead of straight, the discoidal nervule is obsolete, in *A. atkinsoni* it is fairly well developed; lastly, the palpi differ considerably, the third joint being almost entirely hidden beneath the long hairs of the second joint instead of being projected far beyond that joint. In *Arnetta atkinsoni* the male has the bases of the first and second median nervules of the hindwing much swollen, this character being found also in the same position in the genera *Gangara*, Moore, and *Paduka*,* Distant, but is absent in the genus *Itys*.

41. (1) ITYS IADERA, n. sp., Pl. Q, Fig. 52, ♂.

HABITAT: Penang, Malay Peninsula; N.-E. Sumatra.

EXPANSE: ♂, 1·2 to 1·4 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* and *cilia* shining brownish-fuscous, immaculate. *Forewing* with the sexual tuft of hairs attached to the inner margin and turned under and forwards deep black. UNDERSIDE, *both wings* as above. *Head*, *antennæ*, *body* throughout, and *legs* fuscous.

This species is one of the most plainly-coloured butterflies I know, and is altogether without markings.

Described from one male from Penang, and three from N.-E. Sumatra, one of which was taken in the Battak Mountains in September, all in my collection, and others in the collection of Hofrath Dr. L. Martin.

(2) ITYS MICROSTICTUM, W.-M. and de N.

Isoteinon microstictum, Wood-Mason and de Nicéville, Journ. A. S. B., vol. lv, pt. 2, p. 385, n. 232, pl. xvii, figs. 3, *male*; 3*a*, *female* (1886).

HABITAT: Silcuri, Cachar (*Wood-Mason* and *de Nicéville*); Silchar, Cachar (*coll. de Nicéville*).

Genus PUDICITIA, nov.

MALE. FOREWING, slightly arched regularly and evenly throughout; *apex* rather acute; *outer margin* nearly straight, convex below the

* *Paduka*, Distant, and *Paduca*, Moore, were described in the same year (1886), and the former has priority. As, however, there is a slight difference in spelling, perhaps both may be allowed to stand.

apex ; *inner angle* rounded ; *inner margin* straight, considerably longer than the outer margin ; *costal nervure* ending before the apex of the discoidal cell ; *subcostal nervules* arising at nearly equal distances apart ; *discoidal cell* a little less than two-thirds as long as the costa ; *upper disco-cellular nervule* very short, stout, outwardly oblique ; *middle* disco-cellular strongly inwardly oblique, in the same straight line as the lower disco-cellular ; *lower* disco-cellular straight, shorter than the middle disco-cellular ; *second median* nervule arising well before the lower end of the cell ; *first* median arising about midway between the base of the wing and the origin of the second median nervule ; *submedian nervure* straight, with a narrow *brand* formed of modified black scales placed anteriorly against it along its basal second and third fifths. HINDWING, *costa* greatly arched at the base, less so to the apex ; *apex* much rounded ; *outer margin* convex, slightly emarginate at the termination of the first median nervule ; *abdominal* margin rounded ; *costal nervure* regularly curved throughout, ending at the apex of the wing ; *first subcostal nervule* arising well before the upper end of the cell ; *discoidal cell* reaching to the middle of the wing ; *discoidal nervule* obsolete ; *disco-cellular* nervules of equal length, slightly concave and slightly outwardly oblique ; *second median* nervule arising quite close to the lower end of the cell ; *first* median arising much nearer to the end of the cell than to the base of the wing, the distance between the base of the first and second median nervules is about three times that between the second and first ; *submedian* and *internal nervures* nearly straight. ANTENNÆ about half the length of the costa of the forewing, with a well-formed club, ending in a long whip-like point. PALPI densely scaly, second joint broad, pressed closely against the face, the third joint entirely concealed. THORAX very robust. ABDOMEN rather stout, tapering, extending well beyond the outer margin of the hindwing. LEGS, femur of hind-leg fringed beneath, tibia with two pairs of spines. FEMALE, a little larger than the male, lacking the sexual brand on the forewing, the abdomen stouter than in the male, shorter, not reaching beyond the outer margin of the hindwing. Type, "*Parnara*" *pholus*, de Nicéville.

Pudicitia is very near to *Erionota*, Mabille, of which genus *E. thrax*, Linnæus, is the type, differing therefrom in the presence of a

secondary sexual character on the forewing of the male ; in the middle disco-cellular nervule of that wing being straight throughout its course, in *Erionota* its posterior portion is strongly outwardly curved ; the second median nervule arises nearer to the lower end of the cell ; and the outer margin of the forewing is more upright, less inwardly oblique, owing to the inner margin being proportionally longer than in *Erionota*.

(1) PUDICITIA PHOLUS, de Nicéville.

Parnara pholus, de Nicéville, Journ. Bomb. Nat. Hist. Soc., vol. iv, p. 172, n. 11, pl. B, fig. 3, *female* (1889).

HABITAT : Bhutan ; Khasi Hills.

Genus ACERBAS, nov.

MALE. FOREWING, triangular, rather narrow ; *costa* nearly straight, slightly arched only ; *apex* somewhat rounded ; *outer margin* at the apex nearly at right-angles to the costa, afterwards inwardly oblique, straight ; *inner* margin straight, distinctly longer than the outer margin ; *costal nervure* ending on the costa before the apex of the discoidal cell ; *subcostal nervules* counting from the base of the wing arising from the subcostal nervure at decreasing distances apart ; *discoidal cell* narrow, long, extending to two-thirds the length of the wing from the base ; *upper disco-cellular nervule* short, strongly outwardly oblique ; *middle* disco-cellular long, upright, concave ; *lower* disco-cellular straight, slightly inwardly oblique, slightly shorter than the middle one ; *lower discoidal* nervule in consequence of the greater length of the middle disco-cellular arising slightly nearer to the third median than to the upper discoidal nervule ; *second median* nervule arising far before the lower end of the cell ; *first* median arising near the base of the wing, arising at about the same distance from the base of the wing as the second arises from the lower end of the cell ; *submedian nervure* slightly curved ; *secondary sexual character* consists of a large inconspicuous patch of plush-like modified scales in the middle of the wing on the lower surface. HINDWING, much longer than broad ; *costa* greatly arched at base, gently arched from thence to apex ; *apex* rounded ; *outer margin* rounded, very slightly excavated on either side of the termination of the submedian

nervure ; *anal angle* rounded ; *abdominal margin* nearly straight ; *costal nervure* long, gently curved throughout its length, ending at the apex of the wing ; *first subcostal nervule* arising far before the apex of the cell ; *disco-cellular* nervules upright, slightly concave, of equal length ; *discoidal* nervule present, fine, the outer portion deflected downwards so that that portion lies nearer the third median than the upper discoidal nervule ; *second median* nervule arising close to the lower end of the cell ; *first* median arising about twice as far from the second as the second does from the third, arising much nearer the lower end of the cell than the base of the wing ; *discoidal cell* reaching to about the middle of the wing ; *submedian* and *internal nervures* straight. ANTENNÆ a little more than half the length of the costa of the forewing, the club moderate, with a fine terminal crook about twice as long as the greatest breadth of the club. PALPI broad, densely hairy, third joint but very slightly projecting above the second. THORAX slender, weak. ABDOMEN reaching just to the outer margin of the hindwing. LEGS, foreleg, tibia with an epiphysis ; hindleg, tibia with two pairs of spurs. FEMALE. Differs from the male only in the absence of the patch of modified scales on the underside of the forewing, and in having both wings somewhat broader. Type, "*Hesperia*" *anthea*, Hewitson.

Acerbas appears to me to be nearest allied to the genera *Eetion*, de Nicéville, and *Zea*, Distant, from the former the male may be readily distinguished by the quite different character of the secondary sexual characters, the lower disco-cellular nervule of the forewing is much shorter, and the first median nervule of the forewing arises nearer the base of the wing ; from the latter it differs in having the middle disco-cellular nervule of the forewing upright instead of strongly inwardly oblique. *Zea* also has no secondary sexual characters in the male whatever.

(1) ACERBAS ANTHEA, Hewitson.

Hesperia anthea, Hewitson, Desc. *Hesp.*, p. 29, n. 17 (1868) ; *Plesioneura* (?) *anthea*, Distant, Rhop. Malay., p. 404, pl. xxxv, fig. 32, *female* (1886) ; *Cobalus ciliatus*, Butler, Trans. Linn. Soc. Lond., Zoology, second series, vol. i, p. 554, n. 2 (1877).

HABITAT : Singapore (*Hewitson*) ; Malacca (*Butler*) ; Borneo (*Doherty, coll. Elwes*) ; Daunat Range, Tenasserim, Burma ; Java (*coll. de Nicéville*) ; N.-E. Sumatra (*coll. Martin*).

This is apparently somewhat variable. My solitary female specimen from central Java, 1,500 feet, captured by Herr H. Fruhstorfer, has the white area on both sides of the hindwing more extensive than in the typical female example from Singapore figured by Distant. My single male from Burma and two from Java also differ slightly in the extent of the white area, the Javan specimens having it the most extensive of all.

42. KERANA FULGUR, de Nicéville, Pl. Q, Fig. 54, ♂.

K. fulgur, de Nicéville, Journ. A. S. B., vol. lxiii, pt. 2, p. 55, n. 46, pl. i, fig. 6, *female* (1894).

HABITAT : N.-E. Sumatra.

EXPANSE : ♂, 1·7 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* dark shining purplish-fuscous. *Cilia* concolorous. *Forewing* with a large discal chrome-yellow patch, occupying about half the surface, the patch is anteriorly bounded by the subcostal nervure, posteriorly it ends on the inner margin, its outer edge is evenly curved throughout, its inner edge is more irregular, from the subcostal nervure to the first median nervule it is upright and nearly straight, posterior to that vein it is directed inwardly obliquely, but does not reach the base of the wing on the inner margin. *Hindwing* has the basal third thickly clothed with long chrome-yellow setæ. UNDERSIDE, *both wings* with the ground-colour duller than on the upperside. *Forewing* with the chrome-yellow area paler, anteriorly continued almost to the costa. *Hindwing* as in the female. *Antennæ*, *palpi*, *eyes*, *head*, and *abdomen* as in the female ; *thorax* above anteriorly clothed with very long fuscous setæ, gradually merging into a thick coat of chrome-yellow setæ, which lie over the base of the abdomen.

This species has been described from two pairs of specimens, the one (the types) is in my collection, the other in Dr. Martin's collection.

43. LOTONGUS AVESTA, Hewitson, Pl. Q, Fig. 56, ♀.

Hesperia avesta, Hewitson, Desc. *Hesp.*, p. 30, n. 19 (1868).

HABITAT : Sumatra (*Hewitson*) ; Pulo Laut, Borneo (*coll. Elwes*) ; Ataran Valley, Tenasserim, Burma.

EXPANSE : ♀, 1·7 inches.

DESCRIPTION : FEMALE. UPPERSIDE, *both wings* shining hair-brown. *Forewing* with two translucent ochreous-white spots placed inwardly

obliquely in the median interspaces, the upper the smaller, their outer edges rounded, their inner edges excavated. *Hindwing* immaculate. UNDERSIDE, *both wings* with the ground-colour as above. *Forewing* with a prominent pale yellow spot towards the end of the discoidal cell, anteriorly placed against the subcostal nervure, undividedly continued to the costa in a broad streak ; the discal spots as on the upperside; the inner margin as far as the first median nervule, but not quite reaching the outer margin, whitish. *Hindwing* with a straight somewhat narrow ante-discal pale yellow band from the abdominal margin to the costa, slightly interrupted by the submedian fold. *Cilia* of both wings anteriorly brown, posteriorly cinereous. *Antennæ* fuscous above, the club beneath pale yellow. *Palpi, head, thorax*, and *abdomen* above dark brown, beneath and *legs* pale yellow.

Nearest to *Lotongus sarala*, de Nicéville,* from the Khasi Hills (*de Nicéville*), Moupin and Omei-shan, both in Western China, taken in July (*Leech*), from the figure of the male of which it differs in having two instead of five spots on the upperside of the forewing, no discal patch on the upperside of the hindwing, the band on the underside of the hindwing half as wide, paler, and less prominently divided by the submedian fold, the cilia on the anal half of the hindwing is cinereous instead of orange-yellow, and the head, thorax, and body above entirely lacking the prominent iridescent green setose covering which is such a prominent and beautiful feature in *L. sarala*. Of the latter I possess three females from the Khasi Hills. Another very closely allied species is the "*Proteides*" *excellens* of Staudinger,† from Palawan in the Philippine Isles (*Staudinger*), N.-E. Sumatra (*colls. Hofrath, Dr. L. Martin* and *de Nicéville*), but that species has an additional small subapical spot (sometimes two) in the forewing, has no spot in the submedian interspace of that wing, and the yellow area in the hindwing on both sides is much wider even than it is in *L. sarala*. I identify this species with "*Hesperia*" *avesta* a little doubtfully, as Hewitson says that that species has the "outer" margin

* *Parnara sarala*, de Nicéville, Journ. Bomb. Nat. Hist. Soc., vol. iv, p. 173, n. 12, pl. B, fig. 6, *female* (1889); id., Leech, Butt. from China, Japan, and Corea, p. 615, pl. xxxviii, fig. 11, *male* (1894).

† Iris, vol. ii, p. 141, pl. ii, fig. 6, *male* (1888).

of the forewing on the underside broadly grey, while my specimen has the inner margin thus coloured. In other respects the description of *H. avesta* agrees.

Described from a single example in my collection.

Genus CRETEUS, nov.

MALE. FOREWING, triangular ; *costa* very straight, slightly emarginate in the middle ; *apex* acute ; *outer margin* at first almost at right-angles to the costa, then straight and inwardly oblique ; *inner angle* rounded ; *inner margin* straight and equal in length to the outer margin ; *costal nervure* ending on the costa about opposite to the apex of the discoidal cell ; *first subcostal nervule* arising twice as far from the second as the second arises from the third ; *third* and *fourth* subcostals arising close together, the latter ending at the apex of the wing ; *subcostal nervure* as usual ending on the outer margin posterior to the apex of the wing ; *discoidal cell* narrow, less than two-thirds the length of the costa; *upper disco-cellular nervule* stout (it is really the basal portion of the upper discoidal nervule), strongly outwardly oblique; *middle* and *lower* disco-cellulars very straight, in one straight line, strongly inwardly oblique, the middle one half as long again as the lower ; *second median* nervule arising long before the lower end of the cell ; *first* median nervule arising nearer to the lower end of the cell than to the base of the wing, bearing a "*male-mark*," which consists of its second and third fifths counting from the base of the wing being distinctly thickened or swollen ; *submedian nervure* nearly straight, slightly curved forwards in the middle. HINDWING, *abdominal margin* heavily fringed with long hair-like scales ; *costa* strongly arched at base, then slightly curved only to the apex ; *apex* rounded ; *outer margin* rounded, but emarginate slightly about the termination of the first median nervule ; beyond this emargination the outer margin towards the anal angle has the appearance of being somewhat produced lobe-like ; *anal angle* rounded ; *abdominal margin* a little convex ; *costal nervure* a little curved only, ending at the apex of the wing ; *first subcostal nervule* arising well before the apex of the cell ; *discoidal cell* broad, reaching to the middle of the wing ; *disco-cellular nervules* short, nearly straight (slightly sinuous only), slightly outwardly oblique ; *discoidal* nervule wanting ; *median*

nervules all arising close together at the lower end of the cell, *second* median arising nearer to the first than to the third; *submedian* and *internal nervures* nearly straight, slightly bowed forwards. ANTENNÆ more than half the length of the costa of the forewing, the club stout, with a long terminal whip-like crook. PALPI, second joint very hairy; third joint also hairy, prominent, long, porrected forwards in front of the face in the same straight line as the axis of the body. THORAX robust. ABDOMEN rather slender, not quite reaching to the outer margin of the hindwing. LEGS, femur and tibia of all three legs most densely hairy in both sexes, but the male does not appear to be furnished with sexual tufts of hairs. FEMALE. Differs from the male only in the absence of the secondary sexual characters, and the much stouter abdomen. Type, "*Hesperia*" *cyrina*, Hewitson.

This genus appears to be nearest to *Lotongus*, Distant, of which the type is the "*Eudamus*" *calathus* of Hewitson, from the Daunat Range, Tenasserim, Burma; Malacca; Sumatra and Java. I possess male examples of *Lotongus schœdia*, Hewitson (= *L. maculatus*, Distant), from Perak in the Malay Peninsula, and Selesseh in N.-E. Sumatra, and a female from the Battak Mountains also in N.-E. Sumatra, taken in March, and both sexes of *L. parthenope*, Weymer, from Nias, from which *C. cyrina* differs in having the third joint of the palpi much longer; the middle and lower disco-cellular nervules of the forewing much more strongly inwardly oblique, in *Lotongus* they are nearly upright; and in the presence in the male of the swollen first median nervule in the forewing, and in the very heavy setose clothing of the abdominal area of the hindwing on the upperside, both these secondary sexual characters being absent in *Lotongus*. The legs too in *Creteus* in both sexes are far more densely setose than in *Lotongus*.

(1) CRETEUS CYRINA, Hewitson.

Hesperia cyrina, Hewitson, Ann. and Mag. of Nat. Hist., fourth series, vol. xviii, p. 450 (1876); *Parnara parca*, de Nicéville, Journ. Bomb. Nat. Hist. Soc., vol. iv, p. 174, n. 13, pl. B, fig. 10, *female* (1889).

HABITAT: Sikkim; Bhutan; Khasi Hills.

Genus ZELA, nov.

MALE. FOREWING, *costa* straight, a little arched only at the base and apex; *apex* acute; *outer margin* almost straight, a little convex

only ; *inner angle* somewhat rounded ; *inner margin* straight, of exactly the same length as the outer margin ; *costal nervure* ending on the costa beyond the apex of the cell ; *subcostal nervules* arising at decreasing distances apart ; *upper disco-cellular* nervule rather long, strongly outwardly oblique ; *middle* disco-cellular upright, strongly concave ; *lower* disco-cellular straight, strongly inwardly oblique, a little longer than the upper, much shorter than the middle disco-cellular ; *second median* nervule arising far before the lower end of the cell ; *first* median arising a little nearer to the base of the wing than to the lower end of the cell ; *submedian nervure* straight ; the *secondary sexual character* consists of an oblique linear glandular streak of very thick scales extending on the upperside from about the middle of the submedian nervure to just before the base of the second median nervule, the lower portion of the streak in the submedian interspace is nearly upright, and divided into two by the internervular fold, the anterior portion is greatly curved outwardly. HINDWING, somewhat circular, longer than broad ; *costa* much arched at base, less arched to apex ; *apex* rounded ; *outer margin* very convex to anal angle, slightly emarginate about termination of first median nervule ; *anal angle* rounded ; *abdominal margin* straight ; *costal nervure* arched, ending at the apex of the wing ; *first subcostal nervule* arising far before the apex of the cell ; *discoidal cell* broad, short, not nearly reaching to the middle of the wing ; *discoidal nervule* present, but very attenuated ; *disco-cellular* nervules upright, concave, of equal length ; *second median* nervule arising a little before the lower end of the cell ; *first median* arising about twice as far from the second as the second does from the first, arising much nearer to the lower end of the cell than to the base of the wing ; *submedian* and *internal nervures* straight. ANTENNÆ very long, a little less than two-thirds as long as the costa of the forewing, the club moderate, terminating in a long curved whip-like point. PALPI broad, densely hairy, the third joint hidden beneath the second. THORAX robust. ABDOMEN rather slender, not reaching to the anal angle of the hindwing. LEGS, hindleg, femur and tibia heavily fringed with long hairs, with two pairs of spines. FEMALE. Differs from the male only in the wings being broader, and in lacking the male brand on the upperside of the forewing. Type, *Zela zeus*, de Nicéville.

This genus is probably nearest to *Zea*, Distant, of which the "*Hesperia*" *mytheca* of Hewitson is the type. *Zea* has never been fully diagnosed, the only characters given are as follows :—"FOREWING. Outer margin subequal [instead of a little longer] in length to inner margin; upper disco-cellular nervule longer than lower; moderately oblique; base of second median nervule about twice as far apart from that of the lower as from that of the upper median nervule. HINDWING. Outer margin sinuated or more or less lobately produced near anal angle." These characters are drawn up from a female specimen. But the type species of *Zela* may instantly be known from the type species of *Zea*, if Mr. Distant's figure is to be relied on, by the hindwing being far shorter. *Zela* is also allied to the genera *Hidari*, Distant, and *Unkana*, Distant,* but may at once be distinguished from these by the middle disco-cellular nervule of the forewing being upright instead of strongly inwardly oblique; the outer and inner margins of the forewing also are of equal length, in both these genera the inner margin is much shorter than the outer. Mr. Distant says that the outer margin in *Zea* is subequal (instead of a little longer) in length to the inner margin, but according to my view of measurement (taken from his figure of the type species) the outer margin is considerably longer than the inner. The genus appears similar to *Perichares*, Scudder, confined to tropical America, as regards the secondary sexual characters. In general appearance it most resembles species of the genus *Matapa*, Moore.

44. ZELA ZEUS, n. sp., Pl. Q, Fig. 57, ♂.

HABITAT: Pulo Laut, Borneo; N.-E. Sumatra.

EXPANSE: ♂, 1·7; ♀, 1·8 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* dark shining hair-brown. *Forewing* with four hyaline shining stramineous spots :—an oval one touching the median nervure towards the outer end of the discoidal cell, a small round one in the subcostal interspace (absent in Sumatran specimens), a round one four times as large as the last-named spot towards the base of the second median interspace, a reversed comma-shaped spot posterior to the last in the first median interspace, the three last-named spots in a straight line; the sexual brand placed just within the posterior spot deep black, inconspicuous. *Cilia*

* Captain Watson has sunk this genus under *Erionota*, Mabille.

cinereous. *Hindwing* immaculate. *Cilia* anteriorly cinereous, posteriorly orange. UNDERSIDE, *both wings* paler and duller than above, the markings similar. *Eyes* crimson. *Antennæ* black, the club beneath whitish. *Head*, *body*, and *legs* concolorous with the wings. FEMALE. Exactly as in the male except that the wings are broader, and it has no "male-mark."

On the upperside this species strongly reminds one of *Zea mytheca*, Hewitson,* but differs in two particulars. In that species the spot in the cell of the forewing lies against the subcostal instead of the median nervure, and the subapical spot is wanting; this latter feature is also found in specimens from Sumatra. The underside of the hindwing of the two species is totally dissimilar; *Z. mytheca* has a broad discal silvery-white fascia from the costa to the submedian fold, which is not found in *Z. zeus*.

Described from a single example (the type) taken in June, 1891, by Mr. W. Doherty, in the island of Pulo Laut, Borneo, and kindly given to me by Mr. H. J. Elwes. Subsequently Dr. L. Martin obtained two males in May from the Battak Mountains and Selesseh, and I a single female, all from N.-E. Sumatra.

Genus ZAMPA, nov.

MALE. FOREWING, *costa* nearly straight, a little arched only at the base and apex; *apex* acute; *outer margin* slightly convex only; *inner angle* somewhat rounded; *inner margin* strongly bowed outwardly in the middle, a little shorter than the outer margin; *costal nervure* barely reaching to the apex of the discoidal cell; *subcostal nervules* arising at nearly equal distances apart, arising slightly nearer the one to the other progressively from the base of the wing; *discoidal cell* narrow, reaching to beyond the middle of the wing; *upper disco-cellular nervule* short, straight, strongly outwardly oblique; *middle* disco-cellular nearly upright, a little inwardly oblique only, posteriorly strongly concave; *lower* disco-cellular quite straight, strongly inwardly oblique, shorter than the middle disco-cellular; *second median* nervule arising well before the lower end of the cell; *first* median arising at about midway between the base of the wing and the lower end of the cell; *submedian nervure* straight. HINDWING, longer than broad; *costa*

* Distant, Rhop. Malay., p. 377, n. 1, pl. xxxv, fig. 7, *female* (1886).

greatly arched at base, less arched to costa ; *apex* rounded ; *outer margin* well rounded, slightly excised at the end of the submedian nervure ; *anal angle* rounded ; *abdominal margin* convex ; *costal nervure* slightly curved, ending at the apex of the wing ; *first subcostal nervule* arising rather close to the apex of the cell ; *discoidal cell* broad, very short, not nearly reaching to the middle of the wing ; *disco-cellular nervules* very short, slightly outwardly oblique, concave ; *discoidal* nervule absent ; *median nervure* greatly distorted, instead of being straight (or nearly so) throughout its length,* the portion between the bases of the first and second median nervules is inclined forwards, and the portion between the bases of the second and third median nervules is inclined still more forwards, almost indeed at right angles to the normal direction of the median nervure, thus giving the outer end of the cell a most unusual shape, being composed of four nearly straight portions of nearly equal length, *viz.* :—(1) that portion of the subcostal nervure from the point where the first subcostal nervule arises to the base of the second subcostal, (2) the disco-cellular nervules, (3) that portion of the median nervure between the bases of the third and second median nervules, and (4) that portion of the median nervure between the bases of the second and first median nervules ; *second median nervule* arising well before the end of the cell, at about the same distance from its end as the first subcostal arises from the apex of the cell ; *first* median arises a little further from the second than the second does from the first ; *submedian* and *internal nervures* straight ; *secondary sexual characters* consist of a very dense patch of long setæ springing from about the middle of the cell on the upperside and lying across the bases of the median nervules ; on the underside of the wing the basal portions for some distance of the second subcostal, third, and second median nervules are much swollen, this character being correlated with the tuft of hairs on the upperside of the wing. ANTENNÆ very long, a little less than two-thirds the length of the costa of the forewing ; the club elongated, moderate, the whip-like apex long. THORAX robust. ABDOMEN rather slender, not quite reaching to the anal angle of the hindwing. Type, *Zampa zenon*, de Nicéville.

* I reckon this vein to terminate at the point where the third median nervule arises.

Probably nearly allied to *Zela*, de Nicéville, but the secondary sexual characters are entirely different. To compare the two genera effectually, the females of both the type species are required. The secondary sexual characters of the hindwing described above are probably unique. The bowed-out inner margin of the forewing with the same portion on the underside highly polished is doubtless also a male characteristic.

45. ZAMPA ZENON, n. sp., Pl. Q, Fig. 58, ♂.

HABITAT : Pulo Laut, Borneo.

EXPANSE : ♂, 1·8 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* shining dark ochreous-brown. *Forewing* with an oval hyaline white spot at the base of the second median interspace, a similar comma-shaped spot a little obliquely inwardly below the first spot in the first median interspace, the convexity of the spot directed to the base of the wing. *Cilia* cinereous. *Hindwing* unmarked ; the sexual tuft of long recumbent hairs in the middle of the wing inconspicuous and concolorous with the wing. *Cilia* anteriorly narrow, cinereous, posteriorly becoming much longer and orange-coloured. UNDERSIDE, *both wings* have the ground-colour paler than on the upperside. *Forewing* has the apex and outer margin broadly paler, this pale area dying away to nothing towards the anal angle of the wing ; the inner margin as far as the median nervure and first median nervule pale and highly polished ; the disco-cellular nervules defined by a narrow pale line ; the two hyaline spots as on the upperside. *Hindwing* has the disco-cellular nervules defined by a narrow pale line as on the forewing ; otherwise unmarked.

In general appearance this species resembles *Z. zeus*, de Nicéville, described above, but has only two instead of three or four spots on the forewing. On the underside of the forewing the present species has a broad outer pale fascia, which is not found in *Z. zeus*.

Described from a single example in Mr. H. J. Elwes' collection captured in June, 1891, by Mr. W. Doherty.

Genus MIMAS, nov.

MALE. FOREWING, *costa* nearly straight ; *apex* acute ; *outer margin* slightly convex ; *inner angle* rounded ; *inner margin* straight, as long as the outer margin ; *costal nervure* not reaching to the apex of the

discoidal cell ; *first subcostal nervule* arising nearer to the apex of the cell than to the base of the wing ; *second*, *third* and *fourth* subcostals arising progressively nearer together ; *discoidal cell* narrow, less than two-thirds the length of the forewing ; *upper disco-cellular nervule* short, strongly outwardly oblique ; *middle* disco-cellular very long, strongly inwardly oblique, at its posterior end curved outwards ; *lower* disco-cellular short, half the length of the middle disco-cellular, strongly inwardly oblique and in the same straight line with the middle disco-cellular ; *median nervure* between the bases of the third and second median nervules distinctly, deflected forwards ; *lower discoidal nervule* curved forwards in the basal portion of its length, lying about midway between the third median and upper discoidal nervules for the greater portion of its length, but arising considerably nearer the third median ; *second median* nervule arising long before the lower end of the cell ; *first* median arising nearer to the base of the wing than to the lower end of the cell ; *submedian nervure* straight. HINDWING, much longer than broad ; *costa* much arched at the base, thence slightly arched to the apex; *apex* rounded ; *outer margin* evenly rounded to the anal angle, slightly, if at all, excavated at the end of the first median nervule ; *anal angle* rather square ; *abdominal margin* straight ; *costal nervure* slightly curved only, ending at the apex of the wing ; *first subcostal nervule* arising well before the apex of the cell ; *disco-cellular* nervules sinuous, outwardly oblique ; *discoidal* nervule absent ; *second median* nervule arising close to the lower end of the cell ; *first* median arising about twice as far from the second as the second does from the first, arising much nearer the end of the cell than the base the wing ; *submedian* and *internal nervures* straight. ANTENNÆ long, more than half as long as the costa of the forewing, the club moderately stout, the terminal crook acuminate, long, about twice as long as the breadth of the club. HEAD broad. PALPI, second joint broad, very hairy, third joint rather short, naked, conical. THORAX robust. ABDOMEN rather slender, not reaching to the outer margin of the hindwing. LEGS, foreleg, tibia with an epiphysis ; hindleg, tibia with two pairs of spurs. Type, "*Ismene*" *miltias*, Kirsch.

This genus would appear to find its natural position in the subfamily *Pamphilinæ*, Section B, of Captain E. Y. Watson's classification, and to come close to the genus *Carystus* of Hübner, *vide* Proc. Zool. Soc.

Lond., 1893, p. 93, the type of which is *C. jolus*, Cramer, from South America. Of the Asiatic genera hitherto diagnosed it comes nearest to *Lotongus*, Distant, from which, however, it may instantly be known by the inner and outer margins of the forewing being of equal length, in *Lotongus* the inner is much shorter than the outer margin. The only species of this genus known to me have very much the aspect from the upperside of species of the genus *Ismene*, Swainson, but they differ from all species of the *Ismene* group in the form of the antennæ and palpi and in the neuration. The male has a short rather indistinct discal black streak of modified scales running obliquely and continuously from the origin of the third median nervule to just beyond the first median nervule and appearing again as a raised spot on the submedian nervure.

(1) MIMAS MILTIAS, Kirsch.

Ismene miltias, Kirsch, Mitth. K. Zool. Museum, Dresden, vol. i, pt. 2, p. 128, n. 127, pl. vii, fig. 6, *female* (1877).

Habitat: Jobi Island near New Guinea (*Kirsch*); Humboldt's Bay, North New Guinea (*de Nicéville*).

Description: Male. Upperside, *both wings* and *cilia* dark shining bronzy-brown. *Forewing* with the basal third of the surface from the costa to the inner margin rich ferruginous, and with the black streak peculiar to the genus on the disc. *Hindwing* also with the basal third of the surface and the abdominal margin almost to the anal angle rich ferruginous. Underside, *forewing* with rather more than the basal third of the costa and extending outwardly into the discoidal cell rich ferruginous. *Hindwing* with the basal half of the costa extending slightly into the cell rich ferruginous. *Thorax* above clothed with ferruginous setæ. *Abdomen* dark brown above, the segments beneath narrowly banded with ochreous. *Antennæ* black, the club beneath cinereous.

Herr Th. Kirsch does not mention the sex of the example of this species which he described, but from the coloration and stoutness of the abdomen, as shewn in his figure, I would judge it to have been a female.

Described from a single example in my collection kindly given to me by its capturer, Mr. William Doherty.

46. (2) MIMAS MELIE, n. sp., Pl. Q, Fig. 55, ♀.

HABITAT: New Guinea.

EXPANSE: ♀, 1·8 inches.

DESCRIPTION: FEMALE. UPPERSIDE, *both wings* shining fuscous with a distinct vinous sheen in some lights. *Cilia* fuscous. *Forewing* with the basal fourth from the costa to the inner margin clothed with long grey setæ. *Hindwing* with the basal third clothed with long grey setæ. UNDERSIDE, *both wings* with the ground-colour as above. *Forewing* with six subapical small white spots placed between the veins, the anterior one on the costa lies between the second and third subcostal nervules; the second spot, about twice as long as the first, lies between the third and fourth subcostals; the third spot is the smallest of all and lies between the fourth subcostal nervule and the terminal portion of the subcostal nervure (the fifth subcostal nervule of some writers); the fourth spot lies in the subcostal interspace and is equal in size to the fifth spot; the fifth spot lies in the upper discoidal interspace; the sixth spot is of the same size as the two above it, and lies in the lower discoidal interspace; there is a large transverse spot in the discoidal cell towards its end, the spot slightly constricted at the middle; a still larger spot in the first median interspace, its inner edge convex, its outer edge concave, extending completely across the interspace; posterior to this again is a large quadrate patch, almost reaching the outer margin, occupying the outer half of the submedian interspace, and extending posteriorly to the inner margin, along which it is continued towards the base of the wing. *Hindwing* with an irregularly-shaped discal white spot placed between the second subcostal and upper median nervules (there is no discoidal nervule in this genus, so the spot really extends across two interspaces); another round spot about twice the size of the first spot at about the middle of the submedian interspace. *Thorax* and base of the *abdomen* above clothed with long grey setæ, the rest of the abdomen fuscous narrowly banded with grey. *Antennæ* black, the base of the club prominently white. *Palpi* and *head* beneath grey. *Legs* and thorax beneath fuscous.

This is a very conspicuously-marked species, especially so on the underside. I do not know any species to which it is even remotely allied.

Described from a single example in my collection presented to me by Mr. W. Doherty, who captured it himself at Humboldt's Bay, North-West New Guinea.

Genus EETION, nov.

MALE. FOREWING, elongated, narrow; *costa* nearly straight, slightly arched only; *apex* acute; *outer margin* at the apex nearly at right-angles to the costa, afterwards strongly inwardly oblique, straight; *inner* margin straight, equal in length to the outer margin; *costal nervure* ending on the costa before the apex of the discoidal cell; *subcostal nervules* counting from the base of the wing arising from the subcostal nervure at decreasing distances apart; *discoidal cell* narrow, long, extending to nearly two-thirds the length of the wing from the base; *upper disco-cellular nervule* short, strongly outwardly oblique; *middle* disco-celullar long, recurved, strongly inwardly oblique; *lower* disco-cellular short, nearly half the length of the middle but twice as long as the upper disco-cellular, strongly inwardly oblique; *lower discoidal* nervule in consequence of the greater length of the middle disco-cellular arising much nearer to the third median than to the upper discoidal nervule; *second* median nervule arising far before the lower end of the cell; *first* median arising a little farther from the second than that nervule does from the third, arising much nearer to the base of the wing than to the lower end of the cell; *submedian nervure* slightly curved; *secondary sexual characters* consist on the upperside of the wing of a narrow inwardly oblique brand or line of scales arising from the second median nervule just after its origin, extending across the first median interspace, and ending on the submedian internervular fold; and on the underside of the wing of a strong tuft or brush of hairs directed forwards and arising near the base of the wing in the middle of the sutural area. HINDWING, much longer than broad; *costa* greatly arched at base, gently arched from thence to the apex; *apex* rounded; *outer margin* regularly curved to the termination of the submedian nervure, beyond which the margin is produced lobe-like; *anal angle* rounded; *abdominal margin* nearly straight; *costal nervure* long, gently curved throughout its length, ending at the apex of the wing; *first subcostal nervule* arising far before the apex of the cell; *disco-cellular* nervules slightly concave, slightly

outwardly oblique, the upper a little longer than the lower ; *discoidal* nervule apparently present, but very fine ; *second median* nervule arising well before the lower end of the cell ; *first* median arising about twice as far from the second as the second does from the third, arising much nearer the lower end of the cell than the base of the wing ; *discoidal cell* broad, short, not nearly reaching to the middle of the wing ; *median nervure* slightly anteriorly deflected between the bases of the first and second, strongly deflected between the bases of the second and third median nervules ; *submedian* and *internal* nervures straight. ANTENNÆ a little more than half the length of the costa of the forewing, the club moderate, with a long terminal whip-like crook, about three times as long as the greatest breadth of the club. PALPI broad, densely hairy, third joint but very slightly projecting beyond the second. THORAX rather robust. ABDOMEN reaching just to the outer margin of the hindwing. LEGS, foreleg, tibia with an epiphysis ; hindleg, tibia with two pairs of spurs. FEMALE. Differs from the male only in the absence of the brand on the upperside and tuft of hairs on the underside of the forewing. Type, "*Hesperia*" *elia*, Hewitson.

This genus comes into Capt. E. Y. Watson's subfamily *Pamphilinæ*, Section B (*vide* Proc. Zool. Soc. Lond., 1893, p. 70), but differs from the genera in that section, though agreeing with some of those in Section C, in having a long crook to the club of the antenna. It is allied to *Lotongus*, Distant, *Cretens*, *Zela*, *Zampa*, de Nicéville, *Zea*, *Hidari*, Distant, and *Mimas*, de Nicéville, but the shape of the wing will separate it from all these except *Zea*, to which it is nearest allied, but the second median nervule of the forewing is much more remote from the end of the discoidal cell, being almost equidistant between the first and third. The secondary sexual characters of the male are unique in the *Hesperiidæ* as far as I am aware, no other species having both a brand above and tuft of hairs below the forewing.

(1) EETION ELIA, Hewitson.

Hesperia elia, Hewitson, Trans. Ent. Soc. Lond., third series, vol. ii, p. 489, n. 9 (1866) ; *Carystus elia*, Druce, Proc. Zool. Soc. Lond., 1873, p. 359, n. 2 ; *Cobalus elia*, Butler, Trans. Linn. Soc. Lond., Zoology, second series, vol. i, p. 554, n. 1 (1877) ; *Unkana elia*, var., Distant, Rhop. Malay., p. 370, n. 2, pl. xxxiv, fig. 25, *female* (1886) ; id., Watson, Proc. Zool. Soc. Lond., 1893, p. 123 ; *Hesperia eburus*, Plötz, Berl. Ent. Zeitsch., vol. xxix, p. 226, n. 8 (1885) ; idem, id., Stet. Ent. Zeit., vol. xlvii, p. 92, n. 121*b* (1886).

HABITAT : Sumatra (*Hewitson* and *colls. Martin* and *de Nicéville*); Borneo (*Druce*) ; Malacca (*Butler* and *Plötz*) ; Province Wellesley and Singapore (*Distant*) ; Perak (*coll. de Nicéville*).

Genus GEHENNA, Watson.

Gehenna, Watson, Proc. Zool. Soc. Lond., 1893, p. 108, n. 27.

MALE. FOREWING, *costa* nearly straight ; *apex* acute ; *outer margin* nearly straight, slightly convex only ; *inner angle* acute ; *inner margin* straight, about the same length as the outer margin ; *costal nervure* ending on the costa before the apex of the discoidal cell ; *subcostal nervules* arising from the subcostal nervure at decreasing distances apart from the base of the wing ; *discoidal cell* more than half but less than two-thirds as long as the wing ; *upper disco-cellular nervule* short, straight, strongly outwardly oblique ; *middle* disco-cellular very long, upright, straight ; *lower* disco-cellular short, about the same length as the upper disco-cellular, straight, inwardly oblique ; *lower discoidal* nervule arises therefore much nearer to the third median than to the upper discoidal nervule ; *second median* nervule arises well before the lower end of the cell ; *first* median arises close to the base of the wing ; *submedian nervure* straight. HINDWING, elongated, much longer than broad ; *costa* much arched at the base, then nearly straight to the apex ; *outer margin* curved regularly and evenly to the anal angle, not at all emarginate ; *anal angle* rounded ; *abdominal margin* straight ; *costal nervure* ending at the apex of the wing ; *costal* and *subcostal* nervures with an apparently common origin, but soon separating, at the point of separation the two veins assume the form of a "tuning-fork ;" *first subcostal nervule* arising long before the apex of the cell ; *discoidal cell* rather long, reaching to the middle of the wing ; *disco-cellular nervules* sinuous, the general direction being slightly outwardly oblique ; *discoidal* nervule obsolete ; *second median* nervule arising a little before the lower end of the cell ; *first* median arising also close to the end of the cell, not quite twice as far from the second as the second arises from the third ; *submedian* and *internal nervures* straight. ANTENNÆ long, more than half (nearly two-thirds) as long as the costa of the forewing ; club moderately large, elongated, with a rather long and fine apex or point. PALPI very broad, densely hairy, porrect, the third joint very small. HEAD

broad. THORAX broad. ABDOMEN rather stout, of the same length as the hindwing. LEGS, hindleg with the tibia slightly fringed, and furnished with two pairs of spines. *Secondary sexual characters* consist on the forewing of a dense tuft of long hairs attached to the base of the inner margin and turned under and forwards ; the basal portions of the median and submedian nervures on the underside furnished with raised lines of scales : and on the hindwing there is a small oval oblique streak on the upperside close to the base of the wing, this gland is almost certainly correlated with the curious "tuning-fork" shape of the base of the costal and subcostal nervures.

Gehenna appears to be nearest to the genus *Halpe*, Moore, from which it differs in the forewing in the first median nervule arising much nearer to the base of the wing ; the male also has a tuft of hairs on the inner margin near the base of the wing ; and the swollen bases of the median and submedian nervures are not found in any species of *Halpe* ; in the hindwing it differs in the curious "tuning-fork" bifurcation of the costal and subcostal nervures, with an oval gland in the male placed between the bases of the prongs of the fork ; in *Halpe* in the male only the first subcostal nervule makes a "tuning-fork" at its origin from the subcostal nervure ; in the female these veins are normal ; the discoidal cell is much longer, extending to at least the middle if not beyond the middle of the wing ; the first subcostal nervule arises much nearer the base of the wing ; the hindwing too differs greatly in shape, being very much longer than broad in the type species of *Halpe* (which I take to be *H. moorei*, Watson, from which Mr. Moore must have diagnosed his genus, and not from the true *H. beturia*, Hewitson, from Celebes), the hindwing is exactly as broad as long in both sexes. I have drawn up this diagnosis from *Gehenna græca*, de Nicéville, having been under the impression till Captain Watson pointed out my oversight that the genus was undescribed. The description is published as it is somewhat more full than Captain Watson's, which was drawn up from "*Hesperia*" *abima*, Hewitson, the only other known species in the genus.

47. GEHENNA GRÆÆ, n. sp., Pl. Q, Fig. 59, ♂.

HABITAT: N.-E. Sumatra.

EXPANSE: ♂, 1·4 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* shining dark reddish-brown. *Forewing* with five semi-transparent ochreous spots, two placed inwardly obliquely at the end of the discoidal cell, the upper small and round, the lower three times as large as the upper and linear, a small round subapical one placed in the subcostal interspace, a rounded one of about the same size as the posterior spot in the cell towards the base of the second median interspace, a triangular one, the largest of all, with its base against the base of the second median nervule, its apex against the submedian nervure in the first median interspace. *Hindwing* immaculate. UNDERSIDE, *both wings* as above, but the costa and apex widely of the forewing, and the whole of the hindwing frosted over with scattered golden-yellow scales. *Forewing* with the hyaline spots as above; the sexual tuft of hairs at the base of the inner margin turned under and forwards black. *Hindwing* immaculate. *Cilia* of the forewing concolorous with the wings; of the hindwing paler, dusky ochreous. *Antennæ* black; the club beneath, all except the whip-like termination, ochreous-white. *Head*, *palpi*, *thorax*, and *abdomen* above dark reddish-brown; beneath and *legs* greenish-ochreous.

Near to "*Hesperia*" *abima*, Hewitson,* from Macassar in Celebes, but that species appears to have a single deeply sinuated spot instead of two in the discoidal cell of the forewing, and both wings are much clothed with ochreous hair. On the underside of the hindwing in *G. abima* there are five undefined brown spots, in *G. grææ* that wing is immaculate.

Described from a single example captured by Hofrath Dr. L. Martin himself in the virgin forest at Namoe Oekor, N.-E. Sumatra, on 23rd January, 1893.

Genus ITON, nov.

MALE. FOREWING, triangular; *costa* nearly straight, slightly arched at the base; *apex* acute; *outer margin* convex at apex, then straight; *inner angle* rounded; *inner margin* straight, of the same length

* Ann. and Mag. of Nat. Hist., fourth series, vol. xix, p. 83 (1877).

as the outer margin ; *costal nervure* ending on the margin a little before the apex of the discoidal cell ; *subcostal nervules* arising at decreasing distances apart ; *discoidal cell* narrow, less than two-thirds the length of the costa ; *upper disco-cellular nervule* stout, straight, short, strongly outwardly oblique ; *middle* disco-cellular thin, long, nearly twice as long as the lower disco-cellular, strongly inwardly oblique, at first straight, the posterior portion curved outwardly ; *lower* disco-cellular short, straight, in the same straight line as the middle disco-cellular ; *second median* nervule arising far before the lower end of the cell ; *first* median arising nearer to the lower end of the cell than to the base of the wing, rising in fact about twice as far from the second median as that vein does from the third ; *submedian nervure* bowed, the curvature being in the direction of the costa ; a long and thick *tuft of hairs* (in the type species only) attached to the wing-membrane on the underside towards the base of the wing between the submedian nervure and the inner margin, the tuft turned forwards. HINDWING, much longer than broad ; *costa* strongly arched at base, thence straight to apex ; *apex* well rounded ; *outer margin* convex on the whole, but between the second median nervule and the submedian nervure it is emarginate ; *anal angle* well rounded ; *abdominal margin* convex ; *costal nervure* ending at the apex of the wing, well curved throughout its length ; *first subcostal nervule* arising well before the apex of the cell ; *discoidal cell* short, not reaching to the middle of the wing, broad ; *disco-cellular nervules* thin, nearly straight, outwardly oblique ; *discoidal* nervule wanting ; *second median* nervule arising well before the lower end of the cell ; *first* median arising about as far (perhaps a little farther) from the second as the second does from the third, all three median nervules crowded together near the lower end of the cell ; *submedian* and *internal nervures* straight. FEMALE differs from the male in lacking the tuft of hairs on the forewing, the hindwing is rather broader, and the disco-cellular nervules are strongly concave instead of nearly straight. ANTENNÆ almost exactly half the length of the costa of the forewing, with a long well-formed club ending in a short whip-like terminal crook. PALPI broad, second joint densely hairy, third joint very short. THORAX robust. ABDOMEN not quite reaching to the anal angle of the hindwing when the butterfly is at rest

with its wings folded over its back. LEGS, hindleg, tibia with two pairs of spines. Type, "*Hesperia*" *semamora*, Moore.

Capt. Watson in Proc. Zool. Soc. Lond., 1893, p. 123, places *I. semamora*, Moore, and *I. watsonii*, de Nicéville, doubtfully in the genus *Unkana*, Distant, of which *U. batara*, Distant (= *I. attina*, Hewitson,= *G. cruda*, Herrich-Schäffer) is the type. The type of *Iton* differs from the type of *Unkana* in the following characters :—The forewing is not so elongated, the apex is less acute, the outer margin is convex instead of straight, it is also of the same length as the inner margin, instead of being considerably longer ; the middle disco-cellular is nearly twice as long as the lower, instead of being exactly the same length ; there is a sexual tuft of hairs in the type species of *Iton* which is lacking in *Unkana* ; in the hindwing the disco-cellular nervules are much more outwardly oblique, instead of being nearly upright ; lastly, the antennæ are shorter with a much shorter crook, in *Unkana* the antennæ are more than half the length of the costa of the forewing. Captain Watson has recently sunk the genus *Unkana* under *Erionota*, Mabille. The genus *Iton* contains but two species, the first with a tuft of hairs in the male, the second without. The position of this tuft is, as far as I know, unique in the family, except in the genus *Eetion*, de Nicéville, in which there is a similar tuft.

(1) ITON SEMAMORA, Moore.

Hesperia semamora, Moore, Proc. Zool. Soc. Lond., 1865, p. 791 ; *Hesperia* (?) *semamora*, de Nicéville, Journ. A. S.B., vol. 1, pt. 2, p. 60, n. 125 (1881) ; *Parnara semamora*, Watson, Hesp. Ind., p. 46, n. 61 (1891) ; *Unkana semamora*, id., Proc. Zool. Soc. Lond., 1893, p. 123 ; id., Swinhoe, Trans. Ent. Soc. Lond., 1893, p. 328, n. 496 ; *Hesperia barea*, Hewitson, Trans. Ent. Soc. Lond., third series, vol. ii, p. 490, n. 12 (1866).

HABITAT : Bengal (*Moore*) ; Sikkim ; Khasi Hills ; throughout Burma ; Perak ; N.-E. Sumatra ; North Borneo.

As will be seen from the localities given above, the species has a very wide range. I have specimens in my collection from Sikkim to Sumatra and North Borneo. It is omitted from Mr. Elwes' Catalogue of the Lepidoptera of Sikkim, and from Mr. Distant's Rhopalocera Malayana. The description of "*Hesperia*" *barea*, Hewitson, from Sumatra, agrees exactly with this species.

(2) ITON WATSONII, de Nicéville.

Parnara watsonii, de Nicéville, Journ. Bomb. Nat. Hist. Soc., vol. v, p. 223, n. 19 (1890); idem, id., l. c., vol. vi, p. 388, pl. G, fig. 29, *male* (1891); id., Watson, Hesp. Ind., p. 46, n. 62, (1891); *Unkana watsonii*, id., Proc. Zool. Soc. Lond., 1893, p. 123.

HABITAT: Burma.

I possess a long series of this species from Telin Yaw, Younzalin, Papun, and Thoungyin, taken in December, February, and March by Captain E. Y. Watson and Lieutenant-Colonel C. T. Bingham.

The type of the genus *Unkana* is the "*Hesperia*" *attina*, Hewitson 1866), = "*Hesperia*" *latreillei*, Felder (1867), = "*Goniloba*" *cruda*, Herrich-Schäffer (1869), = *Unkana batara*, Distant (1886).

I possess specimens from Bassein, Henzada, and Maulmain (all in Burma) and from Java. It occurs also in Malacca, Singapore, N.-E. Sumatra, and again in Palawan and Mindanao, two of the Philippine Isles. In the verandah of Colonel C. T. Bingham's bungalow at Maulmain, during the month of October, the butterfly comes commonly to the flowers of the Eucharist Lilies to rob the honey. The males are far commoner than the females. The flight of this large "Skipper" is very swift and headlong, but when settled on the flowers busily engaged drinking the honey it may be caught between the fingers. Mr. Distant, in describing *Unkana batara*, a MS. name of Mr. Moore's, did not recognise that it is the opposite (male) sex of *U. attina*, owing doubtless to the very great superficial dissimilarity between the sexes. My own observations on the live animals had, however, convinced me of the fact before Herr Georg Semper had published the same conclusion in his Butterflies of the Philippine Isles, p. 288, n. 417.

48. BAORIS (*Parnara*) PHILOTAS, n. sp., Pl. Q, Fig. 60, ♂.

HABITAT: North Kanara and Trevandrum, both in South India.

EXPANSE: ♂, 1·2 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* dark brown with a vinous reflection. *Cilia* cinereous. *Forewing* with a quadrate dot at the base of the second median interspace; a quadrate spot, four times as large as the dot anterior to it, near the middle of the first median interspace. *Hindwing* with two hyaline white dots just beyond the

discoidal cell divided by the second median nervule ; the base of the wing clothed with long ochreous-green setæ. UNDERSIDE, *both wings* dark purplish-brown, this ground-colour appearing, however, only broadly on the inner margin of the forewing, all the rest of the surface (as seen under a strong magnifying glass) being thickly covered with "old-gold" coloured scales ; the pair of spots on each wing as on the upperside. *Antennæ*, *head* and *body* above fuscous ; antennæ beneath have the base of the club, *palpi*, *legs* and *body* beneath pale ochreous.

This distinct little species appears to be nearest to *B. bevani*, Moore, with which it agrees in size, but instead of from five to eight spots on the forewing and three to five on the hindwing, it has a pair of spots on each wing only.

Described from a single example taken in August at Trevandrum Travancore, by Mr. Harold S. Ferguson, and another in Mr. T. R. Bell's collection taken in North Kanara, Bombay Presidency.

49. ISMENE IONIS, n. sp., Pl. Q, Fig. 61, ♂.

HABITAT : Sambawa ; Western Java.

EXPANSE : ♂, 1·8 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* shining ochreous-brown. *Forewing* with a prominent narrow black androconal streak extending parallel to the outer margin from the middle of the submedian nervure to near the base of the second median nervule. *Cilia* cinereous. *Hindwing*, the whole surface clothed, except the costa and outer margin rather broadly, with long orange-yellow setæ. *Cilia* anteriorly narrow and cinereous, posteriorly becoming long and orange-yellow. UNDERSIDE, *both wings* shining purplish fawn-colour, crossed by a common broad straight discal purplish-white band. *Forewing* has the discal band short, commencing at the costa, becoming lost posteriorly in a large ochreous-white area ; this latter occupies the whole of the inner margin, and extends broadly on to the disc as far as the second median nervule. *Hindwing* has the discal band extending right across the surface, its inner edge sharply defined, its outer edge diffused, posteriorly the band is recurved to the abdominal margin ; the small anal lobe bears a fuscous patch. *Head* and *thorax* clothed with long orange-yellow setæ. *Abdomen* fuscous,

tipped with orange-yellow. *Hindleg* has the tibia greatly swollen, almost as much so as in *I. mahintha*, Moore.

I. ionis is closely allied to *I. mahintha*, Moore,* from Silcuri, Cachar ; the Khasi Hills; Kalewa in the Chindwin Valley, Bernardmyo, Theyetmyo, the Ataran Valley, the Daunat Range, and Kunpadie—all in Burma, from which it differs in the shape of the "male mark," this latter in *I. mahintha* being very broad, as broad as long, instead of four times as long as broad as it is in *I. ionis*. In *I. mahintha* the "male-mark" is somewhat variable, being in some specimens a solid square, in others it is broken up into two, three, or four streaks, the streaks being separated from one another by the veins and internervular folds. The coloration of the upperside differs in the two species also, the long setæ which clothe the wings being orange-yellow in *I. ionis*, rich orange-red in *I. mahintha*. *I. ionis* has no discal hyaline spots on the forewing, in *I. mahintha* there are two in the female divided by the second median nervule ; usually two (but the spots, especially the posterior one, are always smaller than in the female), always one, in the male on the underside, the anterior one of these in the second median interspace sometimes shewing through on the upperside, sometimes absent. On the underside *I. ionis* has a prominent discal purplish-white band across both wings, in *I. mahintha* there is the very faintest trace only of this band on the hindwing in some specimens. *I. ionis* is also allied to *I. antigone*, Röber,† from Flores, but from the figure that species appears to have the "male-mark" reduced to two small round clumps of scales, and the discal band on the underside is confined to the hindwing. Lastly, *I. ionis* is allied to *I. iluska*, Hewitson,‡ from Macassar in Celebes, which, like *I. mahintha*, has no discal band on the underside, and has the "male-mark" on the upperside as large as in that species, but of quite a different shape, being anteriorly rounded.

Described from a single example kindly given to me by Mr. H. J. Elwes, captured by Mr. W. Doherty in the island of Sambawa in September, 1891. He did not meet with this species apparently on

* Proc. Zool. Soc. Lond., 1874, p. 575, pl. lxvii, fig. 4, *male*.

† Tijd. voor Ent., vol. xxxiv, p. 320 (1891); vol. xxxv, pl. v, fig. 6, *male* (1892).

‡ Ex. Butt., vol. iv, pl. *Ismene* ii, figs. 10, 11, *male* (1867).

his first visit to the island in 1887.* Mr. H. Fruhstorfer has also given me two males captured by himself in August, 1892, on Mount Gede, 4,000 feet, in Western Java.

50. HASORA (*Parata*) SIMPLICISSIMA, Mabille, Pl. Q, Figs. 62, ♂ ; 63, ♀.

Ismene simplicissima, Mabille, Bull. Soc. Ent. France, fifth series, vol. vi, p. xxv, n. 1, (1876); idem, id., Ann. Soc. Ent. France, fifth series, vol. vi, p. 265, n. 11 (1876); id., Staudinger, Iris, vol. ii, p. 138 (1889); *Parata simplicissima*, Semper, Schmett. Philipp., p. 292, n. 428 (1892); *Ismene philetas*, Plötz, Stet. Ent. Zeit., vol. xlv, p. 56, n. 14 (1884).

HABITAT : Moluccas (*Mabille*) ; Palawan in the Philippines, Minahassa in Celebes (*Staudinger*) ; Babuyanes, Luzon, Mindoro, Samart Bohol, Camiguin de Mindanao, Mindanao (*Semper*) ; Philippines (*Plötz*) ; Yunzalin Valley, Tenasserim, Burma ; N.-E. Sumatra.

EXPANSE : ♂, 1·7 to 1·9 ; ♀, 1·8 to 1·9 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* dark shining hair-brown. *Forewing* with an oblique discal narrow somewhat indistinct black streak of modified scales from the inner margin to the third median nervule. *Hindwing* immaculate. UNDERSIDE, *both wings* ochreous-brown, more or less faintly glossed with violet. *Forewing* with the inner margin broadly somewhat paler than the rest of the wing ; a broad discal fascia somewhat darker than the rest of the wing parallel with the outer margin from the costa to near the submedian nervure. *Hindwing* with the discal band of the forewing continued as far as the submedian interspace, where it ends in a small ochreous spot ; the anal lobe purplish-black. *Cilia* pale ochreous throughout. FEMALE. UPPERSIDE, *both wings* dark shining hair-brown. *Forewing* with the base of the wing and basal half of the inner margin heavily clothed with long ochreous setæ ; three, two, one, or no minute subapical diaphanous "old-gold" dots ; an oblique quadrate similar spot at the middle of the discoidal cell ; a small rhomboidal one placed obliquely across the middle of the second median interspace ; a similar one twice as large as the last-mentioned spot and placed inwardly obliquely posterior to it in the first median interspace ; in one specimen there is still another small obliquely-placed similar spot

* Journ. A. S. B., vol. lx, pt. 2, p. 141 (1891).

touching the middle of the submedian nervure in the submedian interspace. *Hindwing* with the abdominal half of the wing heavily clothed with long ochreous setæ. UNDERSIDE, *both wings* paler(more ochreous) than in the male. *Forewing* with all the spots as on the upperside; the inner margin broadly ochreous-yellow. *Hindwing* as in the male, except that there is a pale ochreous spot at the end of the cell.

Very near to *H. badra*, Moore, first recorded from Java in the Cat. Lep. Mus. E. I. Co., p. 245, n. 532 (1857), afterwards described from Bengal in Proc. Zool. Soc. Lond., 1865, p. 778, from which *H. simplicissima* differs in both sexes in the absence of the "small bluish-white spot" in the discoidal cell on the hindwing on the underside, the spot anterior to the anal lobe is also smaller and pale ochreous instead of "purple-white," the male also has a distinct "male-mark" on the upperside of the forewing which is entirely wanting in *H. badra*.

Described from one male taken in April by Colonel C. T. Bingham in the Yunzalin Valley, five males and four females from N.-E. Sumatra, and a pair of specimens from the Philippine Isles sent to me by Herr Georg Semper. I possess specimens of *H. badra* from Sikkim, Calcutta, Trevandrum, Ceylon, Sibsagar in Upper Assam, the Naga Hills, the Khasi Hills, Cachar, Chittagong, Maulmain, the Andaman Isles, Perak in the Malay Peninsula, N.-E. Sumatra, and Java; and it has been recorded from Upper Burma, Rangoon, North Tenasserim, Engano, Sumba, Sambawa, Celebes, and Palawan in the Philippine Isles. Mr. Leech once recorded *H. badra* from Kiukiang, Yangzee River, China, but subsequently seems to have considered this specimen to be *H. anura*, de Nicéville. The specimens figured are from Sumatra; they are somewhat smaller than those from the Philippines.

51. HASORA CHABRONA, Plötz.

Ismene chabrona, Plötz, Stet. Ent. Zeit., vol. xlv, p. 56, n. 16 (1884); *Hasora vitta*, Distant (*nec* Butler), Rhop. Malay., p. 375, n. 2, pl. xxxv, fig. 4, *male* (1886); id., Semper, Schmett. Phillip. Ins., p. 291, n. 424 (1892); id., Swinhoe, Trans. Ent. Soc. Lond., 1893, p. 329, n. 505.

HABITAT: Malacca (*Plötz*); Perak; Malacca (*Distant*); Luzon, Cebú, Bohol, Camotes, Camiguin de Mindanao, Mindanao—all in the Philippine Isles (*Semper*); Shillong; Sikkim; several places near Bombay; Khasia Hills (*Swinhoe*); Karinja Island, Bombay; North Kanara,

Bombay Presidency ; Bangalore ; Ganjam ; Orissa ; Calcutta ; Sikkim ; Shillong, North Khasi Hills, Sibsagar—all in Assam ; Kalewa in the Chindwin Valley, Rangoon, Daunat Range, Ataran Valley—all in Burma ; Andaman Isles ; Perak ; N.-E. Sumatra ; Java (*coll. de Nicéville*).

Colonel Swinhoe writes of *Hasora vitta* :—"It has been mixed up in Indian collections with the commoner Indian *Parata alexis*, Fabricius,* but can easily be distinguished by the subapical white [not white, distinctly ochreous] spot on the upperside [on both sides] of the forewing, and the entire absence of the very characteristic subgeneric [*sic*] sexual character of *Parata*, *i.e.*, an oblique glandular streak of laxly raised scales below the cell in the forewing above." This writer uses *Parata* in a generic sense, while speaking of its "subgeneric" characters. For my own part, I think *Parata* might with advantage be used as a subgenus, as its "male-mark" is a very useful character by which to separate off certain species, such as *chromus* and *alexis*, from typical *Hasoras*, such as *badra*, *coulteri*, *hadria*, *anura*, and *chabrona*, which do not possess this "male-mark."

The confusion regarding this species is very great. As far back as 1881, the late Mr. Wood-Mason and I in discussing the butterflies of the Andaman Isles,† wrote of *Ismene chromus*, Cramer :—"Andaman females all have only a single small semi-transparent subapical speck between the last two branches of the subcostal [nervure] of the anterior wing ; but those from Continental India have sometimes one and sometimes two besides this on the disc of the same wing, which in one from Bangalore in South India are enlarged into two conspicuous reversed comma-shaped spots." The identification of the species is incorrect, *Hasora chromus* does not occur in the Andamans, the species referred to is *H. chabrona*. At the time of writing we had only received males of *H. chabrona* from the Andamans ; we did not recognise this fact, taking them to be females, as we expected to find in the males of this species a similar "male-mark" to that present in

* The species here meant is more probably *Hasora chromus*, Cramer. *Hasora alexis* is a scarce species, being, as far as I know, confined to South India (Ootacamund and Coonoor in the Nilgiri Hills, North Kanara, and Travancore), and to Ceylon. Colonel Swinhoe records both *Hasora chromus* and *H. alexis* from "Shillong," the latter in error I think.

† Journ. A. S. B., vol. l, pt. 2, p. 254, n. 104 (1881).

Hasora malayana, Felder, a common Andamanese butterfly. It is possible that the late Carl Plötz has also incorrectly recorded "*Ismene*" *vitta* from the Philippines as well as from Sarawak (Borneo) from whence the type of *H. vitta* came. In this Herr Georg Semper in his Philippine Butterflies follows Plötz, as he records *H. vitta* from numerous islands in the Philippine group. Strangely enough he does not give "*Ismene*" *chabrona* as a synonym of *H. vitta* as Mr. Distant does, nor refer to the species in any way, though Plötz records it, as noted above, from the Philippines, but he notes the presence in his specimens of the characteristic spot of *H. chabrona* towards the apex of the forewing. Again, Mr. A. G. Butler records* "*Hesperia*" *vitta* (his own species) from Malacca. In this he may be correct, though I doubt it, but cannot be sure, not having seen the specimen in question. He also remarks on the characteristic spot, and notes two of them in his male specimen; in some examples there are as many as three. My impression is that *Hasora vitta* is confined to Borneo. It may be at once known from *H. chabrona* by the absence in the male (the only sex described and figured) of the small subapical spot in the forewing.† It is by this feature alone I am able to distinguish between the females of *H.* (*Parata*) *chromus* and *H. chabrona*, the former never possessing this spot, while in the latter it is invariably present. The males of the two species are at once differentiated by the presence or absence of the "male-mark." In addition to this character the sexes of *H. chabrona* can be at once distinguished by the male lacking and the female possessing two somewhat large spots in the median interspaces of the forewing. *H. coulteri*, Wood-Mason and de Nicéville,‡ from Cachar, is very closely allied to *H. chabrona*, the females of the two species may be distinguished on the underside of the hindwing by both the edges of the discal white band being sharply defined in *H. coulteri*, much blurred in *H. chabrona*. The female of *H. coulteri* possesses the subapical spot to the forewing, which is lacking in the male, and by the absence of which, together with the discal band, it is distinguished

* Trans. Linn. Soc. Lond., Zoology, second series, vol. i, p. 554, n. 2 (1877).

† *Hesperia vitta*, Butler, Lep. Ex., p. 167, n. 3, pl. lix, fig. 9, *male* (1874).

‡ Journ. A. S. B., vol. lv, pt. 2, p. 378, n. 201, pl. xviii, figs. 8, *male*; 8*a*, 8*b*, *female* (1887).

from the same sex of *H. chabrona*. Should the test of the presence or absence of the subapical spot to the forewing be found ultimately to fail, then I think *H. chabrona* will have to fall before *H. vitta*.

EXPLANATION OF THE PLATES.

Plate N.

Fig. 1. *Lethe* (*Rangbia*) *gulnihal*, de Nicéville, ♀, p. 259.
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A KEY TO THE ASIATIC GENERA OF THE *HESPERIIDÆ*.

By Capt. E. Y. Watson, Indian Staff Corps, F.E.S., F.Z.S.

(*Read before the Bombay Natural History Society on 2nd April*, 1895.)

In the Proceedings of the Zoological Society of London for 1893, page 3, there appeared a paper by me on a proposed arrangement of the genera of the *Hesperiidæ*, and Mr. de Nicéville has suggested to me that, for the convenience of workers in India, I should publish an excerpt of it as far as relates to Indian genera. In adopting his suggestion, I have considered it would render the paper more complete if all the Asiatic genera were included, as there are only sixteen of the latter at present described, which have not been recorded from within Indian limits, and it is quite probable that some of these will also be obtained hereafter within the Indian region.

I have found it necessary to alter, to a certain extent, the arrangement of my previous paper owing to several new genera having been recently described, and I have also found that, by slightly modifying the characters taken, it has been possible to arrange the genera more naturally. Having also seen specimens of the true *Isma obscurus*, or some species very closely allied to it, I now consider that I was wrong in assigning "*Isoteinon*" *cephala*, Hewitson, to the genus *Isma*, from the type species of which it differs markedly in the length of the antennæ. It does not, however, appear necessary to found a new genus for *cephala*, as it only appears to differ from *Zographetus* in wanting the male-mark characteristic of that species. It is therefore tentatively included in that genus, together with its close ally *cephaloides*, de Nicéville.

Since the publication of my paper above referred to, some nineteen new Asiatic genera have been described—sixteen* of them by Mr. de Nicéville, who has in every case kindly sent the types to me for examination to enable me to include them in the present paper; one, *Apostictopterus*, by Mr. Leech, in the "Butterflies from China, Japan, and Corea;" and two by Colonel Swinhoe in the Transactions of the Entomological Society of London for 1893, which are referred to below.

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* *Crossiura*, Journ. Bomb. Nat. Hist. Soc., vol. vii, p. 350 (1892).

Charmion, *Ochus*, *Sepa*, Journ. As. Soc. Beng., vol. lxiii, pt. ii, p. 48 (1894).

Suada, *Ge*, *Ityx*, *Idmon*, *Pudicitia*, *Mimas*, *Creteus*, *Zela*, *Zampa*, *Iton*, *Eetion*, and *Acerbas* which are described in the paper which precedes this in the present Volume of this Journal.

Mr. de Nicéville has also cleared up some confusion which originally existed in the genera *Pisola* and *Capila*. As I had fallen into the same error as other workers with reference to these two genera, and had omitted to notice that the insect usually identified as the female of *C. jayadeva* was correctly the male of *P. zennara* and *vice versa*, the character on which I separated the two genera in the synopsis in my previous paper is quite valueless, as it simply separates the two sexes of one and the same species; it has therefore been found necessary to take a fresh character on which to separate the two genera.

The paper* by Colonel Swinhoe referred to above is an excellent example of the pitfalls and inconsistencies into which those fall who found Hesperid genera on male characteristics alone. In this paper Colonel Swinhoe erects two new genera—*Caltoris* and *Burara*—which differ from *Baoris* and *Ismene* respectively in certain male characteristics, but are otherwise identical with them. But, while describing these two genera, Colonel Swinhoe still leaves *stigmata* and *jhora* in the genus *Aëromachus* (presumably because even he had not the heart to separate two such intimate relations), and also retains the genus *Ismene* for the species *ataphus*, *jaina*, and *amara*, which differ from *œdipodea*, the type of *Ismene*, in the very important male character of not having the costal margin of the hindwing folded over, while the three species themselves differ, *inter se*, both in neuration and in the development of the sexual patch on the forewing, in which latter respect *amara* is certainly more distinct from *ataphus* than *vasutana* (the type of *Burara*) is from *amara*. The description of *Burara* is also very faulty, as, while Colonel Swinhoe notes the absence of the androconia on the forewing, he makes no mention of the folding over of the costa of the hindwing, thereby leaving it to be implied that in this detail *Burara* does not differ from *Ismene*, which is not the case.

So much for the inconsistencies, and now for the pitfalls. Under *Hasora vitta*,† Colonel Swinhoe states that that species can be readily distinguished from *Parata alexis* by "the entire absence of the very characteristic *subgeneric* sexual character of *Parata*, *i.e.*, an oblique

* It is doubtful if a paper so full of misprints and inaccuracies has ever been published by any scientific Society.

† This is probably an incorrect identification, the species meant being *Hasora chabrona*, Plötz.

glandular streak on the fore wings above." The next line reads "Genus *Parata*, Moore," but if *Parata* differs from *Hasora* only in an admittedly "subgeneric sexual character," why treat it as a distinct "genus." The same remarks, *mutatis mutandis*, apply to the re-erection of the "genus" *Pyrgus*, which differs (*teste* Swinhoe) from *Hesperia* in wanting the "sub-generic" character of a tuft of hair on the hind tibiæ. In this case, however, the pitfall is of greater depth, as, though Colonel Swinhoe is quite right in saying that *Pyrgus* and *Hesperia* differ as stated above, yet he has unfortunately overlooked the fact that the species *galba*, for which he re-erects the genus *Pyrgus*, differs from *syrichtus*, Fabricius, the type of *Pyrgus*, in the absence of the sub-generic sexual character of a costal fold on the forewing, so that, arguing on Swinhoean lines, the generic name *Pyrgus* is no more appropriate to *galba* than is the name *Hesperia*.

In this same paper Colonel Swinhoe describes eight new species of *Hesperiidæ* of only one of which mention will be found in the lists of species below, as I consider that the rest of them belong to species which have already been described and named. The eight species are *Isma isota*, *Caltoris onchisa*, *Halpe aucma*, *H. marta*, *H. wantona*, *H. perara*, *H. teliga*, and *Astictopterus kada*. What is described as *Isma isota* is simply the male of *Z. cephala*, which species differs sexually precisely in the points which Colonel Swinhoe has laid stress upon; *Z. cephala* was originally described from a female, and the type is in the Hewitson collection at the British Museum, while in the general collection at the same Museum there is a series of both sexes which Colonel Swinhoe apparently omitted to consult before describing his *I. isota*. "*Caltoris*" *onchisa* is an aberration of "*Caltoris*" *austeni*. I have seen the two specimens described, and can state with certainty that the "pale subapical fascia" on the forewing, which is the sole distinguishing character of *onchisa*, is not natural, but is the result of an accident either before or after capture, while the fascia is not of the same extent in both specimens; I suspected the nature of the fascia when I saw the specimens, and have since myself obtained a specimen of *Baoris conjuncta*, which has a precisely similar fascia; the marking is in all probability due to the insects having been stained by moisture while in their "papers." In the description the

apical fascia is said to be on the forewing, and in the note below on the hindwing; it is in reality on the forewing. *Halpe aucma*, *H. marta*, *H. wantona*, *H. perara* are without question merely slight forms of *H. homolea*, and it is incredible that any author could, from five specimens only, describe four "new species," which are admitted by the describer to be allied to such an exceedingly variable species as *H. homolea*. *H. teliga*, described from a single specimen, is a rather prominently-marked example of *H. moorei*, and is readily matched in any long series of that species. *Astictopterus kada* is probably what has been described by Mr. Moore as the female of his *Astictopterus olivascens*, specimens of which occur with one, two, or three subapical spots or with none at all; however, since, as pointed out by Mr. Elwes, there appear to be two species confused under the one name *A. olivascens*, I have tentatively admitted Colonel Swinhoe's species, though I am by no means certain he has correctly discriminated it, as he makes no mention of having examined Mr. Moore's types so as to decide for which species his name should stand. As the species has an anal tuft which entirely conceals the sexual organs, so that it cannot be sexed without the last segment of the abdomen being denuded of scales and examined microscopically, Colonel Swinhoe's sexing must be accepted with reservation.

Colonel Swinhoe states in his introductory notes to the paper that he submitted all his new species to me for examination; this is quite correct, except that I did not see specimens of *I. isota* or *A. kada*, but with reference to the other species, Colonel Swinhoe has omitted to mention that I told him I did not consider any of them to belong to undescribed species.

Mr. de Nicéville having sent me for examination a clearing of *batara*, the type of *Unkana*, I have seen from it that this species correctly belongs to the genus *Erionota*, and as *batara* was specified as the type of *Unkana*, that genus must sink as a synonym. Of the three other species placed under *Unkana* by Mr. Distant, *U. attina* is the female of *U. batara* and is the oldest name for the species, while for *U. elia* the genus *Eetion* has been described by Mr. de Nicéville.

In the present paper the genus *Parnara* has not been retained as distinct from *Baoris*. I previously kept these two distinct on a slight antennal character, but this has since proved to be more individual than

generic. The Indian species of the genus present three variations in their secondary sexual characters, viz., there either a tuft on the upperside of the disc of the hindwing (*Baoris*), or an oblique discal stigma on the upperside of the forewing (*Chapra*), or, lastly, no secondary sexual character on the wings at all (*Parnara*). As far as the Indian species are concerned, these three groups can be kept as distinct subgenera, but when we come to African species, it is quite impossible to separate into natural subgenera species without a linear brand and those provided with it; in Africa also a fourth group occurs, which not only has a brand on the forewing, but also has a tuft on the hindwing, showing that these two characters are closely correlated.

The genera *Pithauria*, *Baoris*, and *Hasora* will be found below subdivided into subgenera on their secondary sexual characters, but these subdivisions, though useful for purposes of identification, are in many cases quite unnatural; for instance, *Hasora chromus* and *H. coulteri*, are certainly more nearly allied to *Parata simplicissima* and *Parata chromus* respectively than to each other or to any other *Hasora*. However, as the subdivisions of the above three genera have been made, it has been thought advisable to make reference to them, but I have not undertaken the responsibility of giving new names to the subgenera which might be formed in the genera *Carcharodus*, *Hesperia*, *Aëromachus*, *Zographetus*, *Padraona*, *Halpe*, *Iton*, and *Ismene*, as the advantages to be obtained by so doing would be very slight, and, with the exception of a small section of *Ismene*, none of the subdivisions have as yet been named by previous writers.

For detailed descriptions of the genera I must refer readers to my earlier paper already referred to, as in the present paper the genera are compared in the keys only on a single character, that taken being the one most readily recognisable. It must, however, be borne in mind that, though in many cases a male character is taken as distinctive of a genus, this is only done when the male character made use of is found to occur in *every described species* of the genus, and that the keys could, if necessary, be constructed on the female insect, but that then the characters taken would of necessity not be so readily recognisable.

The total number of genera dealt with as Asiatic is 90, of which 74 have been recorded from within Indian limits. This latter number will probably not be much increased hereafter, but there is no doubt that

many new genera remain to be described from the islands of the Malay Archipelago, and probably also from Southern China.

There are 27 species of *Hesperiidæ* described from India by various authors which I have not been able to identify with certainty, and which will not be found in the lists of species given below. These species are :—*Proteides lankæ*, Plötz, Ceylon, which is stated to be near (*Coladenia*) *indrani*, Moore ; *Hesperia taprobana*, Plötz, Ceylon, about the identity of which I can make no suggestion ; *Hesperia kolantus*, Plötz, India, which is a *Baoris* allied to or identical with *B. toona*, Moore ; *Hesperia saruna*, Plötz, India, which is a *Baoris* allied to, or identical with, *B. kumara* ; *Antigonus sezendis*, Plötz, Ceylon, which appears to be identical with *Sarangesa albicilia ; Apaustus discreta*, Plötz, India, which appears to be an *Aëromachus* possibly *A. jhora ; Hesperia vaika*, Plötz, India, which is perhaps a male of *Suastus gremius ; Apaustus sinhalus*, Plötz, Ceylon, which is almost certainly identical with *Suastus minutus* ; *Apaustus luteipalpis*, Plötz, Ceylon, which may be *Iambrix salsala ; Tagiades vulturna*, Plötz, Calcutta, which is apparently a true *Tagiades ; Tagiades cosima*, Plötz, N. India, which agrees with *Satarupa sambara ; Hesperia nala*, Plötz, India, which appears to be a *Padraona ; Plesioneura leucographa*, Plötz, which is apparently a *Notocrypta ; Hesperia alice*, Plötz, Mergui, which is near to *B. conjuncta* (=*narooa*) ; *Tagiades area*, Herrich-Schäffer, Bengal, which is a *Celænorrhinus* near to *C. munda ; Telesto cæcilius*, Herrich-Schäffer, India, which appears to belong to *Telesto* or an allied genus, and is probably from the Australian region ; *Hesperia larika*, Pagenstecher, Ceylon, which appears to be similar to *Baoris* (*Chapra*) *mathias*, except that there are no spots in the discoidal cell of the forewing ; *Cyclopides lynx*, Möschler, Silhet, which appears to be a female *Ampittia maro ; Tagiades litigiosa*, Möschler, Silhet, which appears to be allied to, or identical with, *T. menaka ; Tagiades athos*, Weymer, Calcutta, which is close to *T. distans* and *T. obscurus ; Plesioneura varians*, Maasen, Southern Asia, and *Plesioneura chimæra*, Kelerst, India, both of which appear to belong to *Notocrypta ;* and *Plastingia egena*, Felder ; *Hesperia onara*, Butler ; *Telesto luteisquama*, Mabille ; *Telesto porus*, Mabille ; *Telesto disu*, Kollar, all described from the Indian region, besides which M. Mabille has described a few other

Hesperiidæ from India, but the names and descriptions are not now accessible to me ; of the above species, all or nearly all are certainly well known under other names.

All other species are ascribed to what are believed to be their correct genera, with the exception of "*Isoteinon*" *flavalum*, de Nicéville, no specimens of which are available for examination.

With the above-mentioned exceptions, it is believed that every species recorded from Indian limits is included in the lists of species below, excepting such as have been sunk as synonyms. Of the 230 species enumerated in "Hesperiidæ Indicæ," the following are omitted, having been wrongly included as from Indian limits : *Carcharodus marrubii*, *Kerana gemmifer*, *Halpe beturia*, *Hasora hadria* and *Ismene œdipodea* ; *Ampittia coras* has been since described as *Taractrocera nicevillei*; *G. litoralis* is sunk to *G. albofasciata*, *A. subtestaceus* and *A. khasianus* to *A. atkinsoni*, *A. nilgiriana* and *A. modesta* to *A. vindhiana*, *M. subfasciata* to *P. lebadea*, *C. consertus* to *C. asmara*, *C. munda* to *C. leucocera* ; *B. cingala* to *B. colaca* ; *B. farri* and *B. penicillatum* to *B. occia*, "*Parnara*" *parca* to *C. cyrina*, and *S. subgrisea* to *S. gremius* ; while *O. sura*, *Z. flavipennis*, *N. alysos*, *H. sikkima*, *B. narooa*, *B. prominens*, and *S. subfasciatus* are shown under the older names *O. angulata*, *Z. ogygia*, *N. feisthamelii*, *H. homolea*, *B. conjuncta*, *B. sinensis*, and *S. pulligo* respectively. On the other hand *D. andamanica*, *I. stellifer*, and *B. bada* are separated from *D. bhagava*, *I. salsala*, and *B. guttatus* ; the following species described from outside the Indian region have been found to occur within it : *Charmion ficulnea*, *Celænorrhinus aspersa*, *Tagiades dealbata*, *Odontoptilum pygela*, *Hesperia poggei*, *Pamphila gemmata*, *Suastus phiditia*, *Taractrocera ziclea*, *Pirdana hyela*, *Baoris brunnea*, *Lotongus calathus*, *Lotongus avesta*, *Isma submaculata*, *Acerbas anthea*, *Ismene etelka*, *Hasora chuza*, *Hasora chabrona*, and *Hasora simplicissima* ; and the following species either have been recently, or shortly will be, described from the Indian region : *Crossiura penicillatum*, *Sarangesa sati*, *Satarupa dohertyi*, *Caprona alida*, *Caprona elwesi*, *Hesperia geron*, *Carcharodus swinhoei*, *Ampittia maroides*, *Taractrocera atropunctata*, *Astictopterus kada*, *Koruthaialos hector*, *Suastus bipunctus*, *Suastus robsonii*, *Lophoides iapis*, *Notocrypta neœra*, *Halpe moorei*, *Halpe hyrie*, *Halpe fusca*, *Halpe astigmata*,

Halpe albipectus, *Onryza meiktila*, *Baoris philotas*, *Ismene ataphus*, and *Ismene fergusonii*, thus bringing the total number of species recorded from Indian limits to 257 (including "*Isoteinon*" *flavalum*).

Key to the sub-families of Asiatic HESPERIIDÆ.

A.—Sub-family HESPERIINÆ.—When in a state of complete repose the butterflies rest with their wings extended flat. The lower radial (vein 5) of the forewing arises nearer to the upper radial (vein 6) than to the third median branch (vein 4), the middle disco-cellular nervule being consequently shorter than the lower one. The male insect nearly invariably has a tuft of hair attached to the proximal end of the hind tibiæ, and occasionally has a costal fold on the forewing, but is never furnished with androconia on the upperside of the forewing.

B.—Sub-family PAMPHILINÆ.—When in a state of complete repose the butterflies rest with their wings perpendicularly closed over their backs. The lower radial of the forewing arises* nearer to the third median nervule than to the upper radial, the middle disco-cellular nervule being consequently longer than the lower one. The male insect frequently has patches of androconia of varying form on the upperside of the forewing, but never has either a costal fold on the forewing or a tuft* of hair on the hind tibiæ.

There seems no doubt that the above two sub-families represent two perfectly natural groups, as not only do they agree in neuration and habits, but a peculiar *facies* runs through each group, by which alone, with a little practice, the great majority of species can be readily assigned to their correct sub-family without the necessity of a minute examination of their neuration or a knowledge of their habits, though, of course, information on both these points should subsequently be obtained to confirm the correct position of any species.

Sub-family HESPERIINÆ.

In my above-quoted revision of the genera of the *Hesperiidæ*, it was found convenient to divide the present sub-family into two sections on a slight character of neuration, but, as nearly all the genera of the first section are confined to the New World, it has been thought more satisfactory to include all the Asiatic genera in one key.

* In some species of the third section of this sub-family, the lower radial is as in the *Hesperiinæ*, and there is a tuft on the hind tibiæ of the male, but in other respects this section is nearer to the *Pamphilinæ*, and its peculiar palpi serve to distinguish it from all the genera of the *Hesperiinæ*.

Key to the Asiatic Genera.

A. Radial of hindwing fully developed.

a. Male with a costal fold on forewing.

a^1. Hind tibiæ with terminal pair of spurs only.

CASYAPA, Kirby.

b^1. Hind tibiæ with both terminal and medial pairs of spurs.

*ORTHOPHŒTUS, nom. nov.

b. Male with no costal fold on forewing.

a^1. Male, inner margin of forewing longer than outer margin.

a^2. Cell of hindwing reaching up to or rather beyond middle of wing.

CALLIANA, Moore.

b^2. Cell of hindwing short, not reaching to middle of wing.

PISOLA, Moore.

b^1. Male, outer margin of forewing longer than inner margin.

a Forewing apically produced, outer margin straight.

CAPILA, Moore.

b^2. Forewing not apically produced, outer margin convex.

CROSSIURA, de Nicéville.

B. Radial of hindwing wanting (*i.e.*, not fully developed into a tubular vein).

a. †Cell of forewing more than two-thirds the length of costa.

a^1. Male with a costal fold on forewing, and with no tuft of hair on hind tibiæ.

ACHALARUS, Scudder.

b^1. Male with no costal fold on forewing, but with a tuft of hair on hind tibiæ.

HANTANA, Moore.

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* I propose this generic name for *phanæus* and its allies, the name *Pterœxys* being preoccupied in *Heterocera*. *O. phanæus* is on the wing before sunrise.

† In measuring these distances, the length of the cell should be taken from the bifurcation of the median and subcostal nervures to the extreme apex of the cell, which in nearly every genus is at the origin of the fifth subcostal branch; the length of the costa should be taken in a straight line from the base of the costa, where it joins the thorax, to the extreme apex of the wing, which is situated practically at the extremity of the fourth subcostal branch. In referring above to the fifth subcostal branch, it would perhaps be more correct to say "terminal portion of subcostal nervure."

b. *Cell of forewing less than two-thirds the length of costa.

a^1. Antennæ, tip acuminate.

a^2. Terminal joint of palpi suberect.

a^3. Second median branch of forewing arising far before end of cell, hardly twice as far from base of wing as from end of cell.

CHARMION, de Nicéville.

b^3. Second median branch of forewing arising shortly before end of cell, more than three times as far from base of wing as from end of cell.

CELÆNORRHINUS, Hübner.

b^2. Terminal joint of palpi horizontally porrected.

a_3. Apex of forewing not truncate.

a^4. Lower margin of cell of forewing not strongly arched between first and second median branches.

a^5. Hindwing, outer margin sinuate.

a^6. Hindwing, hardly or not at all elongate; hind tibiæ of male with a tuft of hair attached to proximal end.

a^7. First subcostal branch of hindwing shorter than first median branch.

a^8. Lower margin of cell slightly arched between first and second median nervules.

SARANGESA, Moore.

b^8. Lower margin of cell straight between first and second median nervules.

COLADENIA, Moore.

b^7. First subcostal branch of hindwing as long as or longer than first median branch.

DAIMIO, Murray.

* In measuring these distances, the length of the cell should be taken from the bifurcation of the median and subcostal nervures to the extreme apex of the cell, which in nearly every genus is at the origin of the fifth subcostal branch; the length of the costa should be taken in a straight line from the base of the costa, where it joins the thorax, to the extreme apex of the wing, which is situated practically at the extremity of the fourth subcostal branch. In referring above to the fifth subcostal branch, it would perhaps be more correct to say "terminal portion of subcostal nervure."

b^6. Hindwing, elongate; hind tibiæ of male densely fringed, but with no tuft of hair attached to proximal end.

SATARUPA, Moore.

b^5. Hindwing, outer margin even.

ODINA, Mabille.

c^5. Hindwing, outer margin very dentate.

DARPA, Moore.

b^4. Lower margin of cell of forewing strongly arched between first and second median branches.

TAGIADES, Hübner.

b^3. Apex of forewing broadly truncate.

a^4. Outer margin of hindwing angled at second median branch.

*TAPENA, Moore.

b^4. Outer margin of hindwing angled at third median and first subcostal branches.

CTENOPTILUM, de Nicéville.

b^1. Antennæ, tip blunt.

a^2. Male with a tuft of hair on fore coxæ.

a^3. Male with a recumbent tuft of hair on fore coxæ.

ODONTOPTILUM, de Nicéville.

b^3. Male with a radiating tuft of hair on fore coxæ.

CAPRONA, Wallengren.

b^2. Male with no tuft of hair on fore coxæ.

a^3. Outer margin of hindwing crenulated.

CARCHARODUS, Hübner.

b^3. Outer margin of hindwing even.

a^4. Antennal club straight.

GOMALIA, Moore.

b^4. Antennal club curved.

a^5. Club robust.

HESPERIA, Fabricius.

b^5. Club comparatively slender.

THANAOS, Boisduval.

* In all the species of *Tapena*, with the exception of the type species *thwaitesi*, the truncation of the forewing is less conspicuous and the hindwing is squared, but not distinctly angled.

SPECIES.—The following list comprises all the species of the subfamily *Hesperiinæ* which are known to occur within Indian limits :—

Orthophætus—
phanæus.
lidderdalei.
Calliana—
pieridoides.
Pisola—
zennara.
Capila—
jayadeva.
Crossiura—
penicillatum.
Achalarus—
liliana.
casyapa.
Hantana—
infernus.
Charmion—
ficulnea.
Celænorrhinus—
leucocera.
pulomaya.
flavocincta.
aspersa (= clitus).
pyrrha.
plagifera.
patula.
pero.
sumitra.
putra.
ambareesa.
chamunda.
nigricans.
fusca.
spilothyrus.
asmara.
cacus.
badia.
dhanada.
aurivittata.

Sarangesa—
purendra.
dasahara.
albicilia.
sati.
Coladenia—
dan.
fatih.
indrani.
tissa.
hamiltonii.
Daimio—
bhagava.
andamanica.
narada.
phisara.
Satarupa—
gopala.
sambara.
dohertyi.
Odina—
decorata.
hieroglyphica.
Darpa—
hanria.
Tagiades—
helferii.
ravi.
khasiana.
distans.
obscurus.
meetana.
alica.
menaka.
atticus.
gana.
dealbata.
pralaya.
trichoneura.
tabrica.
pinwillii.

Tapena—
thwaitesii.
agni.
laxmi.
buchananii.
Ctenoptilum—
vasava.
multiguttata.
Odontoptilum—
angulata.
pygela.
Caprona—
ransonettii.
saraya.
alida.
syrichthus.
elwesii.
Carcharodus—
dravira.
swinhoei.
Gomalia—
albofasciata.
Hesperia—
galba.
evanidus.
zebra.
geron.
poggei.
cashmiriensis.
Total 86 species.

AFFINITIES.—The above arrangement will be found to be very fairly natural. The genera *Casyapa*, *Orthophætus*, *Calliana*, *Pisola*, *Capila*, and *Crossiura* are all very closely allied, in fact the differences

between the last four might be reasonably treated as only subgeneric, *Achalarus*, though closely allied to several North American genera, appears to have no nearer Asiatic ally than *Celænorrhinus*; all the genera enumerated between *Hantana* and *Tagiades* are undoubtedly closely allied to one another; *Tapena* appears to be allied to *Tagiades*, *Celænorrhinus* and *Ctenoptilum*; the last mentioned is closely allied to *Odontoptilum* and *Caprona*; while the last four genera are very close to one another, and also show relationship to *Achalarus* on the one hand and *Pamphila* on the other.

RANGE.—The genera *Casyapa* and *Thanaos* have not yet been recorded from within Indian limits: *Achalarus*, *Carcharodus* and *Thanaos* are almost entirely Arctic in their range; the first is found in North America as well as in Asia; *Carcharodus* is chiefly European, but also ranges to North Africa, while *Thanaos* is typically European, but species which have been assigned to it, though probably erroneously, are found in North America. Species of *Hesperia* occur throughout the whole of both Hemispheres with the exception of the Australasian region; it will probably, however, be found practicable hereafter to found new genera for many of the species which are now included under this genus. *Sarangesa*, *Coladenia*, *Tagiades*, *Caprona*, and *Gomalia* range to Africa; while species of *Celænorrhinus* occur both in Africa and South America. The remaining genera are confined to the Asiatic region as far as present knowledge goes.

Sub-family PAMPHILINÆ.

The genera of this sub-family, being very numerous, are conveniently divided into three sections, of which the two first, founded on a slight difference in neuration, are purely artificial and are adopted only for convenience; the third section, however, consists of a group of closely allied genera, which appear to have no near allies among the other *Pamphilinæ*, so much so that it is questionable whether it would not be advantageous to form them into an additional sub-family under the name of *Ismeninæ*,* the species contained under which would stand in much the same relation to the remainder of the Old World *Hesperiidæ* that the *Pyrrhopyginæ* do to those of the New World.

* This name (but with a much more extended meaning) has been made use of by M. Mabille in a paper on the *Hesperiidæ* of the Brussels Museum published in the Annals of the Entomological Society of Belgium, vol. xxi (1878).

SECTION I.

Palpi various, but never as in Section III. Lower radial of forewing straight throughout its length and not arising markedly nearer to the third median branch than to the upper radial, the middle discocellular being therefore only slightly longer than the lower one.

Key to the Asiatic Genera.

A. Fore tibiæ without epiphysis, and hind tibiæ with terminal spurs only.

a. *Hindwing, second median branch immediately before end of cell, first median branch nearer to end of cell than to base of wing.

PAMPHILA, Fabricius.

b. *Hindwing, second median branch well before end of cell, first median branch nearer to base of wing than to end of cell.

HETEROPTERUS, Dumeril.

B. Fore tibiæ with epiphysis, and hind tibiæ with terminal and medial pairs of spurs.

a. First subcostal branch of forewing running very close to, or actually touching, costal nervure.

a^1. Terminal joint of palpi porrect, plainly visible.

a^2. First median branch of forewing nearer to end of cell than to base of wing.

BARACUS, Moore.

b^2. First median branch of forewing nearer to base of wing than to end of cell.

ASTICTOPTERUS, Felder.

†APOSTICTOPTERUS, Leech.

b^1. Terminal joint of palpi concealed in clothing of second joint.

SANCUS, de Nicéville.

c^1. Terminal joint of palpi erect, usually long, slender, and curving over vertex.

a^2. Forewing, second median about twice as far from first as from third ; hindwing, second median well before end of cell.

KORUTHAIALOS, Watson.

* In my P. Z. S. paper referred to above, the forewing is given instead of the hindwing owing to an unfortunate oversight.

† In describing this genus Mr. Leech does not say how it differs from *Asticopterus* with which he says it agrees in neuration. The type species figured might from its appearance belong either to *Asticopterus* or *Sancus*.

b^2. Forewing, second median about four times as far from first as from third ; hindwing, second median almost at end of cell.

SUADA, de Nicéville.

b. First subcostal branch of forewing well separated from costal nervure throughout its entire length.

a^1. Terminal joint of palpi conspicuous, erect, long, slender, and curving over vertex.

a^2. Second median branch of forewing well before end of cell, and second median branch of hindwing from before end of cell.

SUASTUS, Moore.

b^2. Second median branch of forewing immediately before end of cell, and second median branch of hindwing from end of cell.

IAMBRIX, Watson.

b^1. Terminal joint of palpi inconspicuous, entirely or almost entirely concealed in clothing of second joint.

a^2. Antennæ very long, more than two-thirds length of costa of forewing.

GE, de Nicéville.

b^2. Antennæ of moderate length, less than two-thirds length of costa of forewing.

a^3. Terminal crook of antennæ short, or entirely absent.

a^4. First median branch of forewing considerably nearer to end of cell than to base of wing.

a^5. Second median branch of hindwing from before end of cell.

a^6. No tuft of hair on underside of forewing in male.

a^7. Club of antennæ forming a hollowed disc.

TARACTROCERA, Butler.

b^7. Club of antennæ elongated.

a^8. Costa of forewing strongly arched.

OCHUS, de Nicéville.

b^8. Costa of forewing straight. Forewing short and broad, apex squared, outer margin very convex.

* AMPITTIA, Moore.

c^8. Costa of forewing straight, apex acute, outer margin nearly straight.

AËROMACHUS, de Nicéville.

b^6. A tuft of hairs on underside of forewing in male.

SEBASTONYMA, Watson.

b^5. Second median branch of hindwing from end of cell.

PEDESTES, Watson.

b^4. First median branch of forewing not at all or only slightly nearer to end of cell than to base of wing, usually much nearer base of wing.

a^5. Male with no secondary sexual characters on upperside of forewing. Cilia at anal angle of hindwing much elongated.

LOPHOIDES, Watson.

b^5. Male with or without secondary sexual characters on upperside of forewing. Cilia at anal angle of hindwing normal.

a^6. Terminal joint of palpi erect.

a^7. Forewing apically produced in male; outer margin very oblique, almost equal in length to inner margin.

HYAROTIS, Moore.

b^7. Forewing not produced apically in male; outer margin hardly oblique, considerably shorter than inner margin.

ISOTEINON, Felder.

b^6. Terminal joint of palpi horizontal.

a^7. Terminal joint of palpi conspicuous.

a^8. Male with a short glandular streak lying along the submedian nervure on upperside of forewing.

IDMON, de Nicéville.

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* *A. maro*, Fabricius, the type of *Ampittia*, has no terminal crook to the antennæ; other species of the genus however have a minute terminal crook.

b^8. Male with no glandular streak on upperside of forewing.

ARNETTA, Watson.

b^7. Terminal joint of palpi concealed.

a^8. Hindwing, produced in submedian area; longer than broad; the submedian nervure practically equal in length to the length of the subcostal nervure from its origin to the extremity of its lower branch.

ITYS, de Nicéville.

b^8. Hindwing, produced in subcostal area; the submedian nervure much shorter than the subcostal nervure from its origin to the extremity of its lower branch.

a^9. Antennæ short, less than length of cell of forewing.

ZOGRAPHETUS, Watson.

b^9. Antennæ comparatively long, longer than length of cell of forewing.

ISMA, Distant.

b^3. Terminal crook of antennæ long, about twice as long as breadth of club.

a^4. Forewing, first median branch practically equidistant from end of cell and base of wing.

MATAPA, Moore.

b^4. Forewing, first median branch nearer base of wing, practically equidistant from base of wing and second median branch.

a^5. Hindwing, first and second median branches not swollen in the male.

a^6. Male with an oblique transverse discal stigma on upperside of forewing.

SEPA, de Nicéville.

b^6. Male with a short glandular streak lying along submedian nervure on upperside of forewing.

PUDICITIA, de Nicéville.

c^6. Male with no secondary sexual characters on upperside of forewing.

a^7. Second median branch of forewing considerably more than twice as far from first as from third.

ACERBAS, de Nicéville.

b^7. Second median branch of forewing hardly or less than twice as far from first as from third.

a^8. Hindwing normal, longer than broad.

* Zea, Distant.

b^8. Hindwing ample, broader than long.

Erionota, Mabille.

b^5. Hindwing, first and second median branches swollen in the male.

a^6. Forewing, apex truncate; hindwing very broad.

Gangara, Moore.

b^6. Forewing, apex acute; hindwing slightly elongate.

Paduka, Distant.

Affinities.—Of the above-named genera, *Pamphila* and *Heteropterus* are closely allied to one another and also apparently to *Hesperia* and the closing genera of the preceding sub-family; the want of the epiphysis on the fore tibiæ and of the medial spurs on the hind tibiæ readily distinguish them. *Baracus* appears to be allied to *Heteropterus* and also to *Astictopterus*. The succeeding genera as far as *Iambrix* connect with one another very naturally, and there seems little doubt as to their close relationship. The genus *Ge* is rather out of place, but is probably close to *Lophoides*; the next few genera, from *Taractrocera* to *Pedestes*, are all certainly closely allied to one another and also probably to *Pamphila*; other near allies appear to be *Halpe* and *Padraona* which fall into the second section of the subfamily. The succeeding genera, as far as *Isma*, all appear to be closely allied to one another; and the remaining genera, from *Matapa* to *Paduka*, also appear to be close allies and show relationship on the one hand with *Idmon* and on the other with *Kerana* and *Lotongus* and the other early genera of the succeeding group.

Range.—All the Asiatic genera of this group, with the exception of *Pamphila* and *Heteropterus*, are confined to the Asiatic region. Of

* Zea, Distant, Rhop. Malay., p. 377. Antennæ, moderate, club elongated, with a long terminal crook. Palpi, densely scaled, third joint almost entirely concealed. Legs, normal. No secondary sexual characters on wings or legs of male. Forewing, apex acute, outer margin straight, slightly longer than inner margin; subcostals normal; lower discoidal arising slightly nearer to the third median than to the upper discoidal nervule; upper disco-cellular minute, middle one slightly longer than lower; second median well before end of cell, less than twice as far from first as from third, first median about equidistant from second and base of wing. Hindwing, slightly elongate, with an inconspicuous lobe; neuration normal, discoidal nervule not traceable, medians well separated. The above description is taken from a Sumatran male of *Z. mytheca*, Distant (the type of *Zea*), in the collection of Hofrath Dr. L. Martin, and lent to me for the purpose.

these two, the latter is European and the former is Holartic. No species of the genera *Heteropterus*, *Isoteinon*, *Ge*, *Idmon*, *Sepa*, *Zea*, or *Apostictopterus* have been recorded from within Indian limits. *Heteropterus* and *Isoteinon* are confined to Northern Asia. *Ge*, *Idmon*, *Zea*, and *Sepa* are at present only known from Malacca and Sumatra, and *Apostictopterus* contains a single species from China.

Species.—The following is a list of the species of this section which have been recorded from within Indian limits :—

Pamphila—
- avanti.
- gemmata.

Baracus—
- septentrionum.
- subditus.
- vittatus.

Astictopterus—
- olivascens.
- kada.

Sancus—
- pulligo.

Koruthaialos—
- hector.
- xanites.
- butleri.

Suada—
- swerga.

Suastus—
- gremius.
- sala.
- aditus.
- bipunctus.
- robsonii.
- minutus.
- phiditia.

Iambrix—
- salsala.
- stellifer.

Taractrocera—
- mævius.
- danna.
- ceramas.
- atropunctata.
- nicevillei.
- ziclea.

Ochus—
- subvittatus.

Ampittia—
- maro.
- maroides.

Aëromachus—
- stigmatus.
- jhora.
- kali.
- indistinctus.
- obsoletus.

Sebastonyma—
- dolopia.

Pedestes—
- masuriensis.
- pandita.

Lophoides—
- lapis.

Hyarotis—
- adrastus.

Arnetta—
- atkinsonii.
- vindhiana.

Itys—
- microstictum.

Zographetus—
- satwa.
- ogygia.
- indrasana.
- cephala.
- cephaloides.

Isma—
- submaculata.

Matapa—
- aria.
- druna.
- sasivarna.
- shalgrama.

Acerbas—
- anthea.

Pudicitia—
- pholus.

Erionota—
- thrax.
- acroleuca.
- attina.

Gangara—
- thyrsis.

Paduka—
- lebadea.

Total 60 species.

"*Isoteinon*" *flavalum*, de Nicéville, probably belongs to this section, but no specimens are available for examination.

SECTION II.

Palpi various, but never as in Section III. Lower radial nervure of forewing deflected downwards at origin and consequently arising much nearer to the third median branch than to the upper radial, the middle disco-cellular being therefore very much longer than the lower one.

Key to the Asiatic Genera.

A. Antennæ, tip acuminate.
  a. Antennæ exceptionally long; terminal crook short, hardly longer than breadth of club.
    a^1. Forewing, outer margin equal to, or shorter than, inner margin.
      a^2. Second median branch of hindwing from well before end of cell.

KERANA, Distant.

      b^2. Second median branch of hindwing from immediately before end of cell.
        a^3. First median branch of hindwing almost equidistant from end of cell and base of wing.

ANCISTROIDES, Butler.

        b^3. First median branch of hindwing more than twice as far from base of wing as from end of cell.

PIRDANA, Distant.

    b^1. Forewing, outer margin considerably longer than inner margin.

PLASTINGIA, Butler.

  b. Antennæ of moderate length; terminal crook long, about twice as long as breadth of club.
    a^1. Male with no tuft of hair on fore coxæ.
      a^2. Second median branch of forewing in male three times as far from first as from third.
        a^3. Male with no secondary sexual characters.

LOTONGUS, Distant.

b^3. Male with first median branch of forewing swollen.

CRETEUS, de Nicéville.

c^3. Male with an oblique linear discal stigma on upperside of forewing.

ZELA, de Nicéville.

d^3. Male with a discal tuft on upperside of hindwing.

ZAMPA, de Nicéville.

b^2. Second median branch of forewing in male less than twice as far from first as from third.

a^3. Inner margin of forewing equal to outer margin.

MIMAS, de Nicéville.

b^3. Inner margin of forewing shorter than outer margin.

a^4. Hindwing broad, evenly rounded, no distinct anal lobe.

HIDARI, Distant.

b^4. Hindwing, elongate, with a distinct anal lobe.

EETION, de Nicéville.

b^1. Male with a tuft of hair at base of fore coxæ.

PITHAURIA, Moore.

Sub-genera { *a*. Male without discal stigma on upperside of forewing, *Pithauria*. *b*. Male with discal stigma on upperside of forewing, *Pithauriopsis*.

c. Antennæ of moderate length; terminal crook short, as long as, or slightly longer than, breadth of club.

a^1. First median branch of forewing considerably nearer to base of wing than to end of cell.

a^2. Male with no secondary sexual characters on wings.

a^3. First median branch of hindwing less than twice as far from base of wing as from end of cell.

a^4. Hindwing not produced in median area; distance from base of wing to extremity of third median branch less than distance from extremity of costal nervure to extremity of submedian.

NOTOCRYPTA, de Nicéville.

b^4. Hindwing produced in median area; distance from base of wing to extremity of third median branch considerably greater than distance from extremity of costal nervure to extremity of submedian.

UDASPES, Moore.

b^3. First median branch of hindwing twice as far from base of wing as from end of cell.

ACTINOR, Watson.

b^2. Male with two glandular streaks and a tuft of hair on underside of forewing.

GEHENNA, Watson.

c^2. Male with a circular glandular patch on hindwing at origin of second median branch.

CUPITHA, Moore.

d^2. Male with an oblique linear stigma on upperside of forewing.

AUGIADES, Hübner.

b^1. First median branch of forewing nearer to end of cell than to base of wing.

a^2. Terminal joint of palpi suberect, distinct.

a^3. Second median branch of forewing almost equidistant from first and third.

*TELICOTA, Moore.

b^3. Second median branch of forewing many times further from first than from third.

PADRAONA, Moore.

b^2. Terminal joint of palpi porrect, almost entirely concealed in clothing of second joint.

†a^3. Second median branch of forewing almost equidistant from first and third.

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* Male only, female almost as in *Padraona*.

† In those species of *Baliş* in which the males have a discal brand, the second median branch of the forewing is in that sex nearer to the first than to the third.

a^4. Second median branch of hindwing immediately before end of cell, much nearer the third than the first. Male with no tuft of hair on upperside of hindwing.

HALPE, Moore.

b^4. Second median branch of hindwing almost equidistant from first and third. Male with a tuft of hair on upperside of hindwing attached along costal nervure.

ONRYZA, Watson.

b^3. Second median branch of forewing much nearer to third than to first. Second median branch of hindwing almost equidistant from first and third.

a^4. Second median branch of forewing more than twice as far from first as from third. First subcostal branch of hindwing almost equidistant from costal vein and end of cell.

ITON, de Nicéville.

b^4. Second median branch of forewing hardly or less than twice as far from first as from third. First subcostal branch of hindwing very much nearer to end of cell than to costal vein.

*BAORIS, Moore.

Sub-genera

a. Male with a tuft of hair on upperside of hindwing.

Sub-genus *Baoris*.

b. Male with a discal brand on upperside of forewing.

Sub-genus *Chapra*.

c. No secondary sexual characters on wings of male ; club of antennæ short and stout.

Sub-genus *Parnara*.

A fourth sub-genus of *Baoris* occurs in Africa, in which the males have both a discal stigma on the forewing and a tuft on disc of hindwing.

d. Antennæ short; terminal crook minute, never as long as breadth of club.

a^1. Antennæ very short, hardly longer than breadth of thorax.

GEGENES, Hübner.

b^1. Antennæ about twice as long as breadth of thorax, but less than half length of costa of forewing.

ERYNNIS, Schrank.

B. Antennæ, tip blunt.

ADOPÆA, Billberg.

AFFINITIES.—The arrangement of the genera in this section appears fairly natural, and connects satisfactorily with the last section; the genera from *Kerana* to *Eetion* all appear to be closely allied, and also show relationship to *Erionota*, *Sancus*, *Koruthaialos*, and *Astictopterus* of the preceding group; *Pithauria* is rather out of place, but appears to be close to *Hidari*, and is probably a near ally of *Baoris*; *Notocrypta* and *Udaspes* are certainly closely related to one another, but show no particular affinity to any other genera; *Actinor*, *Gehenna*, *Cupitha*, and *Onryza* appear to be allied to *Halpe*, which is itself close to *Iton* and *Baoris*; *Padraona* and *Telicota* are hardly generically distinct and are certainly close to *Augiades*, *Erynnis*, and *Adopæa*; while *Gegenes* appears to be allied to both *Baoris* and *Erynnis*.

RANGE.—All the Asiatic genera of this group are found within Indian limits with the exception of the following:—*Gehenna*, two species of which are known, one from Borneo and the other from Sumatra; *Ancistroides*, the two species of which are confined to the islands of the Malay Archipelago; *Zela*, *Zampa*, and *Eetion*, all of which are confined to Malaysia; *Mimas*, which is found in New Guinea; and *Adopæa*, which is Holarctic in its range. The following genera extend beyond Asiatic limits:—*Taractrocera* and *Telicota* to the Australasian region; *Ampittia*, *Baoris*, and *Baracus* to Africa; *Augiades* to Europe; *Gegenes* to Europe and Africa; *Padraona* to Australia and doubtfully to Madagascar and South America; while *Adopæa* and *Erynnis* are Holarctic.

SPECIES.—The following is a list of the species of this section which have been recorded from within Indian limits :—

Kerana—
diocles.
Pirdana—
rudolphii.
hyela.
Plastingia—
callineura.
noëmi.
margherita.
naga (?=tessellata).
Lotongus—
*sarala.
*avesta.
calathus.
Creteus—
cyrina.
Hidari—
irava.
bhawani.
Pithauria—
(*Pithauria*).
murdava.
stramineipennis.
(*Pithauriopsis*).
aitchisonii.
Notocrypta—
feisthamelii.
paralysos.
albifascia.
necera.
restricta.
monteithii.
basiflava.
Udaspes—
folus.
Actinor—
radians.
Cupitha—
purreea.
Augiades—
siva.
brahma.
Telicota—
augias.
bambusæ.
Padraona—
dara.
mæsoides.
pseudomæsa.
palmarum.
gola.
goloides.
Halpe—
moorei.
ceylonica.
homolea.
separata.
kumara.
hyrie.
aina.
gupta.
fusca.
ornata.
cerata.
astigmata.
zema.
sitala.
brunnea.
albipectus.
masoni.
honorei.
decorata.
Onryza—
meiktila.
Iton—
semamora.
watsonii.
Baoris—
(*Baoris*).
oceia.
(*Parnara*).
cahira.
austeni.
kumara.
plebeia.
seriata.
pagana.
†conjuncta.
assamensis.
uma.
tulsi.
toona.
eltola.
canaraica.
bevani.
colaca.
philotas.
moolata.
bada.
guttatus.
flexilis.
(*Chapra*)—
†brunnea.
†sinensis.
agna.
subochracea.
mathias.
Gegenes—
nostrodamus.
karsana.
Erynnis—
dimila.

Total 87 species.

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* These species are nearest to *Lotongus*, but, when their males are discovered, may prove to be distinct.

† Mr. Leech has recently shown that *Baoris sinensis*, Mabille, is the oldest name for *Baoris prominens*, Moore. Mr. de Nicéville also informs me that *Baoris conjuncta*, Herrich-Schäffer, is an older name for *Baoris narooa*, Moore, and that *Chapra brunnea*, Snellen, is an older name for *C. cære*, de Nicéville.

Section III.

Third joint of palpi long, slender and naked, porrected horizontally in front of the face. Species robust. Habits often crepuscular.

Key to the Asiatic Genera.

A. Radial of hindwing well developed.

a. Second median nervule of hindwing immediately before end of cell.

a^1. Club of antenna longer than shaft.

Ismene, Swainson.

b^1. Shaft of antenna longer than club.

a^2. Submedian vein of forewing distorted downwards near its origin.

Hasora, Moore.

Sub-genera
- *a.* Male with no discal brand on upperside of forewing. Sub-genus *Hasora.*
- *b.* Male with a discal brand on upperside of forewing. Sub-genus *Parata.*

b^2. Submedian vein of forewing not distorted.

Bibasis, Moore.

b. Second median nervule of hindwing well before end of cell.

Badamia, Moore.

B. Radial of hindwing wanting.

Rhopalocampta, Wallengren.

Affinities.—This is a well-marked group of closely-allied genera which show no close relationship with any other genera of the *Hesperiidæ*; their habits and general *facies* agree best with the genera contained in the subfamily *Pamphilinæ*; their neuration, however, appears to have more resemblance to that found in the *Hesperiinæ*; as suggested above, they might possibly with advantage be treated as a distinct sub-family.

RANGE.—This group of genera is confined to the Asiatic, African, and Australasian regions; *Ismene* and *Bibasis* have not been recorded out of Asiatic limits; *Hasora* is chiefly Malayan, and extends as far as Australia; *Badamia* also extends to the Australian region; *Rhopalocampta* is a very large genus, the species of which are almost entirely African, only two or three being found within Asiatic limits.

SPECIES.—The following are all the described species of this group recorded from within Indian limits :—

Ismene—
- ataphus.
- jaina.
- etelka.
- fergusonii.
- amara.
- anadi.
- harisa.
- gomata.
- vasutana.
- mahintha.

Hasora—
(*Hasora*)—
- badra.
- anura.
- chabrona.
- coulteri.

(*Parata*)—
- chromus
- alexis.
- malayana.
- simplicissima.
- chuza.

Bibasis—
- sena.

Badamia—
- exclamationis.

Rhopalocampta—
- benjaminii.
- crawfurdii.

Total 23 species.

ON THE SPECIES OF *GALEODIDÆ* INHABITING INDIA AND CEYLON.

By R. I. Pocock, of the British Museum.

(*With Plates A. & B.*)

(*Read before the Bombay Natural History Society on 2nd April*, 1895.)

The animals which form the subject of the present paper belong to the group known to zoologists as the *Arachnida*, which contains, in addition, the scorpions, spiders, ticks, and the like. For want of a vernacular term to fit them, they are usually called spiders, but they differ widely in many structural points from the true spiders, and constitute in reality a very distinct order of the *Arachnida*. In the first place being devoid of spinning glands they make no web of any kind, and in the second place the cephalothorax and abdomen are divided into a series of definite segments. There are also very many other characters to distinguish the two groups, but it is not my purpose to enter upon a discussion of them here, enough having been said to enable any one readily to recognise a *Galeodes* from a true spider.

In their distribution the *Galeodidæ* much resemble scorpions. They are found in S. Europe, over the whole of Africa, in Asia Minor, Persia, Afghanistan, India, Ceylon, Siam, and Austro-Malaya; and in America they range from the southern United States in the north to Chili in the south. So far as has been at present ascertained only two genera exist in India, but neither of these has as yet been recorded from Burma or any part of Further India, and only one of them appears to extend into Ceylon. Moreover, it is probable that they are both relatively recent immigrants into India, for they both form a prominent part of the Mediterranean Arachnid fauna. These two genera are *Galeodes* and *Rhax*. The former ranges from Morocco to Nubia, all over Arabia, Asia Minor and Persia into Greece, S. Russia, Transcaspia, Afghanistan, and thence into the Punjab and extends eastwards to the neighbourhood of Calcutta and southwards into the presidency of Madras. The range of *Rhax* covers that of *Galeodes* and appears slightly to overlap it in N. Africa and in the Oriental Region. For it extends from the Gambia to Masai-Land, and, as has been already stated, into Ceylon.

The two genera may be easily recognised as follows :—

a—*Legs* and *palpi* short and robust with all the tarsi or terminal segments undivided. The *tarsus* of the palp is immovably fused with the preceding segment or protarsus. The *abdominal spiracles* are visible as distinct apertures in front of the posterior edge of the second and third ventral plates and are not protected by teeth.....*Rhax.*

b—*Legs* and *palpi* long and slender; the tarsus of the palp distinctly movable ; tarsi of second and third leg composed of two segments, that of the fourth of three segments. *Abdominal spiracles* situated behind the second and third ventral plates and protected by a series of spiniform teeth.....*Galeodes.*

The known Indian and Ceylonese species of these two genera are enumerated below. But considering the relatively small number of localities from which examples have been obtained, it is impossible to doubt that a large number yet remain to be discovered.

We know but little of the habits of the *Arachnida* of this group. But from the few accounts that have come to hand, they appear to frequent sandy, dry localities, to be nocturnal, and extremely voracious but not venomous. *Galeodes* is remarkably agile in its movements, and *Rhax* by comparison is somewhat slow. An interesting account of a female *Galeodes* that was kept in captivity is given by Captain Hutton in vol. xi of the Journ. As. Soc. Bengal (1842). This gentleman incidentally states that his specimen laid a batch of eggs ; but since other authors declare that the young are born alive, it is clear that fresh observations on the subject are much needed. We also know absolutely nothing about their method of pairing; and this subject is of the greatest importance, in view of the unexplained and striking differences that exist between the sexes of the same species. The males are slenderer than the females, and have much longer legs and palpi, from which we may infer that they have need of greater activity. Their mandibles are, however, considerably weaker, the dentition of the upper jaw is nearly obsolete, and they are furnished above with a curious organ known as the *flagellum*. The function of the flagellum is entirely unknown ; but from the small size of the mandible and from the feebleness of its teeth one would be inclined to suspect that the mandibles are used by the male for holding the female during copulation. We also have no positive knowledge of the function of those very characteristic organs, the *malleoli*, which are situated upon the

basal segments of the legs of the fourth pair. But from the fact that they are considerably larger in the males than in the females, and from their situation in front of the generative orifice, we may infer that they are sense organs, probably of a tactile nature. The male in *Galeodes* is also furnished with a cluster of curious spiniform hairs upon the fifth ventral plate of the abdomen, and nearly always has the lower surface of the tarsi of the legs of the fourth pair clothed with somewhat similarly modified hairs. But our ignorance of the function of these two sets of modified hairs is total. Perhaps it need hardly be added that any observations upon the habits, sexual relations, sense organs, &c., of these animals would form a subject for a paper of great interest and of real and permanent value.

In the accompanying paper the total measurements of the palpi and fourth legs do not include the basal segment, which is immovably united to its fellow of the opposite side. The individual segments of these limbs are taken along their upper sides; but the length of the mandible is measured along its outer surface from its joint to the apex of the upper jaw.

Genus *Galeodes*.

Key to the identification of the Indian species.

A. Flagellum of the male with its basal cylindrical portion much shorter than its distal expanded portion. Lower fang of the mandible with three or two minor teeth. Palpi and limbs, at least in the adult, not noticeably infuscate.....*fatalis* (Herbst.).

B. Flagellum of the male with its basal cylindrical portion nearly as long as its distal portion. Lower fang of the mandible with one or two minor teeth between the large teeth. Palpi and limbs in parts strongly infuscate.

A¹. Protarsus of the palp fuscous only in its proximal half .....*arabs* (C. Koch).

B¹. Protarsus of palp fuscous throughout its length.

A². Male larger; palp and legs longer; tibia of palp as long as twice the width of the head-plate; tarsus of palp black.....*agilis*, sp. n.

B². Male smaller; palp and legs shorter; tibia of palp not long as twice the width of the head-plate; tarsus of palp pale .....*orientalis* (Stol.).

(1) *Galeodes fatalis* (Licht. and Herbst).

(Pl. A. fig. 2-2*a* and Pl. B. fig. 1-1*a*.).

Solpuga fatalis, Licht. and Herbst; Nat. ungeflugelt. Insekten, Pt. 1, p. 32, Pl. I. 1, fig. 1, ♀ (1797).

Galeodes vorax, Hutton, Journ. As. Soc. Bengal, xi, Pt. 2, p. 857 (1842).

Galeodes bengalensis, Butler, Trans. Ent. Soc. 1873, p. 419.

Galeodes orientalis, Simon, Bull. Soc. Zool. Fr., x, p. 1 (not of Stoliczka).

Colour of head, mandibles, and appendages mostly pale yellow, the head generally lightly infuscate and the mandibles sometimes ornamented above with two faint greyish-black stripes; patella and tibia of the palpi and legs also sometimes lightly infuscate; ocular tubercle and mandibular fangs black, abdomen greyish-black above, deeper in the middle on the tergal plates.

Adult ♀. *Cephalic plate* (head) very wide, its width slightly exceeding the length of the tibia of the palpus; ocular tubercle polished, distance between the eyes greater than the diameter of an eye, the membranous prominence below the eyes smooth and rounded.

Mandibles very powerful; dentition like that of the rest of the genus, but with two small teeth between the two large fangs on the movable or lower jaw.

Palpi shortish, the tibia slightly shorter than the following two segments, protarsus and tarsus, taken together; the former armed with a few long spines at its distal end on the inner side; the tibia armed below with two series of longish slender spines, the protarsus with six pairs of short, sharp spines, the latter segment narrower towards its distal end.

Legs shortish, normally spined tarsi of the second and third armed with seven spines, 3 in pairs at the distal end, the other on the anterior aspect of the proximal end of the first segment, the distal tarsal segment of the fourth leg armed with a single posterior spine.

Measurements in millimetres.—Total length from anterior border of head to anus 46, length of head 8·8, width 13·5, length of mandible 17·2, of palp 41·5, its tibia 13·3, protarsus and tarsus 13·8, of fourth leg 54, its tibia 12, protarsus 9·5.

♂ Easily to be recognised from the ♀ by it smaller size, relatively narrower head, weaker mandibles, bearing a flagellum, extremely long legs, etc ; (*cf.* measurements).

Head a little wider than long ; *mandibles* clothed above with stout erect hairs for the protection of the flagellum ; *flagellum* with its basal cylindrical portion about half the length of the terminal expanded portion ; teeth in the distal half of the upper jaw rounded lobate, and ill-defined ; on the lower jaw there are three small teeth between the two large ones. The tarsi of the fourth legs have their first and second segments clothed below with thick hairs, these hairs gradually increase in thickness from their point of origin throughout about two-thirds of their length, then gradually narrow to the apex, which is rather blunt ; the third tarsal segment clothed below with normal hairs.

The fifth abdominal sternum furnished posteriorly with a row in parts double, of cylindrical slender, straight or bent, stout filiform hairs.

Measurements in millimetres.—Total length 31, length of head 6, width 7·2, width of ocular tubercle 1·6, length of mandible 11, of palp 51, its tibia 17, its protarsus and tarsus 15·5, length of fourth leg 61, its tibia 14·5, protarsus 12.

In the same bottle as that containing the two specimens described above from Gwalior there is a third example which appears to be an immature female. The head and mandibles are considerably smaller as compared with the length of the palpi and legs than in the adult, and the specimen thus approaches the male. Moreover what are stout short spines upon the protarsus of palpi of the adult are long setiform spines in the young, so that it seems clear that the shortness of these spines in the adult is due to fracture. Similar changes with age seem to occur in many species of the genus *Galeodes*.

The late Dr. Stoliczka long ago suggested that the species described by Captain Hutton as *Galeodes vorax* was identical with that which the German authors, Lichtenstein and Herbst had previously named *fatalis*. This conclusion is at all events perfectly justified by the fact that

Hutton in his very brief account of the physical characters of his species not only mentions no differential feature for *vorax*, but uses words which apply accurately to *fatalis*.

The type of Butler's *bengalensis* is preserved in the British Museum of Natural History. It is a female and is not distinguishable specifically from another example of the same sex, which agrees almost exactly with the figure of *G. fatalis* published by Herbst.

Distribution.—If we may trust the accuracy of the localities that are ascribed to specimens of this species, it certainly has a wide range in India. The British Museum has received examples from Gwalior (C. Maries), Secunderabad (A. Ricardo), Bengal (W. Masters), and Madras (Jerdon). According to Hutton the species occurs in Central and North India. Moreover, Stoliczka states that it is said to extend into the Punjab and Afghanistan, and the British Museum has received from Kohat in the Punjab a single immature female example, which I refer, although with some hesitation, to this species. This example was kindly presented by Lieut. A. Græme Batten.

I think there is no doubt that Monsieur Simon had examples of this species before him when he compared *orientalis* with *araneoides*. For he asserts that in his *orientalis* the basal part of the flagellum is much shorter than the lanceolate distal portion, and that the fourth tarsus has its proximal two segments covered with robust truncate hairs, both of which statements apply to the ♂ I have described above as *fatalis*. But for reasons given below in connection with the species I identify as *G. orientalis*, I believe that my *fatalis* is not identical with Stoliczka's *orientalis*.

Simon's examples came from Guntakal near Bellary, and his description applies to my example from Gwalior, except that he asserts that the appendages are infuscate. I do not feel justified, however, at present in regarding this as a character of much importance; for amongst five males which I have from Secunderabad—all of which were taken by the same collector, are undoubtedly co-specific and, I believe, are referable to *fatalis*—one, the largest, has entirely pale limbs, while the smaller examples have the protarsus of the palp and the tibia of the fourth leg infuscate. Curiously enough, however, these examples from Secunderabad and the two mentioned above from

Madras differ from the ♂ from Gwalior, in having the modified hairs upon the fourth tarsi pale in colour, more numerous, longer and sharper apically. But since it seems to me to be not improbable that these hairs become blunted with use and darker with age, I do not feel justified in regarding the character as one of specific or varietal importance.

(2) *Galeodes orientalis*, Stol.

Stoliczka, Journ. As. Soc. Bengal, xxxviii, p. 209, 1869, not *G. orientalis*, Simon, Bull. Soc. Zool. France, x, pp. 1-2 (1885), xl.

♂. Much darker in colour than *G. fatalis*, the head largely infuscate and the mandibles very generally infuscate above ; in the palpi the protarsus is deeply infuscate, as also is the tibia, but the distal end of this segment is paler, the femur also is lightly infuscate at its distal end; in the legs the distal end of the femur and the tibia are infuscate, the legs of the fourth pair more deeply so than the others, the upper side of the abdomen has a much more clearly defined median dorsal band. *Mandibles* stouter than in *fatalis*, and the stem of the flagellum is about as long as the expanded distal portion; the teeth on the upper blade of the jaw as in *fatalis*, but on the lower there are only two small teeth between the two large ones.

Palpi much shorter and stouter than in *fatalis ; e.g.*, the length of the tibia is considerably less than twice the width of the head, instead of exceeding it as in *fatalis* ; moreover, the length of this segment as compared with its thickness is about 7 to 1 ; whereas in *G. fatalis* it is about 11 to 1.

Legs correspondingly shorter, *e.g.*, the protarsus of the fourth only slightly exceeds the width of the head.

The *malleoli* on the coxæ long as in the ♂ of *fatalis*, but the distal portion differently shaped; for instance, in the outer *malleolus*, the blade is wider as compared with its length, has the edge slightly more convex, the internal process longer as compared with the external, and its border sinuate instead of straight.

The thickened spines on the fifth sternite of the abdomen vary greatly in form, being either long, slender, and cylindrical as in *fatalis*, or quite short, stout and clavate ; in fact, in each of the four specimens examined by me these hairs are differently constituted ; these organs

therefore cannot be used in distinguishing the species. The tarsi of the fourth legs have the distal segment either without spines or with a pair of spines and clothed with normal hairs, or furnished with a few modified hairs; the modified hairs on the other two segments are either closely or scantily packed together and are long and lanceolate; often, when unfractured, terminating in a setiform apex; they are much longer and thinner than the corresponding modified setæ in *fatalis*.

Measurement in millimetres of largest example.—Total length of trunk 30, width of head 8, length 6, length of mandible 11, of palp 42, of its tibia 13·5, width of latter 2, length of protarsus and tarsus 12, of fourth leg 49·5.

Locality, Gwalior (*British Museum*), Birbhum and Delhi (*Stoliczka*).

Of this species I have only seen four males, which were obtained at the above locality. They are all alike in most of their characters, although differing slightly in colour and in the features pointed out. I can find no reasonable grounds for doubting that these specimens are referable to the same species as those that Stoliczka figures as *orientalis*. He seems, however, to have wrongly sexed his large specimen as a ♀; it appears in reality to be a ♂.

My reasons for thinking that I have correctly determined the above described examples are, that the largest example figured by Stoliczka resembles those examined by me in possessing robust and short palpi.

(3) *Galeodes agilis*, sp. n. (Pl. A, Figs. 1, 1 c.).

This species is very nearly related to *G. orientalis*, but is much larger and has longer palpi and legs. *Colour*: head-plate is infuscate anteriorly, the ocular tubercle black; mandibles pale above; palpi with femur pale yellow, tibia deeply infuscate but paler at its two extremities; the protarsus and tarsus deeply infuscate, nearly black; the free thoracic segments and abdomen infuscate above; legs almost entirely pale yellow, the femur and tibia of the fourth pair lightly infuscate.

Ocular tubercle narrower than in *G. orientalis*; *mandibles* rather weaker, with the terminal fangs of the upper and lower jaws longer and straighter, the terminal part of the flagellum a little longer as compared with the distal portion. *Palpi* considerably longer than in *G. orientalis*; the *tibia* twice as long as the width of the cephalic

plate and nearly nine times as long as wide ; the *protarsus* longer than the width of the head by about one-third of its length. *Legs* also longer than in *G. orientalis*, the protarsus of the fourth greater than the width of the head.

The spiniform hairs on the fifth abdominal sternite are long, nearly as long as the plate that bears them, nearly straight, slender, subcylindrical, but very gradually incrassate for two-thirds of their distance, then becoming gradually narrowed to the apex. *Spiniform hairs* on the fourth tarsi like those of *G. orientalis*, pointed apically.

The *malleoli* very long, the head of the fifth much longer than half the width of the carapace, slender, with a long internal process.

Measurement in millimetres.—Total length of trunk 44 ; width of head 11, length 9, width of ocular tubercle 2, length of mandible 15, of palp 65, its tibia 22, width of tibia 2·5, length of protarsus and tarsus 18·5, length of fourth leg 76, its tibia 17, protarsus 13·5.

Locality, Bikanir in Rajputana (*Mrs. Talbot*).

In its large size, long legs and palpi, this species approaches *G. arabs*. In the latter, however, the distal half of the protarsus and the whole of the tarsus of the palp are pale, the ocular tubercle is larger, the spiniform hairs on the fourth tarsi have blunt apices, the inner process of the malleoli is shorter, and the spines on the legs are stouter.

(4) *Galeodes arabs*, C. Koch.

G. arabs, C. Koch, Die Arachn., xv, p. 85 (1848).

G. lucasii, L. Dufour, Mem. Ac. Sci. St. Petersburg, xvii, p. 385, Pl. II, Fig. 5 (1862).

G. araneoides, Olivier and Savigny (not of Pallas) *arabs*, *araneoides* and *Græcus* (?), Butler, Tr. Ent. Soc., 1873, p. 418.

G. araneoides and *græcus*, Simon, Ann. Soc. Ent. Fr., 1879, pp. 99-100 (at least in part).

This species has an extensive range, spreading from South Algeria (Dufour's *lucasii*) through Egypt into Arabia and Asia Minor. The British Museum has a large number of examples ranging from Smyrna to Afghanistan and from Egypt and Somaliland to Muscat, and lastly there is a bottle ticketed Nepal, Hardwicke coll., which contains half a dozen examples.

It is solely upon the evidence supplied by this label that I include *G. arabs* in the Indian fauna. At the same time I may add that I do not at present believe in the accuracy of the locality. Since, however, it may be found that the species does actually extend over the borderland of the Punjab, I subjoin the following brief notes of its chief characters.

The colour is whitish- or reddish-yellow, variegated with fuscous. The cephalic plate is fuscous on each side, and the mandibles are usually furnished above with two stripes of the same colour. The *tibia* of the palpus is fuscous, except its two ends which are flavous, and the *protarsus* is furnished with a wide fuscous band in the proximal half of its length, the proximal extremity and distal half, as well as the tarsus being pale yellow; the femora of the legs are very generally infuscate, and the dorsal plates of the abdomen and the free thoracic segments are also generaly infuscate, so that there is a median series of fuscous patches—not a continuous fuscous band—along the middle line of the back.

The ocular tubercle is large. In the adult ♀ the cephalic plate either excels in width or is about equal to the protarsus of the palp or of the fourth leg; in the adult ♂ the cephalic plate is less in width than half the length of the tibia of the palpi. In the mandibles the lower jaw is furnished with either one or two minor teeth between the two major teeth, the posterior of the minor teeth being always small, and in mature females absent.

In adult males the terminal part of the flagellum is about as long as the basal portion, the modified hairs on the posterior tarsi are narrower at the base and at the apex than in the middle; but the apex may be rather sharp or somewhat bluntly rounded, the acuteness apparently depending upon the amount of wear to which the organs are subjected; the modified hairs of the abdomen vary greatly in shape and length in the same individual. The distal tarsal segment of the fourth leg is generally without spines. The *malleoli* are usually long, especially in the male.

Genus *Rhax*.

Key to the identification of the Indian species.

A. Legs yellow, not adorned with black bands or spots; tarsi of palp and of first pair of legs ferruginous; without a complete median dorsal white band on the abdomen.

A[1]. The anal segment and the anterior abdominal tergal plates deep black, the sixth to the ninth terga pale yellow (head and mandibles as in *brevipes*)... *semiflava*, Poc.

B[1]. Upperside of abdomen not strikingly particoloured, either black or entirely pale ochre-yellow.

A[2]. Head and abdomen entirely black or deep brown.

A[3]. Mandibles the same colour as the head, *i.e.*, blackish-brown ... *brevipes*, Gerv.

B[3]. Mandibles pale yellowish-red and contrasting strongly in colour with the black head ... ... *nigriceps*, sp. n.

B[2]. Thorax and abdomen entirely pale, much paler than the head and mandibles, which are deep brown ... ... *phipsoni*, sp. n.

B. Legs yellow, but adorned with conspicuous black bands and spots; upper surface of the abdomen black at the sides, white in the middle.

A[4]. Antero-lateral angles of the head yellow; femur and trochanter of palp black; a black spot on the lower surface of the femur and tibia of the first leg and on the posterior surface of the tibia of the fourth leg... *nigrocincta*, Bern.

B[4]. Antero-lateral angles of head not yellow, lower surface of femur of palp, the legs of the first pair and the tibia of the fourth pair, not ornamented with black (*teste*, Simon) ... *annulata*, Sim.

(5) *Rhax phipsoni*, sp. n. (Pl. A, Fig. 3, & Pl. B, Fig. 4.)

♂ *Colour*; mandibles, cephalic plate, distal end of protarsus, and tarsus of palp and tarsus of first leg, ferruginous, the rest of the body and limbs entirely yellow, although clothed with red hairs, the antero-lateral edge of the cephalic plate is narrowly yellow, and the membrane in front of it is, as usual, white.

Head clothed with very long hairs, ocular tubercle of medium size, furnished with the two normal setæ in front, but along the middle line there is a series of four hairs.

Mandible clothed above and externally with long setæ, the upper-inner edge furnished with spines scattered amongst the hairs, those at the base of the immovable digit apically setiform, normally spined on the inner surface, teeth of the upper digit subequal in size, the lower digit furnished with a minute tooth in front of the principal fang, and one upon it on the inner side.

Appendages.—Protarsus of palp armed below with about 16 spines, that of the first leg with about 6 longish spines, tibia of the same appendage furnished below with a number of stout setæ; tibia of second and third leg armed above distally with one short stout spine, the protarsi armed above with 6 spines, the tibia of the second armed in addition with one short spine behind and several stout setæ below; that of the third with about 3 spines behind and stout setæ below, protarsus of second and third armed below with stout setæ and a pair of long distal spines; tarsus of second not spined (that of third absent); tarsus of fourth leg armed with 3 pairs of spines below, and the protarsus with 4 spines in front in its distal half and 2 behind. Malleoli longish, stalks stout.

♀ resembling the ♂, but larger, with relatively shorter legs, the entire protarsus of the palp and first leg ferruginous, the ocular tubercle flatter. The mandibles with the third tooth of the upper series much the largest, protarsus of second leg with 6 upper spines on one side of the body, 9 (in two rows) on the other side; that of the third with seven on one side and about 12 (in two rows) on the other. Malleoli with shorter handles and smaller heads.

Measurements in millimetres—♂. Total length of trunk (from ocular tubercle to anus) 32, length of cephalic plate 5·5, width 8·5, length of abdomen 21, of mandible 12·8, length of palp 21, of fourth leg 32.

♀. Total length 64, length of head 8, width 14·5, length of abdomen (much distended) 52, of mandible 18, of palp 25·5, of fourth leg 36.

Locality, Trincomali (Ceylon).

This is, I believe, the first record of a species of this group of *Arachnida* from Ceylon. The two above described examples were kindly sent to the British Museum by Mr. H. M. Phipson, to whom I have great pleasure in dedicating the species.

The species of the genus *Rhax* do not appear to differ greatly from each other in any characters except colour, and possibly size and length of limbs, so that the description given above of the dentition of the jaws, spine-armature of the legs, &c., may be taken as applying tolerably accurately to all the species enumerated in this paper.

(6) *Rhax brevipes* (Gervais), (Pl. A, Fig. 4, & Pl. B, Fig. 3).

Solpuga brevipes, Gervais, Insectes Apteres, 3, p. 87 (1844).

The type of this species, bearing the ticket Nepal, Hardwicke-Bequest, and labelled by Gervais, is in the British Museum of Natural History. The head plate is deep black with a yellowish-green patch at its antero-lateral angles; the abdomen is quite black; the free thoracic segments lying behind the head are paler but lightly infuscate; the mandibles are deep reddish-brown, the legs and palpi yellow; on the palp, however, the tarsus and protarsus, except just its proximal end, are deep brown, and on the legs of the first pair the tarsus and distal end of the protarsus are also deep brown.

This species is very nearly related to the Algerian species *Rhax ochropus* of L. Dufour. But, according to Simon, the latter has no small tooth in front of the great fang on the movable digit of the mandible, while in *R. brevipes* this tooth is very noticeable. Moreover, the published figures of *R. ochropus* show that the entire protarsus and tarsus of the legs of the first pair are reddish-brown. *R. ochropus* is, however, unfortunately unknown to me, so that I am unable further to compare the two species.

R. brevipes also seems to be very nearly allied to, if it be not identical with, the Persian species *R. phalangium*, Oliv. The latter, however, has been too briefly characterised to be identifiable.

In addition to the example mentioned above as ticketed Nepal, the British Museum has a second example of apparently the same species from Maballah, and a third which is vaguely ticketed East Indies.

(7) *Rhax semiflava*, Pocock (Pl. B, Fig. 2).

Ann. Mag. Nat. Hist. (6), iv, p. 473 (1889).

The single known example of this species is, like the type of *R. brevipes*, a female with the abdomen not distended.

The two species are very nearly related, but *R. semiflava* may be distinguished at a glance by the difference in the colouring of its abdomen. This part of the body instead of being black as in *R. brevipes*, is yellowish below and at the sides, but on the dorsal surface the anterior 5 tergal plates are blackish, the 5th, however, being yellow

posteriorly, while the succeeding 4 are entirely yellow, and the last or anal is entirely black. Moreover, the free thoracic segments lying behind the head are white and not infuscate as in *R. brevipes*.

The type of this species was obtained at Kohat in the Punjab by Lieut. A. Græme Batten, and presented by him to the British Museum in 1888.

(8) *Rhax nigriceps*, sp. n.

Colour, head, thorax and abdomen entirely black, mandibles reddish-yellow above and externally becoming redder towards the base of the fangs, palpi and legs pale, the tarsus of the first pair and the tarsus and distal half of the protarsus of the palp deep ferruginous. Total length of trunk 20 mm, length of head 3·7, width 6·3, length of mandible 9, of palp 12·5, of fourth leg 16.

Locality, East Indies. A single female example.

The above-given table shows that this species is allied to *R. brevipes* of Gervais, but that it may be distinguished from *R. brevipes* as from all the Indian species of the genus by the pale colour of its mandibles coupled with the black of the head plate. In this character as well as in other respects connected with colouring, it closely resembles the East African species *R. termes* of Karsch, of which I have seen a single female example from Kilima Njaro. I separate it from *R. termes*, because in the latter the third (the largest) tooth of the upper fang of the mandible projects far below the level of the fourth tooth, whereas in *R. nigriceps* the apices of the two teeth are not so noticeably unequal. No doubt other differential characters will come to light when long series of properly preserved examples have been examined.

(9) *Rhax nigrocincta*, Bernard.

Journ. Linn. Soc. Zool., xxiv, p. 361, Fig. 2 (1893).

This is a strikingly-coloured little species. The head is deep brown, but bears a conspicuous lemon-yellow patch upon its antero-lateral angles; the mandibles are brown; the abdomen is purplish-brown at the sides and below, with the anal segment black; but its upper side is ornamented with a wide continuous median yellow band; the legs and palpi are for the most part yellow, but they are ornamented with black in the following manner. The trochanter and inferior edge of femur are fuscous. There is a broad black ring round the tibia, and the distal half of the protarsus and the tarsus are also black; on the first leg the tarsus is brown, and there is a fuscous spot upon the lower edge of both tibia and femur; on the second leg there is a complete

black ring round the femur ; on the third leg there is a corresponding ring on the femur, and an additional one on the tibia ; on the fourth leg the ring on the femur is incomplete in the middle line above, while the ring on the tibia is reduced to a black spot on its posterior surface.

The type and only known example of this species is a female from Vellore. It is in the collection of the British Museum.

This species is very nearly related to *R. annulata* (*cf. infra*), with which Mr. Bernard compared it. One of the differential characters, however, pointed out by Mr. Bernard does not in reality exist. For he states that *R. nigrocincta* has black rings on the tibia of the legs and not on the femora, as stated by Simon for *R. annulata*. This is an error, the bands being in both species found on the femora.

(10) *Rhax annulata*, Simon.

Bull. Soc. Zool. France, x, p. 2 (1885).

From Wagra-Koroor near Guntakul, which is not far from Bellary. Very closely allied to *R. nigrocincta*, but I provisionally regard it as distinct on the ground that Simon does not mention the presence in *R. annulata* of any lateral yellow patches on the head, nor of the blackness on the lower surface of the femur of the palp, nor on the lower side of the femur and tibia of the first legs, nor on the posterior surface of the tibia of the fourth leg.

EXPLANATION OF PLATES.

Pl. A, Fig. 1. *Galeodes agilis*, Sp. n. ♂, nat. size.
1*a* " " External aspect of mandible.
1*b* " " First abdominal sternum.
1*c* " " External malleolus.
2 " *fatalis* (Licht. and Herbst), ♂, external view of mandible.
2*a* " " " " " of ♀.
3 *Rhax phipsoni*, Sp. n., external view of mandible of ♂.
4 " *brevipes*, (Gervais), " " of ♀.

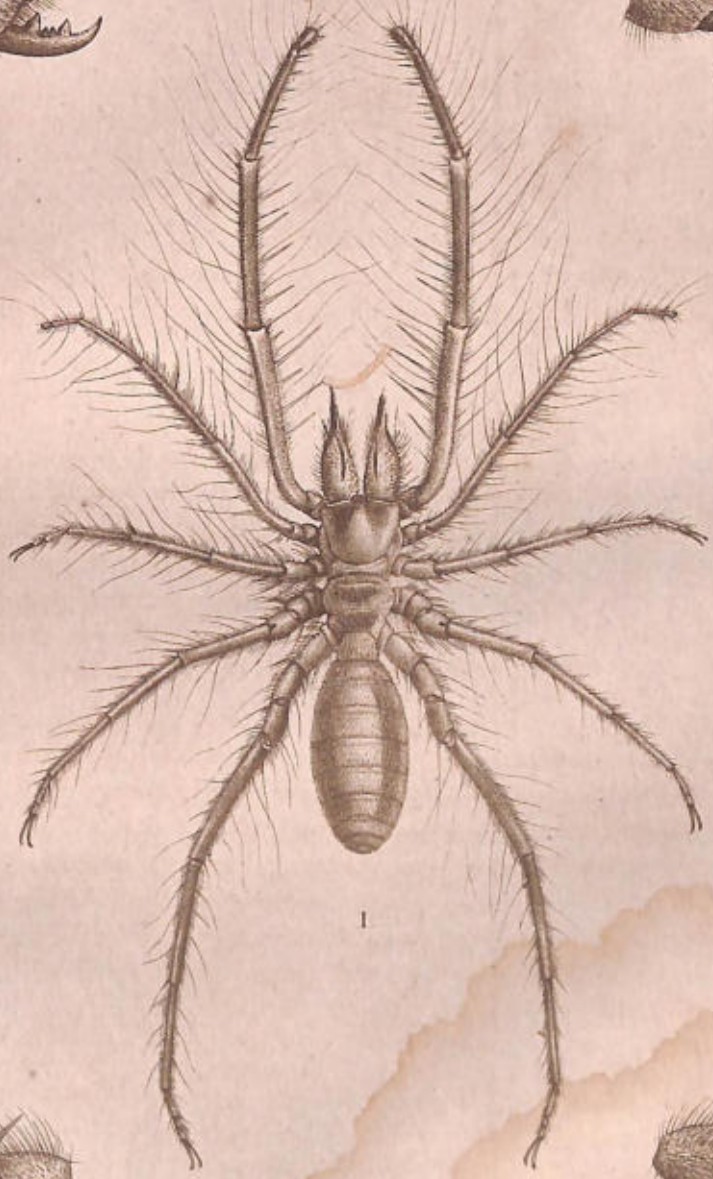
Pl. B, Fig. 1. *Galeodes fatalis*, (Licht. and Herbst) nat. size ♀.
1*a* " " " ♂.
2 *Rhax semiflava*, Pocock, nat. size ♀.
3 " *brevipes*, Gervais, " ♀.
4 " *phipsoni*, Sp. n., " ♂.



2a.



4.



1.



2.



3.



1c.



1a.



1b.

Mintern Bros. del. et lith. London.

INDIAN GALEODIDÆ.



Mintern Bros. delet. Chromo lith. London

INDIAN GALEODIDÆ.

LES FORMICIDES DE L'EMPIRE DES INDES ET DE CEYLAN.

Par Auguste Forel.
Professeur a l'Université de Zürich.

Part V.

(*Read before the Bombay Natural History Society on 2nd April*, 1895.)

Adjonction aux Camponotinæ.

27. *Camponotus Wasmannii* (Emery).

☿ *Major* :—L. : 10 à 12 mill. Mandibules armées de 7 dents, lisses, luisantes, ponctuées. Tête trapeziforme, courte et très large, beaucoup plus large que longue. Stature robuste, comme chez le *C. sericeus*. Epistome caréné ou subcaréné, avec un lobe rectangulaire. Arêtes frontales extrêmement divergentes. Angles antérieurs du pronotum avec deux dents triangulaires obtuses. Suture méso-métanotale très profonde et très large, formant presque une échancrure. Face déclive du métanotum tronquée, lisse, luisante. Pédicule surmonté d'un noeud arrondi, deux fois plus haut et plus large qu' épais. Densément réticulé-ponctué et mat (sauf les parties luisantes indiquées). Une grossière ponctuation superposée en fossettes, dense sur le métanotum (sauf la face déclive) et sur le pédicule, éparse sur la tête et le thorax, tout-à-fait effacée sur l'abdomen. Une abondante pilosité blanchâtre, longue et brillante, sur tout le corps, les pattes et les antennes. Pubescence très diluée. Entièrement noir, avec quelques articulations et extrémités brunâtres ou rougeâtres.

☿ *Minor* :—L. : 5·4 à 9 mill. Tête beaucoup plus large derrière que devant. Pronotum armé devant de deux fortes dents pointues, triangulaires. Noeud du pédicule presque aussi épais que large. Du reste identique à la ☿ major.

♀ :—L. : 13 à 14 mill. Ailes enfumées de brunâtre. Pronotum obtusément anguleux.

Sikkim (Wasmann) ; Assam (Smythies).

Var. *mutillarius* (Emery). Thorax et pédicule d'un rouge ferrugineux. Souvent une tache noirâtre sur le pronotum. Le 1er segment de l'abdomen est noir avec deux taches d'un rouge ferrugineux ou d'un rouge ferrugineux avec une tache dorsale, postérieure, d'un brun foncé.

Carin Cheba, Birmanie (Fea) ; Dehra Dun (Smythies).

Cette singulière espèce forme un groupe à part et se place, dans notre tableau, en tête du genre, comme suit.

O. Pronotum bidenté devant.....C. WASMANNII (Emery).
Pronotum inerme.....1.

12. *Camponotus angusticollis*, Jerdon.

Var. *sanguinolentus*, n. var. ☿ *major-media* (tête à peine plus large derrière que devant). L. 15 mill. D'un rouge sanguinolent, ferrugineux et terne. Abdomen, pattes (sauf les tarses et les articulations) et scapes d'un brun noirâtre. Pédicule, devant de la tête et mandibules plus ou moins brunâtres. Pubescence d'un brun jaunâtre, assez abondante sur tout le corps et plus longue que chez la forme typique. Pilosité brune un peu plus abondante et un peu plus longue aussi que chez l'*angusticollis*, i. sp. Du reste identique.

Assam (Smythies).

1. *Camponotus sericeus* (Fab.)

Var. *mendax*, n. var. ☿ *major*. Thorax sans échancrure méso-métanotale, avec une simple suture, sans trace de segment intermédiaire. La face basale du métanotum a la même largeur que chez la forme typique, mais elle n'est bordée nulle part, et passe par une courbe arrondie, tant aux côtés qu'à la face déclive. Cette dernière est en plan incliné. Le métanotum est très semblable à celui du *C. Gestroi*, Em., mais un peu plus étroit et plus long. A part cela absolument identique au *C. sericeus*, variété à tête d'un brun un peu rougeâtre.

Deux ☿ maxima de Mysore (Lee).

Est-ce vraiment une variété du *sericeus* ? Est-ce une autre espèce imitatrice ? Est-ce peut-être une anomalie embryogénique de la ☿ major ? Une ♀ qui se trouvait dans le même envoi ne diffère en rien des ♀ ordinaires. D'un autre côté, aucune particularité du thorax ne dénote chez les deux ☿ un passage à la forme ♀.

Var. *integer*, n. var. ☿ *minor*. Thorax sans trace d'échancrure, également convexe d'avant en arrière. La face basale du métanotum à rebord latéral aigu, dirigé latéralement ; derrière, elle se termine par deux dents ou lamelles obtuses, horizontales, avec une forte échancrure médiane. Face déclive fort concave. Variée de ferrugineux et de brunâtre ; devant de l'abdomen ferrugineux.

Ceylan.

Cette forme rappelle la var. *rectus* du *C. lateralis*, Ol., mais le thorax, malgré le manque complet d'échancrure, est fortement convexe. Sous le nom de Race *peguensis*, M. Emery, a décrit la variété *sericeo-opaciventris*.

20. *Camponotus nicobarensis* (Mayr).

Var. *monticola*, Emery. Birmanie. Emery a donné ce nom à la variété foncée, de couleur brunâtre, terne et mêlée.

28. *Camponotus herculeanus*, L.

Race *pennsylvanicus*, De Geer, v. *punctatissimus* (Emery). Carincheba, Birmanie (Fea).

Cette forme doit être intercalée dans notre tableau au numéro 7, à côté du *C. reticulatus*, par les mots.

L. : 7 à 14 mill. Epistome biéchancré, voisin de la race. *Japonicus* Mayr.

29. *Camponotus Simoni* (Emery).

N'est probablement qu'une race très petite du *dorycus*. ☿ major : L. 8·5 mill ; ☿ *minor* 7·6 mill. Pilosité oblique sur les scapes et les tibias. Testacée ; abdomen et derrière de la tête plus foncés. Les mandibules ont 6 dents. Tibias dépourvus de petits piquants.

30. *Camponotus albipes* (Emery).

N'est guère qu'une variété du *reticulatus*, r. *Yerburyi*, avec les mandibules, les antennes, les pattes et une large tache transversale sur le 1er segment de l'abdomen d'un jaune pâle. Peut-être race à part.

Le *C. Bedoti*, Emery, n'est, à mon avis, pas autre chose non plus qu'une race du *reticulatus*. La var. *Motschulsky*, Emery, à en juger par la description, est identique à ma race *Yerburyi*.

2. *Colobopsis* (*Camponotus*) *vitrea* (Smith).

Le *Camponotus vitreus*, Sm. (☿ *minor*) est identique à ma *Colobopsis angustata*, v. *Siggii*. L'énorme différence entre la ☿ *minor* et le ♀ excuse en partie cette erreur de ma part. La description de la *Formica vitrea* (Smith) étant la plus ancienne, l'espèce devra prendre ce nom ; *angustata*, Mayr, devient la variété.

12. *Polyrhachis punctillata* (Roger).

Var. *Smythiesii*, n. var. ☿. Dehra Dun (Smythies). ☿ Correspondent bien à la description de Roger que nous avons traduite, sauf les yeux qui ne sont pas sphériques, mais seulement proéminents. Deux fortes dents triangulaires au pronotum.

Mais la nouvelle variété se distingue surtout par les dents plus fortes, presque spiniformes de l'écaille ; surtout les deux dents supérieures ou médianes sont très pointues at aussi fortes que les latérales.

26. *Polyrhachis Hippomanes* (Sm.)

Race *lucidula* Em. ☿ :—L. : 5 mill. Intermédiare entre la form typique et la race *Ceylonensis*. Plus luisante. Ponctuation réticulaire plus faible. Epines du métanotum à peine plus longues que leur distance réciproque. Birmanie (Fea).

60. *Polyrhachis fortis* (Emery).

☿ :—L. : 5·7 mill. A côté d'*armata*, mais plus trapue ; épines pronotales beaucoup plus courtes. Noire, abdomen ferrugineux. Sculpture finement réticulée ponctuée avec de grosses fossettes superposées assez indistinctes, formant des rides réticulaires. Suture méso-méta notale très indistincte. Dans le tableau, à côté de l'*armata*. Birmanie (Fea).

61. *Polyrhachis subpilosa* (Emery).

Très voisine de *punctillata*, mais avec une pilosité blanchâtre éparse qui manque à cette espèce. Le pronotum n'a que deux angles rectangulaires. Ecaille comme chez le *punctillata* i. sp. L. 6 mill. Palon, Birmanie (Fea).

5. *Polyrhachis sélene* (Emery).

Race *obtusata*, Emery. Abdomen réticulé-ponctué, presque mat. Ecaille avec un cône très obtus, à peine indiqué. Du reste comme le type. Carin, Birmanie (Fea).

39. *Polyrhachis simplex* (Mayr).

Var. *grisescens*, Emery. Abdomen grisâtre par suite d'une pubescence plus abondante. Palon, Birmanie (Fea).

44. *Polyrhachis tibialis* (Sm.).

M. Emery a décrit sous le nom de *caligata* la forme extrêmement voisine d' *argentea*, Mayr. que j'ai considérée comme étant la *tibialis*, Smith. Je suis pour ma part toujours persuadé que *caligata*, Emery = *tibialis*, Smith.

57. *Polyrhachis acasta* (Sm.).

D'après Emery et Dalla Torre, l' *argentea*, Mayr = *acasta*, Smith. C'est fort possible. L' *acasta* est de Batjan. Il faudrait savoir exactement si à Batjan on trouve l' *argentea* ou la *tibialis*.

58. *Polyrhachis Wroughtonii* (Forel).

♀ :—L : 4·3 à 4·7 mill. Mésonotum déprimé. Le pronotum n'a que deux petites dents triangulaires. Les épines du métanotum sont bien plus courtes que chez l'ouvrière et dirigées bien plus horizontalement, en dehors. Ailes brunes ; une tache pâle devant la tache marginale. Du reste comme l'ouvrière.

♂ :—L: 5 mill. Pas trace de dents ni d'épines. Métanotum arrondi; face déclive beaucoup plus longue que la face basale. Pédicule surmonté d'un noeud arrondi, plus large que long. Finement réticulé-ponctué et mat ou subopaque. Abdomen finement réticulé et subluisant.

Pilosité nulle ou à peu près. Une fine pubescence grisâtre assez abondante partout, sans toutefois former de duvet distinct. D'un noir brunâtre ; bouche, extrémité des antennes, valvules génitales, articulations, parfois les tibias, les tarses et les anneaux fémoraux d'un jaune roussâtre.

Kanara (M. Wroughton), avec les ☿. Cette charmante espèce parente de *cryptoceroides*, Emery, fait son nid en papier brunâtre, dans les feuilles.

15. *Polyrhachis striata* (Mayr.)

☿ :—Assam (Smythies).

2. *Formica rufa*. (L) ; race. *truncicola*, (Nyl.)

☿ :—Cashmeere (J. F. Duthie).

3. *Formica fusca*, (L) ; race. *rufibarbis*, (*F.*)

☿ :—Cashmeere (Mrs. de Lotbinière).

7. *Prenolepis melanogaster* (Emery).

☿:—L. : 4·3 à 4·5 mill. D'un jaune testacé, très luisante, abdomen brun. Pubescence nulle. Pilosité dressée longue et fine. Thorax allongé. Mésothorax étroit, rétréci en selle. Ecaille épaisse. Pattes grêles.

Carin, Ascinii Ghecu, Birmanie, 1,300 mètres (Fea).

8. *Prenolepis Jerdoni* (Emery).

☿:—L: 3 mill. Grêle ; semblable à la précédente, par son mésothorax étranglé. Diffère de la *Pr. Emmæ*, Forel, par son métanotum beaucoup moins élevé, moins bossu, par son écaille plus épaisse, ses yeux plus aplatis et la convexité plus courte, plus postérieure, moins égale du pronotum. Elle est aussi beaucoup moins poilue. D'un brun foncé. Funicules, base des scapes et articulations plus pâles.

Perak, Malacca (Emery).

Cette espèce forme avec la précédente et la *Pr. Emmæ* un groupe à mésothorax rétréci, rappelant les *Acantholepis*.

Ma *Prenolepis Adlerzi* n'est autre chose que le *Camponotus* (*Colobopsis*) *vitreus*, Smith, qui m'a été donné par M. Emery. Cette espèce ressemble beaucoup à une *Prenolepis* et je l'ai décrite en 1886, connaissant encore très mal la faune indo-malaise, sur deux seuls exemplaires secs, ce qui explique en partie ma méprise.

1. *Acantholepis Frauenfeldi* (Mayr), var. *integra* (*For.*)

Cashmeere (Mrs. de Lotbinière).

2. *Acantholepis capensis* (Mayr).

Race *lunaris* Em. M. Emery a décrit sous le nom d'*A. lunaris*, n. sp. la variété de l'Inde que j'ai signalée (Part IV, p. 19) dans ce travail, et dont, le métanotum ressemble à celui de l'*A. opaca*. Je ne puis la considérer que comme une race ou variété, car cette forme du métanotum est très inconstante.

5. *Acantholepis opaca* (Forel).

Cette espèce a été retrouvée à plusieurs reprises dans la province de Kanara, par MM. Wroughton et Bell; elle semble propre à cette partie de l'Inde. Par contre la race *pulchella* de Poona n'a pas été retrouvée jusqu'ici. Ce fait est à noter, parce que j'ai reçu une quantité très considérable de fourmis de toutes les parties de l'Inde par l'obligeance de MM. Wroughton et Rothney.

6. *Acantholepis Fergusoni*, n. sp.

☿ :—L. : 2·7 à 3·3 mill. Mandibules à bord terminal très oblique, armé de 4 à 5 dents très obliques ; elles sont luisantes avec quelques stries et points effacés. Tête en carré un peu arrondi, à peine élargie derrière, un peu déprimée. Epistome avec une forte voûte ou carène obtuse, longitudinale, médiane. Yeux grands, déprimés, situés un peu en arrière du milieu des côtés de la tête. Les scapes, peu épaissis vers leur extremité, dépassent d' $\frac{1}{3}$ de leur longueur le bord occipital. Trois ocelles très petits, mais distincts, surtout les deux latéraux.

Pronotum large, déprimé en dessus, presque subbordé, plus encore que chez l' *A. opaca*. Mésonotum et métanotum comme chez l' *A. opaca* (mésonotum faiblement et brièvement rétréci), mais l'échancrure méso-métanotale est encore beaucoup plus forte : le métanotum s'élève d'abord perpendiculairement derrière l'échancrure et forme ensuite deux lobes élégamment courbés en ailes d'oiseau qui vole. Ces lobes sont beaucoup plus longs que chez l'*opaca*, terminés en pointe, et semblables à deux ailes ou à deux cornes. Les stigmates inférieurs du métathorax proéminents comme chez l' *A. opaca*. Entre leur extrémité et celle des ailes du métanotum se trouve de chaque côté une profonde échancrure qui forme plutôt plus d'un demi cercle (beaucoup moins chez l'*opaca*, où les ailes sont courtes et obtuses, et chez la race *lunaris* de la *capensis* qui a un métanotum analogue).

Ecaille élevée, sans dents, ni épines, médiocrement échancrée au sommet. Pédicule longuement prolongé en arrière en cylindre, comme chez l'*opaca*. Abdomen assez grand ; premier segment avancé en dessus, devant.

Epistome, aire frontale, thorax, pattes et pédicule assez luisants irrégulièrement réticulés. Le reste de la tête est mat, avec un reflet soyeux, et a une sculpture très fine et très dense, irrégulièrement réticulée-ponctuée avec tendance à rugosités longitudinales sur le front. Abdomen très luisant, très faiblement réticulé. Face déclive du métanotum luisante, avec de faibles rides transversales.

Une pilosité jaunâtre, fine pointue, assez longue, abondamment répandue sur tout le corps et sur les cuisses. Sur les tibias et les scapes elle est bien plus courte, oblique, mais abondante. Pubescence presque nulle.

D'un roux jaunâtre. Abdomen, sauf les $\frac{2}{3}$ anterieurs du premier segment, d'un brun noirâtre. Dessus de la tête brunâtre. Pattes et antennes d'un brun jaunâtre. Tarses jaunâtres.

Travancore, Inde (M. Ferguson).

Cette belle espèce se rapproche surtout de l'*opaca*, mais elle est beaucoup plus grande et plus luisante. L'*opaca* a de longues épines a l'écaille et une pilosité rare et obtuse. La pilosité rapproche l'*A. Fergusoni* de la *modesta*, dont elle est du reste entièrement différente.

2me Sous-Famille DOLICHODERINÆ.

Tableau des Genres (chez l'ouvrière).

Un aiguillon distinct. Pédicule très allongé, avec un noeud derrière, métanotum bispineux.....Gen. ANEURETUS (Emery).

Aiguillon rudimentaire. Pédicule court, de forme ordinaire.....1

1. Peau chitineuse raide, cassante, à sculpture souvent grossière. Métanotum de forme particulière, plus ou moins cubique ou anguleux. Gésier sans calice et sans partie moyenne. Abdomen arrondi, non prolongé en avant.....Gen. DOLICHODERUS (Lund.).

   Peau chitineuse molle, délicate, à sculpture fine. Métanotum presque toujours arrondi. Gésier avec un calice plus ou moins rudimentaire dont les sépales sont chitineuses et retroussées en parasol des leur base 2

2. Orifice du cloaque apical. Dos de l'abdomen prolongé en avant et cachant le pédicule ; écaille rudimentaire.

   Gen. TECHNOMYRMEX (Mayr).

   Orifice du cloaque infère ; cinquième segment de l'abdomen entièrement caché sous le quatrième, comme chez tous les genres de la sous famille, sauf *Technomyrmex*. Des glandes anales en général odorifiques 3

3. Dos de l'abdomen non prolongé en avant. Ecaille non inclinée ou à peine inclinée. Gésier avec un grand calice retroussé, dont les sépales recouvrent la boule en tout ou en partie.

   Gen. IRIDOMYRMEX (Mayr).

   Dos de l'abdomen prolongé en avant et recouvrant le pédicule, comme chez les *Technomyrmex* 4

4. Ecaille inclinée, basse, mais élevée au dessus du pédicule. Palpes maxillaires de 2 à 4, labiaux de 3, parfois de 2 articles. Les glandes anales ont un conduit excréteur central. Gésier avec un calice retroussé de grandeur moyenne, à sépales distinctes, recourbées...Gen. BOTHRIOMYRMEX (Emery).

Ecaille rudimentaire, entièrement soudée au pédicule. Palpes maxillaires de 6, labiaux de 4 articles. Chaque cellule des glandes anales s'ouvre directement dans la vessie anale par son propre conduit. Callice du gésier en général très rudimentaire, presque nul, mais fortement chitinisé à l'origine des valvules qui le constituent presque entièrement.....

Gen. T. APINOMA (Först.).

1er Genre Aneuretus (Emery).

Emery (Anal. Soc. Ent. France, 22 Février, 1893), en fondant ce nouveau genre sur une espèce de Ceylan, récoltée par M. E. Simon, a cru devoir le placer dans les *Ponerinæ*, à cause de l'aiguillon. Je considère cette opinion comme érronée. Le genre *Aneuretus* est certainement extrêmement curieux mais il se rattache sans aucun doute aux *Dolichoderinæ* ou il me parait occuper une place voisine de *Dolichoderus*. Emery a attaché trop d'importance à la grosseur de l'aiguillon qui est le seul caractère séparant ce genre des autres *Dolichoderinæ*. Je dis la grosseur, car tous les *Dolichoderinæ* ont un aiguillon, tres petit, rudimentaire si l'on veut, cela est vrai, mais nullement transformé en appareil de soutien, servant à faire jaillir le venin comme chez les *Camponotinæ*. Il s'agit donc d'une simple différence de calibre, de développement d'un organe, différence exceptionelle, il est vrai, dans cette sous-famille, mais fréquente dans d'autres.

Tous les autres caractères de l'*Aneuretus Simoni* le rattachent aux *Dolichoderinæ*, et je ne puis comprendre l'analogie qu' Emery trouve entre sa tête et celle des *Typhlomyrmex*. Les antennes, la chitine, l'epistome, tout est semblable jusque dans les plus petits détails aux genres *Iridomyrmex*, *Dolichoderus* et *Tapinoma*. Le thorax resemble à celui de beaucoup de *Dolichoderus* qui est souvent bispineux. Le pédicule allongé retrouve, d'une autre façon il est vrai, chez certaines *Acantholepis*, chez les *Oecophylla*, certains *Dolichoderus*, &c. ; il ressemble, il est vrai, surtout à celui du premier noeud de beaucoup de *Myrmicinæ*, mais ceci est un fait de convergence et

d'adaptation, non pas de phylogénèse. Je soupçonne qu'il s'agit d'une adaptation à l'usage de l'aiguillon. Enfin l'abdomen n'a pas trace de constriction ; il a tout à fait l'aspect de celui d'un *Dolichoderinæ* à part l'aiguillon qu'on voit sortir du cloaque. Le gésier est encore inconnu, mais ne servira guère à éclaircir cette question puisqu'il est à peu près identique chez les *Ponerinæ* et le genre *Dolichoderus*.

Quoi qu'il en soit, ce genre constitue un certain lien entre les *Dolichoderinæ* et les *Poneriuæ* et semble montrer comment les premiers sont sortis des seconds.

Des Hétérogynes solitaires sont sortis les *Amblyoponinæ*, comme première souche des fourmis. De ceux-ci sont sortis les *Ponerinæ* Les *Ponerinæ* ont donné le jour à trois sous familles : les *Dorylinæ*, les *Myrmicinæ*, et les *Dolichoderinæ*, indépendamment l'une de l'autre. Des *Dolichoderinæ* sont sortis les *Camponotinæ*, comme groupe le plus récent et le plus dérivé (le plus éloigné de la souche). J'ai émis ces vues sur la phylogénèse des fourmis en 1890, à la réunion de Brême des naturalistes allemands, et je ne puis que les confirmer aujourd' hui.

A. Simoni (Emery).

♀ :—L.: 1·8 mill. Antennes de 12 articles, à funicule filiforme. Mandibules avec trois dents devant, denticulées derrière. Epistome échancré devant, grand, prolongé en arrière entre l'insertion des antennes. Yeux grands. Tête cordi forme. Thorax à sutures fortement imprimées ; métanotum avec deux épines. Pédicule formant devant un long cylindre et derrière un petit noeud arrondi. Du reste caractères du genre. Faiblement réticulée. Presque glabre. D'un jaune à peine roussâtre.

Ceylan (E. Simon).

2me Genre DOLICHODERUS (Lund.)

Tableau des ouvrières.

Un sillon longitudinal profond sur le vertex, au milieu, entre les yeux. L. 5·5 à 7 mill. Noir ; abdomen roussâtre postérieurement. Tête plus large que longue. Stature robuste. Presque tout le corps, les pattes et les scapes lisses, luisants, hérissés de longs poils assez abondants. Pédicule surmonté d'un noeud plus large que long ... D. SULCATICEPS (Mayr).

Pas de sillon longitudinal sur le vertex. Stature moins robuste....1

1. Pédicule allongé, surmonté devant d'un noeud bas, plus long que large et au moins aussi long que haut. Brun, poilu, assez luisant. L. 4·5 à 5 mill ..... D. SIGGII (n. sp.)

Pédicule surmonté d'une écaille. Thorax bigibbeux 2

2. Corps et pattes sans pilosité dressée. Mésonotum avec un sillon longitudinal médian 3

Corps couvert d'une pilosité dressée plus ou moins abondante. Mésonotum convexe, sans sillon 4

3. L. 4·8 à 6 mill. Subopaque, finement et densément réticulé-ponctué. Couvert d'une fine pubescence jaunâtre. Thorax bigibbeux ; métanotum anguleux, cunéiforme, concave derriére. Mandibules ponctuées, pubescentes. Rouge jaunâtre. Pattes plus jaunâtres ; tête et abdomen bruns..... .....D. FEAE (Emery).

D'un brun noir ; mandibules, funicules, tarses et articulations ferrugineux. Un peu plus grand et plus opaque que le type .....var. FUSCUS (Emery).

L: 2·3 mill. Tout le corps luisant, finement réticulé, finement pubescent. D'un jaune rougeâtre ou brunâtre foncé, uniforme. Thorax analogue à celui du précédent..... ....D. MOGGRIDGEI (Forel).

4. L. 4 mill. Mandibules mates, très densément ponctuées, noires, bordées de roux, armées de 10 à 12 dents. Tête large. Articles 3 à 6 du funicule à peine aussi longs que larges. Métanotum avec une surface supérieure plane, un court talus devant et une face déclive perpendiculairement tronquée. Noir, mat, abdomen subluisant. Ponctué. Pubescence fine. Pilosité dressée longue sur le corps, nulle sur les pattes et les scapes. Pronotum non bordé. Mésonotum subcirculaire .....D. CARBONARIUS (Emery).

Mandibules luisantes, éparsément ponctuées. Métanotum cunéiforme, n'ayant que deux surfaces séparées par une arête transversale, la basale ascendante, la déclive descendante. Pattes et scapes poilus 5

5. Articles 3 à 6 des funicules beaucoup plus longs que larges. Face basale du métanotum deux fois plus longue que large, peu convexe, en plan ascendant. Taille assez grêle, tête plus

longue que large. Pilosité dressée assez éparse. Sculpture et pubescence intermediaires entre les deux espèces suivantes. L. 3·5 à 4 mill. Tête assez luisante. Ferrugineux ou brun ; abdomen brun. Antennes, mandibules et pattes roussâtres ....D. AFFINIS (Emery).

Noir ou d'un brun noir; sculpture plus forte; plus robuste .....var. NIGRICANS (Emery).

Noir ; pattes rousses. Taille plus grêle. Tibias presque sans poils dressés.....var. GLABRIPES, n. var.

Articles 3 à 6 des funicules seulement un peu plus longs que larges. Face basale du métanotum convexe, moins de deux fois plus longue que large. L. 2·7 à 3·3, mill 6

6. Taille robuste. L. 3 à 3·3 mill. Tête au moins aussi large que longue, à côtés très convexes. Pronotum plus large que long avec le cou. Tête mate, densément réticulée-ponctuée, avec de plus grosses fossette éparses. Thorax grossièrement rugueux. Pilosité et pubescence abondantes. Noir ou d'un brun noir ; pattes et scapes bruns ; funicules, mandibules et tarses roussâtres.....D. BITUBERCULATUS (Mayr).

Taille plus grêle. L. 2·7 à 3 mill. Tête plus longue que large à côtés moins convexes. Pronotum aussi long que large, avec le cou. Tête subopaque, parfois luisante, moins densément ponctuée. Thorax en partie subopaque, finement réticulé-ponctué, avec de grosses fossettes plus espacées, non confluentes. Pilosité plus éparse. Pubescence assez diluée. Abdomen très luisant. D'un brunâtre sale, assez uniformes. Abdomen plus foncé. Parfois entièrement brunâtre. Patte et antennes roussâtres. Tarses jaunâtres, avec les crochets bruns .....D. TAPROBANÆ (Sm.)

Un peu plus grand et de couleur roussâtre plus claire, testacée-ferrugineuse.....var. GRACILIPES (Mayr.)

Liste des Dolichoderus *de l' Inde ; synonymie et geographie.*

1. *D. sulcaticeps* (Mayr).

Burma (Colonel Bingham). Répand une odeur tenace d'après Colonel Bingham.

2. *D. Siggii*, n. sp.

☿ (Voir tableau). Mandibules lisses et luisantes vers l'extrémité, finement réticulées vers la base, avec de gros points fort épars, armées de 10 à 12 dents. Tête en trapèze très arrondi, rétrécie devant, aussi longue que large au milieu (sans les mandibules). Yeux gros. Epistome comme chez le *D. sulcaticeps*, a bord antérieur presque droit (très faiblement concave vers le milieu). Aire frontale triangulaire, peu distincte. Les scapes dépassent l'occiput de presque la moitié de leur longueur. Pronotum deux fois plus large que long, peu convexe. Suture pro-mésonotale profonde. Mésonotum un peu plus long que large. Echancrure méso-métanotale très forte. Métanotum cunéiforme, à face basale faiblement convexe, un peu plus courte que la face déclive ; cette dernière en talus abrupt. Passage des deux faces arrondi. Noeud du pédicule (voir tableau) cunéiforme-arrondi ; sa face postérieure, lentement inclinée, est plus longue que sa face antérieure et se continue en arrière par un pétiole encore plus allongé que chez la *D. sulcaticeps*.

Corps, pattes et antennes luisants, faiblement réticulés, avec d'assez-gros points épars, irréguliers, souvent en partie élevés, piligères. Epistome, métathorax, côtés du mésothorax et une partie du noeud du pédicule mats ou subopaques, densément réticulés-ponctués (côtés réticulés-rugueux).

Tout le corps, les pattes et les antennes, ces dernières jusqu' à l'extrémité du funicule, hérissés d'une pilosité jaunâtre, raide, de longueur médiocre, assez espacée. Sur la massue sensorielle des antennes, cette pilosité est courte, mais distincte. Pubescence presque nulle.

D'un brun châtain assez foncé, uniforme. Base des scapes, base de la massue, mandibules et devant de la tête d'un brun plus clair, un peu roussâtre ou jaunâtre.

Bangkok, récolté par M. Sigg.

Bien caractérisé par la forme du pédicule.

3. *D. Feae* (Emery).

Burma (Colonel Bingham), Tenasserim (Fea), Frontière de Siam (Major Fulton).

Race *fuscus* (Em.) Tenasserim (Fea), Burma (Bingham).

4. *D. Moggridgei* (Forel).

Sibsagar, Assam (Mr. Wood-Mason).

5. *D. carbonarius* (Emery).

Perak (Presqu' île de Malacca).

6. *D. affinis* (Emery).

Tenasserim (Fea); Ye Valley et Thaungyin Valley, Burma (Colonel Bingham); Frontière de Siam (Major Fulton).

Var. *nigricans*, Em. Tenassarim (Fea).

Var. *glabripes*, n. v. Taille plus grêle ; écaille très inclinée ; tibias sans poils dressés, ou peu s'en faut. Sikkim, avec des chenilles, *Arhopala abseus* (3,000 feet).

7. *D. bituberculatus* (Mayr).

Bangkok (Sigg) ; Burma (Bingham) ; Kanara (Wroughton).

8. *D. taprobanæ* (Smith).

= *D. gracilipes*, Mayr (var.)

= *D. semirufus* (André).

Répandu dans toute l'Inde, de l'Himalaya, à Ceylan (sauf au Nord-Ouest).

Une ☿ de Ceylan correspond en tout point à la description de Smith qui a la priorité sur les autres.

Ceylan (Yerbury); Kanara (Wroughton); Trevandrum (Ferguson); South Konkan (Wroughton), etc., etc.

Var. *gracilipes* (Mayr) ; Calcutta (Rothney); Annam (par André) ; Ceylan (Yerbury) ; Kanara (Aitken) ; Barrackpore (Rothney) ; Burma (Bingham) ; Bangalore (Rothney), &c.

3me Genre TECHNOMYRMEX (Mayr).

1. T. *albipes*, Smith.

= *tapinoma nigrum* (Mayr).

= *tapinoma albitarse* (Motschulsky).

☿. L. 2·4 à 3 mill. Assez ramassé. Scapes dépassant un peu le bord occipital (de $\frac{1}{6}$ de sa longueur). Echancrure méso-métanotale anguleuse. Face basale du métanotum très courte, séparée de la face déclive par un angle droit ; cette dernière plane, obliquement tronquée. Noire ou d'un noir brun. Mandibules, pattes et funicules bruns ; trochanters, genoux et tarses d'un jaune pâle, blanchâtre. Souvent l'extrémité du funicule jaunâtre. Parfois les pattes sont entièrement brunes (var. *bruneipes*, n. v.) Mate, densément ponctuée ; abdomen reticulé-ridé ; métathorax plus grossièrement réticulé-ponctue. Pubescente, Parfois en partie subopaque.

Espèce cosmopolite des tropiques. Très commune dans toute l'Inde. Ceylan (Yerbury); Poona, Kanara (Wroughton); Calcutta, Mysore, Travancore, Cochin, Bhavnagar, Madras (Rothney), &c.

Race *brunneus*, n. st. L. 3 mill. Tête plus grosse et plus large. Yeux situés plutôt en arrière du milieu des côtés de la tête (un peu en avant chez l' *albipes*). Les 2/3 postérieurs de l'abdomen noirâtres à segments bordés de jaune ; funicules d'un brun foncé ; le reste d'un brun clair, un peu roussâtre ; tarses plus pâles. Pattes plus grêles que chez le type ; devant du thorax plus convexe ; métanotum moins anguleux.

Poona (Wroughton).

2. *T. bicolor*, Emery.

Ceylan (E. Simon).

Diffère du *T. albipes* par sa forme plus grêle (L. 2·5 à 2·8 mill.), ses antennes plus longues (scapes dépassant l'occiput d' 1/4 de leur longueur), le funicule à peine épaissi vers le bout, avec les articles du milieu presque de moitié plus longs que larges. Pubescence bien plus rare ; abdomen luisant. Tête et abdomen noirs ; tout le reste du corps, les pattes et les antennes d'un jaune testacé.

4me Genre IRIDOMYRMEX (Mayr).

Tableau des ouvrières.

Dos du thorax (sauf le devant du pronotum) horizontal en profil. Une incisure très étroite entre le mésonotum et le métanotum. Ce dernier cubique, avec une face basale horizontale et une face déclive obliquement tronquée. Ecaille verticale, large, haute, mince, arrondie. Robuste, glabre, luisant, faiblement réticulé. Noir ; mandibules et antennes roussâtres; tarses et genoux testacés.....I. GLABER (Mayr).

Dos du thorax formant deux convexités séparées par une large échancrure évasée ; la première convexité pro-mésonotale faiblement et longuement inclinée en arrière ; la seconde formée par la courte bosse du métanotum qui est arrondi. Ecaille inclinée en avant..... 2

2. Corps pourvu d'une longue pilosité dressée, courte sur les tibias et les tarses. L. 3·5 à 3·7 mill. Mandibules avec 9 à 10 dents. Ecaille inclinée, épaisse, aussi longue que haute. Finement pubescent ; luisant, microscopiquement ponctué. D'un brun noirâtre ; bouche, thorax (surtout dessous) et

pédicule roussâtres ; antennes, tarses et articulations des tarses d'un jaune testacé pâle.....I. LÆVIGATUS (Emery).

Corps presque entièrement dépourvu de pilosité dressée ; tibias et scapes sans poils dressés.....3

3. Ecaille très fortement inclinée an avant. Noir, faiblement luisant. Antennes, mandibules, funicules et tarses d'un ferrugineux pale. Epistome d'un roux obscur ; extrémité des funicules brunie. Tête, prothorax et cuisses roussâtres. Entièrement glabre. L. 3·2 mill (d'après Smith)...I. GLABRATUS (Smith).

Ecaille à peine inclinée en avant, haute, beaucoup plus haute qu'épaisse, et plus haute que large, à bord obtus. L. 3·3 à 5 mill. Quelques poils dressés aux deux extrémités du corps et dessous. Subopaque ; finement réticulé-ponctué, avec une pubescence grisâtre qui recouvre le corps, les pattes et les scapes, et rend la sculpture parfois difficile à reconnaître. Noir ou d'un noir brunâtre ; antennes, mandibules et pattes brunes ; tarses plus ou moins pâles. Un reflet metallique d'un bleu verdâtre ou d'un vert bleuâtre, surtout marqué sur l'abdomen.....I. ANCEPS (Roger).

L. 3·7 mill. Brun, un peu plus élancé. Convexité antérieure du thorax un peu plus faible et plus allongée ; métanotum un peu plus bas et plus arrondi. Pas d'éclat metallique..... Var. WATSONII, n. var.

Liste des espèces du genre IRIDOMYRMEX.

1. *I. glaber* (Mayr).

Poona (Wroughton) ☿ ; Kanara (Wroughton) ☿ ♀. Jusqu'ici on avait cru cette espèce exclusivement Australienne, mais la double trouvaille de M. Wroughton ne laisse aucun doute sur sa présence en Inde. Y a-t-elle été importée par les vaissaux ? Je ne puis découvrir la plus petite différence entre les exemplaires de l'Inde et ceux d'Australie, ni chez l'ouvrière, ni chez la ♀.

2. *I. lævigatus* (Emery).

Carin Chebà, Birmanie (Fea).

3. *I. glabratus* (Smith).

Malacca (d'après, Smith). Si Mayr n'avait pas controlé le type de Smith et constaté sa forte inclinaison de l'écaille, on pourrait croire qu'il s'agit d'une forme douteuse ou d'une variété de l' *anceps*.

4. *I. anceps* (Roger).
= *I. excisus* (Mayr).

Répandu dans toute l'Inde, de Ceylan à la Birmanie ; Assam (Smythies). Se trouve aussi à Java et à Sumatra. Cependant je ne l'ai pas reçu de la côté occidentale, ni du Nord-Ouest (cette dernière partie est presque toujours exclue pour les espèces qui n'appartiennent pas à la faune paléarctique).

Var. *I. Watsonii*, n. var. (Voir tableau). Birmanie supérieure (M. Watson).

Cette espèce repand une odeur aromatique.

5me. Genre BOTHRIOMYRMEX (Emery).

Tableau des ouvrières.

Ecaille très inclinée en avant, moins haute que la longueur du pédicule. Yeux fort petits. Entièrement d'un jaune testacé pâle. L. 1·8 à 2 mill.....B. MYOPS, n. sp.

Ecaille peu ou à peine inclinée, beaucoup plus haute que la longueur du pédicule 1

1. Palpes maxillaires de deux, labiaux de deux articles. Second article du funicule très court, aussi court que le 3me, ou peu s'en faut, aussi large que long. Mandibules armées de 7 dents. Couleur noire. L. 1·5 à 1·9 mill .....B. WALSHI, n. sp.

Palpes maxillaires de deux, labiaux de 3 articles. Second article du funicule sensiblement plus long que le 3me, bien plus long que large. Mandibules armées de 4 à 6 dents. Testacé ou brun clair. L. 2 à 2·8 mill.....B. WROUGHTONII, n. sp.

Mandibules fournies de 4 dents obtuses. L. 2 à 2·8 mill. Tête carrée, aussi large que longue. D'un brun jaunâtre sale. Echancrure meso-métathoracique assez forte. Pubescence de la tête fine et assez courte. Troisième article du funicule aussi large que long ; 4me plus large que long.....
.....r. B. WROUGHTONII, i. sp.

Mandibules armées de 6 dents ; 3me article du funicule un peu plus long que large.....var. VICTORIÆ, n. var.

L. 2 à 2·2 mill. Tête un peu plus allongée et plutôt plus large derrière. Mandibules armées de 4 à 6 dents moins obtuses. D'un jaune brunâtre sale ou d'un brun jaunâtre plus clair. Echancrure du thorax plus faible. Pubescence de la tête plus longue et moins fine. Troisième article du funicule un peu plus large que long.....r. B. DALYI, n. st.

N. B.—Tous les *Bothriomyrmex* de la faune de l'Inde ont deux articles aux palpes maxillaires, tandis que les formes Méditerranéennes : *meridionalis*, Roger, et *atlantis*, Forel, en ont quatre. Ces dernières ont en outre la tête plus allongée, avec un bord postérieur assez aigu, tandis que celui des formes de l'Inde est obtus. Le *B. pusillus*, Mayr, d'Australie se rapporte par ses palpes et sa tête au type de l'Inde, et ressemble au *B. Walshi* par ses palpes labiaux de deux articles, tandis que par ses yeux et sa couleur il se rapproche plutot du *B. myops*.

Liste des espèces du genre BOTHRIOMYRMEX.

1 *B. Wroughtonii*, nov. spec.

Poona (Wroughton) ; Kanara (Wroughton) ; Dehra-Dun (Smythies) ; Ceylan (Yerbury). Répand une odeur de rose volatile, lorsqu'on le dérange, d'après M. Wroughton. Les formes Mediterranéennes ne répandent pas d'odeur.

☿ (Voir tableau). Les scapes atteignent le bord occipital de la tête, sans le dépasser. Côtés de la tête convexes. Echancrure méso-métathoracique plus forte que chez le *meridionalis*.

♀ :—L : 3·5 à 3·8 mill. Tête large, convexe, plus large que longue, plus large derrière que devant, à côtés convexes, a bord postérieur obtus, arrondi, à peine concave au milieu, et un peu convexe de chaque côté (chez le *meridionalis*, la tête est rectangulaire-allongée, concave derrière, de toute autre forme). Les scapes dépassent à peine l'occiput. Face basale du métanotum aussi longue que la face déclive (beaucoup plus courte chez le *meridionalis*). Du reste comme le *meridionalis* (aussi les ailes hyalines), mais la pubescence est plus fine, plus pruineuse, les funicules sont bruns, sauf le 1er article, et la pilosité dressée est presque nulle.

♂ :—L : 2 à 2·2 mill. Mandibules avec le bord interne parallèle au bord externe. Elles ont 2 à 3 dents. Bord postérieur de la tête fort convexe. Premier article du funicule plus court et plus renflé que chez le *meridionalis* ; scutellum plus élevé en dessus du métanotum ; face basale de ce dernier plus courte que la face déclive (plus longue chez le *meridionalis*) ; organes génitaux pâles, plus gros que chez le *meridionalis*. D'un brun plus ou moins noirâtre. Pattes et antennes d'un jaune testacé pâle sale ; les funicules (sauf le 1er article) d' un brun jaunâtre.

Var. *Victoriæ* n. var. (Voir tableau) ; Victoria Pic, Hongkong. (Dr. Ris.)

Race *Dalyi*, n. st. (Voir tableau).—Coonoor (M. Daly) ; Barrackpore (M. Rothney) ; Kanara, Poona (M. Wroughton).

2. *B. myops*, n. sp.

Kolaba, South Konkan (Wroughton). Dehra-Dun (Smythies).

☿ : (Voir tableau). Mandibules armées de 6 à 7 dents. Les palpes labiaux ont trois articles presque égaux. Les scapes n'atteignent pas tout-à-fait le bord occipital ; ce dernier est relativement assez aigu. Second article du funicule, aussi large ou presque aussi large que long, un peu plus long que le 3me. Ce dernier et les suivants sont beaucoup plus larges que longs. Le gésier est identique à celui du *B. meridionalis* et à celui de toutes les autres espèces du genre. Tête un peu plus longue que large, très semblable à celle du *B. atlantis* ; les yeux sont aussi petits, mais les scapes un peu plus courts. Thorax plus court et plus large que chez les *B. meridionalis* et race *atlantis* ; les sutures bien plus profondément imprimées, l'échancrure méso-métanotale plus forte que chez le *meridionalis* i. sp. Couleur, sculpture, pubescence comme chez le *B. atlantis*. Taille plus petite.

♀ :—L : 3·5 mill. Tête un peu plus longue que large. Ecaille basse, à peine aussi haute qu' épaisse. Les scapes dépassent à peine l'occiput. Bord postérieur de la tête assez obtus, à peine échancré au milieu, et convexe de chaque côté de l'échancrure (chez le *meridionalis* il forme un bord presque droit, à peine, mais également concave d'un bout à l'autre, et fort aigu). Côtés de la tête un peu convexes (parallèles chez le *meridionalis*). Face basale du métanotum plus longue que la face déclive (bien plus courte chez le *meridionalis*). D'un brun noirâtre. Tarses et articulations pâles. Ailes manquent. Très voisine de celle du *B. Wroughtonii*.

3. *B. Walshi*, n. sp.

Calcutta (Dr. Tull Walsh) ; Orissa (M. Taylor).

☿ (Voir tableau). Très petit. Tête et thorax bruns ou noirâtres ; abdomen noirâtre, avec le bord des segments jaunâtre. Pattes et funicules d'un testacé roussâtre. Thorax court et épais, presque sans échancrure méso-métathoracique.

♀ Presque identique à celle du *B. Wroughtonii*, mais un peu plus petite (L. 3·3 mill).

6me Genre TAPINOMA (Foerst).

1. *T. melanocephalum* (Fabr.)

= *Formica nana* (Jerdon).
= *Myrmica pellucida* (Smith).
= *Formica familiaris* (Smith).

Kanara (Wroughton); Ceylon (Yerbury); Toute l'Inde, spécialement, Mysore (Jerdon), etc. Espèce cosmopolite, commune partout sous les tropiques. Mysore, Madras, Bombay, Bhavnagar, Bangalore (Rothney).

☿ :—L : 1·5 à 1·8 mill. Tête seule ou tête et thorax d'un brun plus ou moins noirâtre ou roussâtre. Le reste du corps, les pattes et les antennes d'un jaune pâle, souvent blanchâtre. Thorax peu convexe, sans échancrure. Les 3me et 4me articles des palpes maxillaires élargis, foliacés, en général du moins. Les scapes dépassent à peine l'occiput. Assez mate. Abdomen avec une fine pubescence soyeuse.

2. *T. indicum*, n. sp.

Poona (Wroughton).

☿ :—L : 1·3 à 1·5 mill. Palpes sans articles foliacés (labiaux de 4, maxill. de 6 articles). Les scapes atteignent tout juste le bord occipital. Epistome sans échancrure distincte, un peu évasé au milieu. Dos du thorax sans aucune échancrure. Entièrement d'un jaune roussâtre pâle, finement pubescent, sans pilosité dressée, finement réticulé ; abdomen faiblement chagriné. Tête et thorax un peu plus foncés que l'abdomen. *Calice du gésier retroussé, à sépales recourbées, distinctes, formant un passage à celles du genre Bothriomyrmex* (le gésier du *T. melanocephalum* a un calice atrophié, sans sépales distinctes, comme celui de l'*erraticum*). Les articles 2 et 3 du funicule sont beaucop plus larges que longs, les articles 4 à 8 au moins aussi larges que longs (chez le *melanocephalum*, les articles 3 à 8 sont plus longs que larges). Mandibules avec 4 dents distinctes devant et plusieurs denticules microscopiques derrière.

Cette espèce ressemble beaucoup au *T. minutum*, Mayr, d'Australie, mais chez ce dernier, les scapes n'atteignent pas le bord occipital, et la couleur est bien plus foncée, d'un brun foncé ; abdomen au moins aussi foncé que le reste.

COLLECTING WAYS AND COLLECTING DAYS,

BY

COLONEL C. T. BINGHAM, FOREST DEPT., BURMA.

II.—THE LIMESTONE ROCKS.

(*Read before the Bombay Natural History Society on 2nd April*, 1895.)

The mist hung heavy on the water, but from where I sat at the edge of the marsh, I could see the dawn breaking behind it. Great shafts of light, at first pale and dim, then glowing deep red, began to pierce the thick haze. Before this light had come, in the murky gloom a couple of little egrets (*Herodias garzetta*), unaware of my proximity, had alighted almost at my feet, looming so large that I had at first taken them for their distant cousin the Jabiru (*Xenorhynchus asiaticus*). Carelessly they stalked about in the shallow water peering into it for their morning meal.

From the centre of the marsh, where the fog lay heaviest, came a deafening uproar of quacking, whistling and piping, with the flutter of many wings beating the water, and the whirring rush of the flocks of teal as they rose and swept away to their feeding grounds. I sat listening trying to make out the calls of the different birds as they came in a babble of sounds to my ear. The hoarse grating clang of the comb-duck or nuckta (*Sarcidiorius melanonotus*), the "gra-aa-ak" of the cotton teal, and the plaintive clear shrill whistle of the red teal (*Dendrocygna javanica*) were easily distinguishable. From the far side of the marsh the purple coots (*Porphyrio*) were calling loudly, sandpipers were whistling, and the swirling wild cry of the curlew rang pleasantly over the water, calling up far-away memories of solitary rambles by a wild rocky shore in the west of Ireland, where over the cliff stretched a wide expanse of barren heath and bog-land, and in the far distance nestling among trees on rising ground lay my home among cottages thatched and picturesque in their old fashioned way. A curlew was the first bird I ever shot, and though it is close on forty years ago, that exciting stalk is never to be forgotten. How I wriggled and crept and made my way, with infinite pains and to the great detriment of my clothes, from rock to rock along the wet sand on my stomach, until I got within shot. How, panting more from the excitement than the exertion I had gone through, I tried to

steady my trembling hands and the old single-barrel Brown-bess I had borrowed on the rock in front of me, and at last pulled the heavy trigger. With what a bang it went off and what a kick it gave me on the nose and cheek, for I had forgotten to press the butt tight to my shoulder. It did not matter though, for one of the two curlews I had fired at lay dead, and though my nose did bleed and my face was swollen and lopsided for a couple of days after, what did I care; I had got my bird. I remember too that I skinned and stuffed that curlew, and a woeful bedraggled likeness of the original it presented when stuck up with wires on a wooden stand, but it was my first specimen! However to return to the Limestone rocks. I was crouched behind a fallen boulder at the foot of a hill and the marsh lay at my feet. Behind me the rocks, in scarped walls and rugged ridges, rose tier above tier, steep and utterly inaccessible, except by the one path pointed out to me by the Karen guide the day before. I had started long before dawn from the zayat or rest-house by the riverside to get to the foot of the limestone hill which I intended to climb, but it being still dark when I arrived, and the old Karen guide saying it would be dangerous to attempt the ascent before daylight, I sat down on a fallen rock at the foot of the hill and listened to the sounds of birdlife on the marsh, the waters of which swept up to the rocks on one side.

These limestone hills are, I believe, peculiar to Burma. Geologists say they are of the same age as the carboniferous limestone of Europe, but very few fossils have been found though the hills abound in caves, which one would think should be rich in the remains of animals if not of prehistoric man; but the fact is, judging from the appearance presented by the coast-line from Moulmain to Mergui to-day, with its numerous rocky islands rising there from the sea, these steep limestone hills, now comparatively far inland, were no doubt once surrounded by the sea, whose waves incessantly sweeping through their caves and crannies sufficiently accounts for the paucity of fossil remains to be found in them now. The most marked feature of these rocks is that they occur in solitary masses, rising abruptly with scarped sides out of the alluvial plains in the valleys of the Salween, the Gyne, the Ataran, and other rivers in Tenasserim. Their precipitous pinnacles worn to needle points and knife-like ridges, are the

chosen breeding haunts of the two species of adjutant, of the great king vulture (*Otogyps calvus*), and of the bar-tailed fishing eagle (*Polioaëtus icthayëtus*). Among their fastnesses the "Taw-seik"—the Burmese wild goat (*Nemorhœdus sumatrensis*)—lives a secure life so far as man is concerned, for few Burmese or Karen "moksohs" (hunters) care to toil up these almost inaccessible heights. That curious thrush (*Gypsophila crispifrons*) too is found nowhere except on these isolated peaks, and it was chiefly for the purpose of securing a series of this rare bird that I had stopped for a day to explore this hill. Moreover though it was too late for adjutant's eggs (they breed in November and December), the guide told me he knew the whereabouts of two nests of the fishing eagle, and I had myself the evening before marked down, with a pair of binoculars, a tree just below the topmost ridge, to which I had seen a male of the larger wreath-billed hornbill (*Rhyticeros undulatus*) fly, with crop and gullet distended with fruit—proof positive that his mate was somewhere around, probably in that very tree, sitting cemented up in her nest-hole, and that he like a good husband was carrying her her supper.

As soon as the guide declared there was sufficient light, we commenced the ascent, and horribly rugged and difficult it was. In ten minutes I had to stop to take breath and to steady myself, for it was a regular case of climbing by hands as well as feet and clinging on by one's eyelashes. We were on the extreme point of a low pinnacle of rock which was a hard dark-grey limestone worn into holes and crannies by the action of water. Above and around a thin scrub jungle allowed great bare masses of the rock to be seen. The vegetation was all stunted and completely different from that of the plain below. A dwarf bamboo, creepers, and cycads with a few trees of lofty height and considerable girth, but with their boles twisted, gnarled and crooked, could be seen clothing the scarped cliffs here and there right up to the top. The guide carried my gun; I had my butterfly net. A little thorny bush with thick, rather small, lanceolate leaves and clustering pretty white flowers was just within reach of me, and, early in the day as it was, the bees were about the flowers sucking out the honey and collecting the pollen. I had to be careful in giving a sweep with my net, for losing one's balance meant a nasty fall on the sharp rocks. Gingerly,

therefore, I swept my net and by degrees emptied its contents into my collecting bottle. One—two—all three kinds of honey bees—*Apis dorsata*, *indica*, and *floralis*—also several flies (*Diptera*) and a whopping female of *Eumenes arcuata*, a black and yellow solitary mud-building wasp. This insect is common all over Burma, and the males are even more common than the females, though apparently de Saussure had not got hold of the former when he wrote his Monograph of the *Vespidæ*, for he says " Male. Inconnu."

While I am putting away my bottle—whish past my ear goes something—a butterfly of sorts and a " blue" at that. I see it sitting underneath a leaf with wings closed over its back, a white bar crosses the underside of the wings, which puts me into a flutter as to the possibility of the butterfly being that awfully rare blue, *Arrhenothrix penicilligera*, de Nicéville. I give a sweep with my net, but the beastly thorns catch it, and the butterfly frightened flies round twice and then settles on a bush behind me. This time I catch it, and find that it is only *Camena cotys*, which is common enough in Tenasserim. It is disappointing. I don't believe I shall ever come across Mr. de Nicéville's butterfly with the jaw-breaking name, and it ought to occur in Tenasserim too.

However, having gained my breath, and the guide being anxious to get on, I bent to the climb again. Up and up we struggled, gaining our way almost inch by inch. Path there was none, only the rubbed look of the rock here and there or of a creeper which had been often used as a help in the climb showed the way. In about an hour we got to the top of a ridge, on which there was a little space not absolutely as steep as the side of a house, and along which some pretence at any rate to a jungle path, led to the foot of the next ridge. I threw myself down and panted freely. If a bird of paradise or the aforesaid long-named butterfly had suddenly made their appearance, I should have regarded them with indifference. I looked at my Karen companion and I got dreadfully angry ; he had not turned a hair ; he was perfectly calm, and was proceeding to light a pipe. Nothing makes me so angry as being very hot and wet myself and seeing another man cool and comfortable. However, most considerately nothing shootable or catchable (I don't know whether I am right in my terms) appeared until I was able to move again, and then the guide pointed at something dark that was mousing about at the foot of a fallen boulder some fifteen yards away ; it was small and I at first took it for a rat, but presently it came more

into view, and then, with a curious grating call like "quai-tch"—"quai-tch-tch," three or four others followed. It was *Gypsophila crispifrons*. To snatch my gun up from where the old guide had laid it down and to fire both barrels (it was luckily already loaded with half charges of No. 10 shot) was the work of a second as the saying is. When the smoke cleared I found one poor bird nearly blown to pieces, and a short search produced another, which was luckily much less knocked about and made a very good specimen afterwards.

Being on my legs now, I looked around. On the plain the sun's rays were fast clearing off the mist. From where I stood I could not see the marsh, but to the right on the other side of a broad belt of forest gleaming under the morning sun, the narrow stream of the Ataran curled and twined out of sight behind another lofty limestone ridge near the village of Nidong. To the left over the marsh which was hidden by intervening pinnacles of rock, and beyond a bare expanse of buffalo grazing ground and paddy fields, the white cupola of a pagoda and a grove of mighty palm trees (*Borassus flabelliformis*) marked the village of Kyaikmyaw, the most important village in these parts.

"Wheu-u-u"—a low whistle—and I turn and see my Karen crouching close to the ground, and I also see the back of a largish animal scuttling off among the rocks and going h—ahem!—for leather. It was a "tawseik." I caught one good view of it as it got to the top of the next ridge, but too far off to shoot at with a smooth-bore. It seemed to be of a reddish-brown colour and rather clumsy in make, and in the mist which still hung thinly about the hill it loomed as large as a good-sized donkey.

Going on towards the foot of the next ridge, I caught flitting about close to the ground a number of *Ypthima huebneri*, *Mycalesis mineus*, and *M. runeka*, with one *Lethe rohria* and one *Ragadia crisilda*, a pretty delicate black and white butterfly. It is strange that, though the vegetation is so different on these limestone hills from what it is on the plains below, the insects do not seem to differ. I could not recognize one single shrub or plant that I knew as occurring below, except perhaps the cycads and an orchid or two; yet none of the butterflies or other insects that I caught that day, or have procured since on these hills, differs one jot from their brethren of the plains, not even in so much as would make a distinguishable variety.

Half way up the second ridge, the climb whereof was not quite so stiff as that of the one we had just done, my guide stopped and pointed

to a tree, on the top of which was a huge nest of sticks with a large bird seated thereon. It was the fishing eagle. The tree grew out of a rift in the face of a bare rock, and the way the old Karen managed to get to it—he must have had prehensile toes—clinging hands and feet to the bare precipice was a sight to see. Arrived at the foot of the tree he quickly swarmed up it. I need not say I did not attempt to follow him. The eagle sat very quiet till the man was right underneath the nest; then she—for it proved to be a female—raised herself and soared off with a grand sweep of the wings. As she passed overhead I let drive at her with a No. 4 cartridge, and to my delight down she came dead as a doornail, with a great thump, on to a bush some fifteen yards down the hill and in an accessible spot. This was great luck, for, had she gone any distance and fallen, we could never have retrieved her. As it was, after the old Karen had brought me down the one large white egg which the nest contained, it took him fully twenty minutes to clamber down to the tree on which the eagle lay and bring her up. It was a fine specimen, scarcely, if at all, injured by the shot. It is or was a disputed point whether the outer toe of these fishing eagles is reversible like that of the osprey. From examination immediately after death of this and other specimens I can state positively that it is.

Recommencing our ascent with stoppages now and again to collect sometimes insects, butterfly, bee or wasp, sometimes a bird (twice it was *Gypsophila*, of which I got three more good specimens); by about 11 o'clock we had got to where I thought, and the Karen said, the hornbill's tree must be. He also said that we were close to where the day before his son had taken up and left under instructions from me six bottles of water. I was awfully thirsty, so previous to hunting up the hornbill, I determined to have a drink and dispose of some sandwiches I had with me. The Karen led the way to a fairly broad and level dip between two ridges and hunting about found the cache made by his son. What a treat that water was, cold as ice from lying out in the open all night. I took a whole bottle off almost in one breath, then I handed a bottle to the old chap, but he was not very thirsty; and only took a short drink; it would have been different if the thing had been whisky. Karens get drunk on all decent opportunities. However he highly approved of half my sandwiches; these finished, he left me to have a smoke and toddled off to search for the

hornbill. I had finished my pipe and was looking at my day's collection, which consisted, besides birds, of some twenty butterflies and some thirty wasps and bees, among the latter several specimens of the beautiful *Sphex erythropoda*, when the old Karen returned with the news that the hornbill's tree was about 400 yards off and easy of access; also that the female was on, or rather in the nest. Up I got and off we set. The tree, like the one that contained the nest of the eagle, grew out of a rift in the smooth perpendicular face of a wall of rock. But in this case access to the tree could be got from above by letting oneself down on to one of the branches by the help of a pendant root coming out of a crevice in the rock at the top. The old Karen swung himself down and, scrambling along the branch, reached a fork between the two large branches into which the tree divided, and where in a hollow, the entrance to which had been considerably narrowed by what seemed to be hard clay mixed with broken leaves and other rubbish, sat the female hornbill with only the tip of her bill showing. Using his heavy dah (hatchet-knife), the Karen enlarged the entrance hole and rather gingerly and with some difficulty, for she resisted stoutly, pulled the old hen out, fluttering and squawking horribly. He was about to kill her, when, remembering that we were pretty heavily laden with specimens, I called to him to let her go. I could see she was *Rhiticeros undulatus*, the larger wreath-billed hornbill. She fell fluttering for a few yards, and then, sailing off, perched on a neighbouring tree, not seeming cramped in any way from her enforced confinement in the nest. There were two perfectly fresh eggs resting, the Karen said, on the bare wood in the hollow. These were soon in my hand, and I found they were of a dull white colour and rather long in shape. Having packed these, we went on following the crest of a long narrow ridge. In about another hour we came to the site of an old nesting place of the adjutants. There were about a dozen old abandoned nests —some on the tops of low bushy trees, some on points of the bare rock. The ground underneath and the leaves, branches and boles of the trees around were white with the droppings of the birds, but of course at this time of the year there was not an adjutant to be seen. A wall of bare rock, some ten feet high, faced us, and this was covered with the bulbs of that beautiful orchid, *Limatodes rosea*, none of which however were in flower. At our back lay the whole valley of the Ataran, and the view stretched right away to the glistening gold pagodas on the hill above Moulmein, up the Salween, with its numerous isolated lime-

stone peaks and, sweeping round, was shut in to the east and south by the far off mountain range of the Dawnat. A beautiful cool breeze was blowing, and I sat down and thoroughly enjoyed the scene.

However we could not loiter long, and, as the old guide said, the other nest of the fishing eagle was still a long way off, and as it was the afternoon now, I determined to leave it for him to investigate next day and bring me the eggs if there were any, and to return now the way we had come.

The ascent had been difficult enough, but the descent, loaded as we were, was, for me at any rate, most fatiguing. At one place we made a detour to visit some caves. These were simply lofty hollows in the rock not going in any distance. From the roof of one of the caves hung large semi-circular combs made by the large honey bee (*Apis dorsata*). A bamboo ladder rested against the side of the cave, and the old Karen informed me that he farmed all the honey and wax on this hill. He had purchased the sole right of collecting from the man who had bought the right of collecting honey and wax throughout the Ataran Valley at the yearly auction in the Deputy Commissioner's Court. At the entrance to the cave we saw the marks of bears, and the old man said that two species—a large and a small one—were by no means uncommon on these hills and destroyed a good number of the combs yearly.

It was getting dusk when we reached the foot of the hills near the marsh, and right glad I was to get down with all specimens, especially the eggs, safe. On the way I had picked up a couple more of the *Gypsophila*, so that I had a nice little series in full breeding dress. That they were breeding or about to breed I discovered by dissection afterwards when skinning the birds. This little thrush has the habits of a wren, mousing about the ground at the roots of bushes and in the holes and crannies in the rock. It is a very silent bird, but once or twice I noticed one perch itself on a bush and give out a low pretty little song. A new moon was up in the west as I approached the belt of jungle immediately round the village of Kyaik-myaw. I looked back at the hill now throwing dark shadows and looming mysterious grim and black in the half light, at the marsh at its feet on whose waters the light still lingered, at the broad expanse of plain I had just traversed, and over which the night jars were wheeling, and, remembering my successful collecting, I felt happy. It was a day not to be forgotten, and the memory of it is vividly revived as I write these lines.



From a photograph by Mr R.A.Heath. Mintern Bros. Photo-ing. London.

THE CHITAL OR SPOTTED DEER.

Cervus axis.

THE CHEETUL OR SPOTTED DEER.

By J. D. Inverarity.

(*With three Plates.*)

(*Read before the Bombay Natural History Society, on 2nd April*, 1895.)

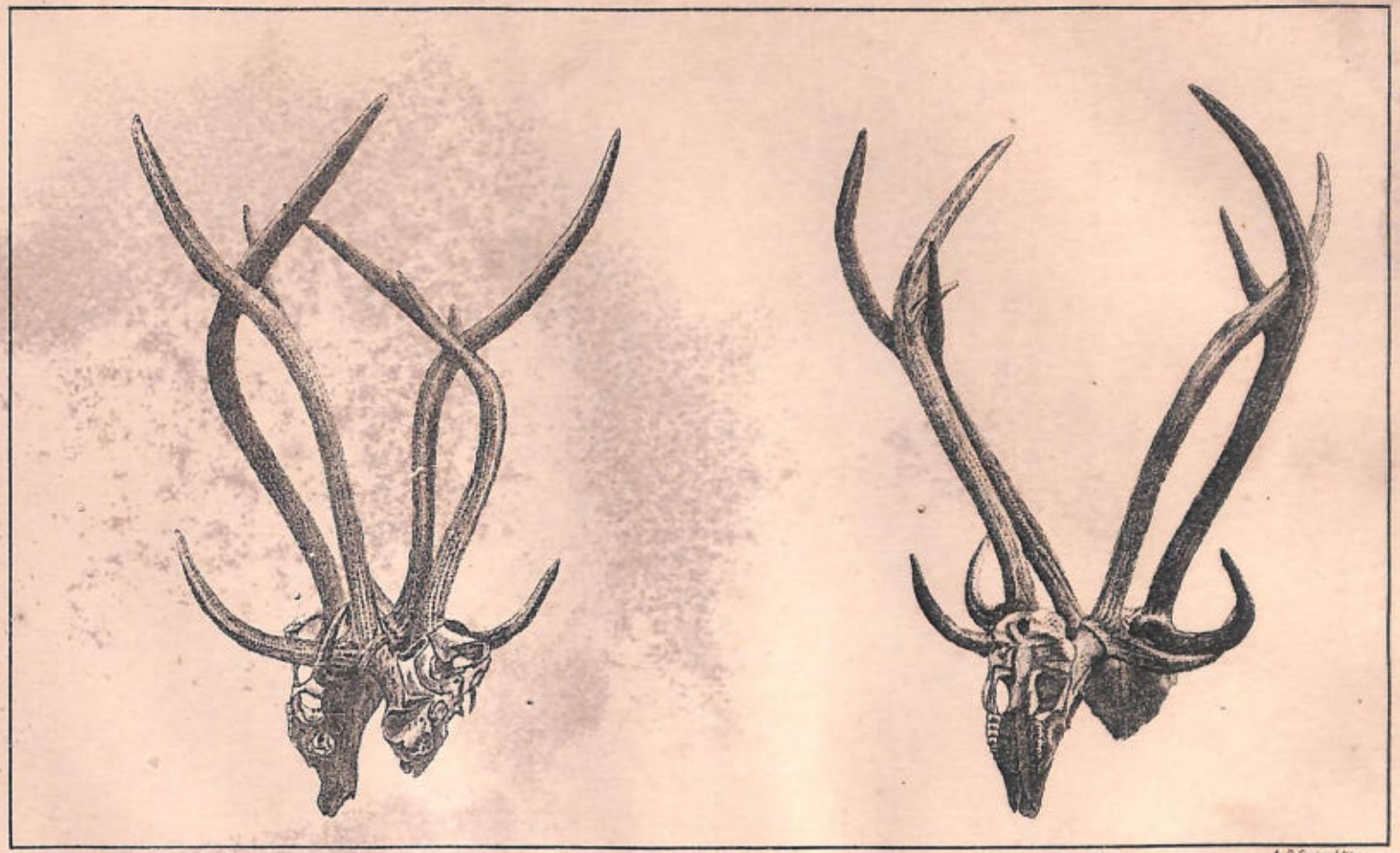
The Cheetul is one of the most graceful of the deer tribe, and its skin, beautifully marked with white spots, would make one think that it would be easily seen in the jungle. This, however, is far from the case, and when standing still it is about the most difficult animal to distinguish. The white spots match exactly the flecks of sunlight thrown through the leaves of the trees on the jungle in the midst of which it stands. The Cheetul is fond of shade and water and is chiefly found in localities where these abound. They go in herds; as many as 20 or 30 may be found together, though it is more usual to find half-a-dozen or a dozen. They sometimes collect in large numbers. The Cheetul has horns of the same number of points as the Samber—3 on each horn—and, measured on the outside curve, a very good head will be 33 to 35 inches in length of horn, and in very exceptional cases will even exceed this. A large number of Cheetul however, never attain to horns of this size, and numbers of old deer will have horns 2 feet and under in length. They are peculiar in having no regular season for shedding their horns. I have seen them with their horns hard, but the velvet still on in the middle of May, and at the same period have seen them with horns just beginning to sprout, and at Christmas time I have observed the same. At all seasons of the year many Cheetul will be found with horns unshed, and in my opinion they do not shed their horns every year. They frequently throw out an extra small tine or two, an inch or half-an-inch in length at the junction of the brow antler with the horn. The longest upper tine is invariably the outside one.

The longest horns I have shot measure 34½ inches. These horns fork at 17 inches, almost exactly half way. The horns of the Cheetul in large heads fork much lower down the beam than is the case in Samber heads, and the inner tine is, I think, invariably in such heads, of short length. In fact the length of a long Cheetul horn is generally made up by the extreme length of the outer upper tine. In smaller heads the upper points are near the top of the horn, but even in them the outer tine is the longest one. The skin of a spotted buck makes a handsome mat. The late Mr. H. P. Le Mesurier, Agent of the

G. I. P. Railway, once took out one of his subordinates on the railway to shoot, and the man, to his great delight, shot a Cheetul stag. He announced to Mr. Le Mesurier his intention of having the skin carefully dressed, and sending it as a present to his brother who kept a public house at Northallerton. As a preliminary the skin was carefully removed and stretched outside the tent, the jackals attracted by it during the night came up and would no doubt have eaten it, but the owner was constantly up and rushing out to see if it was safe. He so disturbed Mr. Le Mesurier that the latter asked him not to make such a fuss about a spotted buck skin, to which the indignant proprietor replied, "It may be a spotted buck in India, but it is a leopard at Northallerton." The above story, which I heard from Mr. Le Mesurier, is told in rather a mutilated form in the Indian Game Volume of the Badminton Library. I believe I told it to the writer myself many years ago.

The first of the plates that accompany this paper is a very good photograph by Mr. H. A. Heath. It will be observed that the stag, a fine one, whose horns measured 34 inches, has an extra tine (the measurement of which I have not got) growing out of the right antler above the junction of the brow antler with the horn. This stag had an extra tine curving downward, growing at the back of the upper fork, but this is not shown in the plate, as it is concealed by the horn. An extra tine at this spot is not very unusual. As I have already mentioned almost every large Cheetul head has small knobs in the axil of the horn; the left horn in the plate it will be seen, has them. Occasionally they continue to grow into a tine. A similar instance will be found depicted in a plate at p. 223 of Vol. I of this Society's Journal. The horn there—the left one—measured 30½ inches, and the abnormal extra tine 20 inches. Mr. N. C. Macleod has a single right horn, a shed one he found on the Taptee, which has an exactly similar extra tine. This horn measures 35 inches, and the extra tine 19 inches. This horn is scored in different places with the marks made by porcupines gnawing it. Shed horns are often marked in this way.

The second plate represents two Cheetul heads locked together. They were found by Mr. H. A. Heath in the Berars and presented by him to this Society. They had got interlocked when the stags were fighting. The deer being unable to disengage themselves, had died of exhaustion, thirst or starvation, or all three combined. The following description of their position I hope is intelligible. For the sake of convenience I call the head of the one that has its horns



from Photographs. A. P. Cortes, Lithr.

INTERLOCKED HORNS OF THE CHEETAL OR SPOTTED DEER.

Presented to the Society by Mr H. A. Heath

resting in the fork of the horns of the other, No. 1. The other I call No. 2. The heads are not exactly opposite each other; the forehead of No. 1 is opposite the right horn of No. 2. The left brow antler of No. 1 is driven over the right brow antler of No. 2, so that the latter is slightly under the burr of the horn of the former. The right brow antler of No. 1, is under the left brow antler of No. 2 for half its length. The right antler of No. 1, which is a switch horn, rests in the fork of the left antler of No. 2. The left antler of No. 1 rests in the fork of the right antler of No. 2. The inner point of No. 1 being securely wedged behind the inner point of the antler of No. 2. It will be seen that if the skulls could move sideways the brow antlers would be at once unlocked, but this is prevented by the locking of the horns at the upper points. If the antlers were sawn off just below the upper forks, the skulls could be moved sideways in opposite directions and the brow antlers unlocked. If the skulls could be moved backwards from each other, the upper forks of the horns of No. 2 could be drawn clear of the horns of No. 1, but this is made impossible by the position and curve of the brow antlers. If the head of No. 2 could be drawn down, or the head of No. 1 drawn up, the upper points would be disengaged, but the position of the brow antlers again prevents this. In fact the horns are immoveable and no one could pull them apart unless he sawed off the antlers below the upper forks, or sawed off one brow antler from each head. What has assisted the locking of the horns in this way is that the horns are about the same length, they are about the same span at the fork of the upper points, and the horns of each fork about the same height. The length of horn of No. 1 is—left horn 32 inches, right horn 31 inches. The inside span of the horns at the upper points is 16 inches. The length of horn of No. 2 is—left horn 33 inches, right horn 33½ inches. The span is 17 inches. The brow antlers of No. 1 measure 10 inches; those of No. 2, 13 inches. The horns of No. 1 are quite smooth along the front, and almost smooth along the sides and back of the antlers. I never saw so smooth a horn on a Cheetul.

The longest Cheetul horn mentioned in Ward's Book of Horn Measurements is 37½ inches. Forsyth mentions one of 38 inches, and Blanford one of 38¾ inches. I have not weighed a Cheetul myself, but from a note I took from some weights given in the "Field" several years ago, I find it was there stated that one Cheetul stag weighed 190 lbs., another 175 lbs., two Cheetul does weighed 105 and 100 lbs. respect-

ively. The skin of the does is not so bright-looking as that of the stag. Some years ago there was in the Victoria Gardens, Bombay, a doe, a cross between a Hog-deer and a Cheetul. I have a photograph of it I took. The body was coarser and stouter built than the Cheetul, and the white spots on it were comparatively few and indistinct, but in colour and general appearance it was more like its Cheetul parent than the Hog-deer. The Cheetul and Hog-deer both belong to the genus *Axis* (see Jerdon), the one being *Axis maculatus*, the other *Axis porcinus*. Mr. Blanford places them under the genus *Cervus*. I have in my possession rather a curious Cheetul head, the brow antlers of which grow straight out sideways, the distance between the points of the brow antlers being 30 inches; the right one throws out no less than six extra points, the left one four points. It is figured at page 125 of Vol. I of this Society's Journal, but the plate does not show all the points. The main beams of these antlers are normal and measure 28 inches. It was shot in the Madras Presidency, not by me. I have seen a head in the possession of Colonel Nevill, Hyderabad; the horns, very thick ones, though normal in every other respect, grow almost straight up parallel to each other. They are 34 inches long, and the distance between the horns half-way up is only 5½ inches. (*See Plate C.*)

I believe that the Cheetul has no regular rutting time, and that the young are born at all times of the year. As far as my observation goes, the Cheetul gives birth to one young one at a time, at any rate when I have come across one, two, or three mothers, each has had one young one with her. In a herd it is not easy to allot the young to their respective parents, and it may be they sometimes have twins. When stalking for Cheetul, the place to look for them is in the neighbourhood of rivers and streams. In the early morning they will be near the water, and later on in the day they will be found in the dry nullahs. They are very fond of the berries of the Ber (*Zizyphus jujuba*), and they have sense enough to strike the stem of the tree with their horns so as to shake the berries down. I have not seen them actually doing this, but I have often seen the bark of the trees wounded with the points of their horns, and was informed by the jungle men that by this means they knock down the fruit. Though the Cheetul is well worthy of a shot, it generally happens, at least to me, that they are shot when out after Samber or some bigger game. When beating for tiger they are often seen, but on these occasions one leaves them alone, and many a good head has



from a Photograph

A. P. Carter, Litho.

ABNORMAL HORNS OF CHEETAL OR SPOTTED DEER.
Shot by Col: R. Nevill, C.I.E.

passed unscathed within a few yards of me. It is an invariable rule not to fire at anything except tiger when one is thought to be in the beat, the only good reason for which is that the tiger may be turned by the shot in front of him back on to the beaters and do some damage, and as there is some risk of this, of course it would not be right to run it. My own opinion is, though in this I know I differ from many whose experience commands respect, that in nine cases out of ten a tiger when a a shot is fired in front of him does not know where it comes from, and does not turn back. I once saw three tigers (not cubs) go by the same gun at short intervals. All were fired at and two of them were killed. Twice I have shot two tigers that followed each other, the second one not being deterred by the previous shots from coming on, and I could mention other instances, but I must remember that my subject is Cheetul, and not tigers. I once got a shot at a Cheetul in a curious way. I had been for some days trying in some flat grass jungle to track two tigers, and had come up to them on two different days without however getting a shot. There was a shallow nullah with no cover in it, up the sandy bed of which I found their tracks almost every day ; indeed one morning they were sitting in it, but just before rounding a corner on the other side of which they were, I unfortunately left the nullah to walk in some long grass by the side of it, and though they bolted close to me, I could not see them. One night I sat over a gara at this nulla and intended to stop till 9 a.m. on the chance of the tigers coming up the nullah in the morning. I was perched in a tree over the nullah, and long after the sun was up a stag and one doe Cheetul walked past me 40 yards off. At first I did not intend to fire and they walked slowly along till they were 100 yards off and stood in an open glade. This was too much for me, and I fired ; neither Cheetul moved. I was reloading a single barrel I had fired with when the stag staggered two or three paces and fell dead. The doe started off a few yards and stood looking for a few moments at the dead one, and then bolted. There were very few Cheetul in this jungle, so it was rather lucky. My luck for the day, however, was not over, as I bagged two tigers the same afternoon, not the same ones I had been previously looking for, but at another place some miles off. If there are Cheetul about you are certain to hear them calling during the night. As one lies in bed under a tree smoking the pipe of peace, listening to the deer, the conclusion is forced on one that there are many worse places than India.

MISCELLANEOUS NOTES.

No. I.—THE IDENTIFICATION OF BIRDS.

Since the publication of my volumes on the Birds of India, I have been pained to find that some ornithologists in India do not agree with many of my conclusions which were arrived at after much investigation and labour. I am the more grieved at this, because my critics in some cases do not appear to peruse my book with attention, and in others they impute ignorance to me which would be quite inexcusable in a child. I will give recent instances to show what I mean and to demonstrate that my work is not so full of errors as these same critics would have us believe.

In a recent number of the Society's Journal (vol. ix, No. 2, p. 116), Mr. E. C. Stuart-Baker tells us that he believes *Pericrocotus fraterculus* to be a bad species and that it should be suppressed. He appears to have procured a considerable series of minivets of this type in North Cachar, and he seems to have laboured hard to make them into two species. It is improbable that the two species, *P. speciosus* and *P. fraturculus* occur together in that country. In any case, he proceeds to measure wings, and to note the colour of the tails. These characters are of subsidiary importance, although undoubtedly useful in their way. But why did not Mr. Baker look at my key to these birds (vol. i, p. 478,) before expressing a hasty opinion on the validity of the two species? He would there have found the really important and unfailing character for discriminating the two birds, viz., the *length of tail*. Let me assure Mr. Baker that the two minivets of this type are perfectly distinct species or races, if he prefers the latter term.

Again, some months ago Mr. H. A. Hole published a list of birds in the "Asian" with charming illustrations. Writing of *Dicrurus ater*, he states that I have described the young of this common species quite wrongly, and he proceeds to describe what he considers is the young of the Black Drongo. Will it be believed that the bird he describes is *Surniculus lugubris*, the Black fork-tailed Cuckoo?

EUGENE W. OATES.

MANDALAY 15*th January*, 1895.

No. II.—ON THE OCCURRENCE OF *GERARDIA PREVOSTIANA* IN BOMBAY.

In the Fauna of British India (*Reptilia*) it is stated that the only authenticated habitat of this snake is Pegu, and consequently it is worthy of record that the four specimens in our collection have all been obtained from the neighbourhood of Bombay, as follows :—

2 Collected by Mr. W. F. Sinclair, I.C.S., at Alibag.
1 Collected by Mr. J. Mason (our Curator) on the shores of Back Bay.
1 Collected by Mr. A. Corrodi in the Varsova Sands, Bandora.

H. M. PHIPSON.

No. III.—THE SPURS OF THE RED SPURFOWL.

I notice that both Hume and Jerdon mention three as the largest number of spurs on the leg of the Red Spurfowl (*Galloperdix spadiceus*), but I have just obtained a specimen which has four on one leg and two on the other. I have kept the two legs in case they should be wanted.

C. F. SHARPE,
General.

COONOOR, *6th January*, 1895.

No. IV.—THE SOUTHERN INDIAN HARRIER EAGLE.

On the 3rd January last I had the pleasure of taking a nest of the Southern Indian Harrier Eagle, 39 bis, *Spilornis melanotis*. The only record of this bird's nidification is in a paper by Mr. Vidal on the Birds of the South Concan, so a few notes may be worth recording. I have taken four nests of this Eagle, two having 2 eggs in each, and the other two a single young one in each. The other three nests were taken in March, and I succeeded in rearing the young one till he was full grown when he left me for pastures new.

The nest taken in January was on the fork of a high Vengai tree (*Pterocarpus marsupium*) and unfortunately had a young one. I brought it home and it thrived well on raw meat and was getting its plumage, when one day last week it died in a fit vomitting all its food.

I had great difficulty in getting a Malayali to climb the tree, for the parent bird repeatedly attacked him and on one occasion clawed his back.

It darted once or twice at me and I had to wave my hat to keep it off. I fired in the air, not caring to shoot the bird, but this had no effect, for it came several times at the man on the tree, and it was only after a great deal of shouting that we were able to bring home the young eagle.

WM. MAHON DALY.

YERCAUD, *24th February*, 1895.

No. V.—PERIODICAL FLOWERING OF *STROBILANTHES KUNTHIANUS*.

I notice an article on page 417, vol. v, by Mr. J. F. Duthie, on the flowering of certain species of *Strobilanthes*.

It may be of some interest to record the flowering of our commonest shrub (*Strobilanthes kunthianus*) in August, 1884, and the plants have never been in flower since, clearly proving that it takes more than 8 or 9 years as noticed.

The natives here call it "Kuranjal" and say that it flowers once in 17 years.

The seed is readily eaten by jungle fowl, and was in many cases collected to feed poultry on.

The hills looked very beautiful and had quite a purple tinge where the shrub was in flower.

WM. MAHON DALY.

YERCAUD, SHEVAROY HILLS, *28th February*, 1895.

No. VI.—ON THE SIZE OF MANGO TREES.

Nearly eight miles from Khandala, and about two miles on the Khandala side of Rajmachi, on the sloping side of a green valley, there is a huge mango tree which has apparently remained unnoticed for many years. It first attracted my attention when I visited the place, nearly a year ago, in company with my brother, Dr. Dixon, of the Bombay Medical Service, but we had no tape with us on that occasion. Later on, I again went to the Rajmachi pass, and measured the tree with the following result :—

> A huge tree, a little over seventy feet in height, covering an area of nearly 5,000 square feet, trunk straight, about six feet, girth 17′5″ ; crown very broad and massive, girth of crown nearly 19 feet ; boughs widely spreading, thirty to fifty feet long, girth from six to thirteen feet.

Some parts of the tree have begun to show signs of natural decay, which is perhaps being accelerated by forest fires, and the present growth of the tree, on the whole, appears to be very weak. It seems to me that within a few years no trace of this gigantic tree will be left on the spot where it is now standing.

In 1837 Col. Sykes noticed a huge mango tree, at Bhimashankar on the crest of the Sahyadris, 3448 feet above sea level, which was stated to be fully eighty feet high and from which boards could be cut thirty feet long and three or four feet wide. It was known as the "Rajah" and was in the immediate neighbourhood of the Hindu temple at Bhimashankar. The tree died however some years ago.

Col. Syke's mango at Bhimashankar does not appear to have been known to Dalzell and Gibson, as no mention is made of it in their Bombay Flora, and according to Brandis, the mango, in Northern India, attains a height of sixty to seventy feet with a girth of fifteen feet.

No botanical writer has, as far as I know, made mention of such a gigantic mango tree as the one above referred to, so I am inclined to believe that the specimen in the Rajmachi pass is in all probability the largest living mango tree in India.

It would be interesting if other members of this Society would measure any large mangoes which they may hear of, with a view of establishing the maximum size attained by this tree.

R. M. DIXON.

BOMBAY, *February*, 1895.

No. VII.—THE BIRDS OF THE BOMBAY PRESIDENCY.

In an interesting article on the birds from Central India, mentioned in Barnes's Handbook, Mr. Blanford draws attention to several birds which he thinks have never been obtained within the limits of the Bombay Presidency proper.

I should like space to make a few remarks on these. With regard to several, as far as I know, he is right, but in this district I have found the following comparatively common : *Chætura sylvatica* and *Carpophaga aënea* ; while *Surniculus lugubris* I have obtained on perhaps half a dozen occasions, and no doubt owing to its resemblance to the *Dicruridæ* it is frequently overlooked.

I have never myself obtained *Centropus bengalensis*, but my friend Mr. E. H. Aitken informs me he has several times seen it in the North of the District, and it therefore deserves its place in the handbook.

I hope in another year when relieved from official duties to write a paper on the Birds of Kanara, a considerable amount of material for which I have collected, but in the meantime I may mention that the following birds not mentioned in the handbook occur there:—

Chætura gigantea, Hass. ;
Batrachostomus moniliger, Lay. ;
Tiga javanensis, Ljung. ;
Vivia innominata, Burt. ;
Alcedo ferruginea, Hodgs. ;
Garrulax delesserti, Jerd. ;
Dendrocitta leucogastra, Gould. ;
Osmotreron bicincta, Jerd ;
Carpophaga cuprea, Jerd. ; and
Rallina euryzonoides, Lafr.

This is not the place to discuss the specific differences among the *Caprimulgidæ*, but I very much doubt the correctness of Mr. Blanford's views as to the identity of *C. albonotatus* and *C. atripennis*. The former bird I have never seen, but I have obtained eggs from the late Mr. Otto Möller, and they though larger were of the *C. indicus* or *C. kelaarti* type, and not in the least like the spotted eggs of *C. atripennis*. I can find no note as to the call of *C. albonotatus*, but I shall be very much surprized if it is not of the "tukkoo tukkoo" description, and not a bit like the very distinct call of *C. atripennis*.

J. DAVIDSON.

KARWAR, *4th March*, 1895.

No. VIII.—THE OCCURRENCE OF THE DUGONG IN THE INDIAN SEAS.

Mr. Edgar Thurston, C.M.Z.S., the Superintendent of the Madras Government Museum, in his recently published description of Rameswaram Island, Gulf of Manaar (*Bulletin No.* 3, *Second Edition*) writes as follows :—

"The phytophagous sirenian, *Halicore dugong* (the dugong), which is said by Jerdon to be found in the salt-water inlets of South Malabar, feeding on the vegetable matter about the rocks and basking and sleeping in the morning sun, is, according to Emerson Tennent, attracted in numbers to the inlet from the Bay of Calpentyn on the west coast of Ceylon to Adam's Bridge by the still water and the abundance of marine algæ in this part of the Gulf of

Manaar. It is of an extremely shy disposition, and I have never seen it myself, though I have heard of dead carcases being thrown up on the Pamban beach, and living specimens being caught in the fishing nets. One was, in fact, caught, together with a young one, the day before my arrival at Pamban in 1889, and promptly sold for food, as it is considered a great delicacy. There is a tradition among the natives that a box of money was found in the stomach of a dugong which was cut up in the Pamban bazar some years ago; and an official is now always invited to be present at the examination of the stomach contents, so that the possessors of the carcase may not be punished under the Treasure Trove Act for concealing treasure. But the stomach contents invariably prove to be green sea-grasses (phanerogams) which are very abundant in the shallows of one to three feet in depth on the Ceylon coast of the Gulf of Manaar, and almost entirely exclude the sea weeds (algæ). The fat of the dugong is believed to be efficacious in the treatment of dysentery, and is administered in the form of sweetmeats, or used instead of *ghi* (clarified butter) in the preparation of food. The skeleton of a female dugong in the Madras museum shows, encased in the upper jaw, the functionless teeth, the blunt points of which are, during life, covered by a fleshy lip forming a snout. The female is described by Tennent when suckling her young, as holding it to her breast with one flipper, while swimming with the other, holding the heads of both above water, and, when disturbed, suddenly diving and displaying her fish-like tail."

The skull of one of these Marine animals was presented to the Bombay Natural History Society by Mr. C. M. Sykes, in April, 1893, the carcase having been washed ashore at Mandvi on the Coast of Cutch.—(Ed.)

No. IX.—A TIGER KILLING A PANTHER.

When in camp the other day at the little village of Kalesar, on the Nizam's side of the Godavery, opposite Sironcha, I heard a curious story of a tiger killing a panther, and after considerable cross-examination elicited the following information which may perhaps be worth sending you.

About a fortnight ago some villagers, on their way to work at daylight, came across, in open country, the recent marks of a tiger and some blood where he appeared to have dragged away some animal. Seeing, as they thought, their way to beef for breakfast, the men got a tomtom from the village and followed up the tracks. Suddenly a tiger (or tigress they say) bounded out of some bushes and made for the forest. On going up to the bushes, instead of a cow, they found a full grown panther (female) frightfully mauled, but still breathing. They state its back was apparently broken and parts of the interior torn out and that apparently the tigress had drunk some of the blood. I saw the skin which was that of a rather large panther. It was much torn, and a large piece 6″ × 5″ had been cut out of the centre of the back.

W. F. BISCOE.

SECUNDERABAD, *March*, 1895.



From a Photograph by Mr W.R. Woodrow.

A LANGÚR IN THE COILS OF A PYTHON.

Mintern Bros. lith. London.

No. X.—THE FOOD OF PYTHON MOLURUS.

(*With a Plate.*)

The accompanying engraving illustrates a somewhat uncommon incident which occurred to Mr. W. Woodrow of the Forest Department and myself, whilst tiger shooting, in the Forest of Canara, on 2nd April, 1892.

On that date a tiger had been wounded in the first beat. After tracking for some time through high-timbered forest, the sportsmen arrived at a bamboo clump, in the trees above which monkeys were swearing vigorously. Feeling sure it must be a tiger passing through—for the cover was not thick enough for him to lie up in—the sportsmen ran round with the object of outflanking him. On arriving in the open forest beyond they were recalled by the "Mahits," who showed them the subject of the engraving lying coiled up amongst dead leaves with the Langour in its embrace as depicted. The sportsmen now approached the python, who slowly uncoiled himself and as slowly advanced on them, when he was killed by the writer with a shot in the neck. The python measured 12′ 10″ and was photographed by Mr. Woodrow the next morning, the monkey being arranged in the python's embrace as originally seen.

O. CHANNER,
Surgeon-Major.

THE FORT, BELGAUM, 2*nd October*, 1894.

No. XI.—*HEMIDESMUS.*

For some years past it has come under my observation, on various occasions and in different places, that this valuable drug has been inadvertently substituted by *Gymnema Sylvestre*. Both these plants, as is well known, not only belong to the same natural order, *Asclepiadeæ*, but their similarity in most respects is so great that they cannot be easily distinguished from each other, unless the person is well conversant with the characteristics of each plant or is cautioned against such an easy error. *Gymnema Sylvestre* is not so rare as Dr. Dymock says in his first edition of the "Vegetable Materia Medica of Western India." The reason of this remark is that, when he wanted to get in the Concan *Gymnema Sylvestre* under the Deccani name of "Kavli," he could not get it, as it is known here as "Kali kardori" (*i.e.*, black cord, from its use in tying firewood bundles,) as it was ascertained subsequently. Hemidesmus is, however, a plant rare, at least from my experience, in several places of the Thana Collectorate, Goa, and Poona, so much so that I can safely say that to every hundred of *Gymnema Sylvestre* about one or so of Hemidesmus will be found. Both these plants are found growing on similar soil and sometimes together. On one occasion the *Gymnema Sylvestre* was brought to supply the Medical Stores of Bombay, and would have been passed unnoticed as Hemidesmus had not the keen scientific eye of Dr. Dymock made it out. I myself on the first occasion when procuring Hemidesmus found it difficult to distinguish it from

Gymnema Sylvestre, but when the plant was in flower Dr. Dymock pointed out the difference, and thus I overcame the difficulty. Hemidesmus by its native name Anantamul is only known this side by the medical profession and a few others connected with Pharmacy. In the Salsette taluka it has no name because it is not considered to be a medicinal plant. In a few places it has a name, but, being confused with *Gymnema Sylvestre*, it is called "Kali kardori," being similarly useful. In the Southern Concan it is known by the name of "*Uparsare*," but not without some confusion. In the Deccan it is not distinguished from *Gymnema Sylvestre* and is known as "Kavli," the name of the latter plant. I have reason to believe that some who use the *Gymnema Sylvestre* believe it to be the true Hemidesmus. A medical man of considerable experience in the Deccan once told me that Hemidesmus was abundant there and it was known by its native name Kavli, being ignorant that "Kavli" was the name for *Gymnema Sylvestre*, and it was the latter plant which he took for Hemidesmus. Perhaps, being ignorant of this confusion and the very minute difference between the two plants, it does not occur to them to separate them by a very close examination.

The most distinguishing mark is the peculiar sweet aroma, nearly like that of Vanilla, of the root of the Hemidesmus plant which is absent in the other.

CAUTION.—To obtain genuine Hemidesmus, the labourer employed for the purpose of collecting should be paid by the day, and not by the amount collected, as in the latter case he will be tempted for the sake of profit to pass off as much *Gymnema Sylvestre* for Hemidesmus as he can. He must also, however, be made thoroughly conversant with the minutest differences in the two plants and be on his guard to avoid the mistake.

HOLARRHENA ANTIDYSENTERICA.

Although it is a well-known fact, as pointed out in the "Pharmacopœia of India," page 455, that there is a confusion in the selection of this plant, yet I find that the details given to distinguish it from others are not observed in procuring the true plant. The confusion which arises and which I wish to point out is due to its various native names here. I believe the various names of this plant and its varieties, *viz.*, Kura, Kuda, Kurwah, Koora, Kureya, are all dialectic corruptions of Kurwa (bitter) with adjectives "Pandra" "Daula" for white, "Tambra" for red, and "Kala" for black. Dr. Kirtikar, in his list of drugs under the natural order *Apocynaceæ*, presented to his summer session class in the Grant Medical College in 1894, while lecturing there on Botany, as a temporary measure, speaks of *Holarrhena antidysenterica* as "Pandra Kuda," *Wrightia tinctora* as "Kala kuda," and *Wrightia tomentosa* as "Tambda Kuda," "Kala Inderjow." Dr. Dymock mentions in the same natural order *Holarrhena antidysenterica* and calls it "Kureya," "Pandra Kura," "Daula Kura," "Karwa-inderjow," and *Wrightia tinctora*, "Kala Kura." In another natural order, *Rubiaceæ*,

he mentions *Hymenodictyon obovatum*, "Saphet Kura," and *Hymenodictyon excelsum*, "Kala Kurwah." So it is clear there are five different plants in two natural orders, "*Apocynaceæ*" and "*Rubiaciæ*," called by native names "Kuras" or "Kurwas," and I do not think the Hindustani name for *Holarrhena antidysenterica* is clear enough to distinguish it from other "Kurwahs." Further, the similarity of most of them to each other adds to the confusion of the names. The natives, ignoring the above varieties, make only two classifications of this plant, black and white, *viz.*, "Kala" and "Pandra" or "Daula," and even this distinction is not characteristic inasmuch as some call a variety *Pandra*, whereas others call it *Kala*, guided by the exterior appearance of the plant, which is variable either on account of its age or some other circumstance. In the native practice only the seeds are used, and I do not know how far their genuineness can be depended upon in the presence of such a confusion. The seeds are procured from the jholliwallahs or travelling vydias and professional herbalists or quacks, and they are paid by the weight of the drug, which is in fact a dangerous temptation. I believe the distinguishing marks of *Holarrhena antidysenterica* have been fully described in the "Pharmacopœia of India," and if the details therein given are strictly observed, the genuineness and purity of the drug will be secured, and I would suggest to those procuring or using it to collect either by paying for the labour or buying it from a reliable dealer. If the true plant is used, I have found it very efficacious as it was once believed to be.

BANDRA, *April* 1895. M. C. PEREIRA.

NOTE BY SURGEON MAJOR K. R. KIRTIKAR.

The *Hemidesmus*, which Mr. Pereira speaks of, should have been named specifically as *Hemidesmus indicus*, R. Br., of which the South Kokan name is उपरसाल (*Uparsal*) or उपलसरी (*Upalsari*) and not *Uparsare* as Mr. Pereira spells it, which is a lingual contortion of the proper name as uttered here. *Anantmul* is also a Marathi synonym of this plant not unknown in the Kokan. It may be added that (वाखंडी) *Wakandi* or वाकोंडी *Wakhondi* is also a Marathi name of *Gymnema Sylvestre* in the Dekkan. I remember that nearly ten years ago a plant was sent to me from Sholapur under that name for identification, as a plant deadening the taste for sweet things, especially cane sugar. The gentleman who sent it was a medical man practising in Sholapur at that time. It was Dr. Dharmaji Ganesh Kamat, L.M., who has since settled in Bombay and is practising there at present, having given up his appointment as a Railway Medical Officer at Sholapur.

No. XII.—MUSCULAR ACTION AFTER DEATH.

In thinking over the extraordinary statement made by your correspondent that he shot a snake into two pieces and saw each half run off into a tank 40 yards away as if they were nothing the worse for the damage, I beg to propound what appears to me a reasonable explanation of the difficulty.

Last monsoon, I on different days in my garden killed two pairs of snakes which were hanging on to the shrubs in a state of coition. In each case, before killing them, I thought there was only one snake, but when killing the one I saw that I had also to despatch its fellow.

Here then is my explanation. The snake your correspondent thought he had shot were two snakes in coition. He missed his aim, or did not greatly injure them, but so startled them that they parted, and rushed off for safety to the nearest water.

BOMBAY, *April*, 1895. D. GOSTLING, F.S.A.

With reference to note II on page 335, I will give my experience : —

I have in two instances cut a rock-snake, measuring about seven feet long, into two pieces at the middle. In one instance the snake was in the rafters of the roof of the cook-room at Matheran. I first pinned it with the prongs of a carving fork tied to a stick, then cut it into two pieces with a sword tied to another stick. When I released it, the fore half dropped on the floor quite alive, when I despatched it, the rear half remaining twisted in the rafters.

In the other case, I was travelling in Baroda territory with a native soldier as escort. I saw a snake twisted in the small branches of a bush by the road-side. I borrowed my escort's sword and cut the snake in two in the middle. In my excitement it seemed to me that I had missed the blow, for the snake went off with great rapidity ; he seemed to me to be of great length, fully fifteen feet long, and his head disappeared down a hole in the ground. I then pinned his body with the point of the sword near the cut, looked back at the bush, and found the rear half entwined in the branches as I had first seen it. The apparent great length was an optical illusion due to the rear half remaining in the bush while the fore half travelled on. With some difficulty I got the fore half out of the hole, very much alive, and despatched it. I made no attempt to watch how long the fore half would live in its mutilated condition. The rear half in each case was practically dead, though showing a slight muscular movement.

D. GOSTLING, F.S.A.

BOMBAY, 17*th April*, 1895.

No. XIII.—FISH LEAVING THE WATER.

It may interest the Society to read my experience of a fish travelling on dry land in our hot Indian sun. In the monsoon of 1893 I was in Porbandar, Kathiawar. It was in August, and there had been little or no rain for two months, and the crops had in many places perished for want of rain. At 1 p.m. during the heat of the day I was seated in the dry sandy bed of a river under a road bridge twelve miles from Porbandar. The sun was burning hot with a cloudless sky. While I was seated eating my tiffin I thought I saw a large fish jump into the air from a dry gravelly sand bank

in the middle of the river. Thinking I had seen nothing, I took no further notice, but went on with my tiffin. Five minutes after I again saw it jump up into the air some distance off. Then I left my tiffin and found the fish travelling over the gravel on its belly, moving rather slowly by means of its lower fins. I took it up by its tail. I found the skin quite dry. It at once wriggled loose. Again I took it up more firmly by the tail and put it into a small gravelly pool about three inches deep but too shallow for it to swim in. Then I took it out of the pool by its tail and dropped it into a pool three feet deep, where it immediately went to the bottom and remained motionless like a pike. I could see it at the bottom of this deep pool during the hour I remained at the bridge. The fish was fully twelve inches long and weighed over one pound. The river was dry except for the two pools I have mentioned, one of which was too shallow for the fish to swim in. Hence the reason for its going on its travels. The heat on the hot gravel was very great. I have on a flat terrace roof in Bombay registered 140° Fahr. with a thermometer laid on the roof. The heat on this gravelly bed must have been at least as great.

This fish had a dry hard skin. I do not recollect there being scales on its skin unless they were quite small. It was in perfectly good condition.

I suppose my word will be taken for the above description. I had with me a well-known pleader of Rajkot, also a well-known contractor of that place and four other people connected with the contractor, who all saw what I did and expressed their great surprise at a fish travelling on dry land in the great heat of after mid-day. I judge that the fish was leaping for the purpose of seeing which way it was travelling.

D. GOSTLING, F.S.A.

BOMBAY, 18*th April*, 1895.

No. XIV.—THE EDIBLE-NEST SWIFT.

I think it was eight or nine years ago that Mr. G. W. Vidal presented the museum of this Society with a skin and some eggs of that curious bird, *Collocalia unicolor*, Jerdon, which supplies the Chinese with the luxury of bird-nest soup. They were obtained from the Vingorla Rocks off the Rutnagherry coast. I believe that the China market is supplied mainly from the Indian Archipelago, and some account of the one place on our coast at which the bird breeds may be interesting to the ornithological members of the Society. The Burnt Islands, or Vingorla Rocks, consist of five or six small islands about nine miles from Vingorla, but not more than four miles from the coast in a direct line, the chief importance of which, from a nautical point of view, is that one of the principal lighthouses on the coast stands upon one of them. Their area is very small, and the height of the largest is only 110 feet. Rising abruptly out of deep water, they are accessible only when the sea is very smooth. Nothing grows on them except coarse grass, and there are of course no wild beasts, nor probably any snakes. The security

of such a situation has not escaped the notice of a species of tern, *Sterna anætheta*, Scop, which breeds on one of the islands in hundreds during the monsoon. I have pleasure in presenting the Society with some eggs collected by the lighthouse keepers. These men tell me that the birds lay their eggs on the ground, among the grass, so near each other that the sitting females almost touch, and when the birds rise together they make a cloud that darkens the air. The swifts do not breed on the same island as the terns, but on a smaller one, the peculiar structure of which is evidently the attraction. I was not able to effect a landing on this island, but the accounts I have received of it tally so exactly with a description quoted by P. H. Gosse of a breeding place near Java that I will extract a few sentences.

"In a little island on the coast of Java, called the Cap, Sir George Staunton found some caverns running horizontally into the side of the rock, in which were numbers of these birds' nests. 'They seemed to be composed of fine filaments, cemented together by a transparent viscous matter, not unlike what is left by the foam of the sea upon stones alternately covered by the tide, or those gelatinous animal substances found floating on every coast. The nests adhere to each other and to the sides of the cavern, mostly in rows without any break or interruption.' ° ° °'Their value is chiefly determined by the uniform fineness and delicacy of their texture; those that are white and transparent being most esteemed and fetching often in China their weight in silver.' ° ° °'When the birds become fledged it is thought time to seize upon their nests, which is done regularly thrice a year, and is effected by means of ladders of bamboos and reeds, by which the people descend into the cavern; but when it is very deep, rope ladders are preferred. This operation is attended with much danger and several break their necks in the attempt.'"

I think Sir G. Staunton must be mistaken when he says that the nests are taken after the young birds are fledged. They would be too dirty then to be of much value. They are taken as soon after they are completed as possible. Then the birds build again, and a second and again a third time the nests are taken. This is the chief reason, I believe, of the difference of quality. The nests, as we know now, are not made of any sort of *spuma maris*, but of a substance secreted by the enormously developed salivary glands of the bird—of spittle in short. In the first set of nests this material is nearly pure, and these are "first sort" nests. When the bird is forced to build again, it ekes out its exhausted supply of saliva with feathers, or other materials, and the nests are "second sort." The third collection is of still poorer quality.

It will be observed that Sir G. Staunton says the nest-hunters *descend* into the caverns. They do the same at the Vingorla Rocks. The caverns appear to be inaccessible from the water below, but there are small openings on the top of the island, through which ladders can be let down. This similarity in the situations selected by the birds is very curious. I have not heard of any necks being broken at the Vingorla Rocks, but the operation of getting the nests is admitted to be very dangerous.

The right to collect the nests is annually sold by Government, and thirty years ago used to realise from 200 to 250 rupees, but the value of the right has declined very much and this year only 41 rupees were obtained. The explanation offered by my informant was that the birds are forsaking the island because they do not like the proximity of the lighthouse. I suggested an alternative explanation by telling him that, if he regularly ate all the eggs that his hens laid and never gave them a chance of rearing a chicken, his poultry-yard would die out in time. He seemed to think that there was something to be said for my view, but preferred his own.

The nests, when collected, are taken to Bombay by the same class of men, I suppose, as those who go about the coast collecting sharks' fins and fish sounds, and are ultimately exported to China.

E. H. AITKEN.

No. XV.—DESCRIPTION OF THE LARVA OF *PAPILIO CLOANTHUS* WESTWOOD.

On 20th June, 1894, at Masuri, in the Western Himalayas, I found a larva of *Papilio cloanthus*, Westwood, on a large and common tree—not a shrub—identified as *Machilus odoratissima*, Nees, on which also feed the larvæ of *Papilio sarpedon*, Linnæus, *P. glycerion*, Westwood, and *P. govindra*, Moore.

The full-fed larva is 1½ inches long. The head and neck are contractile. The body is widest at the fifth segment, from which it tapers gradually to the thirteenth segment. The ridge over the head is furnished with two tubercles, black in front, white posteriorly. The fifth segment has a yellow bar which projects on each side beyond the body, and has the appearance of a yoke. The points of this yoke are black. Colour, green. The thirteenth segment is of a pale transparent blue-green. A pale yellow subdorsal line and an almost white spiracular line are the only markings. Head of a greenish-yellow. Legs, claspers, and abdomen of the same colour as the thirteenth segment. The thirteenth segment terminates in two sharp points which join at the end, so that the division between them is apparent only on a close examination.

BANKIPUR, BEHAR,
20th June, 1894.

MRS. S. ROBSON.

No. XVI.—LIFE-HISTORY OF *PAPILIO GLYCERION*, WESTWOOD.

Larva, when full-fed, 1⅜ to 1¼ inches in length. The fourth and fifth segments are the thickest, and the larva tapers from the fifth segment to the thirteenth.

Colour, green, of the same shade as the food-plant of the larva, the leaves of *Machilus odoratissima*, Nees. The whole larva is covered with minute black dots, except on the anal segment. The third segment is bordered anteriorly by a narrow ochreous ridge, which surmounts the head when drawn in, and is continued in unbroken spiracular lines to the tail.

This ridge or hood is furnished with two short, blunt, black, subdorsal spines. The fourth and fifth segments are furnished each with two subdorsal vermilion tubercles armed with a short black spine. The last segment is bifurcated, and the points are yellow tipped with black. These appendages are about $\frac{1}{32}$ of an inch apart at the base, and project outwards at an angle of about 15°. The legs, claspers, and abdomen are all of a whitish-green.

Pupa, 1 inch long. It is of a brighter green than the larva, and is marked longitudinally with four ochreous-yellow curved bars.

The larva described above was found at Masuri, in the Western Himalayas, in June, 1894. The pupa was kept in Masuri from June to October, and then brought down to Bankipur in the plains of Behar. The imago emerged at Bankipur to-day.

MRS. S. ROBSON.

PANKIPUR, BEHAR,
21*st March*, 1895.

No. XVII.—CUTTING A TIGER'S CLAWS.

For some time I had noticed that the claws of a fine male tiger in the public gardens here were growing into the flesh, so I determined to operate upon him, but unfortunately I adopted the resolution a bit too late, for on the night of the 25th February he began operations himself and tore out one of the claws of his left fore foot by the roots leaving an ugly sore. Matters therefore had to be pushed on at once. The cage in which the larger animals are sometimes transported was brought into requisition. This is a strong one six feet long by three feet six inches broad and four feet in height, consisting of a framework composed of four inch beams fitted with three-quarter inch bars of iron, one and-a-quarter inches apart on three sides; while the fourth side was a sliding door with bars one and-a-half inches apart. From the top of this cage I had a false ceiling hung, consisting of one inch teak boards padded with sacking filled with straw, and from the two ends of the cage I had a couple of bars removed to give room for the tiger's paws to come through. All was then ready. The patient was induced on the 28th February to enter the cage by placing his food in it, and now came the tug-of-war. The false ceiling was supported at the corners by ropes which were held up by men standing on the top of the cage, six long iron bars were then passed through the cage so as to rest on the false ceiling and the ends were manned by two men on each side. At a signal given by the superintendent of the gardens, the twelve men bore down on the ceiling while we anxiously awaited events; and to our great satisfaction we found that the men were able easily to press the tiger down and to keep him down for any length of time. Indeed so helpless was he that we were able to lever his legs about into the desired position, and so examined them one by one. The Superintendent had caused iron bars to be fixed horizontally opposite the openings at the end of the cage. A noose was fixed to the leg that was to be operated on and it was pulled through the opening and lashed on to the horizantal bar. The veterinarian

who was in attendance had only brought a saw which was useless, but the superintendent produced a pair of good rose clippers and very soon had all the claws cut. Some of them had grown into the flesh nearly an inch and had caused nasty sores, but the worst place of all was the toe from which the tiger had torn the claw. The bone was exposed, and there was a sinus about three inches long from which at least a hundred maggots were taken. It looked so bad that I almost made up my mind to shoot the poor beast there and then. However, the places were dressed with antiseptics and we agreed to see how they looked next day. The tiger seemed none the worse for the operation and took his food as usual. Next day the same process had to be gone through, but on this occasion only ten men manned the bars and pressed the tiger down, and we found them quite sufficient, the only difficulty was when the beast sat up, when no amount of pressure would induce him to bend his forelegs, the only thing then was to lever his hindquarters and throw him on his side, which was easily done. The wounds looked so much better that there seemed a prospect of their healing, so every day the tiger was thus pinioned and the sores dressed, and on the 15th April, after forty-five days confinement, he was put back into his own run completely cured and with all his claws in order.

H. S. FERGUSON, F.L.S.,
Hon. Secy., Govt. Public Gardens, Trevandrum.

26th April, 1895.

No. XVIII.—THE FOOD OF THE KRAIT.

A few days ago Mr. F. L. Muir, of this place, sent me a krait (*Bungarus arcuatus*) which he had killed while it was in the act of swallowing another snake (*Dipsas gokool*). He writes as follows :—" They were found about six o'clock in the morning on a sort of rockery, round one of the neem trees in our compound. I went out to see them and found the krait with only its head out of a hole in the rockery, gradually swallowing the other snake which was hanging down the rockery with its tail firmly twisted round a tuft of grass. I watched them for a long time, the krait very gradually getting the *Dipsas* further into its mouth. The exertion of doing this gradually drew it from its hole, and eventually the two fell to the ground and I killed them both." The *Dipsas* measured 2′ 9½″ and was much thicker than the krait, having a large lizard, a foot long, in its stomach. The krait measured only 2′ feet ; so it is difficult to see what would have eventually happened.

W. H. TRAILL.

JHANSI, *April*, 1895.

[As far as my experience goes the food of the krait consists almost entirely of other snakes, and we recently received a specimen which contained a young Dhâman (*Zamenis mucosus*) several inches longer than its host ; showing that the lesser *can* contain the greater, provided it is capable of expansion.—ED.]

No. XIX.—FOOD OF THE BULL-FROG.

I observe in the last number of the Society's Journal a note by J. Dundas Whiffin on the food of the bull-frog. I thought it was generally known that the food of the bull-frog is any living thing which he can get outside of. If it is not, I will give examples of his fare from my own experience.

Three times at least I have known a frog try to swallow a chicken. The chicken was rescued in each case while some of it was still outside, so it must ever remain uncertain whether the frog could have taken in the whole, or was making an attempt at what was beyond its powers. As far as I remember, the chickens were at least a week or two old, in fact they must have been more, for they were wandering far from the mother when seized.

Once I saw an enormous frog swallow the head of a snake about two feet long, and it was gulping down the body as you wind up a measuring tape, when the struggles of the snake became so violent that the frog tumbled with it into a tank, so the result of that experiment must also remain unknown.

Some months ago I caught a mouse in a trap and dropped it alive into a duck pond in the garden, in which there were several frogs. It had scarcely touched the surface of the water when a frog darted forward and the mouse disappeared. The thing was so quickly and neatly done that I am unable to assert that I saw the frog swallow the mouse, but there was no mouse thereafter for ever.

Finally, a friend of mine and a vice-president of B. N. H. Society once commissioned somebody to get him a frog for dissection, and a large bull-frog was brought to him in a very remarkable condition. It was globular and so hard that it would have made a good cricket ball. He proceeded to dissect it and took out a full-grown sparrow. If he is in the chair when this note is read, he will confirm my story.

A poisonous humour is secreted by the skin of the toad which makes most animals refuse it, but the frog mentioned by J. Dundas Whiffin acted quite in accordance with its nature in swallowing the toad first and thinking about that afterwards.

E. H. AITKEN.

RATNAGIRI DISTRICT,
7th May, 1895.

PROCEEDINGS

OF THE MEETING HELD ON 23RD OCTOBER, 1894.

A meeting of the members of this Society took place on Tuesday, the 23rd October, 1894, Brigade-Surgeon-Lieutenant-Colonel G. A. Maconachie presiding.

NEW MEMRERS.

The election of the following new members was announced:—

LIFE MEMBERS—H. H. Maharajah Jey Singh of Ulwar, and Mr. Goverdhundas Goculdas Tejpal (Bombay).

MEMBERS—Lieutenant Bertram A. G. Shelley, R. E. (Mhow); Hon. R. A. Forbes-Sempill (Bombay); Dr. Bhowanishanker Balchrishna Dadarkar, L. M. & S. (Dadar); Mr. A. G. Cardew, I.C.S., (Ootacamund); Mr. J. N. Dallaporta (Bombay); Mr. Samuel Haughton, C. C. S. (Ceylon); Mr. Charles E. Seal, M.R.C.S., L.R.C.P.E. (Sylhet); Rev. E. Browne (Ahmednugger); Mr. H. J. Landon (Tanna); Mr. H. E. John (Bombay); Captain H. V. Cox (Meerut); Mr. J. Maclean (Bombay); Mr. J. H. Vanderzee (Ellichpur); Captain F. T. Williams (Upper Burma); Surgeon-Captain F. W. C. Jones, A. M. S. (Mhow); Mr. H. N. Thompson (Burma); Surgeon-Lieutenant J. P. Morton, M.B. (Upper Burma); Mr. Arthur G. Chuckerbutty, I.C.S. (Bombay); Mr. J. G. Covernton (Bombay); Lieutenant A. E. Hatch (Hyderabad, Sind); Lieutenant C. O. O. Tanner (Hyderabad, Sind); and Mr. T. L. F. Beaumont (Kurrachee).

CONTRIBUTIONS.

The Honorary Secretary acknowledged the receipt of the following contributions since the last meeting:—

Contribution.	Description.	Contributor.
A quantity of Insects from Baroda district	.....	Mr. R. Bruce Foote.
1 Krait	Bungarus cæruleus	Mr. W. Thacker.
1 Cobra	Naga tripudians	Surg-Capt. J. Girvin.
16 Snakes' Eggs	Tropidonotus stolatus	Mr. W. Steers.
1 Himalayan Viper	Ancistrodon himalyanus	Mr. W. H. Traill.
1 Black Cobra	Naga tripudians	Mr. G. Elton.
1 Pied-crested Cuckoo (alive)	Coccystes jacobinus	Mr. N. S. Symons.
Some Snakes and Lizards from Beluchistan.	Psammophis leithii Echis carinata Zamenis mucosus Eremias velox Zamenis diadema Zamenis karelinii	Lieut.-Col. J. Babington Peile.
1 large Crab	Cancer integrifortes	Mr. W. Webb.
Indian Monitor (alive)	Varanus bengalensis	Mr. J. C. Maynard.
1 Chinkara's Skin and Horns.	Gazella bennetti	Mr. B. A. Gupte.
1 Indian Monitor	Varanus bengalensis	Do.

Contribution.	Description.	Contributor.
A number of Snakes	Bungarus cæruleus	Mr. R. P. Banerjee.
	Echis carinata	
	Vipera russelli	
1 Tortoise (alive)	Testudo elegans	Mr. H. F. Hatch.
1 Snake	Lycodon aulicus	Mr. G. R. Lowndes.
2 Florican Eggs	Sypheotides aurita	Surg.-Capt. Henderson.
1 Snake	Typhlops brahminus	Do.
1 Snake	Dipsas trigonata	Do.
1 Snake	Lycodon striatus	Do.
Indian Monitor.....	Varanus bengalensis	Do.
1 Phoorsa (alive)	Echis carinata	Do.
1 Dhaman (alive).....	Zamenis mucosus	Mr. H. McNee.
4 Crocodiles (alive)	Crocodilus palustris.....	Mr. H. Bulkley.
1 Snake (alive)	Homalopsis buccata	Capt. Forbes.
1 Snake (alive)	Dipsas trigonata	Mr. H. W. Barrow.
1 Cobra (alive)	Naga tripudians	Mr. D. Smith.
1 Clutch of Eggs of the Black-breasted Quail	Coturnix coromandelica	Mr. E. W. Campbell.
1 Kite (alive)	Milvus govinda.....	Mrs. Lees.
1 Snake	Zamenis ventrimaculatus ...	Capt. R. Light.
1 Lizard	Hemidactylus triedrus	Do.
1 Snake	Dipsas trigonata	Mrs. Hutchinson.
1 Black Cobra	Naga tripudians	Surg-Capt. Henderson.
A collection of N. Canara Ferns.	.....	Major T. Macpherson.
1 Painted Bat	Cerivoula picta	Mr. Fry.
1 Snake	Zamenis mucosus	Mr. C. E. Kane.
1 Spotted Owlet (alive)	Carine brama.....	Mr. T. Baker.
1 Snake	Typhlops brahminus	Major F. G. Mainwaring.
1 Snake (alive)	Do.	Mr. J. H. Hawkins.
2 Snakes (alive).....	Eryx johnii	Surg.-Capt. Henderson.
1 Small Indian Civet (alive).	Viverricula malaccensis	Mr. Jas. Dunlop.
2 Heads of 4-horned Rams...	Ovis aries	Mr. C. L. Smith.
1 Snake (alive).....	Eryx johnii	Rev. F. Dreckmann, S. J.
1 Snake	Vipera lebitana	Major R. C. Pentland.
Nest and Eggs of Common Wren Warbler	Drymœca inornata	Kumar Shri Juswunt Singji of Jamnugger.
2 Snakes (alive)	Dipsas trigonata	Surg.-Capt. J. Girvin.
2 Lizards (alive)	Varanus griseus.....	Surg.-Capt. R. S. F. Henderson.
1 Great Hornbill (alive) ...	Dichoceres cavatus	Mr. H. Ingle.
1 Indian Palm Civet (alive).	Paradoxurus niger	Mr. D. George.
1 Tree Viper (alive).....	Trimeresurus anamallensis...	Rev. F. Dreckmann, S. J.
A large pair of Koodoo Horns	Strepsicerous kudu	Surg.-Capt. H. F. Cleveland.
2 Geckos.....	Eublepharis maculatus	Mr. F. A. Ingle.
1 Snake (alive)	Zamenis diadema	Surg.-Capt. R. S. F. Henderson.
1 Snake (alive)	Dipsas ceylonensis	Hon'ble R. A. Forbes Sempill.
2 Snakes	Zamenis mucosus and Tropidonotus piscator	Mr. A. M. Caccia.
1 Indian Roller (alive)	Coracias indica.....	Mr. J. F. Snuggs.
1 Clutch of Eggs of the Blue-breasted Rail.....	Hypotænidia striata.....	Mr. N. S. Symons.
2 Eggs of the Sarus Crane...	Grus antigone	H. H. the Rajah of Dewas, J. B.

MINOR CONTRIBUTIONS.

From Mr. N. S. Symons, Major H. B. Thornhill, Mr. G. Hodding, Mr. W. Webb, Mrs. T. Gray Hill, Mrs. Birdwood, Mr. J. Stiven, Rev. F. N. Hill, Mr. H. N. Bhatkanday, Mr. H. Bricknell, Mr. D. Lindsay, Mr. N. P. DaCunha, Mr. E. W. Campbell, and Mr. F. Hutchinson.

CONTRIBUTIONS TO THE LIBRARY.

The Indian Forester, Vol. XX., Nos. 7, 8, and 9	In exchange.
Smithsonian Report for 1891	Do.
Annales de la Faculté des Sciences de Marseille	.....
Reminiscences of Sport in India, by Major-Genl. Burton	E. Y. Watson.
Etudes Critique de la Shells and Echideuden	Rev. F. Dreckmann, S. J.
Handbook of the Flora of Ceylon, Part II, by H. Trimen	The Author.
Actes de la Société Scientifique du Chili, Vol. IV, No. 1	In exchange.
Monographies D'Echinodermes vivans et Fossites (Louis Agassiz)	Rev. F. Dreckmann, S. J.
The Canadian Entomologist, Vol. XXVI., Parts 7 and 8	In exchange.
Journal Asiatic Society of Bengal, Vol. LXIII., Part II, No. 2	Do.
Verhandlungen Zoologisch-Botanischen esellschaftin Wein	Do.
Proceedings of the Linnæan Society of New South Wales, Vol. IX, Part 1	Do.
Abstract of the Proceedings of the Linnæan Society of New York for the year ending March 27, 1894	Do.
The Tin Mines and the Mining Industries of Perak and other papers, by L. Wray	.....
Victorian Naturalist, Vol. XI., Nos. 3, 4, and 5	In exchange.
Administration Report of the Madras Government Museum for the year 1893-94	.....
Records of the Zoological Survey of India, Vol. XXVII., Part 3	In exchange.
The Annual Report of the Zoological and Acclimatissation Society of Victoria for the year 1893	.....
Indian Museum Notes, Vol. III., No. 3	In exchange.
The Annual Report of the Provincial Museum Committee, London, for the year ending March 31, 1894.	.....
Pearl and Chank Fisheries of the Gulf of Manaar by Edgar Thurston, C.M.Z.S.	The Author.

MR. W. F. SINCLAIR, I.C.S. (RETIRED).

The following resolution was proposed by Dr. Maconachie :—"That the members of the Bombay Natural History Society wish to record their appreciation of Mr. W. F. Sinclair's services to this Society, in consideration of the numerous contributions he has made to the Museum, as well as for the valuable and interesting articles contributed by him to the journal." Dr. Maconachie said Mr. Sinclair was one of the original members of the Society, and he thought that it would not be right to allow him to leave India without the members expressing in some way their appreciation of all that he had done for them. The Museum contained a great number of Natural History specimens which had been collected by Mr. Sinclair at Allibag and elsewhere, whilst few of the journals had appeared without some interesting note or paper under his signature, or such as "Waters of Western India" under that of his *nom-de-plume* "Keswal."

Mr. R. C. Wroughton seconded the resolution, which was carried unanimously.

INDIAN WILD DUCKS.

The attention of the members was drawn to the circular on this subject, which was inserted in the journal just issued (No. 1, Vol. IX), and the Honorary Secretary said that he hoped that up-country members would not hesitate to send down all the specimens which they could obtain in addition to the notes particularly mentioned in the circular. This interesting subject could only be properly worked up by the co-operation of a large number of members.

GAME BOOKS.

The Honorary Secretary mentioned that these could be had by applying to the Society, and it was desirable that every local sportsman should possess one, so that a fairly complete record of the small game killed within a radius of forty miles of Bombay during this season might be obtained.

PAPERS READ.

The following papers were then read:—"*A Bison Calf*," by Major G. W. S. Rodon; "*Hybrid Francolins*," by Mr. G. W. Vidal, I. C. S.; *A Note on Birds from Central India in Barnes's "Handbook*," by Mr. W. T. Blanford; and "*Mule Breeding*," by Veterinary-Surgeon-Major Rayment.

A vote of thanks was passed to all the contributors, and the meeting then terminated.

PROCEEDINGS

OF THE MEETING HELD ON 28TH JANUARY, 1895.

A meeting of the members of this Society took place on Monday the 28th January, 1895, H. E. Rear-Admiral Kennedy presiding.

NEW MEMBERS.

The election of the following new members was announced :—H. H. the Maharaja of Bikanir, Major R. Fulton (Dharamsala), Lieut. Colin Campbell Renton (Jalna), Mr. K. R. Bomanjee, I.C.S. (Dhulia), Surgeon-Major P. J.

Damania (Bombay), Mrs. Hight (Nasik), Mr. J. H. Atterbury (Bombay), Mr. A. Jamieson (Ootacamund), Mr. Jamsetjee Nusserwanjee Tata (Bombay), Mr. J. Sanders-Slater (Bombay), Mr. J. Macfarlane (Mangalore), Mr. Charles B. Smales (Burma), Mr. Judah Hyam (Poona), Lieut. A. J. Peile, R.A. (Bombay), Mr. Samuel M. Johnson (Cawnpore), Captain David B. Thomson (Bombay), Mr. A. Kearns (Canara), Mr. A. E. Lowrie (Chanda), Mr. C. O. Hanson (Chanda), Mr. F. D. Whiffin (Singbhoom), Mr. Moulavi Shaikh Habeb-ud-din (Hyderabad), Mr. T. J. Ward (Bombay), Captain W. G. Hatherell (Bombay), Lieut. M. D. Goring-Jones (Mhow), Lieut. H. B. Rattray (Jhansi), Honorary Secretary of the Calcutta Zoological Society (Calcutta), Mr. P. R. Cadell, I.C.S. (Surat), Mr. Wm. Shipp, Jun. (Bombay), Surgeon-Captain G. B. French (Saugor), Mr. John Young (Rangoon), Mr. J. F. Bourdillon (Quilon), Mr. Wm. Mahon Daly (Yercaud), Mr. R. Foulkes (Yercaud), Surgeon-Major H. P. Dimmock (Bombay), Dr. Tribhuvandas Motichund Shah (Junagad), Professor O. V. Muller (Bombay), Miss Benson, M. D. (Bombay), Mr. G. H. Townsend (Bombay), Mr. R. Reeve (Bombay), and Mr. Jasee Shabudin (Surat).

CONTRIBUTIONS.

Mr. H. M. Phipson, the Honorary Secretary, acknowledged receipt of the following contributions since the last meeting :—

CONTRIBUTIONS TO THE MUSEUM.

Contribution.	Description.	Contributor.
1 Snake	Dipsas hexagonatus	Capt. G. H. Loch.
1 Large Cormorant	Phalacrocorax carbo	Mr. H. Bulkley.
1 Pair of abnormal horns of Blackbuck	Antelope cervicapra	Do.
1 Snake (alive)	Gongylophis conicus	Mrs. A. Reel.
1 Monitor	Varanus bengalensis	Mr. T. O'Leary.
2 Great Hornbills	Dichoceros cavatus	Capt. A. Fraser.
1 Snake	Tropidonotos piscator	Hon. Mr. Justice Jardine.
1 Snake	Gerardia prevostiana	Mr. A. Corrodi.
1 Snake	Coluber hodgsonii	Mr. H. Bicknell.
1 Snake	Eryx johnii	Mr. N. S. Symons.
1 Comb Duck (alive)	Sarcidiornis melanonotus	Do.
A Black Buck's head with only one horn	Antelope cervicapra	Mr. J. Sewell.
1 Chestnut Bittern (alive)	Ardetta cinamomeea	Mr. H. B. Thorburn.
1 Fishing Cat (alive)	Felis viverrina	Mr. J. F. Walke.
1 Cobra	Naga tripudians	Mr. A. C. Walker.
A number of birds' skins from the Naga Hills	.....	Capt. D. B. Thomson.
1 Monkey (alive)	Macacus sinicus	Major D. de Houghton.
The lower jaw of some extinct species of Rhinoceros	Rhinoceros sivalensis (?)	Mr. T. M. Cotgrave.
Teeth of Mastodon	Mastodon sp	Do.
1 Panther (alive)	Felis pardus	Mr. W.D. Sheppard., I.C.S.
1 Chamæleon	Chamæleon calcaratus	Mr. J. Du Boulay, I.C.S.
3 Daboias (alive)	Daboia elegans	Surg.-Capt. S. E. Prall.
1 Palm Civet (alive)	Paradoxurus niger	Mr. G. A. Gupte.
35 Birds' skins from Java	.....	Mr. E. J. Kerkhoven.
1 Indian Screech Owl (alive)	Strix javanica	Mrs. Fulton.
1 Saw Fish	Pristis pectinatus	Mr. A. Corrodi.

Contribution.	Description.	Contributor.
2 Young Wild-cats (alive) ...	Felis chaus.....	Mr. G. K. Wasey.
2 Black-headed Mynas (alive).....	Temenuchus pagodarum	Mrs. Dimmock.
1 Snake	Calophis trimaculatus	Mr. W. G. Betham.
1 Daboia	Daboia elegans	Mr. W. Thacker.
1 Cobra (alive).....	Naga tripudians	Mr. E. J. Ebden, I.C.S.
1 Clutch of Bronze winged Jacana's eggs.....	Parra indica	Mr. W. Shipp (jun.)
Nest of the Indian Palm Swift	Cypsellus batassiensis	Do.
2 Jackal-Cubs (alive)	Canis aureus	Mr. P. J. Tonkin.
A pair of Black-buck Horns, 25 inches	Antelope cervicapra.....	Mr. H. T. Ommaney, I.C.S.
1 Red-crested Pochard..... ..	Fuligula rufina.....	Mr. W. F. Jardine.
Nest and eggs of the black-bellied finch lark	Pyrrhulauda grisea	Mrs. A. C. Walker.
Fossil bivalves from Burma	.....	Mr. S. B. Bates.
1 Dhaman	Zamenis mucosus	Surgn.-Lt.-Col. Weir.
1 Skin of the marbled Teal...	Chaulelasmus angustirostris..	Capt. A. R. Hatch.
1 Gecko	Hemidactylus triedrus.....	Mr. Lester.
1 Hawk	Astur badius	Mr. B. A. Shelley.
1 Shrike.....	Lanius erythronotus.....	Do.
20 Birds' eggs	.....	Do.
1 Nukta Goose (alive).....	Sarcidiornis melanotus	Col. J. Biddulph.
42 Birds' eggs	.....	Capt. P. Z. Cox.
9 Pairs of Horns from Berbera.....	.....	Do.
A number of birds' nests.....	.....	Mr. W. Shipp (jun.)
A large collection of snakes and lizards.....	.....	Mr. F. Gleadow.
2 Young Wild Dogs (alive)..	Cyon dukhunensis.....	Mr. A. Elliott.

MINOR CONTRIBUTORS.

Messrs. W. Thaker, L. Penny, P. E. Myer, W. M. Bell, J. Moreau, James Moore, A. C. Walker, J. A. Betham, and C. R. Rose.

CONTRIBUTIONS TO THE LIBRARY.

The Indian Crustacea (Henderson), from the Author ; The Birds on the Byingyi Mountains (Oates), from the Author ; The Irish Naturalist, January to July, 1894, from W. F. Sinclair, C. S. ; The Canadian Entomologist, Vol. XXVI, Nos. 9 to 11, in exchange ; The Victorian Naturalist, Vol. XI, Nos. 6, 7, 8, in exchange ; Records of the Botanical Survey of India, Vol. I, Nos. 3, 4, from Government ; The Indian Forester, Vol. XX, No. 12, in exchange ; Records of the Geological Survey of India, Vol. XXVII, No. 4, in exchange ; Journal of the Asiatic Society of Bengal, Vol. LXIII, No. 3, in exchange ; Field and Garden Crops of the N. W. P., Part III (Duthie), from the Author ; Proceedings of the Linnæan Society of N. S. W., Vol. IX, No. 2, in exchange.

THE ACCOUNTS FOR 1894.

Mr. E. M. Slater, the Honorary Treasurer, placed before the meeting a statement of the accounts for the year ending 31st December, 1894, showing a balance at credit of Rs. 3,360-9-6. It was resolved that the accounts be passed subject to the usual audit.

PAPERS READ.

The following papers were then read :—1. Notes on the Thamin, or Brow-Antlered Deer (*Cervus eldi*), by Veterinary-Captain G. H. Evans; 2. The life-history of various Indian Butterflies, by Mrs. S. Robson ; 3. The Oorial, or Sha (*Ovis vignii*), by J. D. Inverarity; 4. Food of the Bull-Frog (*Rana tigrina*, by J. Dundas Whiffin ; 5. The poisonous properties of *Semecarpus anacardium*, by Surgeon-Major K. D. Kirtikar ; 6. Muscular action after death, by Captain L. H. Parry, R. A. ; 7. An addition to the Ophidian fauna of India, by G. A. Boulenger, F. R. S. ; 8. The power of mimicry in Canaries, by W. W. Squire.

An interesting discussion took place with reference to the various subjects contained in these papers, in which the following members joined :—H. E. Rear Admiral Kennedy, the Hon'ble Mr. G. W. Vidal, Mr. F. Gleadow, Mr. N. S. Symons, Surgeon-Major K. R. Kirtikar, and Dr. M. D. Cama.

The meeting terminated with a vote of thanks to the Chairman.

PROCEEDINGS

OF THE MEETING HELD ON 2ND APRIL, 1895.

A meeting of the members took place at the Society's rooms on Tuesday, the 2nd April, 1895, Mr. Robert C. Wroughton presiding.

NEW MEMBERS.

The election of the following new members was announced :—

H. E. Lord Sandhurst (Bombay), Lieutenant B. Waterfield, I.S.C. (Punjab), Major J. W. Wray (Cutch), Mr. T. E. Moultrie (Burma), Lieutenant Stanley S. Flower (Benares), Major G. A. Collins (Sirdarpore), Mr. Shalom Bapujee Israel (Janjira), Surgeon-Captain F. I. Wade-Brown (Bombay), Lieutenant George T. Robinson (Rawulpindi), Mr. T. Lawson Roberts (Bombay), Lieutenant F. H. Goldthorpe (Punjab), Mr. N. S. Brodie, I.C.S. (Chingleput), Mr. E. S. Currey (England), Mr. Rustom F. Seervai (Bombay), Mr. C. F. Egerton (Europe).

ELECTION OF OFFICE-BEARERS.

The following office-bearers were then duly elected :—

President—H. E. Lord Sandhurst.

Vice-Presidents—The Hon'ble Mr. H. M. Birdwood, Brig.-Surg.-Lt.-Col. G. A. Maconachie, and Dr. D. MacDonald.

Managing Committee—The Hon'ble Mr. H. M. Birdwood, Brig.-Surg.-Lt.-Col. G. A. Maconachie, Dr. D. MacDonald, the Hon'ble Mr. G. W. Vidal, I.C.S., Rev. F. Dreckmann, S.J., Surg.-Lt.-Col. T. S. Weir, Surg.-Major K. R. Kirtikar, Dr. J. C. Lisboa, Mr. J. D. Inverarity, Mr. W. S. Millard, Col. W. S. Bisset, R.E., Lt. H. E. Barnes, Mr. J. C. Anderson, Messrs. R. Gilbert, R. M. Branson, E. L. Barton, N. S. Symons, and R. C. Wroughton.

Honorary Treasurer—Mr. A. Abercrombie, *ex-officio*.

Honorary Secretary—Mr. H. M. Phipson, *ex-officio*.

GAME RECORDS.

The Honorary Secretary requested that members would now send in their records of game birds shot by them, in the neighbourhood of Bombay, during the past season, so that a summary might be published, in the Society's journal, in the same manner as in previous years.

CONTRIBUTIONS TO THE SOCIETY.

Mr. H. M. Phipson then acknowledged receipt of the following contributions to the Society's collection since the last meeting :—

Contribution.	Description.	Contributor.
1 Lammergeyer	Gypætus barbatus	Major A. L. Sinclair.
1 Fish	Platax teira	Mrs. Gilbert.
Land Shells, from Aden	.....	Lieut. A. J. Peile, R.A.
1 Cheetah (alive)	Cynælurus jubatus	Capt. D. O. Morris.
1 Nilghai	Portax pictus	Do.
1 Phoorsa	Echis carinata	Mr. E. H. Elsworthy.
Nest and Eggs of the Rufous-tailed Babbler	Malacocercus somervilli	Mr. A. C. Walker.
1 Box Fish	Ostracion cubicus	Capt. T. Thorburn.
1 Snake	Typhlops brahminus	Do.
A Collection of Moths and other Insects	.....	Mr. E. H. Aitken.
5 Snakes	Silybura brevis Ancistrodon hypnale Trimeresurus strigatus T. anamallensis Chrysopelea ornata	Do.
1 Widgeon	Mareca penelope	Mr. M. D. Mackenzie.
1 Avocet	Recurvirostra avocetta	Do.
1 Florican	Sypheotides aurita	Genl. H. Anderson.
1 Spotted Owlet	Carine brama	Mr. A. M. Tod.
1 Bittern	Botaurus sinensis	H. H. the Rao Saheb of Cutch.
1 Snake	Lycodon aulicus	Mr. W. Murray.
1 Barbet's Nest	Xantholæma hæmacephala	Mr. W. Shipp.
2 Rock Horned Owls (alive)	Bubo bengalensis	Mrs. McCorkell.
Eggs of Iora	Iora tiphia	Miss M. Horne.
Eggs of Dabchick	Podiceps minor	Do.
1 Red-headed Merlin	Falco chiquera	Mr. W. Shipp.
1 Cobra (alive)	Naga tripudians	Rev. F. Dreckmann, S.J.
3 Phoorsa (alive)	Echis carinata	Do.
1 Brown Tree Snake (alive)	Dipsas trigonata	Do.
Pigeon's Eggs	Columbia intermedia	Mr. J. W. Hind.
1 Screech Owl	Strix javanica	Mr. Le Maistre.
1 Coronetted Sand Grouse	Pterocles coronatus	Major R. Fulton.
A number of Butterflies from Bangalore	.....	Capt. E. Y. Watson.
1 Lammergeyer	Gypætus barbatus	Genl. W. L. Symons.
Pariah Kites' Eggs	Milvus govinda	Mr. J. Brand.
Spotted Owlets' Eggs	Carine brama	Do.
White-breasted Water Hens' Eggs	Hypotænidia striata	Do.
Nest of Tickel's Flower-Pecker	Dicæum erythrorhynchus	Mrs. Pearson.
1 Marmoset (alive)	Hapale vulgarus	Mr. D. Glade.
A collection of Shells from Port Blair	.....	Purchased through Capt. T. Finny.

Contribution.	Description.	Contributor.
1 Cobra	Naga tripudians	Mr. W. Murray.
4 Young Hyænas (alive)	Hyæna striata	Mrs. W. Betham.
2 Antelopes (alive)	Antelope cervicapra	Surg.-Capt. J. Lloyd-Jones.
1 Pelican	Pelecanus javanicus	Mr. H. Bulkley.
Head of African Wart-Hog	Phacochœrus æthiopicus	Capt. P. Z. Cox.
19 Birds' Skins from Central Asia	.....	Lieut. E. G. Farquharson, R. E.
1 Long-tailed Field Mouse (alive)	Vandeluria oleracea	Miss N. Otto.
1 Spotted Owlet (alive)	Carine brama	Mrs. Pearson.
1 White-winged Wood-duck	Anas leucoptera	Mr. C. W. A. Bruce.
1 Solitary Snipe	Gallinago solitaria	Do.
A collection of Insects from Mysore	.....	Mr. P. H. R. Lee.
1 Daboia	Daboia russellii	Surg.-Lieut.-Col. Weir.

MINOR CONTRIBUTIONS.

From Mr. H. Bicknell, Lieut. S. H. Close, Mr. S. Rebsch, Mr. J. L. Orr, and Mr. L. Stansfield.

CONTRIBUTIONS TO THE LIBRARY.

The Irish Naturalist, for January and February, from Mr. W. F. Sinclair, C.S.; The Zoological Record, Vol. XXX, from Mr. W. F. Sinclair, C.S.; The Victorian Naturalist, Vol. XI, No. 9, in exchange; Proceedings of the Manchester Lit. and Phil. Soc., Vol. IX, No. 1, in exchange; On the Diseases of Cattle in India (Vet.-Capt. S. Mills), from the author; The Canadian Entomologist, Vol. XXVII, in exchange; Notes and Jottings from Animal Life (Frank Buckland), from Mr. H. W. Buckland; Log Book of a Fisherman (Frank Buckland), from Mr. H. W. Buckland; Natural History of British Fishes, from Mr. H. W. Buckland; Birds of India (Jerdon), from Mr. H. W. Buckland; Entomological Soc. of Ontario (Report), in exchange; Proceedings of the Zoological Society of France, 1894, in exchange; Fauna of British India (Moths), Vol. III, from Mr. W. F. Sinclair, C.S.; Photographs of a Tiger, from Private D. Pearce; Handbook of S. Australia, from Government.

The following papers were then read and a vote of thanks was passed to the authors:—(1) The Cheetal or Spotted Deer, by J. D. Inverarity; (2) Collecting Ways and Collecting Days, No. II., by Colonel C. T. Bingham; (3) Indian *Arachnida*: The Species of *Gnleodidæ* inhabiting India and Ceylon, by R. I. Pocock; (4) A Key to the Asiatic genera of the *Hesperiidæ*, by Captain E. Y. Watson, F.E.S., F.Z.S.; Miscellaneous Notes—(*a*) The Identification of Birds by E. W. Oates; (*b*) The Occurrence of *Gerardia prevostiana* in the neighbourhood of Bombay, by H. M. Phipson, C.M.Z.S.; (*c*) Spurs of the Red Spurfowl, by General C. F. Sharpe; (*d*) On the size of Mango Trees, by R. M. Dixon; (*e*) The Southern Indian Harrier Eagle, by William Mahon Daly; (*f*) Periodical Flowering of *Strobilanthes hunthianus*, by William Mahon Daly. (*g*) The Birds of the Bombay Presidency, by J. Davidson, I.C.S.

Index to Volume IX.

Names of New Genera and Species have an asterisk (*) prefixed.

Specific Names are written with a small initial letter; Generic, Sub-family, Family, and Order Names are written with a capital initial letter.

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