TRANSACTIONS

OF THE

ENTOMOLOGICAL SOCIETY

OF

LONDON.

THE

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OF THE

ENTOMOLOGICAL SOCIETY

OF

LONDON

FOR THE YEAR

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EXPLANATION OF THE PLATES.

ERRATA AND ADDENDA.

TRANSACTIONS.

Page 104, line 12, for *Hereogenea* read *Heterogenea*.
Page 126, line 1, for *Mardaria* read *Mardara*.
Page 164, line 2 from bottom, for *Numens* read *Numenes*.
Page 269, line 9, for *cinnabarina*, sp.n., read *cinnabarina*, Fairm.
Page 286, as a Footnote to line 19, add:—These two nymphs form the subject of an article by Mr. Lillie, in Trans. New Zeal. Instit. (vol. xxxi., pp. 164—169, pls. xiv.—xix.). *Deleatidium* (referred to *Atalophlebia scita*) has the tracheal branchiæ of the 1st abdominal segment reniform, unlike those of the other segments. They are missing in the specimen received.
Page 353, lines 16 and 15 from bottom, for the south-western part of the Altai (near Semipalatinsk) read Mt. Chaman, south of Minusinsk on the Mongolian frontier.
Page 358, line 12, for Iris, viii. read Iris, vii.
Page 364, after line 1 insert:—I found this species first in the Tchuya valley on June 18th. It was abundant in the Kurai steppe on June 20th, and was common also in the high mountains up to nearly 8000 feet in July. It has a peculiar weak, low flight, and always settles on grass.
Page 444, last line, for *Ayr* read *Agricultural*.
Page 450, line 12, for *tormentosus* read *tomentosus*.
Page 461 line 22, for *Apimorpha* read *Apiomorpha*.

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1876 † Horniman, Fredk. John, M.P., F.L.S., F.Z.S., &c., *Surrey Mount, Forest Hill*, S.E.
1865 † Hudd, A. E., "*Clinton,*" *Pembroke-road, Clifton, Bristol.*
1888 Hudson, George Vernon, *The Post Office, Wellington, New Zealand.*
1897 Image, Selwyn, M.A., 6, *Southampton-street*, W.C.
1893 Irby, Lieutenant-Colonel Leonard Howard Loyd, F.L.S., F.Z.S., 14, *Cornwall-terrace, Regent's Park*, N.W.
1891 Isabell, The Rev. John, c/o *Rev. Charles Courteney, St. Peter's Vicarage, Tunbridge Wells.*

1886 Jacoby, Martin, 7, *Hemstall-road, West Hampstead*, N.W.
1892 Jaffrey, Francis, M.R.C.S., L.R.C.P., 8, *Queen's-ride, Barnes*, S.W.

1869 Janson, Oliver E., *Cestria, Claremont-road, Highgate*, N ; and 44, *Great Russell-street, Bloomsbury*, W.C.
1898 Janson, Oliver J., *Cestria, Claremont-road, Highgate*, N.
1886 Jenner, James Herbert Augustus, *Eastgate-house, Lewes.*
1899 Jennings, F. B., 152, *Silver-street, Upper Edmonton, N.*
1886 John, Evan, *Llantrisant, Pontyclun*, R.S.O., *Glamorganshire.*
1889 Johnson, The Rev. W. F., M.A., *Acton Rectory, Poyntz Pass, Co. Armagh.*
1888 Jones, Albert H., *Shrublands, Eltham.*
1894 Jones, Frederic Whitworth, *Cleef, Vryburg, British Bechuanaland, Africa.*
1894 † Jordan, Dr. K., *The Museum, Tring.*

1884 Kane, W. F. de Vismes, M.A., M.R.I.A., *Drumleaske House, Monaghan.*
1884 Kappel, A. W., F.L.S., *Hilden*, 18, *Sutton Court-road, Chiswick*, W.
1876 † Kay, John Dunning, *Leeds.*
1896 † Kaye, William James, *Worcester Court, Worcester Park, Surrey.*
1884 Keays, F. Lovell, F.L.S., 26, *Charles-street, St. James's*, S.W.
1890 Kenrick, G. H., *Whetstone, Somerset-road, Edgbaston, Birmingham.*
1898 Kershaw, J. A., *Morton Banks, Lewisham-road, Windsor, Melbourne, Victoria.*
1889 King, J. J. F. X., 207, *Sauchiehall-street, Glasgow.*
1861 Kirby, William F., F.L.S., *Hilden*, 18, *Sutton Court-road, Chiswick*, W.
1893 Kirkaldy, George Willis, *St. Abbs, Worple-road, Wimbledon*, S.W.
1889 Klapálek, Professor Franz, *Karlins Palacky-str.* 20, *Prague, Bohemia.*
1887 † Klein, Sydney T., F.L.S., F.R.A.S., *Hatherlow, Raglan-road, Reigate.*
1876 Kraatz, Dr. G., 28, *Link-strasse, Berlin.*
1895 Krantz, Paul, *Box* 413, *Pretoria, Transvaal, South Africa.*

1868 Lang, Colonel A.M., R.E., *Box Grove Lodge, Guildford.*
1895 Latter, Oswald H., M.A., *Charterhouse, Godalming.*
1899 Lea, Arthur M., Government Entomologist, *Hobart, Tasmania.*
1887 † Leech, John Henry, B.A., F.L.S., F.Z.S., F.R.G.S., &c., *Bulbridge House, Wilton, Salisbury.*
1883 Lemann, Fredk. Charles, *Blackfriars House, Plymouth.*
1892 Leslie, J. H., *Bryn Glas*, 33, *Streathbourne-road, Upper Tooting*, S.W.
1898 Lethbridge, Ambrose G., *Glynde Place, Lewes.*
1898 Lewis, E. T., 4, *Elwick-road, Ashford.*
1876 Lewis, George, F.L.S., *St. Regulus, Archer's-road, Southampton.*

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1886 Livett, H. W., M.D., *Wells, Somerset.*
1865 † Llewelyn, Sir John Talbot Dillwyn, Bart., M.A., M.P., F.L.S., *Penllergare, Swansea.*
1881 † Lloyd, Alfred, F.C.S., *The Dome, Bognor.*
1885 † Lloyd, Robert Wylie, *St. Cuthberts, Thurleigh-road, Balham,* S.W.
1899 Lounsbury, Charles P., B.Sc., Government Entomologist, *Cape Town, S. Africa.*
1894 Lowe, The Rev. Frank E., M.A., *St. Stephen's Vicarage, Guernsey.*
1850 Lowe, W. H., M.D., *Woodcote Lodge, Inner Park-road, Wimbledon Park,* S.W.
1893 Lower, Oswald B., *Bleak House, Park Side, Adelaide, South Australia.*
1898 Lucas, W. J., B.A., 12, *Caversham-road, Kingston-on-Thames.*
1880 Lupton, Henry, *Lyndhurst, North Grange-road, Headingley, Leeds,*

1887 M'Dougall, James Thomas, *Dunolly, Morden-road, Blackheath,* S.E.
1851 † M'Intosh, J.
1888 Mackinnon, P. W., *Lyndale, Mussoorie, N.W.P., India.*
1858 McLachlan, Robert, F.R.S., F.L.S., F.Z.S., Treasurer, *Westview,* 23, *Clarendon-road, Lewisham,* S.E.
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1895 Marshall, G. A. K., *The Master's Office, Salisbury, Mashonaland, South Africa.*
1896 Marshall, P., M.A., B.Sc., F.G.S., *Grammar School, Auckland, New Zealand.*
1865 Marshall, The Rev. Thos. Ansell, M.A., *Ucciani, Ajaccio, Corsica.*
1856 † Marshall, William, *Auchinraith, Bexley, S.O., Kent.*
1897 Martineau, Alfred H., *Solihull, Birmingham.*
1874 † Mason, Philip Brookes, M.R.C.S., F.L.S., *Trent House, Burton-on-Trent.*
1895 Massey, Herbert, *Ivy-Lea, Burnage, Withington, Manchester.*
1865 Mathew, Gervase F., R.N., F.L.S., F.Z.S., F.R.G.S., *Lee House, Dovercourt, Harwich.*
1887 Matthews, Coryndon, *Stentaway, Plymstock, Plymouth.*
1899 May, Harry Haden, *Redlands, Hillbury-road, Upper Tooting,* S.W.
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1872 † Meldola, Professor Raphael, F.R.S., F.C.S., 6, *Brunswick-square* W.C.

1885 Melvill, James Cosmo, M.A., F.L.S., *Brook House, Prestwich, Manchester.*
1887 Merrifield, Frederic, 24, *Vernon-terrace, Brighton.*
1888 Meyer-Darcis, G., c/o Sogin and Meyer, *Wohlen, Switzerland.*
1880 Meyrick, Edward, B.A., F.Z.S., *Elmswood, Marlborough.*
1894 Miall, Professor Louis Compton, F.R.S., 8, *Spring-road, Headingley, Leeds.*
1883 Miles, W. H., *The New Club, Calcutta.*
1896 Moberly, J. C., M.A., 9, *Rockstone-place, Southampton.*
1879 Monteiro, Dr. Antonio Augusto de Carvalho, 70, *Rua do Alecrinar, Lisbon.*
1853 Moore, Frederic, D.Sc., A.L.S., F.Z.S., 17, *Maple-road, Penge*, S.E.
1899 Moore, Harry, 12, *Lower-road, Rotherhithe.*
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1889 † Morice, The Rev. F. D., M.A., Fellow of Queen's College, Oxford, *Brunswick, Mount Hermon, Woking.*
1895 † Morley, Claude, *Ipswich.*
1893 Morton, Kenneth J., 13, *Blackford-road, Edinburgh.*
1882 Mosley, S. L., *Beaumont Park, Huddersfield.*
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1872 † Murray, Lieut.-Col. H., 43, *Cromwell Houses, Cromwell-road*, S.W.

1896 Nesham, Robert, *Utrecht House, Queen's-road, Clapham Park*, S.W.
1889 Nevinson, Basil George, M.A., F.Z.S., 3, *Tedworth-square, Chelsea*, S.W.
1890 Newstead, R., *The Museum, Chester.*
1882 Nicéville, Lionel de, F.L.S., C.M.Z.S., *Indian Museum* ; and 1, *Sudder-street, Calcutta.*
1895 Nicholson, Charles, 202, *Evering-road, Clapton*, N.E.
1886 Nicholson, William E., *School Hill, Lewes.*
1893 Nonfried, A. F., *Rakonitz, Bohemia.*
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1886 Norris, Herbert E., 15, *Market-place, Cirencester.*
1878 Nottidge, Thomas, *Ashford, Kent.*
1895 Nurse, Captain C. G., F.R.G.S., Indian Staff Corps, *Deesa, India.*

1869 Oberthür, Charles, *Rennes (Ille et Vilaine), France.*
1877 Oberthür, René, *Rennes (Ille et Vilaine), France.*
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1895 Page, Herbert E., *Bertrose, Gellatly-road, St. Catherine's Park*, S.E.
1898 Palliser, H. G., Chief Engineer, P.W.D., *Karachi, India.*
1893 Paulcke, Wilhelm, 4, *Marienstrasse, Freiburg im Breisgau, Germany.*
1897 Peers, C. R., M.A., 107, *Grosvenor-road*, S.W.
1883 Péringuey, Louis, *South African Museum, Cape Town, South Africa.*
1879 Perkins, Vincent Robt., *Wotton-under-Edge.*
1897 Phillips, Hubert C., M.R.C.S., 262, *Gloucester-terrace, Hyde Park*, W.
1891 Pierce, Frank Nelson, 1, *The Elms, Dingle, Liverpool.*
1885 Poll, J. R. H. Neerwort van de, *Heerengracht* 476, *Amsterdam.*
1870 † Porritt, Geo. T., F.L.S., *Crosland Hall, Huddersfield.*
1884 † Poulton, Professor Edward B., M.A., F.R.S., F.L.S., F.G.S., F.Z.S., Hope Professor of Zoology in the University of Oxford, *Wykeham House, Banbury-road, Oxford.*
1851 Preston, The Rev. Thomas Arthur, M.A., F.L.S., *Thurcaston Rectory, Leicester.*
1878 Price, David, 48, *West-street, Horsham.*
1893 Prout, Louis Beethoven, 246, *Richmond-road, Dalston*, N.E.

1898 Quail, Ambrose, *Palmerston North, New Zealand.*

1874 Reed, Edwyn C., C.M.Z.S., *Rancagua, Chili.*
1893 Reid, Captain Savile G., late R.E., *The Elms, Yalding, Maidstone.*
1891 Reid, William, *Pitcaple, R.S.O., Aberdeenshire.*
1898 Relton, R. H., c/o Perkins and Co., Ltd., *Brisbane, Queensland.*
1890 Rendlesham, The Right Honble. Lord, *Rendlesham Hall, Woodbridge.*
1898 Reuter, Professor Enzio, *Helsingfors, Finland.*
1886 Rhodes, John, 360, *Blackburn-road, Accrington.*
1891 Richardson, Nelson M., B.A., *Monte Video, Weymouth.*
1894 Riding, William Steer, B.A., M.D., *Buckerell Lodge, Honiton.*
1853 Ripon, The Most Noble the Marquis of, K.G., D.C.L., F.R.S., F.L.S., etc., 9, *Chelsea Embankment*, S.W.
1892 Robinson, Sydney C., *Goldsmith's Hall*, E.C.
1869 † Robinson-Douglas, William Douglas, M.A., F.L.S., F.R.G.S., *Orchardton, Castle Douglas.*
1890 Robson, John Emmerson, *Hartlepool.*
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1868 Rothney, George Alexander James, 8, *Versailles-road, Anerley*, S.E.
1894 † Rothschild, The Honble. Nathaniel Charles, F.Z.S., 148, *Piccadilly*, W. ; and *Tring Park, Tring.*
1888 † Rothschild, The Honble. Walter, D.Sc., M.P., F.Z.S., 148, *Piccadilly*, W. ; and *Tring Park, Tring.*

1890 Routledge, G. B., *Tarn Lodge, Heads Nook, Carlisle.*
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1892 Russell, S. G. C., 19, *Lombard Street,* E.C.
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1886 Salwey, Reginald E., *Sungate, Hook-road, Kingston-on-Thames.*
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1886 Saunders, Prof. Wm., *Central Experimental Farm, Ottawa, Canada.*
1881 Scollick, A. J., *Boldrewood, Ditton Hill, Surbiton, Kingston-on-Thames.*
1864 Semper, George, c/o Bernhard Beer, Esq., 10, *Newgate-street,* E.C.
1862 Sharp, David, M.A., M.B., F.R.S., F.L.S., F.Z.S., *Hawthorndene, Hills-road, Cambridge* ; and *University Museum of Zoology and Comparative Anatomy, Cambridge.*
1883 Shaw, A. Eland, M.R.C.S., *Althorpe, Doncaster.*
1883 † Shelley, Capt. George Ernest, F.G.S., F.Z.S., 10, *Thurloe-square,* S.W.
1887 Sich, Alfred, *Brentwood,* 65, *Barrowgate-road, Chiswick,* W.
1887 Sidgwick, Arthur, M.A., Fellow of Corpus Christi College, Oxford, 64, *Woodstock-road, Oxford.*
1895 Smith, W. W., *Ashburton, Canterbury, New Zealand.*
1885 South, Richard, 96, *Drakefield-road, Upper Tooting,* S.W.
1897 Sparke, E. G. J., B.A., 1, *Christchurch-Villas, Tooting Bec-road,* S.W.
* † Spence, William Blundell, *Florence, Italy.*
1889 Standen, Richard S., F.L.S., *Thorpe-hall, near Colchester.*
1898 Stares, C. L. B., M.R.C.S., L.R.C.P., *The Infirmary, Wandsworth,* S.W.
1890 Stearns, A. E., 99, *Gloucester-terrace, Hyde Park,* W.
1897 Stebbing, E. P., Indian Forest Service, c/o King, Hamilton and Co., *Calcutta.*
1898 Stebbing, Henry, *The Shawe, Jarvis Brook, Tunbridge Wells.*
1862 Stevens, John S., 4, *Pope's Grove, Twickenham.*
1889 Straton, C. R., F.R.C.S., *West Lodge, Wilton, Salisbury.*
1896 Strickland, A. Gerald, 28, *Elm Park-gardens,* S.W.
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1882 Swanzy, Francis, *Stanley House, Granville-road, Sevenoaks.*
1884 Swinhoe, Colonel Charles, M.A., F.L.S., F.Z.S., *Avenue House, Oxford.*
1894 Swinhoe, Ernest, *Avenue House, Oxford.*
1876 Swinton, A. H., c/o General Callender, *Vineyard, Totnes.*

1893 Taylor, Charles B., *Rae-street, Rae Town, Kingston, Jamaica.*
1892 Taylor, The Rev. George W., F.R.S. (Canada), *St. Alban's Rectory, Nanaimo, British Columbia.*
1886 Theobald, F. V., M.A., Lecturer in Economic Entomology and Zoology to the South Eastern Agricultural College, *Wye Court, near Ashford, Kent.*
1892 Thornley, the Rev. A., M.A., F.L.S., *South Leverton Vicarage, Lincoln.*
1897 Tomlin, B., *West Lodge, Stancliffe Hall, Matlock.*
1893 Townsend, Professor C. H Tyler, *Las Cruces, New Mexico, U.S.A.*
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1893 Turner, Henry Jerome, 13, *Drakefell-road, St. Catharine's Park, Hatcham,* S.E.
1894 Turner, Thomas, *Cullompton.*
1886 Tutt, J. W., *Rayleigh Villa, Westcombe Hill,* S.E.

1893 Urich, Frederick William, *Port of Spain, Trinidad, British West Indies.*

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1866 Verrall, George Henry, President, *Sussex Lodge, Newmarket.*
1897 Vice, William A., M.B., 5, *Belvoir-street, Leicester.*
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1897 Wainwright, Colbran J., 2, *Handsworth Wood-road, Handsworth, Birmingham.*
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1878 Walker, James J., R.N., F.L.S., Secretary, H.M.S. "Katoomba," *Sydney, N.S.W.*
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1866 † Walsingham, The Right Honble. Lord, M.A., LL.D., F.R.S., F.L.S., F.Z.S., High Steward of the University of Cambridge, *Merton Hall, Thetford* ; and 66*a*, *Eaton-square,* S.W.
1886 Warren, Wm., M.A., 80, *Frithville-gardens, Shepherd's Bush,* W.
1869 Waterhouse, Charles O., *Ingleside, Avenue-gardens, Acton,* W. ; and *British Museum (Natural History), Cromwell-road,* S.W.

1893 Webb, John Cooper, 218, *Upland-road, Dulwich*, S.E.
1876 † Western, E. Young, 36, *Lancaster Gate, Hyde Park*, W.
1886 Wheeler, Francis D., M.A., LL.D., *Paragon House School, Norwich.*
1884 White, William, *The Ruskin Museum, Meersbrook Park, Sheffield.*
1896 Wileman, A. E., c/o H.B.M.'s Consul, *Kobe, Japan.*
1894 Wilson, Edwin, *Post Office-terrace, Cambridge.*
1894 Wolley-Dod, F. H., Box 225, *Calgary, Alberta, N.W.T., Canada.*
1881 Wood, The Rev. Theodore, 157, *Trinity-road, Upper Tooting*, S.W.
1899 Wooley, H. S., 1, *Park-road, Greenwich*, S.E.; and 68, *Third-place, Brooklyn, N. Y., U.S.A.*
1891 Wroughton, R. C., Conservator of Forests, Indian Forest Service, *Poona, Bombay Presidency, India*; and c/o Army and Navy Co-operative Society, Ltd., 105, *Victoria-street*, S.W.

1888 Yerbury, Colonel John W., late R.A., F.Z.S., *Army and Navy Club, Pall Mall*, S.W.
1892 Youdale, William Henry, F.R.M.S., 29, *Market Place, Cockermouth.*

ADDITIONS TO THE LIBRARY

During the Year 1899.

Barrett (C. G.). Lepidoptera of the British Isles. Vol. V., Heterocera: Noctuæ. 8vo, London, 1899. *The Publishers.*

Becker (L.). Les Arachnides de Belgique. 4 vols., fol., Bruxelles, 1896. *Mus. d'Hist. Nat. Belgique.*

Berg (C.). Duæ species novæ Argentinæ *Gyponæ* generis.
[An. Soc. Cien. Argentina, Tomo XLVII., 1899.]

Observaciones sobre Lepidopteros Argentinos y otros Suda Americanos.
[An. Mus. Nac. Buenos Aires, Tomo VI., 1899.]

Brenthis Cytheris y Brenthis Dexamene.

Apuntes dipterologicos.
[Com. Mus. Nac. Buenos Aires, Tomo I., 1899.] *The Author.*

Sobre les enemigos pequeños de la Langosta peregrina, *Schistocerca paranensis* (Burm.).

Sobre el *Thelyphonus maximus*, Tarnani.

Descriptio novi generis Cerambycidarum Reipublicæ Argentinæ.
[Com. Mus. Nac. Buenos Aires, Tomo I., 1898.] *The Author.*

Bignell (G. C.). The Ichneumonidæ (Parasitic Flies) of the South of Devon.
[Trans. Devon. Assoc. Sci. Lit. and Art, Vol. XXX., 1898.]
The Author.

Burr (M.) Further new Species of Forficularia.
[Ann. and Mag. N. H., Ser. 7, Vol. III., 1899.]

Notes on the Forficularia.
[Ann. and Mag. N. H., Ser. 7, Vol. IV., 1899.] *The Author.*

Cambridge (F. O. P.). [See Godman (F. D.). Biologia Centrali-Americana.]

Cambridge (O. P.). [See Godman (F. D.). Biologia Centrali-Americana.]

Cambridge Natural History, Vol. VI. Insects, Part II. By Dr. D. Sharp, Cambridge, 1899. *The Author.*

Candèze (E.) Obituary Notice of [see Lameere].

Champion (G. C.). Supplementary Lists to the Munich Catalogue of Coleoptera:—Lagriidæ, Othniidæ, Nilionidæ, Petriidæ, Pythidæ, Melandryidæ, Pedilidæ (part), Pyrochroidæ, Mordellidæ, Rhipidophoridæ, Œdemeridæ, and Cantharidæ.
[Ann. Soc. Ent. Belgique, Tomes XLII., XLIII., 1898-9.] *The Author*

[See Godman (F. D.). Biologia Centrali-Americana.]

Charmoy (D. d'E.). Notes sur les Cochenilles.
[Soc. Amicale Scientifique, 1899.]

Chittenden (F. H.). Some Insects injurious to Garden and Orchard Crops
[U. S. Dep. Agric., Div. Ent., Bull. No. 19, N. S. 1899.]
The U.S. Dept. Agric.

Cockerell (T. D. A.). First Supplement to the Check-list of the Coccidæ.
[Bull. Illinois St. Laboratory N. H., Vol. V., 1899.]

Catalogo de las Abejas de Mexico, 1899.

The Zonal Distribution of Coleoptera.
[Agric. Exp. Stn. Mesilla Park, N. M., Bull. No. 28, 1898.]
The Author.

[See Godman (F. D.). Biologia Centrali-Americana.]

Cockerell (T. D. A.) and Parrott (P. J.). Contributions to the Knowledge of the Coccidæ.
[The Industrialist, 1899.] *The Author.*

Dierck (Fr.). Etude comparei des Glandes Pygidiennes chez les *Carabides* et les *Dytiscides*, avec quelques remarques sur le classement des Carabides.
[La Cellule, Tom. xvi, 1899.] *The Author.*

Distant (W. L.). Description of a new Species of the Genus *Pœcilopsaltria* belonging to the Family Cicadidæ.
[Ann. and Mag. N. H., Ser. 6, Vol. XIX., 1897.]

Cicadidæ from the North Chin Hills, Burma.

Cicadidæ from the Malay Archipelago.

On a Collection of Heterocera made in the Transvaal.
[Ann. and Mag. N. H., Ser. 6, Vol. XX., 1897.]

Coleoptera collected in the Transvaal.

Description of two new Species of Oriental Cicadidæ.

The Butterflies of the Transvaal.

Heterocera from the Transvaal.
[Ann. and Mag. N. H., Ser. 7, Vol. I., 1898.]

Hemiptera-Heteroptera.

Rhynchota from the Transvaal, Mashonaland, and British Nyasaland, Part I.
[Ann. and Mag. N. H., Ser. 7, Vol. II., 1898.]

On some South African Insects.
[Ann. and Mag. N. H., Ser. 7, Vol. III., 1899.]

Some apparently undescribed species of Heterocera from the Transvaal.

Rhynchotal Notes, I. and II.

Some apparently undescribed Neotropical Homoptera.

On some South African Homoptera.
[Ann. and Mag. N. H., Ser. 7, Vol. IV., 1899.]

Additions to our knowledge of the Cicadidæ of New Guinea.

Description of a new Genus and Species of Cicadidæ collected by Dr. Modigliani at Mentawei Island.
[Ann. Mus. Civ. St. Nat. Genova, Ser. 2, Vol. XVII., 1897.]
The Author.

Druce (Herbert). Descriptions of some new Species of Heterocera from Tropical America, Africa, and the Eastern Islands. I. and II.
[Ann. and Mag. N. H., Ser. 7, Vol. III., 1899.]

Descriptions of some new Species of Heterocera from Tropical America.
[Ann. and Mag. N. H., Ser. 7, Vol. III., 1899.]

Description of some new Species of Heterocera.
[Ann. and Mag. N. H., Ser. 7, Vol. IV., 1899.] *The Author.*

[See Godman (F. D.). Biologia Centrali-Americana.]

Eaton (A. E.). Ephemeridæ taken by Mr. McLachlan in the District of the Lac de Joux (Swiss Jura) in 1898.
[Ent. Monthly Mag., 2 Ser., Vol. IX., 1898.]

List of Ephemeridæ hitherto observed in Algeria, with localities.
[Ent. Monthly Mag., 2 Ser., Vol. X., 1899.] *The Author.*

Erichson (W. F.). Naturgeschichte der insecten Deutschlands *Coleoptera*. Band V., Hälfte 2, Lief. 2 and 3. By G. Seidlitz.
Purchased.

Fairmaire (L.) et Laboulbène (A.). Faune Entomologique Française. Tome I., Coléoptères. 8vo., Paris, 1854. *Purchased.*

Felt (E. P.). Collection, Preservation and Distribution of New York Insects.

Shade Tree Pests in New York State.
[Bull. N. Y. State Mus., Vol. VI., Nos. 26 and 27, 1899.]
The Museum.

Fieber (F. X.). Les Cicadines d'Europe. Traduit de l'allemand, par Ferd. Reiber, avec des additions par L. Lethierry. 8vo, Paris, 1875—1880. Caen, 1884—1885. *Purchased.*

Forel (A.) La Parabiose chez les Fourmis.
[Bull. Soc. Vaud. Sc. Nat., Vol. XXXIV., 1899.]

Trois notices Myrmécologiques.
[Ann. Soc. Ent. Belge., Tom. XLIII., 1899.] *The Author.*

[See Godman (F. D.). Biologia Centrali-Americani.]

Fowler (W. W.) [See Godman (F. D.). Biologia Centrali-Americani.]

Ganglbauer (L.). Die Käfer von Mitteleuropa. Bd. III. 8vo, 1899.
Purchased.

Godman (F. D.). Biologia Centrali-Americana.

Araneidea, by O. and F. O. P.-Cambridge.

Insecta, by G. C. Champion, T. D. A. Cockerell, H. Druce, A. Forel, W. W. Fowler, F. D. Godman, H. S. Gorham, A. Pictet, H. de Saussure, D. Sharp, and F. M. van der Wulp. Parts CXLVI.—CLII. *The Editor.*

Gorham (H. S.). [See Godman (F. D.). Biologia Centrali-Americana.]

Green (E. Ernest). The Coccidæ of Ceylon. Part III., 8vo, London, 1899.
The Author.

Grimshaw (P. H.). Lincolnshire Diptera—a Preliminary List.

Nottinghamshire Diptera—a Preliminary List.
[Naturalist, 1898.] *Rev. A. Thornley.*

Grote (A. Radcliffe). Specializations of the Lepidopterous Wing, the Parnassi-Papilionidæ. I., II.
[Proc. Am. Phil. Soc., Vol. XXXVIII., 1899.]
Smithsonian Inst.

Hampson (Sir George F.). Catalogue of the Syntomidæ in the collection of the British Museum. Vol. I., Lepidoptera Phalenæ. Text and Plates. 8vo, London, 1898. *B. M. Trustees.*

Hanbury (F. J.) and Marshall (E. S.). Flora of Kent. 8vo, London, 1899.
F. J. Hanbury.

Hommell (R.). L'Apiculture par les méthodes simples. 8vo, Paris, 1898.
The Author.

Jacoby (M.). Additions to the Knowledge of the Phytophagous Coleoptera of Africa. Part II.
[Proc. Z. S. Lond., 1899.] *The Author.*

Janet (C.). Études sur les Fourmis, les Guêpes et les Abeilles. Notes 16—18. Lille et Paris, 1897-8.

Sur l'emploi de Desinences caracteristiques dans les denominations des groupes établis pour les classifications zoologiques. Beauvais, 1898.

Sur un cavité du tégument servant chez les Myrmicinal à étaler, au contact de l'air, un produit de sécrétion.

Réaction alkaline des chambres et galeries des Nids de Fourmis. Durée de la vie des Fourmis de capitées.

[C. R. Acad. Sci., Paris, 1898.] *The Author.*

Kellicott (D. S.). The Odonata of Ohio.
[Ohio Acad. Sci., Special Papers, No. 2, 1899.] *Ohio State Univ.*

Kellogg (V. L.). A List of the Biting Lice (Mallophaga) taken from Birds and Mammals of North America.
[Proc. U. S. Nat. Mus., Vol. XXII., 1899.] *U. S. Nat. Museum.*

Kirkaldy (G. W.). List of Rhynchota-Heteroptera collected by Dr. Chapman at Cannes.
[Ent. Rec. and Journ. Var., Vol. IX., 1897.]

On the Specific distinctions of *Corixa carinata* and *C. Germari*, and the Restoration of the latter to the list of British Rhynchota.
[Entomologist, 1898.]

On some Aquatic Rhynchota from Jamaica.
[Entomologist, 1899.]

Corixa Saundersi, a new Species of Aquatic Rhynchota from England.
[Ent. Monthly Mag., 1899.]

Note sopra alcuni Rincoti Acquatici Africani del Mus. Civ. di Storia Nat. di Genova.
[Ann. Mus. Civ. S. N. Genova, Vol. XIX., 1898.]

On some Aquatic Rhynchota from South America.
——————————————— Darien and Venezuela.
——————————————— Ecuador.
——————————————— Argentina and Paraguay.
——————————————— Argentina and Bolivia.
[Boll. Mus. Zool. ed Anat. comp. Torino, 1899.]

Descriptions of ten new Species of Hemiptera from the Islands of Abd-el-Kuri and Sokotra.
[Bull. Liverp. Mus., No. 2, 1899.]

Kirkaldy (G. W.). Notes and Descriptions of Aquatic Rhynchota in the Royal Museum of Belgium.
[Ann. Soc. Ent. Belgique, 1899.] *The Author.*

Krieger (R.). Über einige mit Pimpla verwandte Ichneumonidengattungen.
[Ber. Naturf. Ges., Leipzig, 1897-8.] *The Author.*

Kuhn (H.). [See Nicéville (L. de).]

Laboulbène (A.). [See Fairmaire (L.).]

Lameere (Aug.). Notice sur le Dr. Ernest Candèze.
[Ann. Soc. Ent. Belgique, 1898.] *The Author.*

Lowe (V. H.). The Raspberry Straw Fly.

The Grape-Vine Flea-Beetle.

The Apple-Tree Tent Caterpillar.

Spraying Experiments against the Spring Canker Worm.
[N. Y. Agric. Expt. Stn., Bulls. No. 150 and 152, 1898.]
The Station.

McLachlan (R.). *Thaumatoneura inopinata*, a new genus and species of Calopteryginæ.
[Ent. Monthly Mag., 2 Ser., Vol. VIII., 1897.]

Æschna borealis, Zett. (1840) = *Æ. cærulea*, Ström. (1783), but not *Æ. squamata*, Müller (1764).

What is *Libellula ænea*, Linné? : a Study in nomenclature.

On Neuroptera collected by Mr. Malcolm Burr in Wallachia, Bosnia, Herzegovina, etc. in 1898.

On two Species of Calopteryginæ from the Island of Lombock, with varietal notes.

A few Psocidæ from the Eastern Pyrenees.

Hyperetes guestfalicus, Kolbe, a Genus and Species of Apterous Psocidæ new to Britain.
[Ent. Monthly Mag., 2 Ser., Vol. IX., 1898.]

Neuroptera-Planipennia collected in Algeria by Rev. A. E. Eaton.

Considerations on the Genus *Tetracanthagyna*, Selys.
[Trans. Ent. Soc., Lond., 1898.]

Descriptions de deux espèces nouvelles de Nemoptères du genre *Croce*, McLach.
[Bull. Soc. Ent. France, 1898.]

Trichoptera, Planipennia, and Pseudo-Neuroptera, collected in the district of the Lac de Joux (Swiss Jura) in 1898.

Trichoptera, Planipennia, and Pseudo-Neuroptera, collected in Finmark in 1898 by Dr. T. A. Chapman and Mr. R. W. Lloyd.

Notes on certain Palæarctic Species of the Genus *Hemerobius*:
(1) Introductory remarks, and on the group of *H. nervosus*.
(2) *H. marginatus*, *H. lutescens*, *H. humuli*, and *H. orotypus*.
(3) *H. stigma* (*limbatus*) and the group of *H. pini*.
(4) *H. nitidulus* and *H. micans*.
[Ent. Monthly Mag., 2 Ser., Vol. X., 1899.]

Remarques sur quelques Odonates de l'Asie Mineure Meridional comprenant une espèce nouvelle pour la faune paléarctique.
[Ann. Soc. Ent. Belgique, Tom. XLIII., 1899.] *The Author.*

Marlatt (C. L.) Japanese Hymenoptera of the Family Tenthredinidæ.
[Proc. U. S. N. Mus., Vol. XXI., 1898.] *Smithsonian Inst.*

Marseul (S. A. de). Essai Monographique sur la Famille des Histérides: 2 vols., Paris, 1853–57.
[Extr. des Ann. Soc. Ent. France, 3 Ser., Tom. I.—IV.]

———————Supplement———————Paris, 1859.
[Extr. des Ann. Soc. Ent. France, 3 Ser., Tom. VIII., 4 Ser., Tom. I., II.] *G. Lewis.*

Marshall. (E. S.) [See Hanbury (F. J.).]

Moore (F.). Lepidoptera Indica, 24 pts. (Vols. I., II.). 4to, London, 1890.
Col. J. W. Yerbury.

Morley (Claude). Coleoptera of Suffolk. 8vo, Plymouth, 1899.
The Author.

Morris (F. O.). British Butterflies. 8vo, London, 1853.

British Moths. 4 vols., 8vo, London, 1872.
Col. J. W. Yerbury.

Mulsant (E.) and Rey (C.). Histoire Naturelle des Punaises de France. 2 vols., 8vo, Paris, 1865-70. *Purchased.*

Nicéville (L. de). Description of a new Nymphaline Butterfly from Burma.
[Ann. and Mag. N. H., Ser. 6, Vol. XVII., 1896.]

Note on Javan Lepidoptera Rhopalocera.
[Berl. Ent. Zeitschr. Bd. XLII., 1897.]

Description of a new *Papilio* from Bali of the *nox* group.
[Ann. and Mag. N. H., Ser. 6, Vol. XX., 1897.]

Description of *Neptis Praslini*, Boisduval, and some species allied to it.
[Journ. Asiatic Soc. Bengal, Vol. LXVI., 1897.]

On new or little-known Butterflies from the Indo- and Austro-Malayan Regions.
[Journ. Asiatic Soc. Bengal, Vol. LXVI., 1897.]

Descriptions of two new Species of Butterflies from Upper Burma.
[Journ. Bombay N. H. Soc., Vol. X., 1897.]

A Revision of the Pierine Butterflies of the genus *Dercas*.
[Ann. and Mag. N. H., Ser. 7, Vol. II., 1898.]

On a small collection of Butterflies from Buru in the Moluccas.
[Journ. Asiatic Soc. Bengal, Vol. LXVII., 1898.] *The Author.*

Nicéville (L. de) and Kuhn (H.). An Annotated List of the Butterflies of the Ké Isles.
[Journ. Asiatic Soc. Bengal, Vol. LXVII., 1898.] *L. de Nicéville.*

Ormerod (Eleanor A.). Report of Observations of Injurious Insects and Common Farm Pests for 1897. 8vo, London, 1898.

———————————————for 1898. 8vo, London, 1899.

General Index to Reports on Injurious Insects, from 1877—1898.
The Author.

Osborn (H.). The Hessian Fly in the United States.
[U. S. Dept. Agric., Div. Ent., Bull. No. 16, N.S., 1898.]
U. S. Dept. Agric.

Pagenstecher (Arnold). Die Lepidopteren fauna des Bismarck-Archipels. Thiel I: Die Tagfalter (Rhopalocera). 4to, Stuttgart, 1899.
The Author.

PARROT (P. J.). [See COCKERELL (T. D. A.).]

PECKHAM (G. W.) and (Eliz. G.). The Instincts and Habits of the Solitary Wasps.
[Wisconsin Geol. and N. H. Survey, Sci. Ser. No. 1., 1898.]
The Authors.

PERINGUEY (L.). Descriptive Catalogue of the Coleoptera of South Africa: Cicindelidæ (2nd Suppl.); Carabidæ (1st Suppl.); Paussidæ (1st Suppl.).
[Trans. S. Afr. Philos. Soc., Vol. X., 1898.]

Fifth Contribution to the South African Coleopterous Fauna.

A Contribution to the Knowledge of South African Mutillidæ.
[Ann. S. Afr. Mus., Vol. I., 1899.] *The Author.*

PICTET (A.). [See GODMAN (F. D.). Biologia Centrali-Americana.]

POCOCK (R. L.). Musical Boxes in Spiders.
[Nat. Sci., Vol. VI., 1895.] *Col. J. W. Yerbury.*

PRYER (H.). Rhopalocera Nihonica, Pts. 1—3. *Col. J. W. Yerbury.*

REUTER (O. M.). Monographia Anthocoridarum orbis terrestris.
[Acta Soc. Sci. Fennicæ, Tomo XIV., 1884.] *Purchased.*

Hemiptera Gymnocerata Europæ, Parts iv. and v.
[Act. Soc. Sci. Fennicæ, Tomo XXIII., Nos. 1 and 2 (1891, 1896).]
The Meteorological Society.

Monographia generis *Reduvius*, Fabr., Lam.
[Acta Soc. Sci. Fennicæ, Tomo XIX., 1892.] *Purchased.*

REY (Cl.). [See MULSANT (E.).]

ROBSON (J. E.). A Catalogue of the Lepidoptera of Northumberland, Durham, and Newcastle-on-Tyne. Pt. 1, 1899. *The Author.*

SAUSSURE (H. de). Un Genero Nuevo de Orthopteros.
[An. Inst. Fisico-geogr. nac. Costa Rica, 1897.] *The Author.*

Analecta Entomologica. I. Orthopterologica.
[Rev. Suisse Zool., Tome V., 1898.] *The Author.*

Orthoptera (Voeltzkow, Wissenschaftliche Erzebnisse der Reisen in Madagaskar und Ost-Afrika).
[Abhand. Senck. Nat. Gesellschaft, F. a' M., Bd. XXI., Hft. IV., 1899.] *The Author.*

SAUSSURE (H. de) and PICTET (A.). [See GODMAN (F. D.). Biologia Centrali-Americana.]

SCUDDER (S. H.). Supplement to a Revision of the Melanopli.
[Proc. Davenport Acad. N. Sci., Vol. VII., 1899.]

The Orthopteran Genus Schistocerca.
[Proc. Am. Acad. Arts and Sci., Vol. XXXIV., No. 17, 1899.]

Everyday Butterflies. 8vo, 1899.

The North American Species of Orphulella.
[Canadian Entom., Vol. XXXI., 1899.]

Short Studies of North American Tryxalinæ.
[Proc. Am. Acad. Arts and Sci., Vol XXXV., 1899.]

Two Genera of North American Decticinæ.
[Proc. Am. Acad. Arts and Sci., Vol. XXXV., 1899.]
The Author.

Seidlitz (G.). [See Erichson. Insecten Deutschlands, *Coleoptera*.]

Semper (G.). Die Schmetterlinge der Philippinischen Inseln. Band II., lief. 3. 4to, Wiesbaden, 1899. *The Author.*

Sharp (D.). [See Cambridge Natural History.]
[See Godman (F. D.). Biologia Centrali-Americana.]

Sirrine (F. A.). Combating the Striped Beetle on Cucumbers.
[N. Y. Agric. Expt. Stn., Bull. No. 158, 1899.] *The Station.*

Skinner (H.). Synonymic Catalogue of the North American Rhopalocera. Philadelphia, 1898. *The Author.*

Smith (John B.). New Species of Nocturnal Moths of the Genus Campometra, and Notes.
[Proc. U. S. Nat. Mus., Vol. XXII., 1899.] *The Author.*

Stål (C.). Synopsis Hydrobatidum Sueciæ.
[Öfvers. K. Vet.-Akad. Förh., 1898.] *G. W. Kirkaldy.*

Theobald (F. V.). Text Book of Agricultural Zoology. 8vo, 1899.

Tabulated List of Orchard "Insect Pests" affected by spraying. 4to, 1899.

Notes on Insect Pests for 1898 (2nd Report).
[Journal S. E. Agric. Coll., No. 8, 1899.] *The Author.*

Thornley (Rev. A.). Nottinghamshire Diptera: Additions and corrections to Mr. P. H. Grimshaw's Preliminary List.

Lincolnshire Diptera: Additions and corrections to Mr. P. H. Grimshaw's Preliminary List.
[Naturalist, 1899.] *The Author.*

Turner (Dr. A. J.). The Xyloryctidæ of Queensland.
[Annals of Queensland Museum, No. 4, 1899.] *The Museum.*

United States Department of Agriculture (Division of Entomology), Bulletins (New Series), 1898.

No. 15. The Chinch Bug. (F. M. Webster.)

No. 16. The Hessian Fly in the United States. (H. Osborn.)

No. 17. Proceedings of the Tenth Annual Meeting of the Association of Economic Entomologists.

No. 18. Some miscellaneous results of the work of the Division of Entomology, III.

No. 13. Some insects injurious to Garden and Orchard Crops. (F. H. Chittenden.) *U. S. Dept. Agriculture.*

Bibliography of the more important contributions to American Economic Entomology. (N. Banks.)

Part VI., 1888—1896. Washington, 1898. *Smithsonian Inst.*

Walker (J. J.). List of the Coleoptera of the Rochester District.
[Rochester Naturalist, 1899.]

Practical Hints on the Formation of a Collection of Coleoptera.
[Trans. S. E. Union of Sci. Socs., 1899.] *The Author.*

Warren (W.). List of the Geometridæ, Epiplemidæ, Drepanulidæ, and Thyrididæ collected on the Key Islands by Mr. H. Kühn.

New Species and Genera of the families Thyrididæ, Uraniidæ, Epiplemidæ and Geometridæ from the Old World regions.

New Species and Genera of the families Drepanulidæ, Thyrididæ, Uraniidæ, Epiplemidæ and Geometridæ from the Old World regions.

[Novitates Zoologicæ, Vol. V., 1898.] *The Author.*

Watson (E. Y.). Notes on some Butterflies from Myingyan, Central Burma.
[Journ. Asiatic Soc. Bengal, Vol. LXVI., 1897.] *L. de Nicéville.*

Webster (F.M.). The Chinch Bug.
[U. S. Dept. Agric., Div. Ent., Bull. No. 15, N. S., 1898.]
U. S. Dept. Agriculture.

Wulp (F. M. van der). [See Godman (F. D.). Biologia Centrali-Americana.]

Yerbury (Col. J. W.). The Butterflies of Aden and Neighbourhood, with some notes on their habits, food-plants, etc.
[Journ. Bombay Nat. Hist. Soc., 1882.] *The Author.*

Periodicals and Publications of Societies.

AFRICA.

CAPE TOWN. South African Philosophical Society. Transactions, Vol. X. *The Society.*

South African Museum. Annals. Vol. I., Pt. 2. *Trustees S. Afr. Mus.*

AMERICA (NORTH).

CANADA.

HALIFAX. Nova Scotian Institute of Science. Proceedings and Transactions. Vol. IX., Pt. 4. *The Institute.*

LONDON, ONTARIO. The Canadian Entomologist. Vol. XXXI., 1899. *By Exchange.*

MONTREAL. Royal Society of Canada. Proceedings and Transactions. Ser. 2, Vol. IV., 1898. *The Society.*

ONTARIO. Ent. Soc. of Ontario. 29th Report, 1898. *The Society.*

UNITED STATES.

CAMBRIDGE, MASS. Museum of Comparative Zoology at Harvard College. Annual Report, 1897–98. *The Curator.*

NEW YORK. N.Y. Entomological Society. Journal, 1899. *Purchased.*
N.Y. State Museum. Reports, 1895, 1896. *The Museum.*

PHILADELPHIA. Academy of Natural Sciences of Philadelphia. Proceedings, 1899. *By Exchange.*

Entomological News, 1899. Proceedings of the Entomological Section. Vol. X. *By Exchange.*

American Entomological Society. Transactions, 1899. *By Exchange.*

WASHINGTON. Entomological Society. Proceedings, 1899. *Purchased.*
U.S. National Museum. Proceedings, Vol. XXI. *The Museum.*

WISCONSIN. Trans. Acad. Sciences, Arts and Letters. Vol. XI., 1897. *The Academy.*

WEST INDIES.

JAMAICA. West Indian Bulletin. Vol. I., No. 1. *The Dept. of Agric.*

AMERICA (SOUTH).

ARGENTINE REPUBLIC.

BUENOS AIRES. Academia Nacional de Ciencias, Cordova. Boletin. Tomo XVI. *By Exchange.*

Museo Nacional de Buenos Aires. Tomo VI. *Dr. C. Bery.*

LA PLATA. Revista del Museo. Tomo IX. *The Museum.*

BRAZIL.

PARA. Boletim do Museu. Vol. II. *The Museum.*

ASIA.

INDIA.

BOMBAY. Natural History Society. Journal. Vol. XII., Nos. 1—4. *By Exchange.*

CALCUTTA. Indian Museum Notes. Vol. IV. *The Trustees.*

AUSTRALASIA.

ADELAIDE. Royal Society of South Australia. Transactions, Proceedings and Reports. Vol. XXII., Pt. II. *By Exchange.*

BRISBANE. Queensland Museum. Annals. *The Museum.*

SYDNEY. The Agricultural Gazette of New South Wales, 1899. *Agric. Dept.*

Linnean Society of New South Wales. Proceedings, 1899. *By Exchange.*

NEW ZEALAND.

WELLINGTON. New Zealand Institute. Transactions and Proceedings. Vol. XXXI., 1898. *The Institute.*

EUROPE.

AUSTRIA-HUNGARY.

BUDAPEST. Termés zetrajzi Füzetek, kiadja a Magyar nemzeti Múzeum. Vol. XXII., Pts. 1—4. *By Exchange.*

VIENNA. K.-k. zoologische-botanische Verein (Gesellschaft) in Wien. Verhandlungen. Band XLIX., 1899. *By Exchange.*

Wiener entomologische Zeitung, 1899. *By Purchase.*

BELGIUM.

BRUSSELS. Société Entomologique de Belgique. Annales. 1899. *By Exchange.*

Académie Royale des Sciences, des lettres et des beaux-arts de Belgique.

Bulletins. Tomes XXXIV.—XXXVI.

Mémoires. Tome LIII.

Mémoires couronnés. Tomes LV. and LVII. *By Exchange.*

Annales du Musée du Congo, Ser.-Zoologie. Tome I. Fasc. 1—3. *The Congo Free State.*

FRANCE.

CAEN. Société Française d'Entomologie. Revue. Tome XVIII., 1899. *By Purchase.*

Soc. Linnéenne de Normandie. Annales. 1898. *By Exchange.*

CHATEAUROUX. Le Frélon, 1899. *By Purchase.*

LYON. Soc. Linnéenne de Lyon. Annales. 1898. *By Exchange.*

Paris. L'Abeille, 1899. *By Purchase.*

Soc. Entom. de France. Ann. et Bulletin. 1897. *By Exchange.*

GERMANY.

BERLIN. Entomologischer Verein in Berlin. Berliner entomologische Zeitschrift. 1899. *By Exchange.*

Deutsche entomologische Gesellschaft. Deutsche entomologische Zeitschrift. 1899. Heft 1. *By Exchange.*

DRESDEN. "Iris." Deutsche entomologische Zeitschrift. Bd. XII. Heft 1. *By Exchange.*

FRANKFORT. Senckenbergische naturforschende Gesellschaft. Bericht. 1898.

Abhandlungen. Bd. XXI., Heft 2. Bd. XXIV., Heft 2—4. *By Exchange.*

HALLE. Abhandlungen der Kaiserlichen Leopoldinisch Carolinischen Deutschen Akademie der Naturforscher. Bd. LXX., LXXI., LXXII., 1898.

STETTIN. Entomologischer Verein. Entomologische Zeitung. Jahrg. LIX., Heft 6—12. *By Exchange.*

WIESBADEN. Nassauischer Verein für Naturkunde. Jahrbücher. Jahrg. LII. *By Exchange.*

GREAT BRITAIN AND IRELAND.

BUCKHURST HILL. Essex Naturalist. Vol. XI., Nos. 1—3. *The Essex Field Club.*

DUBLIN. Roy. Dublin Society. Transactions and Proceedings. 1898. *By Exchange.*

LEEDS. Naturalist (The). 1899. *The Yorks. Nat. Union.*

LONDON. Annals and Magazine of Natural History. 1899. *By Purchase.*

Athenæum. *The Publishers.*

City of London Entomological and Natural History Society. Transactions for 1898. *The Society.*

Entomologist (The). 1899. *R. South.*

Entomologist's Monthly Magazine. 1899. *The Editors.*

Entom. Record and Journal of Variation. Vols. VI.—X. *Purchased.*

Linnean Society of London. Transactions, Vol. VII., Pts. 5—8. Journal, Nos. 173—176. *By Exchange.*

Linnean Society of London. Proceedings. 1899.

Nature. 1899. *The Publishers.*

LONDON. Nature Notes. 1899. *The Publishers.*

Quekett Microscopical Club. Journal. 1899. *The Club.*

Royal Agricultural Society. Journal. 3rd Ser., Vol. X. *The Society.*

Royal Microscopical Society. Journal. 1899. *By Exchange.*

Royal Society. Proceedings. Nos. 405—421. *By Exchange.*

Year Book. 1896-97, 1897-98. *By Exchange.*

Philos. Trans. Ser. B., 190. *By Exchange.*

South London Entomological and N. H. Society. Proceedings. 1898. *The Society.*

Year Book of Scientific Societies. 1899. *By Purchase.*

Zoological Record for 1898. *By Purchase.*

Zoological Society. Proceedings, 1899. Transactions, Vol. XV., Pt. 2—4. *By Exchange.*

Zoologist (The). 1899. *The Publisher.*

HOLLAND.

THE HAGUE. Tijdschrift voor Entomologie. Jahr. 1899. Nos. 1, 2, 3. *By Exchange.*

ITALY.

FLORENCE. Societa Entomologica Italiana. Bullettino, XXX. 1898. *By Exchange.*

GENOA. Museo Civico di Storia Naturale di Genova. Annali. Ser. 2. Vol. XIX. *By Exchange.*

RUSSIA.

MOSCOW. Société Impériale des Naturalistes de Moscou. Bulletin. 1898. *By Exchange.*

ST. PETERSBURG. Societas Entomologicæ Rossicæ. Horæ. Tome XXXII. 1898. *By Exchange.*

SWEDEN.

STOCKHOLM. Entomologisk Tidskrift. 1898. *By Exchange.*

SWITZERLAND.

GENEVA. Société de Physique et d'Histoire Naturelle. Compte rendu. Tom. XV. *By Exchange.*

Soc. Ent. Suisse. Bulletin. Vol. X. Heft 4, 5. *By Exchange.*

SCHAFFHAUSEN. Schweizerische entomologische Gesellschaft. Mittheilungen. Bd. X., Hft. 3—5. *By Exchange.*

TRANSACTIONS

OF THE

ENTOMOLOGICAL SOCIETY

OF

LONDON

FOR THE YEAR 1899.

I. *A Monograph of British* Braconidæ. Part VIII.

By the Rev. T. A. MARSHALL, M.A., F.E.S., Member of the Société Entomologique de France.

[Read October 5th, 1898.]

PLATE I.

(Continued from Trans. Ent. Soc. Lond. 1897, p. 31.)

VIII. CŒLINIUS, Nees.

Nees, Act. Ac. L.C., 1819, p. 301.

Originally synonymous with genus IX. *Chænon*, the two forming a natural group. Their artificial separation is due to Förster, who retained the name *Chænon* for the largest species: see the following genus, under which the chief characters are detailed. Some slight peculiarities are distinctive of *Cœlinius*, viz.:—head not so prominent beneath the antennæ; face punctate or rugulose, its carina shortened or wanting; clypeus more perceptibly discrete, and more prominent; palpi shorter, 3rd and 4th joints of the maxillary nearly equal; mandibles bidenticulate; antennæ with a smaller number of articulations; mesosternum flattened, its medial furrow rugose, not reaching the 2nd pair of coxæ; carina of the metathorax single or

obsolete. Radial nervure forming a regular curve, not sinuated, originating beyond the middle of the stigma. Hind coxæ not so much compressed, rugulose at the base. First abdominal segment more than twice as long as the hind coxæ, punctate-rugose, more or less emarginate at the extremity; 2nd segment smooth at the base, or scarcely striolate; abdomen ♀ not so strongly compressed; 4th and following segments very short. Size of the species much inferior to that of *Chænon*.

The insects are parasitic on the small acalypterous *Muscidæ* of such genera as *Chlorops*, *Hydrellia*, etc. Of the six British species *niger* is abundant everywhere, *viduus*, *gracilis*, and *elegans* are less common; *podagricus* is doubtful, perhaps an accidentally deformed *viduus*; *procerus* is rare.

TABLE OF SPECIES.

(2)	1.	Mesothoracic furrows faintly traced, converging to a point near the middle of the disc, thence continued in an indistinct line to the base of the scutellum	1. *viduus*, Curtis.
(1)	2.	Mesothoracic furrows more distinct, punctate, converging into a rather deep fovea before the scutellum ...	3
(4)	3.	Legs of normal length	5
(3)	4.	Legs very short, the hind pair hardly longer than the abdomen; hind femora incrassated, not longer than the trochanters	2. *podagricus*, Hal.
(6)	5.	Abdomen entirely black, or at most somewhat piceous at the base of the 2nd segment	3. *niger*, Nees.
(5)	6.	Abdomen more or less rufous, testaceous, or yellowish in the middle ...	7
(8)	7.	Prothorax red	4. *procerus*, Hal.
(7)	8.	Prothorax black	9
(10)	9.	Length 2½–3 lines; antennæ 36-jointed in the ♀, 54-jointed in the ♂	5. *gracilis*, Hal.
(9)	10.	Length 1½–2½ lines; antennæ 30–32-jointed in the ♀, 40–45-jointed in the ♂	6. *elegans*, Hal.

1. *Cœlinius viduus*, Curtis.

Chænon viduus, *ater*, and *obscurus*, Curt., B. E., 289.
Alysia (*C.*) *vidua*, Hal., Hym. Brit., ii, 22, ♂ ♀.
C. viduus, Marsh., Species des Hym. d'Eur. et d'Alg. Bracon., ii, p. 515, ♂ ♀.

♀ Black, pubescent. Head rather longer than broad; posterior margin of the vertex nearly straight; front bearing an impression on each side above the antennæ, and in the middle, a small carina;

mandibles rufescent; palpi testaceous, fuscous at the tips. Antennæ longer than the head and thorax, stout, rufescent beneath at the base, 29–32-jointed. Mesonotum punctulate, its furrows subobsolete, converging about the middle of the disc, and prolonged in a faint linear fovea to the base of the scutellum. Wings dusky hyaline; squamulæ fuscescent; nervures and stigma dark fuscous, the latter narrow. Fore legs rufous, sometimes dark at the base; 4 posterior legs black, with piceous tibiæ and tarsi; extremities of the trochanters reddish, as well as the base of the tibiæ and of the tarsi. Abdomen compressed, carinated both above and beneath; 1st segment elongate, striolate, emarginate at the apex. Terebra very short, somewhat elevated. ♂ Antennæ slender, as long as the body, 42–47-jointed, the 2nd and 3rd joints equal, the 2nd piceous; stigma and radial areolet narrower than in the ♀; abdomen depressed, sublinear. Length, $1\frac{3}{4}$ lines.

Var. ♀ *Chænon obscurus*, Curt. Antennæ rufescent at the base for some distance; legs testaceous; middle femora streaked with blackish above; hind coxæ and femora blackish, as well as the base of the trochanters; middle of the abdomen rufescent.

Not uncommon in Ireland, in sandy places, according to Haliday; taken in England by Walker, Rudd, and several times by myself.

2. *Cœlinius podagricus*, Haliday.

Alysia (*C.*) *podagrica*, Hal., *l. c.*, ♂.
C. podagricus, Marsh., *lib. cit.*, p. 516, ♂.

♂ Similar to *viduus*, but less elongate. Mandibles rufescent; palpi short, testaceous. Wings narrow; radial areolet and stigma more attenuated. Legs very short, the hind pair scarcely exceeding the abdomen; femora almost oval, incrassated, not longer than the trochanters; legs black, the first pair and the base of all the tibiæ rufescent. ♀ Unknown. Length, $2\frac{1}{2}$ lines.

Not seen since the time of Haliday, who captured one ♂ at the end of July on a sandy shore near Dublin.

3. *Cœlinius niger*, Nees.

Stephanus niger, Nees, Mag. Ges. Berl., 1811, p. 5.
C. niger, Nees, Mon. i, 10; Curtis, in Morton's Cyclop. of Agricult., *s. v. Chlorops*, pl. clv, ff. 7, 8; Farm Ins., 242, pl. xxxiv, f. 8, and pl. H. frontisp. f. 16; Marsh., *lib. cit.*, p. 517, ♂ ♀.
Alysia (*C.*) *nigra*, Hal., *lib. cit.*, 24, ♂ ♀.

Chænon affinis, Curt., B. E., 289.
Chænon nigricans, Westw., Loud. Mag. 1835, p. 177, pl. xvi, ff. g, h.
Alysia Olivierii, Guér., Mém. Soc. Agric. 1842, p. 26, pl. iv, ff. 1, 2.

♀ Black, pubescent. Palpi and 4 anterior legs testaceous or ferruginous, sometimes more or less blackened ; abdomen entirely black, or at most slightly reddish at the base of the 2nd segment. Head short for the genus, subcubic, transverse, sloping and emarginate behind ; front slightly impressed ; mandibles rufescent ; labial palpi short, attenuated at the tips. Antennæ more slender than in other females of the genus, as long as the body, rufescent at the base, 35–40-jointed. Mesothoracic furrows converging to a foveola before the scutellum, from which emanates a short medial channel between two furrows ; metathorax coarsely punctate, rugose. Wings hyaline with a dusky tinge; squamulæ fuscous, nervures and stigma dark fuscous, the latter broader than usual, like the radial areolet, which is lanceolate, forming almost a half-oval. Fore legs testaceous, with the coxæ and base of the trochanters black ; femora streaked with blackish above ; 4 posterior legs black, the tibiæ and tarsi somewhat piceous ; tips of the trochanters and base of the tibiæ rufescent. Abdomen compressed towards the apex only ; 1st segment coarsely punctate, shorter than in the other species, hardly emarginate at the extremity. Terebra very short, or concealed. ♂ Antennæ entirely black, longer than the body, 44–47-jointed ; abdomen longer than the head and thorax, depressed, spathuliform. Length, $1\frac{1}{4}$–$2\frac{1}{2}$ lines ; exp. 2–4 lines.

This is the commonest species, occurring everywhere in cornfields and hedges. Goureau has reared it from the dipterous *Chlorops læta*, Meig., *C. herpini*, Guér., *C. lineata*, Meig. etc., and Westwood found it in spoiled ears of barley, which had been infested by some other of the 60 or 70 known species of *Chlorops*. Curtis, in the works above referred to, may be consulted for additional information.

4. *Cœlinius procerus*, Haliday.

Alysia (*C.*) *procera*, Hal., *lib. cit.*, 23, ♀.
C. procerus, Marsh., *lib. cit.*, p. 519, ♀.
C. ruficollis, H. Sch. Fortsetz. v. Paûzer, 154. 22. ♀.

♀ Black, with rufous prothorax. Similar to the following species, but larger. Palpi testaceous ; mandibles rufescent. Antennæ

testaceous at the base, with more than 41 joints (mutilated). Wings hyaline with a glaucous tinge, infumated in the middle and in the cubital region; squamulæ testaceous; nervures and stigma fuscous. Legs testaceous; 2nd pair of femora with a dark spot in the middle; hind coxæ and femora fuscescent, as well as their tibiæ and the tips of their tarsi; hind femora testaceous at the extreme base. Second abdominal segment testaceous, blackish at both ends. ♂ Unknown. Length, 3½ lines.

Taken once in England by Haliday; unknown to me; otherwise noticed as captured in Holland and Germany.

5. *Cœlinius gracilis*, Haliday.

Alysia (*C.*) *gracilis*, Hal., *lib. cit.*, 23, ♂ ♀.
Chænon gracilis, Curt., B. E., 289.
C. gracilis, Marsh., *lib. cit.*, p. 519, ♂ ♀.

♀ Black, pubescent, with the middle of the abdomen ferruginous. Head subcubic, as broad as long, hardly emarginate posteriorly, wider than the thorax; mandibles and palpi ferruginous. Antennæ shorter than the body, stout, submoniliform, broadly rufous towards the base, 36-jointed. Wings largely infumated in the middle; stigma and nervures of the characteristic region fuscous; base and extremity of the wings whitish, with yellowish nervures; the fuscescent patch generally extends across the cubital areolets to the tip of the wing, the radial and posterior areolets remaining pale; sometimes however the wings are hardly at all clouded. Legs ferruginous; femora of the 2nd pair in great part blackish; hind coxæ and femora, together with the tips of the tibiæ, blackish, as also are the extremities of all the tarsi. Abdomen claviform, slightly compressed; 2nd segment ferruginous, bright testaceous, or yellow, blackish at the apex; all the following segments blackish. Terebra almost concealed. ♂ Antennæ slender, longer than the body, black, with the base piceous, 54-jointed; wings infumated, hyaline at the base and in the radial areolet; squamulæ piceous; legs darker than those of the ♀, having also the intermediate coxæ and the hind tarsi blackish; abdomen very elongate; 1st segment black; 2nd and 3rd (taken together) obscurely ferruginous, darker at the base and apex; 4th and 5th blackish, or the base of the 4th ferruginous; the following segments blackish. ♀ Length, 2½; exp. 3¾ lines; ♂ length, 3; exp. 4½ lines.

Var. ♂ Abdomen black, with only a rufous band across the 2nd segment.

The ♀ may be distinguished from that of the following species by the clearness of its tints, the greater size, and more elongated form, especially as regards the head and the basal segment of the abdomen: but the differences are less marked in the other sex.

Found very rarely in N. Ireland, according to Haliday: more common in England, where I have taken 4 ♀s and 3 ♂s.

6. *Cœlinius elegans*, Haliday.

Alysia (*C.*) *elegans*, Hal., *lib. cit.*, 23, ♂ ♀.
Chænon elegans, cingulatus, similis, rufonotatus, and *brevicornis*, Curt., B. E., 289.
C. elegans, Marsh., *lib. cit.*, p. 520, ♂ ♀.

♀ Black, with the middle of the abdomen ferruginous. Head transverse, as wide as the thorax, or nearly so. Antennæ stout, longer than the head and thorax, submoniliform, 30–32-jointed, blackish, ferruginous at the base and sometimes as far as the middle; the articulations subquadrate. Wings slightly infumated, subhyaline towards the base; squamulæ brownish; stigma and nervures fuscous or fusco-ferruginous. Fore legs testaceous; intermediate coxæ, and greater part of the femora of the same pair, blackish, as well as the tips of all the tarsi; hind legs blackish, with the trochanters, the tibiæ nearly to the apex, and the base of the tarsi, ferruginous; the extent of the dark colour is liable to vary. First abdominal segment shorter than in the preceding species; segments 2–3 rufous or dull testaceous, the rest black. Terebra almost concealed. ♂ Antennæ rather longer than the body, slender, black, 40–45-jointed; middle of the abdomen very obscurely ferruginous or piceous. Length, $1\frac{1}{2}$–$2\frac{1}{2}$ lines; exp. $2\frac{1}{4}$–$3\frac{3}{4}$ lines.

Var. ♂ Black; mandibles rufescent; palpi ferruginous; base of the antennæ beneath, middle of the abdomen, and legs, rufous; 4 posterior coxæ, and sometimes the upper edge of the hind femora, blackish. Length, $2\frac{1}{2}$ lines (Haliday). The author adds that having no ♀ of this var. he did not venture to set apart the ♂s as a distinct species. In fact they do not appear to differ, except in coloration.

A common species in Great Britain and Ireland.

IX. CHÆNON, Curtis.

Curt., B. E., 289 (1829).

Form elongate, sublinear. Maxillary palpi unusually long, with 6 joints; of which the 3rd is shorter and stouter than the 3 following; labial palpi 4-jointed. Head longer than broad, much prolonged.

behind the eyes, depressed, not wider than the thorax ; occiput deeply excavated ; vertex slightly emarginate posteriorly, traversed by a fine medial furrow ; a deep fovea at the base of the antennæ ; face horizontal, carinated in the middle ; clypeus discrete ; mandibles 4-denticulate, the 3rd denticle elongate, acute. Antennæ setiform, multiarticulate, shorter than the body in the ♀, very elongate in the ♂. Prothorax deeply sunk between the head and the mesothorax, transversely wrinkled ; mesonotum punctate, with inchoate furrows ; an oblong foveola before the scutellum ; furrow of the mesopleuræ rugose, metathorax rugose, reticulate, with two irregular longitudinal carinæ. Stigma elongate-oval, lanceolate, emitting the radial nervure near the middle ; radial areolet like that of *Dacnusa*, semi-oval, attenuated and slightly sinuate before the extremity, which is remote from the tip of the wing. Hind pair of legs robust, elongate. Abdomen twice as long as the head and thorax ; 1st segment in the ♀ slender, sublinear, finely striolate ; 2nd and following segments strongly compressed, like the blade of an oar ; hypopygium somewhat prominent, shewing the blunt extremity of the terebra ; in the ♂ the 2nd and following segments are depressed, forming an elongate club.

Curtis in 1829 published an excellent figure of *C. anceps* ♀, with indications of eleven other British species : he was not aware that the same genus had been described in 1818 by Nees v. Esenbeck, under the name *Cœlinius*. The latter author in his Monograph described two species of *Cœlinius*, of which the first, *parvulus*, is a synonym of *anceps*, but he was not acquainted with the ♀, and described two ♂s as ♂ ♀ ; the second ♂, from Vienna, belongs to an uncertain species. These defects render it advisable, in spite of priority, to prefer the more characteristic name *anceps*, and to avoid the absurdity of calling the largest species *parvulus*. Haliday in 1839 suppressed *Chænon*, and assembled all the cognate species under the name *Cœlinius*. Förster has utilised both names, attributing to *Chænon* the large typical species, and all the others to *Cœlinius*. Schiödte and Zetterstedt have contributed to increase the number of synonyms.

Chænon anceps, Curtis.

Stephanus parvulus, Nees, Mag. Ges. Berl. 1811, p. 4, ♂ (not of H. Sch.)
Cœlinius parvulus, Nees, Mon. i, 9, ♂.
C. anceps, Curtis, B. E., pl. cclxxxix, ♂ ♀ ; Marsh., *lib. cit.*, p. 513, ♂ ♀.

Alysia (*Cœlinius*) *anceps*, Hal., *lib. cit.*, 20, ♂ ♀.
? *Ichneumon cultriformis*, Latr., Hist. Nat. Cr. et Ins., iii (1802).
Cœlinius flexuosus, H. Sch. Fortsetz. v. Panzer, 156. 13.

♀ Black ; abdomen rufous, black at the base. Face clothed with whitish pubescence ; mandibles piceous ; clypeus and palpi testaceous; antennæ pubescent, shorter than the body, 50–55-jointed, the 2nd, or more joints, brownish testaceous. Mesosternum beset with whitish hairs. Wings slightly infumated ; squamulæ rufous ; stigma and nervures fuscous; hind wings proportionately broader than in *Cœlinius*. Legs rufous, hind tibiæ and tarsi black, as well as the tips of the hind femora and of the 4 anterior tarsi ; hind tibiæ sometimes rufous at the base ; hind coxæ somewhat compressed, punctulate, often fuscescent, scarcely shorter than the 1st abdominal segment. This latter, and the base of the 2nd segment, black, the 2nd striolate at the extreme base ; 3rd and following rufous with a black streak on the dorsal ridge ; hypopygium and valves of the terebra black. ♂ Antennæ longer than the body, 60–67 jointed ; posterior segments infuscated, or at least cinctured with fuscous. Length, $2\frac{1}{2}$–$3\frac{1}{2}$; exp. $3\frac{1}{3}$–$4\frac{2}{3}$ lines.

Var. ♂ Palpi and squamulæ fuscous ; intermediate coxæ blackish at the base ; middle of femora and tips of tibiæ and of tarsi in the same pair blackish ; hind legs blackish with the trochanters and the extreme base of the femora rufous ; abdomen black above, rufous in the middle. Haliday.

The white cocoon of *C. anceps* was found by Nees attached to a dead larva unknown. If this remark of Nees refers to the present species, the larva in question must have been dipterous: but there is nothing to shew that the ♂ intended was not the second specimen sent by Dahl from Vienna, which could not have been *C. anceps*. This species is not very common, but occurs occasionally in marshy places throughout Great Britain and Ireland, also in Sweden, Lapland, and France. I have found the ♂ in Devonshire, singly, and once captured several of both sexes in a watery meadow on the banks of the Dee near Braemar.

X. POLEMON, Giraud.

Giraud, Verh. der zool.-bot. Ges. in Wien, 1863, p. 17, *sqq.*

This genus, now first introduced into the British Fauna, has many of the characters of *Cœlinius* and *Chænon*, but

differs in the important structure of the abdomen. Form elongate, subcylindric. Head subcubic; vertex almost plane; front depressed; occiput deeply excavated, not margined; clypeus broad, transverse, elevated, separated from the face by a deep suture; mandibles quadridentate, one of the median teeth being the largest: maxillary palpi 6–, labial 4–jointed, one half shorter than the maxillary; eyes glabrous. Antennæ ♀ shorter than the body, those of the ♂ rather longer, multiarticulate. Prothorax very short; mesothorax and scutellum finely but sparingly punctulate; mesothoracic furrows wide and deep, converging to a broad fovea before the scutellum; furrow of the mesopleuræ broad, crenulate, united anteriorly to a second furrow, obliquely placed near the insertion of the wings; metathorax rugose, irregularly and often indistinctly canaliculate in the middle longitudinally. Stigma lanceolate, emitting the radial nervure somewhat beyond the middle; radial areolet lanceolate, remote from the tip of the wing; radial nervure faintly sinuated before the extremity; recurrent nervure distinctly rejected. Abdomen sessile, depressed, as long as the rest of the body, or longer, striolate from the base to beyond the middle of the 3rd segment, moderately compressed at the apex in the ♀; 1st segment nearly as wide as the metathorax, very little contracted at the base; 2nd suture well marked. Terebra hardly exserted. Description slightly abridged from Giraud.

Only two species of *Polemon* are known, *P. liparæ* and *P. melas*, Giraud, the second of which is suspected of being a melanic variety of the first. A third species has been described by Van Vollenhoven as *P. albimanus*; this however has not the sessile abdomen and striolate segments of *Polemon*, and manifestly belongs to *Cœlinius*.

Polemon liparæ, Giraud.

P. liparæ, Giraud, *lib. cit.*, p. 18; Marsh., *lib. cit.*, p. 524, ♂ ♀, pl. xvi, f. 6, ♀.

♀ Black; middle of the abdomen rufous. Head pubescent, rather wider than the thorax, punctate on the face, and sides of the vertex, more vaguely above; clypeus very short, more or less sinuate on the anterior margin; palpi testaceous, the two first joints of the

maxillary smaller than the rest, the 3rd stoutest, the following elongate, nearly equal. Antennæ about 55-jointed. Thorax pubescent; mesonotum and scutellum rather shining, finely and sparingly punctulate. Wings more or less infumated or tinged with rufous; squamulæ and stigma black; nervures fuscous or fusco-rufescent, lighter towards the base; 2nd discoïdal areolet completely closed. Legs rufous; hind tarsi and tips of tibiæ of the same pair blackish. Abdomen depressed for the greater part of its length, slightly compressed near the apex, sessile; 1st segment one half longer than broad, hardly contracted at the base, faintly margined, covered with rugosities which become longitudinal posteriorly, and surmounted by a medial carina which is effaced before the hind margin; this segment is rufous more or less at the apex; segments 2–3 are also rufous; 4 rufous with the hind margin black, or black with the base rufous, or even entirely black; the longitudinal striæ extend as far as the middle or two thirds of the 3rd segment, the margin of which, and the whole of the following segments are smooth, and very vaguely punctulate; the ventral surface is of the same colour as the dorsal, but the red extends over the first segment; a distinct fold runs throughout the ventral surface; the terebra issues from the anal extremity, and not from a ventral fissure. ♂ Similar; antennæ longer, with 65–68 joints; abdomen not compressed at the apex, and shewing one more segment than that of the ♀; apical segments black. Length, 3½; exp. 6¼ lines.

Var. ♀ First abdominal segment entirely rufous.

Parasite of the diptera *Lipara lucens*, Meig., *L. tomentosa*, Macq., and *L. similis*, Schiner, all three of which are abundant in the islands and on the banks of the Danube, near Vienna, forming galls on *Phragmites communis*. The size of *P. liparæ* varies naturally as that of its victim, the specimens proceeding from *L. lucens* being the largest. The cocoon is of a deeper rufous than that of the flies, more strongly compacted and more narrowly cylindric; the parasite, in order to escape, perforates the culm of the reed near the top. The species of *Lipara* are rare in Britain, and hence the presence of this parasite was not suspected until, by the kindness of Mr. Bignell, I was shewn the unique specimen in Mr. Dale's cabinet, ticketed as having been bred from *L. lucens*. *P. liparæ* is also recorded by Van Vollenhoven as taken in Holland.

VI. FLEXILIVENTRES.

Aphidiides.

Head usually transverse, contracted posteriorly, articulated to the lower part of the anterior face of the thorax; occiput margined, at least in part, (except in the genus *Dyscritus*), narrow, abruptly truncate; mandibles bidenticulate, cuneiform, narrow, hardly curved; palpi short, the maxillary not so long as the head, 2–4-jointed; labial palpi 1–3-jointed; clypeus subtriangular. Antennæ filiform or submoniliform, 11–25–27-jointed, shorter than the body in the ♀s, longer in the ♂s. Prothorax short; mesothorax gibbous; furrows of the mesonotum generally effaced, but distinct in *Praon* and some species of *Aphidius*; metathorax short, sloping from its base, usually areolated. First discoïdal areolet of the fore wings contiguous to the parastigma; the rest of the neuration is either tolerably complete, with 3 cubital areolets (*Ephedrus*, *Toxares*), or incomplete (*Praon*, *Aphidius*, *Monoctonus*, *Dyscritus*), having but 2 cubital areolets, often only 1, and sometimes none; in these latter cases the radial and cubital nervures are abruptly effaced before running half their course, and the exterior third of the wing is deprived of nervures: intercubital nervures effaced; 1st cubital areolet confounded with the 1st discoïdal (in *Praon* the separation exists imperfectly); anal nervure interstitial (except in *Dyscritus*), but feebly expressed or obsolete; the inferior wings have only two longitudinal nervures, indicating a costal areolet which is open at the extremity; the ♀ of one species of *Aphidius* is entirely apterous, the corresponding ♂ is unknown. Legs of ordinary form. Abdomen subpetiolate or subsessile, longer than the head and thorax, exhibiting 7 segments above, and 6 beneath; the 3 first segments are loosely articulated, so that the abdomen curves easily forwards under the thorax, an attitude necessary for oviposition, originally belonging to the larva when curled up within the globular body of an Aphis, and which the perfect insect shews a tendency to assume occasionally throughout life; 2nd suture replaced by an extensible membrane; hypopygium slightly projecting beyond the apical dorsal segment of the ♀, form-

ing a support to the terebra ; this last briefly exserted, its valves broad, compressed, of variable form.

The parasitic habits of these insects, differing from those of the majority of the Braconidæ, have been known ever since the year 1695, the date of the "Arcana Naturæ" of Van Leeuwenhœk, who first observed them attacking Aphides. His observations have been repeated and extended by a number of subsequent writers, so that the principal facts must be familiar to all entomologists. It is therefore unnecessary here to enter into many details. There is nothing remarkable in the process of oviposition, which is conducted in the manner usual with parasitic Hymenoptera : the female confides to each puceron a single egg, which is matured in a few days ; the larva remains generally in the body of the victim till the final change, making no separate cocoon ; the interior of the inflated Aphis is however lined with very fine silk. This is the general rule, to which the genus *Praon*, so far as is known, offers the only exception, to be mentioned hereafter in its place. The apterous adult Aphides are generally chosen by preference, probably because they are commonly of large size, and supply a greater portion of nutriment.

No doubt a vast number of these destructive vermin perish annually from the attacks of their enemies, but it does not appear that the mischief they cause is ever effectually controlled. The amateurs of rose-culture generally find that an infested plant shews strong signs of deterioration in spite of the industry of the female Aphidius, which, to be effectual, must be supplemented by the more vigorous measures of human skill. Some of these parasites, as the common *Aphidius avenæ* and *A. ervi*, Haliday, are known to attack several different kinds of Aphis ; but in general they are more exclusive, attaching themselves each to one particular species.

The number of species is certainly very large, but so little attention has been paid to their distinctions, that it is impossible to speak with any confidence ; the subject may almost be regarded as untouched. In fact there exist only two monographs to which recourse may be had for detailed information, that of Nees v. Esenbeck, containing 15 species, and that of Haliday, which extends to 44 : the few scattered descriptions occurring in other authors

refer for the most part to species previously published, or not being conceived upon any fixed plan, they are in general useless for identification. My own opportunities of observing these insects have been too few and too desultory to be of much importance in so wide a subject, and the increased number of species which I am able to record, as well as the facts relating to their habits, are largely due to my friend Mr. Bignell, who with his accustomed liberality, entrusted to me his whole collection for a long time. This collection includes the pucerons and their parasites exhibited together, with the necessary notes of their origin, and is probably unique in the kingdom. The Aphides have been named from Buckton's Monograph, while they were fresh; the parasites were determined by me. I need scarcely remark that this operation involves much difficulty. It appears useless, except in a limited number of cases, to collect specimens at hap-hazard, as they can seldom be identified with certainty. The minute differences which distinguish them, and the dissimilarity of the sexes, are serious obstacles, which become still more intractable after the drying of the specimens. The only way seems to be, to take from their food-plant a sufficient number of infested Aphides (easily recognised by their swollen and motionless bodies), and to keep them till their parasites come forth: by this means the correct association of the sexes is insured, and their characters may be verified or recorded from fresh specimens. A certain smattering of botanical knowledge is requisite, sufficient to name the wild and garden plants of Great Britain; and also the somewhat rarer accomplishment of a knowledge of Aphides; but this latter may always be acquired by the use of Buckton's Monograph.

A few hyperparasites of the Aphidiides have been observed, the commonest being the minute Cynipids of the genus *Allotria*. It is now certain, from the observations of Bignell, that these are true hyperparasites, depositing their eggs in the bodies of the *Aphidii* contained within the pucerons. Other parasites, of less certain habits, belong to the Chalcididæ and Proctotrypidæ, respecting which it still remains doubtful whether their attacks are directed against the *Aphides* themselves, or against their internal devourers. I shall take occasion to mention these hyperparasites in their proper places.

TABLE OF GENERA.

(2)	1.	Prædiscoïdal areolet separated from the 1st cubital by a nervure which is often partially, but never wholly, effaced ...	3
(1)	2.	Prædiscoïdal areolet not distinct from the 1st cubital	7
(4)	3.	No intercubital nervures; the single cubital areolet extends to the tip of the wing	i. PRAON.
(3)	4.	Intercubital nervures more or less distinct; 3 cubital areolets	5
(6)	5.	Abdomen lanceolate, subsessile; antennæ 11-jointed in both sexes	ii. EPHEDRUS.
(5)	6.	Abdomen orbicular, subpetiolate; antennæ with more than 11 joints ...	iii. TOXARES.
(8)	7.	Abdomen orbicular	iv. MONOCTONUS.
(7)	8.	Abdomen lanceolate	9
(10)	9.	Antennæ 10–13-jointed; ventral valve of the ♀ furnished with two setiform apical appendages, longer than the terebra	v. TRIOXYS.
(9)	10.	Antennæ with more than 13 joints (rarely with 11, 12, or 13 joints, in the most minute of the genus *Aphidius*); ventral valve of the ♀ without appendages	11
(12)	11.	Head transverse, not produced behind the eyes; cheeks not dilated; anal nervure interstitial	vi. APHIDIUS.
(11)	12.	Head longer than broad, much produced behind the eyes; cheeks dilated; anal nervure springing from the middle of the extremity of the podiscoïdal areolet	vii. DYSCRITUS.

I. PRAON, Haliday.

Hal., Ent. Mag., i, 483 (1833).

Head subglobular, flattened anteriorly; maxillary palpi 4-, labial 3-jointed; mandibles deeply bidenticulate. Antennæ with a variable number of joints, always greater in the males. Mesothoracic furrows distinct; thorax somewhat downy. Prædiscoïdal areolet separated from the 1st cubital by a nervure more or less indistinct; podiscoïdal widened exteriorly: no intercubital nervures, the radial nervure forming no angles, the single cubital areolet extending to the tip of the wing; stigma triangular, short, but prolonged in a fine line to the parastigma; costal areolet of the hind wings closed. Abdomen of the ♀ almost sessile, lanceolate, shorter in the ♂, oval sublinear, first segment short, the spiracular tubercles basal. Terebra conical, horizontal or slightly curved upwards.

This genus may be recognised (1) by the radial nervure, which presents no vestige of the anastomoses giving origin to the intercubital nervures; (2) by the stigma, which is shorter than in the other genera, but emits a linear prolongation to the parastigma; and (3) by the

shortness and width of the 1st segment, giving a sessile appearance to the abdomen. Eight species have been described in Europe, and a greater number in America; the determination of all of them is difficult. Three are found in the monograph of Nees v. Esenbeck, arranged by that author under the genus *Blacus*, but their descriptions are unsatisfactory. The species of *Praon*, in passing into the pupal state, depart from the practice adopted by the other known Aphidians; the latter, as mentioned above, remain within the body of the puceron, which serves them instead of a cocoon. The *Praons*, on the contrary, pierce a hole in the belly of the Aphis, and construct for themselves a separate shelter on the leaf beneath, resembling a tent or pavilion, usually surmounted by the empty skin of the victim; see a Memoir by Mr. Howard (*Insect Life*, vol. iv., p. 196) where is figured the construction made by an American species, corresponding exactly with those found in England on currant and other leaves. The Chalcid hyperparasite *Pachycrepis clavata*, Walker, was supposed by Haliday to be the maker of these tent-like cocoons (Ent. Mag., ii., p. 99), but, as it appears, erroneously, both Bignell and myself having several times obtained *Praon*, and not *Pachycrepis*, from the tents in question. The Chalcididæ also are not generally known to make cocoons, availing themselves of the body of their defunct host, or else changing into a naked pupa on the ground.

TABLE OF SPECIES.

(2).	1.	Antennæ of the ♀ 14-jointed (rarely with 13 or 15–18 joints); those of the ♂ 15–18-jointed	1. *abjectum*, Hal.
(1)	2.	Antennæ ♂ ♀ 18–23-jointed	3
(4)	3.	Abdomen yellowish rufous; occiput and mesonotum black, the rest of the body testaceous, pubescent	2. *exoletum*, Nees.
(3)	4.	Abdomen blackish or fuscous, often more or less testaceous at the base ...	5
(6)	5.	Wings infumated below the radial areolet	3. *dorsale*, Hal.
(5)	6.	Wings not infumated	7
(8)	7.	Antennæ ♂ ♀ notably longer than the body	4. *longicorne*, Marsh.
(7)	8.	Antennæ of the ♀ not or hardly longer than the body; those of the ♂ a little longer	9
(10)	9.	First abdominal segment reddish testaceous at the extremity, or entirely of that colour, as well as the base or the whole of the 2nd segment	5. *flavinode*, Hal.
(9)	10.	First abdominal segment fuscous, like all the following; segments 2–3 with a slight rufous tinge	6. *volucre*, Hal.

1. *Praon abjectum*, Haliday.

Aphidius (*P.*) *abjectus*, Hal., Ent. Mag., i, 485, ♀.
P. abjectum, Marsh., Species des Hym. d'Eur. et d'Alg., Bracon. vol. ii, p. 534, ♂ ♀.

The smallest species, of shorter form than the rest, and resembling *exoletum* which is distinguished by its rufous abdomen.

♀ Black, abdomen brown, paler at the middle of the base. Oral parts and palpi brownish. Antennæ rather shorter than the body, 14-jointed, rarely with 13- or 15–18-joints, the 3rd joint testaceous at the base. Metathorax smooth, not areated. Wings subhyaline; squamulæ black; radicles brownish; stigma pale, cinerous; basal nervures fuscous, the others almost effaced; cubital nervure scarcely perceptible, but reaching to the point where the 2nd cubital should terminate. Legs ferruginous; base of the 4 posterior femora, middle of tibiæ, coxæ and tips of tarsi, fuscescent. Abdomen somewhat longer than the head and thorax, and in the middle as broad as the latter; 1st segment clear brown, one half longer than broad, its tubercles basal, subobsolete; the following segments form an oval, lanceolate, and acute at the apex; 2nd segment of the same colour, the following becoming gradually darker, the last black. Valves of the terebra black. ♂ Similar; antennæ entirely black, somewhat longer than the body, 15–18-jointed; 1st segment narrower than that of the ♀. Length, $\frac{3}{4}$–1 line; exp. $1\frac{1}{2}$–2 lines.

Common in autumn; a parasite, according to Haliday, of one of the pucerons of *Angelica sylvestris*; also taken by him on a willow. More recently Bignell reared several specimens from *Aphis epilobii*, Kaltenbach, on *Epilobium hirsutum*, hairy willow-herb; from *Aphis hieracii*, Kaltenbach, on *Pastinaca sativa*, the parsnip; and from *Tychea phaseoli*, Passerini, on *Phascolus vulgaris*, the kidney bean. It attacks also *Siphonophora lactucæ*, Kalt., on *Lactuca scariola*, the lettuce, and from this last aphis, which formerly infested lettuces in my garden, I bred the two sexes.

2. *Praon exoletum*, Nees.

Bracon exoletus, Nees, Mag. Ges. Berl., 1811, p. 30.
Aphidius exoletus, Nees, Mon. i, 25; Wesm., Nouv. Mém. Ac. Brux. 1835, p. 81; Ratz., Ichn. d. Forst. iii, 63; Bouche, Naturg. (1834) 162, ♂ ♀.

Aphidius (*P.*) *exoletus*, Hal., *lib. cit.*, 484, ♂ ♀.
P. exoletum, Marsh., *lib. cit.*, p. 535, ♂ ♀.

Abdomen reddish testaceous; occiput and mesonotum black; the rest of the body testaceous, pubescent. ♀ Head wider than the thorax, testaceous beneath the antennæ, black above, almost smooth. Antennæ blackish with the 3 first joints testaceous, 18–23-jointed. Wings hyaline with an obscure tinge, pubescent; stigma and nervures pale. Legs testaceous; claws black. First abdominal segment rectangular, subcylindric, margined, slightly rugulose, somewhat constricted in the middle; the following segments almost flat above, the apical segment bifid at the extremity. Terebra as long as the two last segments. ♂ Testaceous; occiput, eyes, and tips of the antennæ, black; mesonotum infuscated; abdomen lanceolate, acute at the extremity. Length, $\frac{2}{3}$ line.

Var. Body blackish; legs rufo-testaceous.

I have not seen this species, described as above by Nees and others. It has been noticed in several countries of Europe, viz., Germany, Italy, Belgium, and Russia.

3. *Praon dorsale*, Haliday.

Aphidius (*P.*) *dorsalis*, Hal., *lib. cit.*, 484, ♀.
P. dorsale, Marsh., *lib. cit.*, p. 536, ♀.

Abdomen fusco-ferruginous, obscure, the 1st segment blackish. ♀ Blackish, the underside of the thorax rufotestaceous. Clypeus and oral parts rufotestaceous; palpi paler, elongate. Antennæ 20–21-jointed, broadly testaceous at the base. Wings elongate, ample, hyaline, with a small cloudy space beneath the radial nervure; stigma pale brown, yellowish during life; nervures fuscous; squamulæ piceous. Legs flavo-ferruginous, slender, longer than in the other species. First abdominal segment narrowed posteriorly. Terebra black. ♂ Unknown. Length, $1\frac{1}{4}$; exp. $2\frac{1}{2}$ lines.

Not common, according to Haliday, who had seen only three females. The species is distinguished by the unusual length of the palpi, wings, and legs.

4. *Praon longicorne*, Marshall.

P. longicorne, Marsh., *lib. cit.*, p. 536, ♂ ♀.

Antennæ ♂ ♀ considerably longer than the body. ♀ Head and thorax black; abdomen piceous, testaceous at the extremity, 1st

segment rufous, black at the base. Antennæ very slender, filiform, 22-jointed, black, with the 3 first joints testaceous. Thorax black both above and beneath ; metathorax beset with whitish hairs. Wings ample, very long, hyaline ; squamulæ and radicles testaceous, stigma pale yellow ; nervures brownish. Legs flavo-testaceous ; abdomen lanceolate, hardly longer than the head and thorax ; 1st segment twice as long as broad, longitudinally wrinkled, margined, with very small tubercles, which are placed before the middle ; the sides of this segment diverge a little from the base as far as the tubercles, after which they are parallel to the extremity ; the last segment, the greater part of the preceding, and the ventral valve are testaceous. Valves of the terebra black. ♂ Smaller ; antennæ one-third longer than the body, 22-jointed, black, with the 2 first joints testaceous ; clypeus and mandibles rufescent ; palpi pale testaceous ; legs more obscure than those of the ♀, femora dull reddish, hind coxæ infuscated at the base ; abdomen shorter than the head and thorax, 1st segment black, 2nd testaceous with a dark spot on each side ; following segments brown. ♀ Length, $1\frac{1}{3}$; exp. 3 lines ; ♂ length, 1 ; exp., $2\frac{1}{2}$ lines.

The sexes not having been bred together, there is no proof that they are correctly paired, nevertheless they present only the usual difference of sex, while the length of the antennæ renders them distinct from the rest of the species. I captured the ♀ in Wales, and Bignell reared the ♂ in Devonshire from *Siphonophora chelidonii*, Kaltenbach, the puceron commonly found on the greater celandine, *Chelidonium majus*, but in this instance living on *Rubus idæus*, the raspberry bush.

5. *Praon flavinode*, Haliday.

Aphidius (*P.*) *flavinodis*, Hal., *lib. cit.*, 485, ♀.
P. flavinode, Marsh., *lib. cit.*, p. 538, ♀, pl. xvii, f. 2.
? *Blacus emacerator*, Nees, Mon., i, 193, ♂ ♀, *teste* Curtis in "Guide."

♀ First abdominal segment rufotestaceous at the extremity, or entirely of that colour, as well as the base or the whole of the 2nd. Head and thorax black above ; face, prothorax, and pectus, rufotestaceous ; abdomen after the 2nd segment, dark brown. Oral parts yellowish. Antennæ shorter than the body, having 18–19-joints, of which the 3 first are testaceous. Mesothoracic furrows complete and distinct ; metathorax rufescent, without a medial carina. Wings hyaline, less ample than those of *dorsale* (sp. 3) ; stigma colourless

(yellow during life), the nervures which surround it, as well as those of the basal region, fuscous, distinct; 1st discoïdal areolet half confounded with the 1st cubital; radial nervure short, arcuate; cubital nervure nearly effaced. Legs shorter than those of sp. 3, testaceous, including the coxæ. Abdomen compressed from the base of the 3rd segment, carinated above throughout its length; 1st segment one half longer than broad, with salient tubercles situated near the base; 3rd and following segments black, as well as the short valves of the terebra.* ♂ Unknown. Length, 1; exp. $2\frac{1}{3}$ lines.

Rare; a parasite of *Pterocallis tiliæ*, L., the puceron of *Tilia europæa*, the lime tree; and of *Siphonophora absinthii*, L., the puceron of *Artemisia absinthium*, wormwood.

6. *Praon volucre*, Haliday.

Aphidius (*P.*) *volucris*, Hal., *lib. cit.*, 484, ♂ ♀.
P. volucre, Marsh., *lib. cit.*, p. 538, ♂ ♀.
? *Blacus angulator*, Nees, Mon., i. 193, ♂.

Abdomen dark-brown, the 2nd and 3rd segments with a rufous tinge. ♀ head and thorax black; prothorax sometimes rufotestaceous above. Head subglobular, not wider than the thorax; clypeus rufotestaceous; palpi paler. Antennæ very slender, filiform, as long as the body, with 19 joints, of which the two basal are rufescent, the 3rd testaceous, and all the rest black; 3rd joint very long. Mesothoracic furrows distinct; prothorax wrinkled transversely, sometimes black beneath and sometimes rufous; metathorax smooth, without a medial carina. Wings hyaline; squamulæ, radicles, and nervures pale brownish testaceous; stigma very pale, yellowish; 1st discoïdal areolet not entirely separated from the 1st cubital; radial nervure curved without an angle, its external portion (the 3rd abscissa) traced almost invisibly to the tip of the wing, as also is the cubital nervure. Legs obscurely testaceous. Abdomen longer than the head and thorax, lanceolate, brown, black at the extremity, somewhat lighter or rufescent on the 2nd suture and at the base of the 2nd segment; belly reddish-brown; ventral valve somewhat surpassing the last dorsal segment. Valves of the terebra black. ♂ Similar; antennæ a little longer than the body, stouter than those of the ♀, 22-jointed, black with the two basal joints brownish; 3rd

* The valves of the terebra of Hymenoptera being almost always black, it seems superfluous to mention their colour; but as some of the present group have testaceous valves, the distinction must be noticed.

joint of the same length as the following; legs more obscure; abdomen somewhat claviform, not longer than the head and thorax. Length, $1\frac{1}{4}$; exp. $2\frac{1}{4}$ lines.

The commonest species of the genus: it seems to be polyphagous, having been reared from the following pucerons: *Callipterus quercus*, Kalt. on *Quercus robur*, the oak; *Siphonophora sonchi*, L. on sow-thistle, *Sonchus oleraceus*; *S. absinthii*, L. on *Artemisia absinthium*, wormwood; *S. chelidonii*, Kalt. on the greater celandine, *Chelidonium majus*; *Aphis pruni*, Réaumur, infesting the apple-tree, *Pyrus malus*; the plum-tree, *Prunus domestica*; the apricot-tree *P. armeniaca*; and the medlar, *Mespilus germanica*. To these may be added some undetermined pucerons of the garden chrysanthemum, *Chrysanthemum sinense*, and of the Reine-Marguerite or China-aster, *Aster chinensis*. The pupal state lasts only 11 days; it is passed in a pyramidal tent-like cocoon constructed on a leaf, under the empty skin of the aphis, which either remains in position, or is detached by the wind or other accident. A ♂ bred from *Callipterus* had the 1st segment rufous, and the dividing nervure between the 1st cubital and prædiscoïdal areolets almost extinct. The hyperparasites observed from this species were *Allotria Ullrichi*, Giraud; *Isocratus vulgaris*, Walker; and an indeterminable or new species of *Lamprotatus*.

II. EPHEDRUS, Haliday.

Hal., Ent. Mag., i. 485 (1833).

Head as in the last genus, except that the labial palpi are only 2-jointed. Antennæ 11-jointed in both sexes, the 3rd joint longest in the ♀, hardly if at all elongate in the ♂. Thorax pubescent or glabrous; mesothoracic furrows indistinct, converging as usual. Prædiscoïdal areolet complete; 3 cubital areolets, the 2nd longer than broad, receiving the recurrent nervure near its base; stigma prolonged and attenuated at both ends; radial areolet complete; cubital nervure inchoate only; anal nervure almost interstitial; no costal areolet in the hind wings. Abdomen subpetiolate or subsessile, lanceolate, compressed at the extremity in the ♀; in the ♂ shorter, oboval or sublinear; 1st segment more or less narrow, cylindric, somewhat arched, its tubercles obsolete.

Four European and two American species have been described. They are very similar to the genus *Aphidius*,

but the neuration of the wings suffices to separate them. It is difficult to determine any one of the three English species without possessing the others for the purpose of comparison. Wesmael, unacquainted with the writings of Haliday, named this genus *Elassus* (1835).

TABLE OF SPECIES.

(2)	1. First abdominal segment subrectangular, shorter and broader than in the two following species, twice as long as broad, gibbous at the base, with spiracular tubercles situated before the middle	1. *validus*, Haliday.
(1)	2. First abdominal segment linear, three times as long as broad; spiracular tubercles situated in the middle	3
(4)	3. Stigma narrow, attenuated and much elongated inwards	2. *lacertosus*, Haliday.
(3)	4. Stigma broader, less attenuated and elongated inwards	3. *plagiator*, Nees.

1. *Ephedrus validus*, Haliday.

Aphidius (*E.*) *validus*, Hal., *lib. cit.*, 485, ♂ ♀.
E. validus, Marsh., *lib. cit.*, p. 542; ♂ ♀, pl. xvii. f. 5.

♀ Form much shorter than that of the other species; body pubescent, pitchy black with a paler spot in the middle of the base of the 2nd segment. Head punctulate. Antennæ shorter than those of sp. 2; 3rd joint testaceous. Thorax punctulate. Wings subhyaline or slightly infumated; stigma pale brown, narrower than that of sp. 3, broader and shorter than that of sp. 2. Legs ferruginous. Abdomen oblong, lanceolate; 1st segment blackish, granulated, not shining. Valves of the terebra stout, black, elevated at the extremity, in form somewhat resembling a plough-share. ♂ Similar; antennæ entirely black. Length, $1\frac{1}{4}$; exp. $2\frac{1}{2}$ lines.

A rare species according to Haliday, described from three specimens in the old collection of the Ent. Soc. of London. Reared by Bignell from *Myzus cerasi*, Fab., the common black puceron of the cherry tree.

2. *Ephedrus lacertosus*, Haliday.

Aphidius (*E.*) *lacertosus*, Hal., *lib. cit.*, 486, ♂ ♀.
E. lacertosus, Marsh., *lib. cit.*, p. 543, ♂ ♀.

♀ Black, shining, pubescent. Antennæ black, with the 1st joint ferruginous, the 3rd very long. Wings longer than in sp. 3, slightly infumated; nervures brown, stigma pale, yellow during

life. Legs ferruginous; hind femora infuscated. Abdomen linear-lanceolate; 1st segment linear, blackish; 2nd and 3rd piceous or testaceous. Valves of the terebra rather slender, black. ♂ Similar; antennæ entirely black, not longer than those of the ♀. Length, 1¼; exp. 2½ lines.

This parasite is rather common in the fields, attacking certain pucerons which live on the tine-tare, *Ervum hirsutum*, the pest of corn-fields; the species of these pucerons has not been determined. Like the preceding, it also destroys *Myzus cerasi*, Fab. According to Haliday the ♀, in the act of oviposition, carries the abdomen in the same manner as the true *Aphidii*, but she pierces the back of the puceron, having the terebra somewhat inclined, for this purpose; the stroke is not so instantaneous, being often prolonged for several seconds.

3. *Ephedrus plagiator*, Nees.

Bracon plagiator, Nees, Mag. Ges. Berl. 1811, p. 17.
Aphidius (*E.*) *plagiator*, Hal., *l. c.*; Curtis in Morton's Cyclop. Agric., s. v. *Aphis*, pl. xvii, ff. 7, 8; Farm. Ins. pp. 290, 292, pl. xxxix, f. 14, ♂ ♀.
Aphidius parvicornis, Nees, Mon., i, 16; *Elassus parvicornis*, Wesm., Nouv. Mém. Ac. Brux., p. 86, pl. i (wing), ♂ ♀.
E. plagiator, Marsh., *lib. cit.*, p. 544, ♂ ♀.

♀ Antennæ longer than the head and thorax. Black, shining, pubescent, abdomen piceous. Oral parts brownish red; palpi obscure. Antennæ compressed, rather short, the apical joint not longer than the preceding; 1st joint rufous, the rest black. Metathorax regularly areated; the middle compartment generally the most distinct, pentagonal. Wings hyaline, nervures brown; stigma rather large, not much elongated internally, testaceous. Legs dull red, the middle pair darker, the hind pair darker still, with the trochanters and the base or the greater part of the tibiæ rufescent; 4 posterior coxæ blackish. Abdomen linear-lanceolate, piceous brown, sometimes obscurely testaceous in the middle of the 2nd segment; 1st segment narrow, cylindric, rugose, marked before the extremity with a transverse impression. Valves of the terebra slender, conical, black, a little longer than the apical segment, truncate at the extremity. ♂ Similar, usually smaller, with darker legs; abdomen rounded at the extremity. Length, ½–1; exp. 1–2 lines.

A supposed parasite of *Siphonophora granaria*, Kirby, a puceron infesting several species of grass. Yet the identification seems doubtful, judging by Buckton's figure, (Aphides, vol. i, pl. vii,) which represents an insect very different from an *Ephedrus*. However that may be, Mr. Buckton's observation is conclusive with regard to the minute hyperparasite *Lygocerus carpenteri*, Curtis, which he viewed under the microscope, enclosed with some *Siphonophoræ*. This was a ♀, who was observed to deposit several eggs in the bodies of those *Siphonophoræ* previously occupied by Aphidian parasites. It is therefore no longer to be doubted that the species of *Lygocerus*, and probably many others, if not all, of the *Ceraphron* group in the Proctotrypidæ, are hyperparasites. *E. plagiator*, though not very common, is widely spread, having been noticed in Germany, Italy, Belgium, Holland, and Spain, whence I have received specimens from Seville.

III. TOXARES, Haliday.

Trionyx,* Hal., Ent. Mag., i, 487 (1833); *Toxares*, Hal., in Westw., Int. ii, Synopsis, 65 (1840).

Head transverse, rounded. Palpi rather long, the maxillary 4–, the labial 3-jointed; mandibles acute, deeply bidenticulate. Antennæ somewhat elongate, 19–22-jointed. Thorax glabrous; mesothoracic furrows hardly visible, converging as usual. Neuration in general similar to that of *Ephedrus*; prædiscoïdal areolet complete; 3 cubital areolets; stigma narrow, elongate, lanceolate at both ends; radial areolet cultriform, reaching the tip of the wing; anal nervure not interstitial; intercubital nervures sometimes indistinct. Abdomen of the ♀ spathulate, or claviform and flattened, subpetiolate; that of the ♂ narrower, oblong; 1st segment linear, the tubercles situated before the middle; segments 2–3 the longest, the rest short, transverse. Terebra curved downwards, its valves much dilated underneath, of deltoïd form, trifid at the extremity.

This genus resembles *Praon* in the palpi, and *Ephedrus* in the wings; in other respects it comes nearer to *Monoctonus*, the antennæ, the 1st segment, the abdomen of the ♀, and the general facies, being much the same; only the *Monoctoni* have their labial palpi 2-jointed, according to Haliday. In order not to mistake a *Toxares*, on

* *Trionyx* was rejected on account of its preoccupation as a genus of Chelonian Reptilia.

a merely cursory inspection, for one of the smaller *Opii*, (*pygmæator*, etc.), it is sufficient to observe the length of the petiole. Only one species occurs in the British fauna, and another in America. The so-named *Toxares* (*Trionyx*) *rapæ*, Curtis (Farm. Ins. 73), and figured in McIntosh (Book of the Garden, ii, 194), belongs to the genus *Aphidius*.

Toxares deltiger, Haliday.

Aphidius (*Trionyx*) *deltiger*, Hal., *l. c.*, ♂ ♀.
Toxares deltiger, Marsh., *lib. cit.*, p. 546, ♂ ♀, pl. xvii, f. 7.

♀ Head and thorax black, shining; abdomen either testaceous, infuscated on the sides, or entirely fuscous; the 1st segment always rufescent. Mouth and palpi yellowish. Antennæ about 19-jointed, longer than the body, blackish with the 5 or 6 basal joints, or only the 3rd joint, testaceous. Metathorax carinated in the middle, and divided into regular compartments, like that of *Aphidius*. Wings hyaline; squamulæ and radicles dull testaceous; stigma brownish yellow, nearly of the same form as that of *Ephedrus validus*. Legs rufotestaceous. Abdomen of the same colour, more or less darkened at the sides and posteriorly. Valves of the terebra rufotestaceous. ♂ Similar; antennæ 21–22-jointed, the two basal joints fuscous, the 3rd testaceous (in my specimen); abdomen less rounded than that of the ♀; 1st segment more clearly rufous. Length, 1¼; exp. 2½ lines.

Rare in England, and unnoticed elsewhere. I have never possessed more than a single example.

IV. MONOCTONUS, Haliday.

Hal., Ent. Mag., i, 487 (1833).

Head transverse, rounded. Maxillary palpi 4-jointed; labial very short, 2-jointed. Antennæ not longer than the body, with a variable number of joints, greater in the ♂. Mesonotum glabrous, the furrows obsolete or very indistinct; metathorax without a medial carina, not areated. Prædiscoïdal areolet confounded with the 1st cubital; 2 cubital areolets at most, the 1st large, irregular, shorter than in the genus *Aphidius*, not so long as the stigma, half obsolete; stigma narrow, triangular, elongate, emitting the radial nervure from its middle; 1st abscissa of this nervure straight, placed obliquely; 2nd as long as the 1st, then suddenly disappearing; podiscoïdal areolet open on the inner side; anal nervure interstitial. This

description of the wings is made from *M. nervosus*; in the other species the characteristic part of the neuration is colourless and indistinct, the cubital and radial areolets entirely disappearing. Some males having the 2nd cubital areolet badly defined are hardly distinguishable from those of the following genus, which however may be separated by the form of the stigma. Abdomen of the ♀ spathulate, suborbicular; or else lanceolate, enlarged in the middle; 1st segment slender, linear. Terebra curved downwards, its valves acutely pointed, and dilated at the base beneath, so as to resemble somewhat a plough-share.

The three species are far from common, and difficult to find, occurring on aquatic plants in marshes.

Table of Species.

(2)	1. Second cubital areolet complete and distinct	1. *nervosus*, Hal.
(1)	2. Second cubital areolet obsolete as to its exterior half, or entirely effaced	3
(4)	3. Face, prothorax, pectus, and tip of the abdomen, rufotestaceous; the rest of the head, and the disc of the thorax, black; abdomen brown, testaceous at both ends	2. *paludum*, Marsh.
(3)	4. Face, prothorax, pectus, and tip of the abdomen, black; the rest of the abdomen pale	3. *caricis*, Hal.

1. *Monoctonus nervosus*, Haliday.

Aphidius (*M.*) *nervosus*, Hal., *lib. cit.*, 488, ♀; *M. nervosus*, Marsh., *lib. cit.*, p. 548, ♀.

♀ Black: antennæ 16-jointed, testaceous towards the base, the scape fuscous. Wings obscure; stigma pale brownish; nervures stout, fuscous. Legs ferruginous, hind femora infuscated. First abdominal segment blackish, 2nd pale brown; the rest blackish. Valves of the terebra brown. ♂ Unknown. Length, ¾; exp. 1½ lines.

Only two females were known to Haliday, the author of the above description; the species has not occurred since.

2. *Monoctonus paludum*, Marshall.

M. paludum, Marsh., *l. c.*, ♀, pl. xviii., f. 2.

♀ Oral parts and palpi testaceous. Antennæ shorter than the body, 13-jointed, black, with the 1st joint and the base of the 2nd testaceous. Metathorax brown, posteriorly rufescent. Wings hyaline;

squamulæ blackish ; radicles testaceous ; stigma pale, almost hyaline ; basal nervures brown ; all the exterior nervures effaced except the commencement of the radial. Legs rufotestaceous, including the coxæ ; femora and tibiæ infuscated above, or almost entirely, both ends remaining pale. Abdomen stout in the middle, lanceolate, acute at the extremity ; 1st segment rufescent, nearly linear, $2\frac{1}{2}$ times as long as broad, the tubercles situated before the middle ; 2nd in great part pale testaceous, fuscescent at the sides ; segments 3 to 5 brown ; the two apical segments pale testaceous. Valves of the terebra pale, streaked with fuscous above. ♂ Unknown. Length, 1 ; exp. 2 lines.

I captured two females in the south of England, probably Devonshire.

3. *Monoctonus caricis*, Haliday.

Aphidius (*M.*) *caricis*, Hal., *l. c.*, ♀ ; Ruthe, Stett. Zeit., 1859, p. 314.
M. caricis, Marsh., *l. c.*, ♂ ♀.

♀ Blackish brown ; abdomen pale brown or dull-ferruginous, black at the extremity. Antennæ testaceous at the base ; the scape blackish. Wings hyaline with an obscure tinge ; stigma pale. Legs flavorufous or ferruginous. First abdominal segment shorter than in *nervosus*. Valves of the terebra brown or testaceous. ♂ Black ; antennæ as long as the body, 16-jointed ; legs piceous or ferruginous at the articulations ; abdomen narrower than that of the ♀, pale piceous, blackish at the extremity, and sometimes on the 1st segment. A variety occurs in which the colours are paler. Length, $\frac{3}{4}$; exp. $1\frac{3}{4}$ lines.

Occurs rarely in swampy places on the fescue-grass, *Festuca pratensis*, on sedge, *Carex*, and various *Graminaceæ*.

V. TRIOXYS, Haliday.

Hal., Ent. Mag., i, 488 (1833).

Head transverse, rounded, more bulky than in the preceding genera. Maxillary palpi 4–, labial 2-jointed. Antennæ of the ♀ short, sometimes incrassated towards the tips, 11-jointed (rarely 10- or 12-jointed) ; those of the ♂ 13-jointed. Mesothoracic furrows obsolete. Prædiscoïdal areolet confounded with the 1st cubital ;

2nd cubital entirely effaced; stigma triangular; radial nervure curved without an angle, effaced before reaching the tip of the wing, it is however longer than in the genus *Aphidius*. Abdomen lanceolate, petiolate; ventral valve of the ♀ furnished with two slender appendages or horns longer than the terebra, curved upwards at the extremity; 1st segment linear, the spiracular tubercles variously placed. Terebra directed somewhat downwards, as in *Monoctonus*.

The females may be distinguished at a glance by the armature of the abdomen; the males may be easily mistaken for such of the genus *Aphidius* as have the 1st cubital areolet indistinct, but in the latter the radial nervure is shorter, the antennæ have usually more articulations, and the form of the stigma is generally narrower. Ten species of *Trioxys* have been described belonging to the European fauna, and a greater number in America.

TABLE OF SPECIES.

I have found it impossible to tabulate some of these species in a satisfactory manner, partly for want of specimens, and partly (as in the case of the three last,) on account of defective descriptions.

(2)	1. Antennæ 12-jointed...	1. *auctus*, Hal.
(1)	2. Antennæ with fewer than 12 joints ...	3
(4)	3. Antennæ with 11 joints	5
(3)	4. Antennæ with 10 joints	2. *brevicornis*, Hal.
(6)	5. Antennæ progressively incrassated from base to apex	7
(5)	6. Antennæ filiform	11
(8)	7. Face testaceous...	3. *heraclei*, Hal.
(7)	8. Face black; only the oral parts pale ...	9
(10)	9. Intermediate segments of the abdomen fuscous; the posterior yellow (1st segment dull testaceous)	4. *aceris*, Hal.
(9)	10. All the segments black, except the 1st, which is clear yellow	5. *betulæ*, Marsh.
(12)	11. Spiracles of the 1st segment situated behind the middle...	15
(11)	12. Spiracles situated in the middle	13
(14)	13. Appendages of the ventral valve in the ♀ black. Length, 1 line	6. *centaureæ*, Hal.
(13)	14. Appendages of the ventral valve in the ♀ testaceous. Length, ½ line	7. *angelicæ*, Hal.
(16)	15. Last joint of the antennæ soldered to the preceding, and hardly discernible	8. *minutus*, Hal.
(15)	16. Last joint of the antennæ free	17
(18)	17. Abdomen pale yellow, the intermediate segments, and sometimes the posterior, infuscated	9. *pallidus*, Hal.
(17)	18. Abdomen indistinctly yellowish anteriorly; 1st segment infuscated in the middle	10. *letifer*, Hal.

1. *Trioxys auctus*, Haliday.

Aphidius (*T.*) *auctus*, Hal., *lib. cit.*, 489, ♂ ♀ ; Marsh., *lib. cit.*, p. 550, ♂ ♀.

♀ Head and thorax black, shining ; abdomen piceous, paler or even yellowish in the middle of the base ; 1st segment fulvo-rufous. Antennæ 12-jointed. Oral parts rufo-flavescent ; base of the antennæ of the same colour. Wings hyaline, somewhat obscure ; stigma narrower than in most of the species, rufo-flavescent during life, afterwards, pale brown, like the nervures. Legs fulvo-rufous ; coxæ of the 4 posterior, middle of their femora and of their tibiæ, and tips of their tarsi, blackish. First abdominal segment rather stout, having its spiracles between the base and the middle. ♂ Antennæ slender, elongate, black, 12-jointed ; fore femora infuscated above, tibiæ of the same pair infuscated in the middle ; 4 posterior legs darker than those of the female. Length, $\frac{3}{4}$; exp. 2 lines nearly.

Not uncommon on willows in England ; taken also in Holland by Van Vollenhoven.

2. *Trioxys brevicornis*, Haliday.

Aphidius (*T.*) *brevicornis*, Hal., *lib. cit.*, 491, ♀ ; Marsh., *lib. cit.*, p. 551, ♀.

♀ Black ; abdomen pale brownish, darker at the sides, dull testaceous at the extremity. Antennæ 10-jointed, very short, thickened towards the tips : apical joint large, oblong, 3rd pale at the base. Legs piceous, all the knees, as well as the underside of the fore femora and fore tibiæ, ferruginous. Spiracles of the first segment indicated by minute denticles, situated near the middle, more or less indistinct. ♂ Unknown. Length, $\frac{1}{3}$; exp. $\frac{2}{3}$ line.

Found by Haliday on *Umbelliferæ*, especially the *Angelica sylvestris*, but unnoticed since his time.

3. *Trioxys heraclei*, Haliday.

Aphidius (*T.*) *heraclei*, Hal., *lib. cit.*, 490, ♂ ♀.
Aphidius obsoletus, Wesm., Nouv. Mém. Ac. Brux. 1835, p. 83, ♀, pl. i, (wing) ; Ratz., Ichn. d. Först., ii, 58 ; iii, 62, ♂ ♀, pl. ii, f. 27 (wing).
T. heraclei, Marsh., *lib. cit.*, p. 552, ♂ ♀.

♀ Black ; face yellowish, abdomen of the same colour, infuscated in the middle. Antennæ 11-jointed, progressively thickened from

the base, which is clear yellow; last joint incrassated. Prothorax yellowish, less frequently brownish. Legs yellowish, 4 posterior femora and tibiæ infuscated, except at the base; hind coxæ blackish. First abdominal segment denticulated or crenulate on each side near the middle; appendages of the ventral valve more strongly curved than in the other species. ♂ Almost wholly black; antennæ of the same colour; fore legs, as well as the trochanters, tibiæ, and base of tarsi of the 4 posterior, dull testaceous; abdomen blackish brown with the base dull yellowish. Length, $\frac{3}{4}$; exp. $1\frac{1}{2}$ lines.

Parasite of the pucerons of the cow-parsnip, *Heracleum sphondylium*; very common in July, afterwards disappearing. Taken in Holland by Van Vollenhoven.

4. *Trioxys aceris*, Haliday.

Aphidius (*T.*) *aceris*, Hal., *lib. cit.*, 490, ♀.
Aphidius cirsii, Curtis, B. E., pl. ccclxxxiii, not of Haliday, ♀.
T. aceris, Marsh., *lib. cit.*, p. 552, ♀, pl. xviii, f. 4.

♀ Black; face of the same colour, except the oral parts, which are testaceous; abdomen brown above, yellow posteriorly, the 1st segment dull testaceous. Antennæ 11-jointed, much longer than in any of the following species, progressively thickened from the base; apical joint large, oblong; 2nd and 3rd joints dull testaceous. Wings hyaline, pubescent, with a slight dusky tinge; stigma very pale, almost hyaline; nervures brown. Legs rufotestaceous; 4 posterior femora, middle of their tibiæ, and tips of their tarsi infuscated; so also the 4 posterior coxæ. Abdomen short, depressed; tubercles of the 1st segment placed near the base. ♂ Unknown. Length, 1; exp. $2\frac{1}{4}$ lines.

Curtis in 1831 described and figured this insect as *Aphidius cirsii*, a supposed parasite of the aphis of *Cirsium arvense*, or *Carduus arvensis*. But Haliday, describing in 1833 the same specimen, reared by himself from the puceron of the sycamore, *Acer pseudoplatanus*, changed the name *cirsii*, as being incorrect. Taken in Holland by Van Vollenhoven.

5. *Trioxys betulæ*, Marshall.

T. betulæ, Marsh., *lib. cit.*, p. 553, ♀.

♀ Black; head and thorax of that colour, only the oral parts testaceous; abdomen black except the 1st segment which is clear

yellow. Antennæ 11-jointed, thickened towards the tips, shorter than the body, black with the 3 basal joints testaceous. Metathorax carinated in the middle, regularly areated. Wings hyaline; squamulæ fuscous; radicles testaceous; nervures very slender, those of the basal region brownish, the radial and border of the stigma testaceous, the latter very pale, hyaline. Legs flavotestaceous; the 4 posterior brown with the knees and base of the tarsi pale; hind coxæ brown. Abdomen longer than the head and thorax, lanceolate, compressed and pointed at the apex; 1st segment linear, $2\frac{1}{2}$ times as long as broad, having its tubercles placed before the middle; 2nd, reddish brown in the middle, blackish on the sides; following segments black. Valves of the terebra black, compressed, curved downwards in form of a stout claw; appendages of the ventral valve testaceous. ♂ Unknown. Length, $\frac{3}{4}$; exp. $1\frac{1}{2}$ lines.

A single ♀ was bred by Bignell from *Callipterus betularius*, the puceron of the birch, *Betula alba*.

6. *Trioxys centaureæ*, Haliday.

Aphidius (*T.*) *centaureæ*, Hal., *lib. cit.*, 490, ♀.
T. centaureæ, Marsh., *lib. cit.*, p. 554, ♂ ♀.

♀ Appendages of the ventral valve black. Black, shining. Antennæ 11-jointed, filiform, longer than the head and thorax, but shorter than in *auctus*, black with the 2nd joint and base of the 3rd testaceous. Palpi brownish. Thorax glabrous; mesothoracic furrows distinct. Wings hyaline; squamulæ and radicles dull testaceous; stigma very pale yellow after death; nervures slender, brownish. Legs dull testaceous; coxæ, femora, and tibiæ of the 4 posterior in great part infuscated; trochanters and base of the tibiæ testaceous. Abdomen linear-lanceolate, black; 1st segment narrow, testaceous at both ends, or entirely; 2nd narrowly testaceous at the extremity; tubercles situated beyond the middle (a character peculiar to this species and the following). ♀ Similar; antennæ rather shorter than the body, 13-jointed, with the extremity of the 2nd joint and base of the 3rd testaceous; legs darker than those of the ♀; abdomen rounded at the apex. Length, 1; exp. 2 lines.

Not common, according to Haliday. The ♀ when engaged in oviposition behaves like an *Aphidius*: she applies the terebra to the belly of the puceron; the stroke given is instantaneous; the two remarkable processes or horns of the 6th segment are quite useless in the operation. Haliday once reared this parasite from the aphis of

the knapweed, *Centaurea nigra*, but obtained only females; in endeavouring to repeat his experiment I had better success, procuring several specimens of both sexes.

7. *Trioxys angelicæ*, Haliday.

Aphidius (*T.*) *angelicæ*, Hal., *lib. cit.*, 489, ♀.
T. angelicæ, Marsh., *lib. cit.*, p. 555, ♀.

♀ Appendages of the ventral valve testaceous. Head and thorax black; abdomen nigro-fuscous, lighter or approaching to testaceous on the 1st segment and in the middle of the 2nd. Oral parts and palpi yellowish. Antennæ 11-jointed, filiform, longer than the head and thorax, the two basal joints yellow. Wings hyaline; squamulæ black; radicles dull testaceous; stigma reddish yellow, pale brown after death. Legs fulvo-ferruginous; 4 posterior femora above, middle of tibiæ, and tips of tarsi, infuscated; hind coxæ blackish, testaceous at the extremity. Abdomen lanceolate, widest in the middle; 1st segment slender, bidenticulate on each side a little beyond the middle, yellowish, more or less infuscated in the middle. ♂ Unknown. Length almost $\frac{1}{2}$; exp. 1 line.

Haliday considered this species to be parasitic on some aphis of the *Angelica sylvestris*. Bred by Bignell from *Siphonophora olivata*, Buckton, infesting in autumn the thistle, *Carduus lanceolatus*.

8. *Trioxys minutus*, Haliday.

Aphidius (*T.*) *minutus*, Hal., *lib. cit.*, 491, ♀.
T. minutus, Marsh., *lib. cit.*, p. 556, ♀

♀ Apical joint of the antennæ closely united to the preceding. Head and thorax black; abdomen piceous, dull testaceous at the apex. Similar to *brevicornis* (sp. 2) but with 11-jointed antennæ, the apical joint not elongate. Legs piceous; knees fulvous; tarsi shorter. ♂ Unknown. Length, $\frac{3}{4}$; exp. $1\frac{1}{2}$ lines.

Taken once only by Haliday upon a box-bush, *Buxus balearica*, crowded with aphides.

9. *Trioxys pallidus*, Haliday.

Aphidius (*T.*) *pallidus*, Hal., *lib. cit.*, 489, ♀.
T. pallidus, Marsh., *lib. cit.*, 556, ♀

♀ Apical joint of antennæ free and distinct. Abdomen pale testaceous, with the intermediate segments, or even the posterior,

infuscated. Head and thorax black; oral parts yellow. Antennæ 11-jointed, slender, longer in proportion to the body than in the rest of the species, fuscous with the 4 basal joints yellow. Wing hyaline; stigma pale yellow; nervures brownish; radicles and squamulæ dull stramineous. Legs either wholly pale, or with the middle of the hind femora and tibiæ slightly infuscated. Abdomen slender. ♂ Unknown. Length, $\frac{7}{8}$; exp. $1\frac{1}{2}$ lines.

Taken rarely by Haliday on sedge, *Carex*, and once on a nut-bush, *Corylus avellana*.

10. *Trioxys letifer*, Haliday.

Aphidius (*T.*) *letifer*, Hal., *lib. cit.*, 491, ♀.
T. letifer, Hal., *lib. cit.*, p. 567, ♀.

♀ Abdomen anteriorly dull yellowish; 1st segment infuscated in the middle. Antennæ 11-jointed, rather short, with the scape brown, and the base of the flagellum pale. Similar to *heracleè* (sp. 3). Head and thorax black. Legs obscure; tarsi short. ♂ Unknown. Length almost $\frac{1}{2}$; exp. 1 line.

Reared by Haliday from the pucerons of a species of willow, *Salix ulmifolia*, in June.

VI. APHIDIUS, Nees.

Nees, Act. Ac. L.C., 1818, p. 302.

Head as wide as the thorax, rarely wider or narrower; face short; mandibles feebly bidenticulate; palpi with a variable number of joints, 4, 3, or 2, in the maxillary, 3, 2, or 1, in the labial. Antennæ 11–27-jointed; the number is important for specific discrimination, it is nearly constant in each species, admitting only 1 or 2 joints in excess or defect; it is more variable in the species which have 20 joints and upwards; only one species is known with 27 joints, which does not occur in England. Mesothoracic furrows usually effaced, rarely more or less visible; metathorax very short, abruptly inclined, often canaliculate in the middle and regularly areated by raised lines. First cubital areolet always confounded with the prædiscoïdal, sometimes open also beneath, owing to the effacement of the cubital nervure, in which case it ceases to exist; sometimes limited on the underside by the same nervure; intercubital nervures none, or very indistinct; the discoïdal areolets are also liable to disappear, the 2nd (when it exists) is closed posteriorly; anal nervure interstitial; præbrachial and pobrachial nervures approximated; no præbrachial

areolet in the hind wings. The ♀ of *A. ephippium* is apterous. Abdomen of the ♀ subpetiolate, lanceolate, longer than the head and thorax; rounded at the apex, and sometimes a little spathulate in the ♂; 1st segment linear, occupying at most $\frac{1}{4}$ or $\frac{1}{3}$ of the total length of the abdomen, rarely constricted in the middle by reason of the prominence of the spiracular tubercles; 2nd suture distinct, covered with a loose and translucent membrane which allows freedom of movement to the abdomen, especially in the act so familiar to these insects of doubling back the abdomen under the thorax; this suture always forms a conspicuous pale mark on the abdomen; ventral valve of the ♀ without appendages.

This genus, after the dismemberments above described, still comprises the vast majority of the tribe. Some further attempts to break up the genus have been made by Förster (Synopsis, p. 247), but they are too partial and vague to be really available, and are rendered useless besides by the existence of transitional forms of doubtful position. The number of species cannot be estimated with any approach to correctness, but it is probably not much less than that of the Aphidæ, comprising therefore many different forms respecting which we have at present no information. Haliday's work, which is the most comprehensive, describes twenty-four species, and the author declares that his only object was to establish a few sections, by the help of which future naturalists might make a more considerable advance in the subject. Most of these sections, converted into genera, have been detailed above; they constitute the principal and most obvious divisions into which the tribe can be separated, and have every appearance of permanence. If we seek to extend further the system of dismemberment, we find, so far as I have been able to make out, only more trifling characters, confined to a single species, and therefore improper for the establishment of good genera. The males of *Aphidius* differ much from their respective females, while at the same time they resemble each other so closely, that their separation by inspection of individuals captured at random is almost certain to lead to error; it is necessary therefore to breed both sexes together, which can generally be done without difficulty. The first table therefore contains males and females of the correctness of whose association there can be no doubt, and this category fortunately comprises the majority of the species. A second dichotomy will be devoted to a few males not

contained in the first table, but whose peculiarities are so marked that they can be recognised apart from their females; the number of these is very restricted, doubtful forms, which are many, having been excluded.

Table of Species.

1. *Males and Females.*

(2)	1.	Apterous in the female sex, male unknown	1. *ephippium*, Hal.
(1)	2.	Winged in both sexes	3
(4)	3.	First cubital areolet limited on the lower side by the cubital nervure, sometimes not very distinctly	5
(3)	4.	First cubital areolet entirely effaced ...	65
(6)	5.	Abdomen linear, very slender, three times as long as the head and thorax..	2. *longulus*, Marsh.
(5)	6.	Abdomen lanceolate, not remarkably slender, more or less dilated in the middle, only a little longer than the head and thorax	7
(8)	7.	Antennæ of the ♀ composed of 20–22 joints, those of the ♂ 25-jointed. Large species (*Pinicolæ*, Hal.) attacking the large pucerons of coniferous trees (*Lachnus*, &c.)	9
(7)	8.	Antennæ ♂ ♀ with fewer joints. Smaller species, attacking the typical *Aphidæ*	17
(10)	9.	Abdomen yellow, at least posteriorly ...	11
(9)	10.	Abdomen black or fuscous, with the two first sutures pale; or cinctured with yellow bands, black posteriorly	13
(12)	11.	Antennæ black at the apex; wings entirely hyaline; 1st segment gradually dilated from base to apex; terebra curved, ascending; tubercles of 1st segment situated before the middle...	3. *pictus*, Hal.
(11)	12.	Antennæ testaceous at the apex; wings infumated beneath the stigma and towards the tip; 1st segment linear as far as the tubercles, which are placed in the middle, the condylus dilated; terebra straight, horizontal...	4. *infulatus*, Hal.
(14)	13.	Abdomen with only the two first sutures more or less pale	15
(13)	14.	Abdomen cinctured with distinct yellow bands, of which the anterior is broadest	5. *abietis*, Marsh.
(16)	15.	First segment linear as far as the tubercles, condylus gradually dilated; terebra obtuse, horizontal	6. *pini*, Hal.
(15)	16.	First segment linear, condylus not dilated; terebra acute, ascending	7. *laricis*, Hal.
(18)	17.	Antennæ of the ♀ 17–20-jointed (in *A. ervi* 21-jointed)	19
(17)	18.	Antennæ of the ♀ 12–16-jointed	37
(20)	19.	Antennæ ferruginous	8. *urticæ*, Hal.
(19)	20.	Antennæ black or blackish	21
(22)	21.	Abdomen, from the base of the 2nd segment, entirely testaceous	9. *gregarius*, Marsh.

(21) 22. Abdomen, from the base of the 2nd segment not entirely testaceous 23
(24) 23. Abdomen saffron yellow, the anterior segments banded or spotted with brownish... 25
(23) 24. Abdomen black, fuscous, or brown, at most with some of the sutures, a spot between the 2nd and 3rd segments, and sometimes the apex, pale 27
(26) 25. First segment brown, rarely testaceous; femora and tibiæ more or less infuscated; a dark spot on each side of segments, 2–5... ... ... 10. *rosæ*, Hal.
(25) 26. First segment and the whole of the legs yellow; disc of the anterior segments more or less infuscated ... ... 11. *loniceræ*, Marsh.
(28) 27. Mesothoracic furrows indicated by longitudinal depressions 29
(27) 28. Mesothoracic furrows effaced... 33
(30) 29. Prothorax black ... ... 12. *avenæ*, Hal.
(29) 30. Prothorax entirely, or on the under side, testaceous 31
(32) 31. Antennæ 19–21-jointed, almost as long as the body; neuration strong and distinct; abdomen black with the 2nd suture pale; tubercles of the 1st segment distinct... ... ... 13. *ervi*, Hal.
(31) 32. Antennæ 18-jointed, much shorter than the body; neuration very fine; abdomen brown with the anterior sutures pale; tubercles of the 1st segment effaced ... ... 14. *ulmi*, Marsh.
(34) 33. Length $\frac{3}{4}$ line; neuration very fine and indistinct; cubital nervure effaced, except under the 2nd cubital areolet ... 15. *pascuorum*, Marsh.
(33) 34. Length $1\frac{1}{4}$–$1\frac{1}{2}$ lines; neuration distinct; cubital nervure visible from its origin to the end of the 2nd cubital areolet.. 35
(36) 35. All the legs rufotestaceous; abdomen brownish, segments 2–5 narrowly pale at the base ... ... 16. *pterocommæ*, Marsh.
(35) 36. Four posterior legs more or less infuscated; abdomen dark brown anteriorly, segments after the 4th yellow.. 17. *granarius*, Marsh.
(38) 37. Valves of the terebra black, straight, horizontal 41
(37) 38. Valves of the terebra testaceous, curved downwards 39
(40) 39. First abdominal segment robust, its tubercles situated before the middle ... 18. *crepidis*, Hal.
(39) 40. First abdominal segment slender, its tubercles situated in the middle ... 19. *pseudoplatani*, Marsh.
(42) 41. Prothorax black; wings infumated; cubital nervure effaced towards its base, reappearing under the 1st cubital areolet, after which it is again obsolete ... ... 20. *dissolutus*, Hal.
(41) 42. Prothorax testaceous; wings hyaline; cubital nervure visible from its origin to the end of the 1st cubital areolet... 43
(44) 43. Antennæ 16-jointed... ... ... 21. *sonchi*, Marsh.
(43) 44. Antennæ with 15 joints, or fewer than 15 45
(46) 45. Antennæ with 15 joints 47

(45) 46. Antennæ with 14 joints, or fewer than 14 53
(48) 47. Base and apex of the abdomen testaceous 49
(47) 48. Only the base of the abdomen testaceous 51
(50) 49. Hind coxæ black ... ... 22. *asteris*, Hal.
(49) 50. Hind coxæ yellow ... ... 23. *ribis*, Hal.
(52) 51. Prothorax rufotestaceous; legs testaceous, hind femora rufescent ... ... 24. *cirsii*, Hal.
(51) 52. Prothorax black or ferruginous; legs rufotestaceous with the outer side of the femora middle of tibiæ, and tips of tarsi infuscated... ... ... 25. *eglanteriæ*, Hal.
(54) 53. Antennæ with 14 joints 55
(53) 54. Antennæ with 13 joints, or fewer than 13 61
(56) 55. Abdomen yellow at both ends; pale brown in the middle ... ... 26. *hortensis*, Marsh.
(55) 56. Abdomen blackish or infuscated at the apex... 57
(58) 57. First abdominal segment yellow or ferruginous 59
(57) 58. First abdominal segment blackish, or partly pale ... ... 27. *chrysanthemi*, Marsh.
(60) 59. Cubital nervure visible as far as the end of the 1st cubital areolet ... ... 28. *matricariæ*, Hal.
(59) 60. Cubital nervure colourless, hardly visible beneath the 1st ... ... 29. *arundinis*, Hal.
(62) 61. Antennæ with 13 joints 63
(61) 62. Antennæ with 12 joints ... ... 30. *cardui*, Marsh.
(64) 63. Under side of 1st cubital areolet distinct; 1st abdominal segment brown or blackish ... ... 31. *salicis*, Hal.
(63) 64. Under side of 1st cubital areolet indistinct; 1st segment yellow ... ... 32. *exiguus*, Hal.
(66) 65. Antennæ 15-jointed 67
(65) 66. Antennæ with 14 joints, or fewer than 14 69
(68) 67. Wings hyaline; stigma very pale, colourless; abdomen pale yellow, infuscated in the middle... ... ... 33. *scabiosæ*, Marsh.
(67) 68. Wings whitish; stigma yellow; abdomen blackish, including the 1st segment ... 34. *leucopterus*, Hal.
(70) 69. Antennæ with 14 joints ... ... 35. *brassicæ*, Hal.
(69) 70. Antennæ with fewer, *i.e.* with 13 or 12 joints 71
(72) 71. Antennæ with 13 joints 73
(71) 72. Antennæ with 12 joints, the apical formed of two joints soldered together 36. *fabarum*, Marsh.
(74) 73. Abdomen subsessile, 1st segment short, cyathiform ... ... 37. *ambiguus*, Hal
(73) 74. Abdomen subpetiolate, 1st segment long, linear, or sublinear 75
(76) 75. Abdomen brown, 1st segment testaceous; length $\frac{1}{2}$ line ... ... 38. *dauci*, Marsh.
(75) 76. Abdomen black with the two 1st sutures pale; length 1 line ... ... 39. *polygoni*, Marsh.

2. *Males whose Females are unknown.*

(2) 1. Cubital nervure distinct as far as the end of the 1st cubital areolet 3
(1) 2. Cubital nervure incomplete or none ... 5

(4)	3. Third abscissa of the radial nervure half completed; nervures very fine; antennæ 20–21-jointed, longer than the body; length 1¼ lines	40. *silenes*, Marsh.
(3)	4. Third abscissa none; basal nervures stout; antennæ 19-jointed, not longer than the body; length 1 line	41. *crithmi*, Marsh.
(6)	5. Antennæ 17–18-jointed	7
(5)	6. Antennæ 16-jointed, or 13-jointed ...	9
(8)	7. Cubital nervure distinctly traced beneath the 1st cubital areolet, elsewhere effaced; antennæ 17-jointed ...	42. *absinthii*, Marsh.
(7)	8. Cubital nervure none, or almost totally extinct; antennæ 18-jointed	43. *euphorbiæ*, Marsh.
(10)	9. Antennæ 16-jointed...	11
(9)	10. Antennæ 13-jointed	13
(12)	11. Podiscoïdal areolet longer than half the præbrachial transverse nervure; wings of normal size; antennæ as long as the body	44. *lychnidis*, Marsh.
(11)	12. Podiscoïdal areolet shorter than half the præbrachial transverse; wings more ample than usual; antennæ rather longer than the body	45. *cerasi*, Marsh.
(14)	13. Mesothoracic furrows not entirely effaced; between them is an additional longitudinal furrow; smallest species, length ⅜ line	46. *acalephæ*, Marsh.
(13)	14. Mesothoracic furrows effaced; no additional longitudinal furrow; length ½ line	47. *callipteri*, Marsh.

I. Males and Females.

1. *Aphidius ephippium*, Haliday.

A. ephippium, Hal., Ent. Mag., ii, 105, ♀; Marsh., Species des Hym. d'Eur. et d'Alg. Bracon., vol. ii, p. 559, ♀.

♀ Rufotestaceous; head, metathorax, and posterior portion of the abdomen infuscated. Antennæ fuscous, yellowish at the base, 14-jointed. Legs ferruginous, 4 posterior coxæ slightly infuscated, as well as the middle of the femora and tibiæ. Abdomen fuscous, pale at the base; 1st segment yellow or ferruginous, slender, linear. Valves of the terebra obtuse, black. Haliday has made a section of this species, at the same time remarking that except in being apterous, it differs in no respect from its congeners. Length, ¾–1½ lines.

Rare; I possess no specimen myself, but have seen it occasionally in other collections. Mr. Alfred Beaumont lately sent me one which he found among wet *Sphagnum* near Whitby, in October, 1897.

2. *Aphidius longulus*, Marshall.

A. longulus, Marsh., *lib. cit.*, p. 560, ♀.

♀ Abdomen linear, very slender, three times as long as the head and thorax. Head black; thorax dark brown above, pale testaceous beneath; prothorax pale; abdomen brown with a transverse band on each suture, and the extremity, pale testaceous. Head somewhat wider than the thorax; oral parts and palpi pale. Antennæ 18-jointed, very slender, as long as the abdomen, brownish testaceous with the 1st and 3rd joints yellow. Thorax blackish above, reddish in certain lights; mesothoracic furrows effaced; metathorax areated. Wings hyaline with a greyish tinge; squamulæ and radicles pale testaceous; stigma pale yellowish; basal nervures stout, distinct; cubital nervure extending to the end of the 1st cubital areolet. Legs long, slender, testaceous; coxæ paler; base of the hind coxæ, femora and tibiæ of the same pair, rufotestaceous; hind tibiæ shorter than the tarsi. First abdominal segment more than three times as long as its mean width; petiole testaceous, condylus brown, testaceous at the anterior end, somewhat dilated; tubercles indistinct, situated below the middle; following segments much narrower than the thorax, forming an elongate cylinder slightly compressed towards the apex; 2nd segment testaceous at the extremity; 3rd and 4th brown, paler on the sutures; 5th and following testaceous, tinged with brownish on the sides; a small brown patch at the extremity of the apical segment. Valves of the terebra stout, blunt, black. ♂ Unknown. Length, $1\frac{1}{2}$; exp. 2 lines.

This female has almost the colours of *urticæ* (Sp. 8) but the differences of form forbid its union withthat species: the remarkable length of the abdomen suffices to distinguish it from all those that follow.

3. *Aphidius pictus*, Haliday.

A. pictus, Hal., *lib. cit.*, 95; Marsh., *lib. cit.*, p. 563, ♀, pl. xviii. f. 7.

♀ Luteous; eyes, a spot on the vertex, margin of the occiput, superior orbits, three patches on the mesonotum, scutellum, metathorax and 1st abdominal segment, black. Antennæ black at the apex. Mesonotum shining, very finely punctulate. Wings hyaline; squamulæ and radicles yellowish, nervures fuscous, stigma, fusco-ferruginous. Fore legs testaceous; the 2nd pair slightly infuscated; hind legs fuscous with the trochanters, the underside of the femora

and the tibiæ at both ends, dull luteous. Abdomen very elongate, turned up at the extremity; 1st segment granulate, not shining, gradually dilated from base to apex, though the increase in width is very small; tubercles scarcely discernible; anterior segments infuscated above. Terebra slender, its valves black, ascending, curved, about as long as half the 1st joint of the hind tarsi. ♂ Unknown. Length nearly 2–2¼; exp. 3 lines.

Found very seldom on *Pinus sylvestris*, the Scotch fir. This species, the four following, and doubtless many more occurring in palæarctic forests, form a section apart, distinguished by greater size and consequent distinctness of the generic characters, as well as by their parasitism on the larger Aphidæ (*Lachnus*, etc.) which infest coniferous trees. These peculiarities, however, are insufficient to justify the establishment of a new genus. The synonymy given in the catalogue (1872) p. 110, under *A. varius*, which includes *pictus*, Hal., seems dubious, and is therefore omitted in this place.

4. *Aphidius infulatus*, Haliday.

A. infulatus, Hal., *lib. cit.*, 96; Marsh., *lib. cit.*, p. 546, ♂ ♀.

♀ Head rufotestaceous; vertex and eyes black; thorax black; abdomen rufotestaceous. Antennæ black, scape testaceous, 5 or 6 apical joints yellow, the terminal joint fuscous at the extremity. Prothorax luteous beneath; mesonotum shining, finely and vaguely punctulate. Wings hyaline, infumated below the stigma and towards the tip; squamulæ and radicles stramineous; nervures fuscous; stigma fusco-ferruginous. Legs luteous, the 4 posterior in great part clouded with an obscure tinge; hind coxæ with a fuscous spot. Anterior segments of the abdomen infuscated above, the posterior immaculate; 1st segment as in sp. 3, but less dilated at the apex, black. ♂ Black; antennæ more slender than in the allied species, entirely black; wings hyaline; squamulæ and radicles dull stramineous; nervures and stigma fuscous; fore legs stramineous, duller on the outer side; 4 posterior legs fuscous with almost the whole of the trochanters, both ends of the tibiæ, and base of the tarsi stramineous; all the coxæ, black; abdomen piceous with a luteous patch in the middle above; 1st segment scarcely dilated at the extremity. Length nearly 1¼–1½; exp. 2¼–2¾ lines.

Found rarely upon *Abies larix*, the larch.

5. *Aphidius abietis*, Marshall.

A. abietis, Marsh., *lib. cit.*, p. 565, ♀.

♀ Black ; face, prothorax, and furrows of the mesonotum, dull testaceous ; abdomen piceous, cinctured with distinct yellow bands, the anterior the broadest. Head somewhat wider than the thorax ; oral parts and palpi dull testaceous. Antennæ nearly as long as the body, 21-jointed, black with the two basal joints testaceous. Thorax testaceous beneath ; posterior portion of the pectus black ; scutellum fuscescent at the extremity ; metathorax beset with white hairs, and bisected by a wide and deep channel. Wings hyaline ; squamulæ and radicles stramineous ; stigma large, triangular, blackish, like the nervures ; 2nd intercubital nervure colourless ; cubital nervure not visible beyond the end of the 1st cubital areolet. Fore legs testaceous ; 4 anterior coxæ of the same colour ; hind coxæ black ; all the trochanters testaceous ; intermediate femora and middle of their tibiæ, fuscous ; hind femora and tibiæ black, the latter testaceous at the base ; their tarsi black. Abdomen shorter than the head and thorax ; 1st segment slender, linear to beyond the tubercles, which are situated somewhat before the middle ; condylus dilated from its base, so that the extremity of the segment is twice as wide as its base ; this segment is black, dull testaceous at the base ; 2nd segment yellow, infuscated in the middle towards the base ; 3rd yellow as far as the middle, the rest piceous ; following segments piceous with a yellow band at the base of each ; abdomen truncate at the extremity. Terebra hardly exserted, its valves conical, stout, black. ♂ Unknown. Length, 1½ ; exp. 2½ lines.

The unique ♀ above described was bred by Bignell out of *Lachnus pini*, L. infesting *Abies excelsa*, the spruce fir, as well as several other kinds of conifers.

6. *Aphidius pini*, Haliday.

A. pini, Hal., *lib. cit.*, 96 ; Marsh., *lib. cit.*, p. 566, ♂ ♀, pl. xviii. f. 6.

♀ Black ; face and prothorax impure testaceous ; a pale indeterminate spot on the 2nd suture. Head very broad ; oral parts and palpi dull testaceous. Antennæ black, with the two basal joints fusco-testaceous beneath. Mesonotum very finely wrinkled and punctulate, not shining ; the ordinary furrows distinct, as well as an additional channel between them, which does not extend to the scutellum ;

the mesonotum is either entirely black, or marked with testaceous lines between the lobes; humeral angles often testaceous; prothorax sometimes black above. Wings slightly infumated, especially towards the tips, and with a nebulous patch on the 2nd intercubital nervure; squamulæ and radicles yellowish; nervures and stigma fuscous, the latter large, triangular. Legs brownish testaceous, the middle pair more or less infuscated in the middle of the femora and tibiæ; hind legs still darker, with the knees and the base of the tarsi pale; hind coxæ infuscated; all the trochanters testaceous. Abdomen black or blackish, longer than the head and thorax, lanceolate, compressed towards the extremity; 1st segment linear to beyond the tubercles, which are placed in the middle; condylus dilated as in the preceding species. Valves of the terebra obtuse, broad, not ascending. ♂ Black, with the 2nd suture pale; legs darker; all the coxæ black; wings hyaline, whitish, stigma and nervures black; condylus of the 1st segment very little dilated. Length, 2; exp. 3 lines.

Parasite of the species of *Lachnus* inhabiting *Pinus sylvestris* and *Abies larix*; bred by Bignell out of *Lachnus pini*, L. taken on the spruce fir, *Abies excelsa*.

7. *Aphidius laricis*, Haliday.

A. laricis, Hal., *lib. cit.*, 97; Marsh., *lib. cit.*, p. 567, ♂ ♀.

♀ Black, with the 2nd suture and less frequently one of the following, pale brownish. Mesonotum shining, very finely and vaguely punctulate. Wings hyaline, infumated towards the tip and below the stigma; squamulæ and radicles brownish testaceous; nervures and stigma blackish. Fore legs yellowish, infuscated on the outer side, tarsi obscure; 4 posterior legs infuscated, tips of the trochanters and both ends of the tibiæ dull yellowish; all the coxæ black. First abdominal segment hardly or not at all widened posteriorly. Terebra short, ascending, the valves acute at the extremity. ♂ Wings white, not infumated; legs darker than those of the ♀. Length about 1½–2; exp. 2–2⅔ lines.

Reared by Haliday out of some puceron inhabiting *Abies larix*.

8. *Aphidius urticæ*, Haliday.

A. urticæ, Hal., *lib. cit.*, 100; Marsh., *lib. cit.*, p. 568, ♀.

♀ Slender, elongate, yellow; head and thorax infuscated or rufescent above; anterior segments of the abdomen infuscated towards

their base, sutures and anal extremity pale. Antennæ 18–16-jointed, almost as long as the body, slender, pale yellow at the base, the flagellum ferruginous, sometimes rather obscure. Mesonotum either ferruginous or blackish, the usual furrows often yellow, feebly traced; scutellum testaceous; metathorax rufescent, areated by elevated lines darker than the ground colour. Wings hyaline; squamulæ and radicles pale yellow; nervures brownish or testaceous; stigma pale yellow, almost colourless; cubital nervure attaining the end of the 1st cubital areolet. Legs pale yellow. Abdomen elongate, compressed and carinated towards the extremity; 1st segment sublinear, three times as long as broad, infuscated in the middle, its tubercles situated beyond the middle, scarcely perceptible; 2nd and 3rd segments infuscated above, yellow on their ventral surface; 4th and 5th with only a small brownish spot on the disc, the rest clear yellow. Valves of the terebra black. ♂ unknown. Length, 1½; exp. 2½ lines.

This species may easily be mistaken for *A. rosæ* (sp. 10), which is occasionally found on nettles, or even for *A. loniceræ* (sp. 11), but these can be distinguished by their black antennæ, shorter and stouter than those of *urticæ*. It is a not very abundant parasite of *Siphonophora urticæ*, Kalt., the puceron of *Urtica dioica*, but which infests also *Geranium robertianum*, *Malva sylvestris*, and *Chelidonium majus*. The males have hitherto escaped observation, though I bred the species with special reference to them. Some of the Aphides which were watched for this purpose produced the common hyperparasite *Lygocerus carpenteri*, Curt.; others, the apterous Cynipid, *Allotria cursor*, Hartig. From one of them Bignell obtained *Agonioneurus basalis*, Westw., a rare and little known Chalcid, of which I have given a figure, I believe for the first time. With *urticæ* commences the long series of normal *Aphidii*.

9. *Aphidius gregarius*, Marshall.

A. gregarius, Marsh., E.M.M., vol. ix. 1872–73, p. 123; Spp. des Hym. d' Eur. et d' Alg. Bracon., vol. ii. p. 569, ♂ ♀; pl. xix, f. 1. ♀.

♀ Abdomen after the 1st segment entirely testaceous. Rufotestaceous; head black; mesonotum and metathorax red, more or less brownish or obscure. Head transverse, wider than the thorax; oral parts testaceous. Antennæ shorter than the body, blackish, 20-

jointed, the 1st joint testaceous, the 2nd brownish. Mesonotum without furrows, smooth, trilobate, each lobe marked with a spot of darker brown than the ground colour; scutellum brown or rufescent, preceded by a paler space; metathorax carinated in the middle, areated, rufescent. Wings hyaline; squamulae and radicles yellow; basal nervures brownish; stigma and nervures of the characteristic region pale green during life, afterwards testaceous; cubital nervure complete as far as the end of the 1st cubital areolet. Legs testaceous; base of hind coxæ, with femora and tarsi of the same pair, more or less infuscated. First abdominal segment brown or blackish, aciculated, three times longer than broad, linear as far as the tubercles, which are situated below the middle; condylus somewhat dilated; the rest of the abdomen fusiform, pale testaceous, each segment bordered posteriorly with a darker tint. Valves of the terebra black, straight, moderately stout. ♂ Similar, but with darker tints; antennæ longer, about 25-jointed. Length, $1\frac{1}{3}$; exp. $2\frac{1}{2}$ lines

Parasite of *Melanoxanthus salicis*, L. a large puceron infesting willows, *Salix viminalis*, and poplars. Observed some years ago by Dr. Knaggs and Mr. McLachlan in a garden at Kentish Town. The pierced Aphides were extraordinarily numerous, crowded together around the base of the leaves on the twigs of willow. One of the observers remarks that he noticed a mass of them composed probably of some thousands, of which each individual must have been stung by an Aphidius. I possess to this day one of the twigs of willow entirely covered with empty skins of the pucerons. *Lygocerus carpenteri*, Curt. is a hyperparasite of this species.

10. *Aphidius rosæ*, Haliday.

Ichneumon aphidum, De Geer, Mém. ii. 866, pl. xxx. ff. 4—13. Not of Linné, Panzer, and Blanchard. The rest of the older synonymy is uncertain.
A. rosæ, Hal., *lib. cit.*, 97; Marsh., *lib. cit.*, p. 571, ♂ ♀.
A. cancellatus, Buckton, Mon. of Brit. Aphides, fig. I have not the precise reference at hand.
A rosarum, var. β, Nees, Mon., i. 19.

♀ Saffron yellow; head above, and mesonotum, blackish; abdominal segments 2–3, and often 4–5 infuscated on each side, in the form of interrupted bands or two rows of spots. Oral parts and palpi pale yellow. Antennæ 17–18-jointed, shorter than the body, and evidently shorter than those of *urticæ* (sp. 8), black, testaceous

beneath at the extreme base. Wings hyaline; squamulæ and radicles pale yellow; stigma yellow or pale green during life, afterwards brownish, like the nervures, which are tolerably stout and distinct; cubital nervure complete as far as the end of the 1st cubital areolet; 2nd discoïdal areolet open internally. Fore legs yellow; the middle pair slightly infuscated; the hind pair still darker, with the tips of the trochanters and base of tibiæ pale; the tarsi infuscated. Abdomen much longer than the head and thorax, compressed posteriorly; 1st segment slightly widened from the base, its tubercles situated before the middle (which is not the case in *urticæ*, sp. 8); sometimes yellowish, sometimes brown with the extremity yellowish; the dark spots on the intermediate segments are variable in number and intensity. Valves of the terebra black. ♂ Dissimilar; black; oral parts testaceous; palpi pale brownish; antennæ 20-jointed; squamulæ and radicles impure testaceous; fore legs yellow, streaked with fuscous; the 4 posterior fuscous with the trochanters and base of the tibiæ yellowish; all the coxæ black; abdomen fuscous with the sutures pale, a larger pale patch on the 2nd suture. Length, 1½; exp. almost 3 lines.

This is the constant parasite of *Siphonophora rosæ*, Réaumur, the well known puceron of several species of rose-tree (*Rosa canina, gallica, centifolia*, etc.) to the exclusion of *R. rubiginosa*, the sweet-briar, which nourishes, according to Haliday, a peculiar *Aphis*, with its parasite *A. eglanteriæ* (sp. 35). Wild roses of whatever variety are less frequently attacked by aphides than the cultivated forms, upon which it is easy to find, in every garden, specimens of *Siphonophora*, accompanied by the present parasite, and another equally abundant, *A. avenæ*, Hal. or *picipes*, Nees (sp. 12), which association of species has originated some confusion in the older descriptions. *A. rosæ*, Hal. is not to be confounded with *A. rosarum*, Nees, which belongs, at least for the most part, to our sp. 12. *A. Protæus*, Wesm. (meant for *Proteus*), is another notable example of the confusion of species. *A. rosæ* was probably the principal subject of the experiments and observations of the older writers, Frisch, Geoffroy, Schrank, etc. but their works are valuable rather for generalities than specific distinctions: the reference to De Geer above given, however, is not doubtful. Haliday, in a long note (Ent. Mag. ii. 98) has given an able summary of the results obtainable from these sources.

In breeding the present species of *Aphidius* I en-

countered only two hyperparasites, *Lygocerus carpenteri*, Curt. in abundance, and a red-headed Cynipid which I believe to be the true *Allotria victrix*, Westw. Other hyperparasites of the species are mentioned by Haliday, belonging to the Chalcididæ; their modern names are *Isocratus vulgaris*, Walker, *Pachycrepis clavata*, Walk., *Cyrtogaster vulgaris*, Walk., and some of the genus *Encyrtus*, undetermined.

11. *Aphidius loniceræ*, Marshall.

A. loniceræ, Marsh., *lib. cit.*, p. 572, ♂ ♀ ; pl. xix, f. 2, ♀.
? *A. lutescens*, Hal., *lib. cit.*, 99, ♀.

♀ First abdominal segment and all the legs, yellow ; disc of the anterior segments more or less infuscated. Head black above ; meso- and metanotum fusco-rufescent ; the rest of the body pale saffron yellow, partly white. Mouth, palpi, cheeks, and the whole underside of the head, white. Antennæ very slender, a little shorter than the body, 18-jointed ; brown, with the radicle, the two basal joints and the base of the 3rd, white. Scutellum rufotestaceous ; metathorax rufescent, areated, the compartments separated by black carinæ. Wings hyaline ; squamulæ and radicles whitish ; stigma pale yellow, almost colourless ; basal nervures rather fine, pale brownish, the radial and other external nervures pale, much attenuated, subobsolete. Legs yellow ; coxæ and trochanters white. Abdomen as in the preceding sp., but the faint dorsal bands are not interrupted, and the colour is paler. ♂ Dissimilar ; head black ; clypeus and palpi testaceous ; antennæ 20-jointed, somewhat longer than the body, stouter than in the ♀, black, with the two basal joints and base of the 3rd rufescent ; thorax black, rufescent beneath ; prothorax entirely rufescent ; legs testaceous ; hind coxæ rufescent above towards the base ; abdomen nigrofuscous with the two first sutures pale ; belly rufescent. Length, 1¼–1½ ; exp. 2½–3 lines.

Nearly allied to the preceding, but distinguished by the great tenuity of the antennæ and the neuration, as well as by difference of origin. It may perhaps be *lutescens*, Hal. but the author has given no detailed description : he possessed only one ♀, the neuration of which, he says, resembled that of *rosæ* ; this is not the case with the 10 specimens above described. They were reared by Bignell, 8 ♀s and 2 ♂s, from *Siphocoryne xylostei*, Schrank, the puceron of *Lonicera xylosteum*, fly-honeysuckle, but in this instance inhabiting *L. pericly-*

menum, the common woodbine. Others were reared out of *Siphonophora pisi*, Kalt. infesting *Silene inflata*, bladder-campion; and a ♀, the smallest of all, out of *Siphonophora urticæ*, Kalt. taken on a nettle, *Urtica dioica*.

12. *Aphidius avenæ*, Haliday.

A. avenæ, Hal., *lib. cit.*, 99, ♂ ♀; Curtis in Morton's Cyclop. Agric., *s. v. Aphis*, pl. xvii, ff. 5, 6; Farm Ins. pp. 290, 291, pl. xxxix, f. 12, and pl. J, f. 12; Marsh., *lib. cit.*, p. 573, ♂ ♀.

A picipes, Nees, Mon., i. 18, ♂ ♀.

?*A. infirmus*, Nees, *l.c.* ♂ ♀.

?*A. vulgaris*, Bouché, Naturg. (1834) 161.

?*A Protæus*, Wesm., Nouv. Mém. Ac. Brux. 1835, p. 75; Ratz. Ichn. d. Först. iii. 62 (partim).

♀ Black, with the 2nd suture fulvous or rufous, and the apical segments testaceous. Head as wide as the thorax: mandibles testaceous; palpi obscure. Antennæ 17–18-jointed, shorter and stouter than those of the following species, black, with the end of the 2nd joint and base of the 3rd, narrowly testaceous. Mesothoracic furrows distinct; metathorax shining, subrugulose posteriorly, areated, carinated in the middle. Wings hyaline, with stout and distinct nervures; squamulæ and radicles testaceous; stigma fulvous, becoming pale brown after death; nervures fuscous; cubital nervure complete to the end of the 1st cubital areolet. Legs in great part fuscous or blackish; fore femora and tibiæ rufescent or testaceous, sometimes streaked externally with fuscous; 4 posterior legs with the 2nd joint of the trochanters, both ends of the tibiæ, and base of the tarsi, testaceous. Abdomen lanceolate, compressed towards the extremity, black, shining, with a transverse band more or less pale on the 2nd suture, and segments 5–6 testaceous. Valves of the terebra black. ♂ similar to the ♂ of *rosæ* (sp. 10); palpi blackish; antennæ 20–21-jointed, as long as the body; legs darker than those of the ♀; abdomen black at the extremity. Length, $1\frac{1}{2}$; exp. 3 lines.

This and the following are the largest species, after the Pinicolæ (spp. 3–7); they are common everywhere, and polyphagous, preying indiscriminately upon various kinds of *Aphis*. The present species has attracted the attention of several continental describers, and received different names: there is not much doubt that *picipes*, Nees, is

identical; the other synonyms are less certain. Haliday reared some of his specimens from the pucerons of *Avena sativa*, the oat, which pucerons were probably *Siphonophora granaria*, Kirby; and others from an unnamed aphis infesting *Hypochæris radicata*, cat's-ear. The numerous specimens in the Bignell collection were bred out of *Siphonophora urticæ*, Kalt. infesting *Urtica dioica*, stinging nettle.

Siphonophora urticæ, Kalt.	infesting	*Urtica dioica*, stinging nettle.
„ *rubi*, Kalt.	„	*Rubus fruticosus*, bramble.
Siphocoryne xylostei, Schrank.	„	*Lonicera periclymenum*, woodbine.
Aphis scabiosæ, Kalt.	„	*Scabiosa succisa*, devil's-bit.
„ *myosotidis*, Koch	„	*Myosotis palustris*, forget-me-not.
„ *cratægaria*, Walk.	„	*Cratægus oxyacantha*, white-thorn.

The only hyperparasite obtained was the apterous Cynipid *Allotria cursor*, Hartig.

13. *Aphidius ervi*, Haliday.

A. ervi, Hal., *lib. cit.*, 100, ♂ ♀; Marsh., *lib. cit.*, p. 575, ♂ ♀; pl. xix, f. 3, ♀.
? *A. constrictus*, Nees, Mon., i. 20, ♀.
? *A. Protœus*, Wesm., Nouv. Mém. Ac. Brux. 1835, p. 75, Var. 7, ♀. (partim).

♀ Very like the preceding. Black, with the 2nd suture pale; face and prothorax testaceous or ferruginous; palpi yellowish; some females present the more sombre colouring of the males. Antennæ 19–21-jointed, slender, almost as long as the body, black, with the 1st joint and the base of the 3rd testaceous. Metathorax carinated in the middle, rugulose posteriorly, indistinctly areated. Wings hyaline or slightly infumated; squamulæ and radicles dull testaceous; stigma yellowish, brownish after death; nervures ferruginous brown, cubital continued to the end of the 1st cubital areolet. Legs flavo-testaceous; hind coxæ infuscated above at the base; 4 posterior tarsi slightly infuscated. Abdomen narrow, lanceolate, compressed towards the apex, somewhat variable in colour, all the sutures being occasionally pale as well as the whole of the apical segments, as in the preceding sp.; 1st segment nearly linear, three times as long as broad, with tubercles situated

near the extremity. Valves of the terebra black. ♂ Similar, black; oral parts yellowish; palpi fuscous or black; antennæ black, about 23-jointed; 4 posterior coxæ, base of intermediate femora, and outer side of hind femora and tibiæ infuscated; or the legs sometimes almost entirely black. Length, 1½; exp. 3 lines.

Easily confounded with the preceding species, being equally common, and attacking some of the same species of Aphides. The antennæ of *ervi* are distinctly longer and more slender, with one or more additional articulations; the legs also are longer, and usually flavescent; the discrimination of the males is more difficult, but the antennæ of *ervi* are 23-jointed. Haliday reared specimens from some indeterminate pucerons infesting *Ervum hirsutum*, the tine-tare, and some species of *Trifolium*. The Bignell collection contains a good number bred out of *Siphonophora urticæ*, Kalt., *S. rubi*, Kalt., *S. rosæ*, Réaumur, *Tychea phaseoli*, Passerini, and *Aphis scabiosæ*, Kalt. The only hyperparasite noted was the Chalcid *Isocratus æneus*, Nees.

14. *Aphidius ulmi*, Marshall.

A. ulmi, Marsh., *lib. cit.*, p. 576, ♂ ♀.

♀ Black; prothorax brown above, testaceous beneath; abdomen brown with the anterior sutures pale. Oral parts and palpi testaceous. Antennæ much shorter than the body, 18-jointed, rather stout, black, with the two basal joints and the base of the 4th testaceous. Furrows of the mesonotum perceptible; metathorax carinated, areated. Wings hyaline; squamulæ, radicles and nervures dull testaceous; stigma very pale, almost hyaline; nervures very fine, scarcely discernible; cubital nervure continued to the end of the 1st cubital areolet. Legs testaceous; 4 posterior femora slightly infuscated; hind coxæ marked above, at the base, with a dusky spot. Abdomen lanceolate, much longer than the head and thorax; 1st segment nearly linear, three times as long as broad, testaceous as far as the middle, thence to the apex, black, its tubercles effaced; following segments brown; 2nd with its hind margin broadly pale; 3rd more narrowly margined; 4th and following rufescent posteriorly. Valves of the terebra black. ♂ Smaller; antennæ stouter, as long as the body, with 20 discrete joints, black, with the radicle testaceous; prothorax black; legs brown with the 2nd joint of the trochanters and the base of the tibiæ and of the tarsi, pale;

hind coxæ blackish ; abdomen much shorter, 1st segment entirely black ; the following brown with only the 2nd suture pale.

♀ Length, $1\frac{1}{3}$; exp. $2\frac{1}{4}$: ♂ length, $1\frac{1}{8}$; exp. 2 lines.

Parasite of *Schizoneura ulmi*, L., the puceron of the elm, *Ulmus campestris*. Bignell has reared both sexes.

15. *Aphidius pascuorum*, Marshall.

A. pascuorum, Marsh., *lib. cit.*, p. 577, ♀.

♀ Black ; abdomen piceous, testaceous above at the apex. Oral parts and palpi fuscescent. Antennæ 17-jointed, shorter than the body, black, with the two basal joints brown. Mesothoracic furrows effaced ; metathorax carinated, areated. Wings hyaline, with very fine and indistinct neuration ; squamulæ and radicles impure whitish ; stigma colourless, hyaline ; nervures pale brownish, but visible only in the basal region, except the commencement of the radial, and the fragment of the cubital which forms the underside of the 1st cubital areolet. Legs fuscous, including all the coxæ ; trochanters and knees pale. Abdomen lanceolate, longer than the head and thorax ; 1st segment piceous, rather stout, twice as long as broad, its tubercles effaced. Valves of the terebra black. ♂ Unknown. Length, $\frac{3}{4}$; exp. $1\frac{1}{2}$ lines.

Parasite of *Siphonophora longipennis*, Buckton, the puceron of *Poa annua*, annual meadow-grass : reared by Bignell. In some of his trials he obtained only two red-headed species of *Allotria*, one being *A. victrix*, Westw., and the other ticketed *erythrocephala*, Jurine ; this latter is now indeterminable. Both were probably hyperparasites of *A. pascuorum*.

16. *Aphidius pterocommæ*, Marshall.

A. pterocommæ, Marsh., *lib. cit.*, p. 578, ♀.

♀ Fuscotestaceous, head and thorax black above ; face and pectus testaceous, the latter black posteriorly. Head wider than the thorax ; oral parts, palpi, and sometimes the occiput, testaceous ; palpi white (in one specimen) ; mandibles black at the points. Antennæ almost as long as the body, 19–20-jointed, black, with the 1st joint, the apex of the 2nd, and the extreme base of the 3rd, testaceous. Prothorax and sides of the mesothorax rufotestaceous ; mesothoracic furrows effaced ; metathorax carinated, areated.

Wings hyaline; squamulæ and radicles testaceous; stigma and nervures brown, the latter stout and distinct; radial nervure angulated at the commencement of the 2nd cubital areolet; 2nd intercubital nervure sometimes faintly indicated; cubital nervure continued as far as the end of the 1st cubital areolet. Legs rufo-testaceous. Abdomen brownish, with segments 2–5 narrowly pale at the base; longer than the head and thorax, narrow, lanceolate, compressed towards the apex; 1st segment somewhat widened posteriorly, three times as long as its mean width, rufo-fuscous, the tubercles obsolete. ♂ Unknown. Length, 1¼; exp. 2½ lines.

Parasite of *Pterocomma pilosa*, Buckton, puceron of *Salix viminalis*, the common osier, on which it lives in company with *Melanoxanthus salicis*, L. (see sp. 9); Bignell bred 6 females. On a cursory inspection they resemble *urticæ* (sp. 8), and *rosæ* (sp. 10).

17. *Aphidius granarius*, Marshall.

A. granarius, Marsh., *lib. cit.*, p. 579, ♂ ♀.

♀ Head and thorax black above; face, prosternum and mesosternum testaceous, this last black posteriorly; abdomen dark brown, segments after the 4th yellow above. Clypeus, mandibles and palpi, testaceous. Antennæ shorter than the body, 17-jointed, black, with the radicle and upper side of the 2nd joint testaceous. Mesothoracic furrows effaced; metathorax carinated, areated, the spaces between the raised lines often rufescent. Wings hyaline; squamulæ and radicles testaceous; stigma hyaline with a yellowish tinge; nervures impure testaceous, moderately distinct; cubital nervure continued to the end of the 1st cubital areolet; a vestige remains of the second intercubital nervure. Legs fuscotestaceous; coxæ, femora, and tibiæ of the 4 posterior more or less infuscated; 2nd joint of trochanters, knees, tips of tibiæ, and base of tarsi, testaceous. Abdomen longer than the head and thorax, lanceolate, compressed towards the apex; 1st segment linear, margined, black, with no visible tubercles; 2–4 brown, becoming progressively paler posteriorly; a pale band on the second suture, or on the three first sutures; the rest of the abdomen pale testaceous above; beneath, it is brown to the apex, with only the sutures pale. Valves of the terebra black. ♂ Antennæ longer than the body, 19-jointed entirely black, except the radicles; face black; oral parts, and sides of prothorax testaceous; the rest of the thorax black; legs darker than those of the ♀; abdomen as long as the head and thorax,

somewhat spathulate, fuscous to the apex, with the two first sutures testaceous. Length almost $1\frac{1}{2}$; exp. $2\frac{1}{2}$ lines.

Parasite of *Siphonophora granaria*, Kirby, a puceron infesting an unknown number of *Graminaceæ*, both wild and cultivated, *Secale*, *Triticum*, *Holcus*, *Poa*, etc. Bignell bred 11 specimens, including both sexes.

18. *Aphidius crepidis*, Haliday.

A. crepidis, Hal., *lib. cit.*, 94; Marsh., *lib. cit.*, p. 581, ♂ ♀.
A. tuberculatus, Wesm., Nouv. Mém. Ac. Brux., 1835; p. 80, ♀ (where the remarkable colour of the valves of the terebra is omitted).

♀ Fulvo-testaceous, head and thorax black above. Head small, contracted posteriorly, hardly transverse; face, oral parts, and apex of the cheeks, testaceous. Antennæ 13-jointed, shorter than the body, black, with the two basal joints and the base of the 3rd, fulvous, which colour is sometimes further extended. On the mesosternum is a large black spot, and another in the middle of the metathorax. The upper portion of the metathorax is occupied by two areæ, leaving between them a right angle, the apex of which reaches the base; this angle forms part of a third area, occupying the middle of the posterior face of the metathorax. Wings hyaline with a cinereous tinge; nervures brown, distinct; stigma elongate, fulvous during life, cinereous in dried specimens; 1st abscissa of the radial nervure curved, originating before the middle of the stigma; cubital nervure continued to the end of the 1st cubital areolet; 1st intercubital nervure half completed. Legs fulvous, sometimes entirely, more commonly the 4 posterior femora and tibiæ (or even those of the forelegs) infuscated on the upper edge; tarsi infuscated. Abdomen lanceolate; 1st segment fulvous, somewhat rugulose, wider than usual, twice as long as broad, with salient tubercles, situated not far from the base; intermediate segments infuscated either on the whole of the disc, or only at the sides. Valves of the terebra testaceous, streaked with black above, exserted, curved downwards and angularly enlarged beneath. ♂ Dissimilar; black; antennæ rather longer than the body, 16-jointed; oral parts fulvous; wings cinereous; legs infuscated, hind coxæ black; abdomen piceous, somewhat spathulate; 1st segment narrow, linear, three times as long as broad, fulvous at the base and sometimes at the extremity

also ; a pale patch occupies the 2nd suture and the disc of the 2nd segment. Length, 1 ; exp. 2 lines.

This species is easily recognised by its many small peculiarities ; both sexes may be known at once by the unusual development of the 1st intercubital nervure ; the female also by the structure of the terebral valves, analogous to that which is seen in the genus *Monoctonus*. Haliday procured these somewhat rare parasites by keeping the pucerons which infest *Crepis virens*, hawk's-beard, and *Cichorium intybus*, succory ; and I obtained a fine set from the pucerons of *Lapsana communis*, nipple-wort.

19. *Aphidius pseudoplatani*, Marshall.

A. constrictus, Hal., *lib. cit.*, 95, ♂ ♀ (*nec* Nees).
A pseudoplatani, Marsh., *lib. cit.*, p. 82, ♂ ♀.

♀ More slender than the preceding. Pale whitish yellow ; head and thorax infuscated above ; mesosternum sometimes infuscated. Palpi very long for the genus. Antennæ slender, blackish, with the 4 or 5 basal joints yellow, a little shorter than the body, 16-jointed (rarely 15-jointed). Mesothoracic furrows effaced ; metathorax smooth, faintly carinated and areated. Wings hyaline ; squamulæ and radicles yellowish ; nervures pale brown, distinct ; stigma yellow during life, afterwards pale brown ; cubital nervure continued to the end of the 1st cubital areolet. Legs yellow ; extremities of the 4 posterior femora and tibiæ infuscated on the outer side. First abdominal segment linear, slender, three times as long as broad, with salient tubercles, situated in the middle. Terebra further exserted than that of *crepidis*, its valves yellow, compressed, conic, not angulated beneath, curved downwards at the apex only. ♂ Head and thorax black ; palpi pale brown ; antennæ 18-jointed, black ; squamulæ and radicles brownish ; legs dull testaceous or brownish, base of coxæ, femora, middle of tibiæ, and tips of tarsi, infuscated ; abdomen impure yellowish, clouded with a darker tint, sometimes entirely infuscated after the 1st segment. Length, 1 ; exp. 2 lines.

Bignell has bred 2 ♀s and a ♂ of this species, out of *Drepanosiphum acerinum*, Walk., the puceron of *Acer pseudoplatanus*, the sycamore. The pucerons which were parasitised turned white, and two of them were winged. The Chalcids *Isocratus æneus*, Nees, and *vulgaris*, Walk., are hyperparasites of this Aphidius.

20. *Aphidius dissolutus,* Haliday.

? *Bracon dissolutus,* Nees, Mag. Ges. Berl., 1811, p. 29; *A. dissolutus,* Nees, Mon., i, 23, ♂ ♀.
? *A. resolutus,* Nees, *lib. cit.,* 24, ♂ ♀.
A. dissolutus, Hal., *lib. cit.,* 105; Marsh., *lib. cit.,* p. 583, ♂ ♀.

♀ Black, shining; abdomen piceous, pale at the base. Mandibles and palpi testaceous; the latter short, maxillary 2-jointed, subclaviform, labial consisting of a single joint. Antennæ stout, black, 16-jointed, the 3rd joint pale. Mesothoracic furrows obsolete. Wings narrow, infumated, clearer towards the base; stigma and nervures fuscous, the former narrow. Fore legs almost wholly pale yellowish; so also the 4 posterior coxæ, trochanters, knees, and tarsi, the rest of the legs fuscescent. Abdomen short, oval-lanceolate; 1st segment short, cyathiform, contracted at the base, dilated and almost rectangular posteriorly, somewhat rugulose. Terebra subexserted, with obtuse, black valves. ♂ Antennæ longer, entirely black, 16-jointed, the articulations more distinct than in the ♀; wings of a lighter tint; fore femora and tibiæ infuscated on the outer side; the 4 posterior infuscated, with yellowish knees and tarsi; abdomen not so distinctly pale at the base; 1st segment less dilated. Length, 1; exp. 2 lines.

There are two descriptions of *dissolutus,* one by Nees v. Esenbeck, the other by Haliday, who has assumed the species of the German writer to be the same as his own. The identity, however, seems doubtful for the following reasons, (1) according to Nees the antennæ of the ♀ have only 14 (i.e. 13) joints; (2) Nees is silent as to the peculiarity of the palpi; (3) the cubital nervure is described as effaced at the base, reappearing under the 1st cubital areolet, and then again effaced. There is nothing special in this character, which is found in many more species, often, I think, accidentally, and confined to the individual. It may have appeared a good distinctive character at a time when few species were known, but is certainly not so now. Hence the genus *Lysiphlebus* of Förster, formed (as the name imports) to include the Aphidii with an interrupted cubital, and without regard to any other character, has no certain foundation. The variety indicated by Nees evidently belongs to a different species; and the *A. obsoletus,* Wesmael, which that author refers doubtfully to *dissolutus,* Nees, is nothing else than

Trioxys heraclei, Hal. *A. dissolutus*, Nees, is stated by that author to occur in hedges and oak-plantations; *A. dissolutus*, Haliday, is found, though rarely, in meadows overgrown with *Ranunculus acris*.

21. *Aphidius sonchi*, Marshall.

A. sonchi, Marsh., *lib. cit.*, p. 585, ♂ ♀.

♀ Black; prothorax, base and apex of abdomen, clypeus, mandibles, and palpi, testaceous. Antennæ slender, filiform, shorter than the body, 16-jointed, the two basal joints and the base of the 3rd testaceous. Mesothoracic furrows obsolete; metathorax carinated in the middle longitudinally, and crossed lower down by another and transverse carina. Wings hyaline; squamulæ and radicles testaceous; stigma colourless; nervures pale brownish; all obsolete beyond the stigma; cubital nervure very weak at its origin, but continued to the end of the first cubital areolet. Legs clear testaceous, including the coxæ. Abdomen lanceolate, as wide in the middle as the thorax; 1st segment nearly linear, three times as long as broad, clear testaceous, its tubercles placed a little before the middle; 2nd brownish with a pale patch in the middle reaching to the anterior margin; 2nd suture bordered on both sides with testaceous; segments 3–4 brownish, the rest testaceous, sometimes with a brownish spot in the disc of the 5th. Terebra very short, with black, stout, obtuse valves. ♂ Antennæ as long as the body, 18-jointed; the testaceous portions of the body less clear; 4 posterior tibiæ and hind femora infuscated; base of hind coxæ marked with a fuscous spot; 1st abdominal segment brownish towards the extremity; 2nd dark brown, leaving the sutures always pale; after the 2nd suture the abdomen is black. This ♂ resembles so many others that it can hardly be recognised apart from the other sex. Length, $1\frac{1}{4}$; exp. $2\frac{1}{2}$ lines.

Six specimens were reared by Bignell, and eight by myself, from *Siphonophora lactucæ*, Kalt., the puceron of *Lactuca sativa*, lettuce; but in the present instance this aphis was found infesting *Sonchus oleraceus*, sow-thistle. Hyperparasite, *Allotria minuta*, Hartig.

22. *Aphidius asteris*, Haliday.

A. asteris, Hal., *lib. cit.*, 100; Marsh., *lib. cit.*, p. 586, ♂ ♀.

♀ The colours are those of *rosæ* (sp. 10), but not so clear. Head and thorax black; abdomen impure yellow, with the intermediate

segments infuscated. Clypeus and palpi yellowish, the latter infuscated towards the tips. Antennæ slender, entirely black, 15-jointed. Anterior portion of the pectus yellowish. Wings hyaline; squamulæ and radicles obscurely yellowish; stigma impure yellow, becoming brownish after death; nervures brownish. Legs impure yellow; femora streaked above with fuscous, the hind pair almost wholly fuscous; 4 posterior tibiæ infuscated except at the base; tarsi almost wholly infuscated; 4 posterior coxæ black. A yellowish patch on the 2nd abdominal suture. ♂ Black, with the oral parts impure yellow; antennæ 18-jointed; legs brown, fore femora and tibiæ ferruginous beneath; ends of the trochanters, and all the knees, ferruginous; abdomen brown, the 1st segment partly yellow; 2nd suture yellowish. (Haliday.) Length, $1\frac{1}{2}$; exp. $2\frac{1}{4}$ lines.

Parasite of the pucerons of *Aster tripolium*, sea starwort.

23. *Aphidius ribis*, Haliday.

A. ribis, Hal., *lib. cit.*, 101, ♀; cf. Réaum., Mém., iii, 286; Marsh., *lib. cit.*, p. 587, ♂ ♀.

♀ Blackish, or dark brown; head black; abdomen yellow at both ends. Oral parts yellow. Antennæ fuscous with the two basal joints yellow, 15-jointed. Prothorax yellow; pectus paler than the disc of the thorax. Wings hyaline; squamulæ and radicles yellowish; stigma yellow, becoming brownish after death; nervures pale brownish, mostly subobsolete; cubital nervure interrupted in the middle, reappearing beneath the 1st cubital areolet and one half of the 2nd, then suddenly effaced; 1st cubital areolet indistinctly separated from the discoïdal. Legs yellow, including all the coxæ; tips of femora above, middle of tibiæ, and tarsi at the apex, slightly infuscated. Abdomen yellow; base of the 2nd segment and extremity of the 3rd infuscated, as well as the disc of the following segments except the apical one, which is yellow. Valves of the terebra black. ♂ Antennæ 15–16-jointed, as long as the body, stout, black with the two basal joints pale; prothorax blackish; abdomen after the 1st segment brown to the apex; otherwise like the ♀. Length, $\frac{1}{2}$–$\frac{3}{4}$; exp. $1\frac{1}{2}$–$2\frac{1}{4}$ lines.

This small Aphidius is abundant, attacking *Myzus ribis*, L., the aphis which infests currant-bushes, both red and black, *Ribis rubra* and *R. grossularia*, causing the well-known puckering of their leaves. The pucerons pierced by the parasite become pearly white; they produce the

hyperparasite, *Allotria minuta*, Hartig, in such numbers that it is often difficult to procure from them a single Aphidius.

24. *Aphidius cirsii*, Haliday.

A. cirsii, Hal., *lib. cit.*, 101, ♀ (not of Curtis); Marsh., *lib. cit.*, p. 588, ♀.

♀ Prothorax flavo-ferruginous; head and thorax black or blackish; abdomen piceous, almost black at the apex, with the 1st segment and two first sutures yellow. Face and clypeus black; palpi fuscous; mandibles yellow, infuscated at the points. Antennæ 15-jointed (rarely with 16, and once only with 17 joints, according to Haliday), shorter than the body, the apical joint largest; they are black, with the two basal joints brownish, the 3rd testaceous, black at the extremity. Mesothoracic furrows obsolete; metathorax carinated, areated. Wings hyaline, with a dusky tinge; squamulæ and radicles testaceous; stigma very pale; nervures fine but distinct, pale brownish; cubital complete as far as the end of the 1st cubital areolet. Legs rufotestaceous, coxæ and trochanters paler; hind coxæ infumated above at the base; femora and tibiæ of the same pair usually of a deeper red. Abdomen lanceolate, slender, narrower than the thorax; 1st segment rufotestaceous, slightly widened posteriorly, $2\frac{1}{2}$ times as long as its mean breadth, without distinct tubercles; the two first sutures and the posterior half of the 2nd segment pale; the following segments black. Valves of the terebra black. ♂ Unknown. Length, $\frac{3}{4}$; exp. $1\frac{3}{4}$.

Bignell has reared six females of this species. One came out of *Aphis cardui*, L., infesting *Carduus lanceolatus*, *Pyrethrum maritimum*, and some other plants. Buckton remarks that this *Aphis* is subject to the attacks of a parasite, probably of the present species. On a single stalk of *Pyrethrum*, an inch and a half long, he counted 19 parasitised pucerons. Three more of *cirsii* were produced from *Aphis tanacetina*, Walk., infesting a geranium, and two from an undetermined puceron found on *Galium verum*, ladies' bed-straw. Haliday procured his specimens from *Cirsium arvense*, creeping thistle, but not by breeding.

25. *Aphidius eglanteriæ*, Haliday.

A. eglanteriæ, Hal., *lib. cit.*, 102; Marsh., *lib. cit.*, p. 589, ♂ ♀.

♀ Black; prothorax sometimes ferruginous; base of abdomen yellow. Oral parts and palpi brownish. Antennæ black, 14–15-

jointed. Legs rufotestaceous, with the outer side of the femora and extremity of the tarsi infuscated; hind coxæ sometimes infuscated. Abdomen piceous, 1st segment rufo-flavous, less frequently brown; middle of the 2nd segment, and anterior sutures, yellowish. ♂ Black; legs brown, the fore pair yellowish beneath; all the knees also yellowish; abdomen darker than that of the ♀. Length, $\frac{3}{4}$–1; exp. $1\frac{1}{2}$–$2\frac{1}{4}$ lines. Haliday.

Reared by Haliday from pucerons of *Rosa rubiginosa*, sweet-briar; the latter, when pierced, retire to the underside of the leaves, and become shining white.

26. *Aphidius hortensis*, Marshall.

A. hortensis, Marsh., *lib. cit.*, p. 590, ♂ ♀.

♀ Abdomen yellow at base and apex, pale brown in the middle. Face brown; clypeus, mandibles, and palpi, whitish. Antennæ shorter than the body, 14-jointed, blackish with the two basal joints whitish. Mesonotum smooth, without the usual furrows; metathorax faintly carinated, areated. Wings hyaline, with a dusky tint; stigma and nervures pale cinereous; cubital nervure almost effaced, except the portion which forms the lower side of the 1st cubital areolet. Legs yellow, femora and tibiæ of the 4 posterior somewhat infuscated. Abdomen narrow, compressed towards the apex; 1st segment yellow, almost linear, without visible tubercles; 2nd yellow, dusky in the middle, or with a dusky spot on each side; 3 5 somewhat obscure above; the remaining segments yellow. Valves of the terebra black. ♂ Antennæ 16-jointed, as long as the body, the two basal joints of each yellowish; posterior femora and tibiæ darker than those of the ♀; abdomen wholly pale brown, except the 1st segment and the extreme base of the 2nd, which are yellow. Length, 1; exp. $1\frac{3}{4}$ lines.

The description is from 9 specimens reared from Aphides infesting a shrub, the name of which was not communicated to me, perhaps not indigenous. The punctured pucerons on the same card are pearly white.

27. *Aphidius chrysanthemi*, Marshall.

A. chrysanthemi, Marsh., *lib. cit.*, p. 591, ♂ ♀.

♀ Black; 1st abdominal segment partly pale; oral parts dull testaceous. Antennæ somewhat longer than the head and thorax,

rather stout, 14-jointed. Prothorax and pectus black; metathorax carinated in the middle, areated. Wings hyaline; squamulæ radicles, stigma and nervures, pale brownish; 1st section of the cubital nervure faintly traced; the nervure is more distinct beneath the 1st cubital areolet. Legs brown, with the trochanters, base and apex of femora and tibiæ, and base of tarsi, testaceous. Abdomen blackish, the two first sutures narrowly pale; 1st segment linear, without distinct tubercles. ♂ Similar; antennæ 16-jointed; legs darker, and 1st segment paler than in the ♀. Length, $1\frac{1}{3}$; exp. 2 lines.

The specimens in the Bignell collection were bred out of *Aphis tanacetina*, Walk., which infests *Tanacetum vulgare*, the tansy, *Chrysanthemum sinense*, the common garden chrysanthemum, and other plants.

28. *Aphidius matricariæ*, Haliday.

A. matricariæ, Hal., *lib. cit.*, 103, ♀; Marsh., *lib. cit.*, p. 592, ♂ ♀.

? *A. restrictus*, Nees, Mon., i, 22; Ratz., Ichn. d. Först., iii, 63, ♀.

? *A. diminuens*, Nees, Mon., i., 22, ♂.

♀ Black; abdomen piceous with the 1st segment ferruginous. Palpi fuscous. Antennæ filiform, 14-jointed, either entirely black, or brownish at the base. Prothorax sometimes ferruginous. Wings hyaline; stigma brownish, very pale; nervures brown; cubital nervure complete as far as the end of the 1st cubital areolet. Legs ferruginous, the fore pair streaked with fuscous above; 4 posterior having their coxæ, femora, tibiæ in the middle, and tarsi at the apex, more or less infuscated. Abdomen lanceolate, rather wide in the middle; 1st segment almost linear, twice as long as broad, its tubercles indistinct, situated in the middle, the colour is very clear, and extends a little on to the 2nd segment, along the median line; the following segments black. Valves of the terebra obtuse. ♂ Similar; antennæ longer, 16–17-jointed; legs darker; abdomen forming a flattened oval, spathulate; 1st segment more slender. Length, $\frac{3}{4}$–1; exp. $1\frac{1}{2}$–$2\frac{1}{4}$ lines.

Found rarely by Haliday on *Pyrethrum inodorum* and *P. maritimum*. The Bignell collection contains two pairs of this species, produced from *Aphis myosotidis*, Koch, which infests *Polygonum aviculare*, common knot-grass. I have also obtained the ♀ from the pucerons of *Raphanus maritimus*.

29. *Aphidius arundinis*, Haliday.

A. arundinis, Hal., *lib. cit.*, 104; Marsh., *lib. cit.*, p. 592, ♀.

♀ Black or piceous; 1st abdominal segment flavo-ferruginous. Oral parts and palpi of the same colour. Antennæ 14- (or sometimes 15-) jointed, black, with the base yellow. Prothorax flavo-ferruginous. Wings hyaline; squamulæ and radicles stramineous; stigma almost hyaline; nervures for the most part colourless; cubital nervure colourless, scarcely perceptible beneath the 1st cubital areolet. Legs flavo-ferruginous. Haliday had before him some specimens, probably immature, in which the black parts were replaced by brownish red, and the scutellum was red; but he regarded them as belonging to the same species. ♂ Unknown. Length, $\frac{3}{4}$; exp. $1\frac{1}{2}$ lines.

This species was doubtfully referred in the Catalogue of 1872 to *matricariæ* and *restrictus* (sp. 28); but such a conjecture should not perhaps have been made without more information. The insect has never been bred by any one, and its description leads to no certain conclusion.

Found by Haliday upon reeds, but not common.

30. *Aphidius cardui*, Marshall.

A. cardui, Marsh., *lib. cit.*, p. 593, ♂ ♀.

♀ Head and thorax black; abdomen subsessile, brown, with the 1st segment and the base of the 2nd whitish yellow. Clypeus, mandibles, and palpi very pale, somewhat rufescent. Antennæ 12-jointed, rather larger than the head and thorax, stout, submoniliform, black, with the two or three basal joints pale rufous, the apical joint elongate and larger than the rest. Prothorax often testaceous beneath; mesonotum without furrows; metathorax rufescent, smooth, without a median carina, and not areated. Wings hyaline; squamulæ, radicles, stigma, and nervures pale brownish, these last tolerably distinct, except the cubital, which is effaced as to its first section, reappearing only to form the lower side of the 1st cubital areolet. Fore legs testaceous; the 4 posterior brownish, with coxæ, trochanters, and knees, pale testaceous. Abdomen rather longer than the head and thorax, lanceolate, slightly compressed at the apex; 1st segment short, not more than twice as long as its mean breadth, linear as far as the tubercles, which are situated before the middle, from thence widened to the extremity, which is twice as broad as the base; posterior segments gradually becoming darker to the apex which is nearly black. Valves of the terebra black. ♂ Similar;

antennæ almost as long as the body, entirely black, 14-jointed. Length, $\frac{2}{3}$; exp. $1\frac{1}{2}$ lines.

A common parasite, reared in numbers by Bignell from *Aphidius cardui*, L., on *Carduus lanceolatus*; from *Siphonophora olivata*, Buckton, also infesting thistles; from *Aphis jacobæa*, Schr., on *Senecio jacobæa*, common rag-wort; and from *Siphocoryne capreæ*, Fab., a puceron inhabiting different kinds of willow.

31. *Aphidius salicis*, Haliday.

A. salicis, Hal., *lib. cit.*, 102; Marsh., *lib. cit.*, p. 594, ♂ ♀.

♀ Black, with a pale patch on the abdomen; 1st segment sometimes brown. Oral parts dull yellow. Antennæ a little longer than the head and thorax, slightly incrassated towards the apex, 13-jointed. Wings hyaline; stigma yellowish, becoming brownish after death; nervures paler brown; lower side of the 1st cubital areolet complete. Four anterior legs dull ferruginous; 2nd pair with the base of their femora, the middle of the tibiæ, and the tarsi, infuscated; hind pair brown, with the trochanters and both ends of the tibiæ ferruginous; all the coxæ black. Second abdominal segment pale in the middle; the two first sutures also pale; or the abdomen shows in the middle an indeterminate pale patch. ♂ Antennæ 15–16-jointed (rarely with 17 joints); wings whitish; legs and abdomen darker brown than in the ♀. Length, $\frac{3}{4}$–1; exp. $1\frac{1}{2}$–2 lines. Haliday.

Like the preceding, this species attacks some of the pucerons of the willow; those that are wounded may be recognised by their pale brown colour; they retire to the extremities of the leaves. The majority of them nourish, beside the *Aphidius*, an *Allotria* with a red head (*fulviceps*, Curtis), or some other species which cannot now be determined. Haliday observed also some still smaller species of *Aphidius* on *Daucus carota*, the carrot, which seemed to him to be *A. salicis*. But see no. 38, *A. dauci*.

32. *Aphidius exiguus*, Haliday.

A. exiguus, ♂ Hal., *lib. cit.*, 104, ♀; Marsh., *lib. cit.*, p. 595, ♂ ♀.

? *A. fumatus*, Hal., *lib. cit.*, ♂.

♀ Black; abdomen pale at the base and in the middle; 1st segment yellow. Oral parts ochreous. Antennæ a little longer than the head and thorax, slightly incrassated towards the apex, 13-jointed. Wings

obscure; stigma pale brownish; 1st cubital areolet indistinctly limited on the lower side. Legs piceous, with pale knees. First abdominal segment almost linear, but slightly widened posteriorly. Valves of the terebra obtuse. ♂ The doubtful male (*fumatus*, Hal.) resembles *Monoctonus caricis*, Hal. Blackish brown, with very short palpi; antennæ a little incrassated, 16-jointed; wings infumated; stigma narrow; 2nd abscissa of the radius somewhat arcuate; 1st cubital areolet indistinct or effaced; legs piceous, with pale knees and tarsi; abdomen brownish, pale at the base, dilated, spathulate; 1st segment stout, linear. Length, $\frac{5}{6}$; exp. $1\frac{1}{4}$ lines, nearly.

The association of the sexes is almost always doubtful, unless they have been reared together; in the present case I have joined *fumatus* to *exiguus* agreeably to a conjecture of Haliday. The insects are unknown to me, unless a ♂ which I captured at large should happen to be *fumatus*; it agrees pretty well with the diagnosis. *Exiguus* and *fumatus* both occur not uncommonly in marshy meadows, overgrown with *Ranunculus acris*.

33. *Aphidius scabiosæ*, Marshall.

A. scabiosæ, Marsh., *lib. cit.*, p. 596, ♂ ♀.

♀ Head and thorax black above, all the underside of the body pale yellow or whitish; abdomen pale yellow, brownish in the middle. Face, clypeus, and palpi of the same pale colour. Antennæ rather shorter than the body, 15-jointed, blackish, with the two basal joints of each yellow. Mesothoracic furrows obsolete; metathorax carinated in the middle, areated. Wings hyaline; cubital areolets and 1st discoïdal effaced, no nervures visible beyond the stigma, or scarcely a trace of them remains; stigma very pale, decolorous. Legs pale yellow, coxæ and trochanters whitish. Abdomen lanceolate, very little compressed towards the apex; 1st segment pale yellow, linear, narrow, without visible tubercles; 2nd pale brownish, yellow in the middle of the base, or yellow with a dusky spot on each side; 3rd and 4th brownish; 5th yellow, more or less brownish posteriorly; 6th with only a small brownish spot at the extremity; apical segment yellow. Valves of the terebra blackish. ♂ Antennæ as long as the body, 17-jointed; 4 posterior femora and tibiæ stained with reddish brown; abdomen rounded at the apex, entirely brownish above, after the 1st segment. Length, 1; exp. 2 lines.

In coloration this resembles *asteris* (sp. 22) and *hortensis* (sp. 26), but its other characters render it sufficiently

distinct. Parasite of *Aphis scabiosæ*, Kalt., which infests *Scabiosa arvensis*. Bignell reared 29 specimens, and observed others, which he thought were of the same species, on the blossoms of *Ballota nigra*, stinking horehound.

34. *Aphidius leucopterus*, Haliday.

A. leucopterus, Hal., *lib. cit.*, 103; Marsh., *lib. cit.*, p. 597, ♂ ♀.

♀ Deep black, shining; 1st abdominal segment dark brown. Antennæ black, slender, 15-jointed. Wings whitish; stigma yellow. Fore legs yellowish; 4 posterior blackish brown, with the trochanters, the base of the tibiæ and of the tarsi pale. A pale patch in the middle of the disc of the abdomen. Terebral valves angulated at the base above, acute at the extremity. ♂ Antennæ 16-jointed; wings white; all the legs blackish brown, annulated with pale colour; abdomen black, the pale patch in the middle less distinct. Length nearly $\frac{3}{4}$; exp. $1\frac{1}{2}$ lines. Haliday.

Förster in his Synopsis (p. 249) has made of this species a genus *Diæretus*, for which he indicates two characters not mentioned by Haliday, viz., metathorax not areated, and pobrachial nervure perceptible. The former peculiarity is shared by several other known species of *Aphidius*; the latter is rather a distinction of individuals, and certainly not of generic value. The present insect is unknown to me, and found rarely, according to Haliday, on coniferous trees.

35. *Aphidius brassicæ*, Marshall.

A. brassicæ, Marsh., *lib. cit.*, p. 597, ♂ ♀.

♀ Black; abdomen brown, with the 1st segment more or less pale towards the base, and the two first sutures pale. Oral parts and palpi pale. Antennæ short, reaching backwards as far as the end of the 1st segment, black, with the extremity of the 2nd joint testaceous, 14-jointed. Mesothoracic furrows obsolete; metathorax carinated, areated. Wings hyaline; squamulæ, radicles, and basal nervures dull testaceous; stigma pale yellowish; cubital areolets and 1st discoïdal effaced; no visible nervures beyond the stigma. Fore legs testaceous, their femora sometimes streaked with fuscous; 4 posterior fuscous, with the extremity of the coxæ, the 2nd joint of the trochanters, the extremity and the underside of the femora, and the

base of the tibiæ, dull testaceous ; tarsi infuscated, each articulation pale at the base. Abdomen lanceolate ; 1st segment linear, three times as long as wide, without distinct tubercles, pale testaceous at the base, fuscous at the extremity ; 2nd fuscous, pale at both ends ; the rest of the segments fuscous. Valves of the terebra black. ♂ Similar ; antennæ almost as long as the body, 17-jointed ; colours darker than those of the ♀, even the forelegs are infuscated, or streaked with fuscous above ; abdomen elongate oval, rounded at the apex. Length, 1 ; exp. 2 lines.

A common parasite ; I obtained six specimens, comprising the two sexes, from *Siphocoryne fæniculi*, Passerini, the puceron of *Fæniculum vulgare*, fennel, and Bignell sent me a male of the same origin. Thirteen others were reared from the pucerons of *Raphanus maritimus*, the stalks of which plant were loaded with dead aphides. The Bignell collection possesses more than forty specimens, the produce of *Aphis brassicæ*, L., the puceron of *Brassica oleracea*, the cabbage, and of some other kindred plants. *Trionyx* (i.e. *Toxares*, afterwards *Aphidius*) *rapæ*, Curtis, probably belongs to this species.

36. *Aphidius fabarum*, Marshall.

A. fabarum, Marsh., *lib. cit.*, p. 599, ♂ ♀.

♀ Head and thorax black ; abdomen dull testaceous as far as the middle, the two basal segments infuscated on the disc, the apical half black. Head rather larger than the thorax ; oral parts and palpi pale brownish. Antennæ 12-jointed, filiform, stout, shorter than the body, black with the two basal joints brown, the apical joint formed of two closely united. Mesonotum finely punctulate in front, smooth posteriorly, as also are the scutellum and the metathorax, this last destitute of a median carina. Wings hyaline ; squamulæ and radicles pale brownish ; stigma hyaline, except a small patch of colouring matter in the middle (in my specimen) ; basal nervures brown, distinct, the rest effaced, except a faint trace of the radial ; even the 2nd discoïdal areolet is subobsolete, open on the underside. Fore legs testaceous ; the 4 posterior the same, but with a brown streak on the femora above, and the tibiæ brown in the middle ; hind coxæ brownish. Abdomen not longer than the head and thorax, lanceolate, as wide in the middle as the thorax ; 1st segment unusually stout, much widened posteriorly, where it is twice as broad as at the base ; tubercles median ; 2nd pale brownish, testaceous at

both ends; the rest of the abdomen black; the apex acute; hypopygium prominent. Valves of the terebra broad, conic, black. ♂ dissimilar; antennæ composed of 13 joints, whereof the two apical ones are discrete; almost moniliform, brownish at the base; stigma hyaline, immaculate; radial nervure more distinct; abdomen much narrower; 1st segment narrow, linear, margined, suddenly contracted at the extremity; the testaceous colour of the two basal segments more obscure; posterior part of the abdomen narrow, oblong, sublinear, rounded at the apex. ♀ Length, $\frac{3}{4}$; exp. $1\frac{3}{4}$: ♂ length, $\frac{5}{8}$; exp. $1\frac{1}{2}$ lines.

I obtained the two sexes out of *Aphis rumicis*, L., a polyphagous puceron inhabiting *Rumex crispus*, the curled dock, and many other plants; found in the present case on *Faba vulgaris*, the broad bean.

37. *Aphidius ambiguus*, Haliday.

A. ambiguus, Hal., *lib. cit.*, 104; Marsh., *lib. cit.*, p. 600, ♀.

♀ Abdomen subsessile, 1st segment short, cyathiform. Antennæ filiform, black, longer than the head and thorax, 13-jointed. Wings hyaline; stigma pale brown; cubital areolets and exterior nervures obsolete. Legs pale yellow, coxæ and tarsal claws infuscated; the 4 posterior legs have the middle of the femora and tibiæ, and the apex of the tarsi infuscated. Abdomen short, oval, lanceolate, pale at the base, piceous posteriorly; tubercles of the 1st segment visible. Valves of the terebra acute. ♂ Unknown. Length, $\frac{5}{8}$; exp. $1\frac{1}{4}$ lines. Haliday.

Found rarely in marshy places.

38. *Aphidius dauci*, Marshall.

A. dauci, Marsh., *lib. cit.*, p. 601, ♂ ♀.

♀ Head and thorax black, abdomen brown, with the 1st segment testaceous. Clypeus black; mouth and palpi either dull testaceous or brownish. Antennæ 13-jointed, scarcely longer than the head and thorax, 1st and 2nd joints brown, base of the 3rd pale. Mesonotum without furrows, but these are sometimes indicated by two slight longitudinal depressions; metathorax carinated, areated. Wings hyaline; squamulæ and radicles pale; stigma hyaline, hardly tinged with yellow; basal nervures tolerably distinct, brownish testaceous; 2nd cubital areolet effaced, or only

a trace of its lower side remains ; radial nervure hardly visible, as long as the stigma, the rest of the neuration effaced. Fore legs testaceous, their coxæ infuscated ; 4 posterior brown, with the ends of the coxæ, the trochanters, and the knees, testaceous, as well as the base of the hind tarsi. Abdomen slender, subcylindric, longer than the head and thorax, lanceolate, somewhat compressed from and after the base of the 2nd segment ; 1st segment testaceous, linear, three times as long as broad, with scarcely perceptible tubercles situated in the middle ; 2nd segment brown, testaceous at both ends along the sutures ; the rest of the abdomen brown, becoming black towards the apex. Valves of the terebra black. ♂ Similar ; antennæ 15–16-jointed, a little shorter than the body ; fore legs brownish, the 4 posterior, and the abdomen, darker than in the ♀. Length less than ½ ; exp. 1¼ lines.

This minute species is perhaps the one mentioned by Haliday as a var. of *salicis* (sp. 31). After examining a great number of both species, I have no hesitation in keeping them apart. *A. dauci* is a parasite of *Siphonophora pastinacæ*, which infests *Pastinaca sativa*, the parsnip, and *Apium graveolens*, wild celery. The Bignell collection contains a series bred out of the same pucerons, but taken on *Daucus carota*, the carrot, and *Crithmum maritimum*, samphire.

39. *Aphidius polygoni*, Marshall.

A. polygoni, Marsh., *lib. cit.*, p. 602, ♂ ♀.

♂ Black, with only the two first sutures pale. Oral parts and palpi testaceous. Antennæ 13-jointed, hardly longer than the head and thorax, black with the base of the 3rd joint testaceous. Mesothoracic furrows obsolete ; metathorax carinated, areated. Wings hyaline with a cinereous tinge ; squamulæ, radicles, stigma and neuration cinereous brown ; basal nervures distinct ; no cubital nervure ; cubital areolets and first discoïdal effaced. Fore legs testaceous, femora fuscous above, tibiæ in the middle, and tarsi altogether, except the base ; 4 posterior legs black, with the extremities of the coxæ, the 2nd joint of the trochanters, the knees, and the base of the tarsi, testaceous ; 1st joint of the trochanters brown. Abdomen twice as long as the head and thorax, lanceolate ; 1st segment a little wider at the apex than at the base, 2½ times longer than its mean breadth, yellowish at both ends, brown in the middle ; tubercles hardly visible, situated in the middle. Valves of

the terebra stout, truncate at the apex. ♂ Black, with the two sutures pale, translucid ; palpi black ; antennæ rather shorter than the body, 15-jointed, black. Legs black. Length, 1 ; exp. 2 lines.

Bred by Bignell out of *Aphis myosotidis*, Koch, found infesting *Polygonum aviculare*, common knot-grass.

II. Males whose Females are unknown.

40. *Aphidius silenes*, Marshall.

A. silenes, Marsh., *lib. cit.*, p. 603, ♂.

♂ Black ; pectus rufescent ; abdomen piceous, with the 2nd suture pale, 1st segment black posteriorly. Clypeus, palpi, and mandibles pale brown. Antennæ stout, 20–21-jointed, longer than the body, black, with the two basal joints brownish, the 3rd testaceous at the base ; joints 3–6 angulated on the outer side, subserrate, the rest nearly filiform. Mesothoracic furrows faintly indicated ; metathorax carinated, areated. Wings hyaline ; squamulæ and radicles dull testaceous ; stigma narrow, hyaline or hardly yellowish ; nervures pale brownish ; 2nd cubital areolet closed on the underside by a very fine nervure, hardly visible, *i.e.* cubital nervure about half completed. Legs testaceous ; femora and tibiæ of the 4 posterior bifuscated ; coxæ, trochanters, and base of the tibiæ, pale ; hind coxæ infuscated at the base ; a second specimen has the legs pale testaceous with the hind femora streaked with fuscous above. Abdomen claviform, somewhat longer than the head and thorax ; 1st segment linear, margined, without visible tubercles. Length, 1¼ ; exp. 2½ lines.

Parasite of *Siphonophora pisi*, Kalt., the puceron of different species of pea, *Pisum arvense, sativum*, etc., also of *Silene inflata*, bladder campion, and other plants. Reared by Bignell.

41. *Aphidius crithmi*, Marshall.

A. crithmi, Marsh., *lib. cit.*, p. 604, ♂.

♂ Black ; abdomen piceous, with the extremity of the 2nd segment, and the 2nd suture, pale. Palpi brown. Antennæ 19-jointed, black, setiform, not longer than the body. Mesothoracic furrows faintly indicated : metathorax smooth, carinated in the middle,

areated. Wings hyaline; squamulæ, radicles, and nervures pale brownish; stigma, yellowish, elongate, emitting the 1st abscissa of the radius obliquely, before the middle; 2nd and 3rd abscissæ effaced; cubital nervure continued as far as the end of the 1st cubital areolet, the under side of which is distinctly incrassated. Legs brown; trochanters, knees, and base of tarsi, testaceous. First abdominal segment linear, black, rugulose, with scarcely perceptible tubercles placed near the extremity. Length, 1; exp. 2½ lines.

Reared by Bignell out of *Aphis crithmi*, Buckton, which inhabits the samphire, *Crithmium maritimum*.

42. *Aphidius absinthii*, Marshall.

A. absinthii, Marsh., *lib. cit.*, p. 605, ♂.

♂ Black; abdomen piceous, the 1st segment pale testaceous. Oral parts and palpi very pale, whitish. Antennæ 17-jointed, as long as the body, black, with the two basal joints piceous. Mesothoracic furrows obsolete; metathorax reddish-brown, carinated in the middle, divided into four areæ. Wings slightly cinereous; squamulæ and radicles impurely whitish; stigma very pale, cinereous; basal nervures brownish, tolerably distinct, the rest effaced, except the radial, which advances as far as the middle of the stigma, and the cubital, which is visible beneath the 1st cubital areolet. Legs blackish; trochanters and knees testaceous. Abdomen somewhat longer than the head and thorax; 1st segment linear, with minute tubercles, situated before the middle; 2nd suture and base of the 2nd segment pale testaceous, the rest of the abdomen dark. Length, ½; exp. 1⅓ lines.

Bred by Bignell from *Siphonophora absinthii*, L. the puceron of *Artemisia absinthium*, wormwood.

43. *Aphidius euphorbiæ*, Marshall.

A. euphorbiæ, Marsh., *lib. cit.*, p. 606, ♂.

♂ Head and thorax black; 1st segment testaceous at the base, reddish on the condylus, two first sutures testaceous, the rest of the abdomen piceous; tubercles situated after the middle of the 1st segment. Oral parts rufescent; palpi darker. Antennæ 18-jointed, stout, black, as long as the body. Prothorax piceous; mesothoracic furrows effaced; metathorax carinated, areated. Wings subhyaline; squamulæ, radicles, and stigma, cinereous; basal nervures

brownish; cubital almost effaced, only a faint vestige appearing beneath the 1st cubital areolet. Legs piceous, the hind pair nearly black; trochanters and knees testaceous. Abdomen as long as the head and thorax; 1st segment linear, at least three times as long as broad; tubercles minute. Length, $\frac{3}{4}$; exp. $1\frac{3}{4}$ lines.

Two males were reared by Bignell out of a species of aphis found on *Euphorbia paralias*, the sea-spurge. This aphis is perhaps *Aphis euphorbiæ* of Koch and Kaltenbach, but I find no mention of it in Buckton's monograph. The ♂ *Aphidius* corresponds very closely with the ♀ of sp. 19, *pseudoplatani*, but there can be no proof of their relationship without breeding, and considering the difference of their origin, I have not united them.

44. *Aphidius lychnidis*, Marshall.

A. lychnidis, Marsh., *lib. cit.*, p. 607, ♂.

♂ Blackish brown, paler on the abdomen; the 1st segment yellow. Oral parts and palpi very pale brown. Antennæ 16-jointed, as long as the body, piceous, the 2nd joint rufescent. Mesothoracic furrows effaced. Wings subhyaline; stigma and nervures very pale, the latter indistinct; radial nervure forming no angle, shortened; cubital effaced; præbrachial transverse more distinct than the rest; 2nd discoïdal areolet longer than half the præbrachial transverse; apical third of the wing entirely nerveless. Legs fusco-testaceous, including the coxæ; 4 posterior femora, tibiæ, and tarsi, infuscated, except at the base. Abdomen elongate, narrowly oval; 1st segment linear, its tubercles imperceptible; extreme base of the 2nd yellow, like the 1st. Length nearly 1; exp. 2 lines.

Parasite of *Aphis lychnidis*, L. which infests *Lychnis viscaria*, *diurna*, and *vespertina*, campion.

45. *Aphidius cerasi*, Marshall.

A. cerasi, Marsh., *lib. cit.*, p. 607, ♂.

♂ Black, with the 1st abdominal segment testaceous; a long, pale, irregular patch extends over the following segments. Oral parts and palpi pale. Antennæ rather longer than the body, slender, filiform, 16-jointed, black, with the two basal joints brownish. Mesothoracic furrows effaced; metathorax very short, divided into 4 areæ by two carinæ in form of a cross. Wings with

a slight dusky tinge ; squamulæ, radicles, and basal nervures very pale brown ; no vestige of the exterior nervures, except the 1st abscissa of the radial ; stigma hyaline, elongate, indeterminate on the under side, emitting the shortened radial from before the middle ; 2nd discoïdal areolet shorter than half the præbrachial transverse ; wings more ample than usual. Legs testaceous ; 4 posterior femora and tibiæ slightly infuscated in the middle, hind coxæ infuscated above at the base. Abdomen as long as the head and thorax, and narrower than the latter ; condylus of the 1st segment somewhat enlarged ; tubercles visible, placed before the middle ; the decolorous patch on the posterior segments is perhaps no character, but an accident resulting from desiccation. Length, $\frac{1}{2}$; exp. $1\frac{3}{4}$ lines.

I reared this species out of *Myzus cerasi*, F. the black puceron of the cherry. Only one specimen was obtained from a number of pucerons, all the rest of these being parasitised in the second degree by the Cynipid *Allotria flavicornis*, Hartig.

46. *Aphidius acalephæ*, Marshall.

A. acalephæ, Marsh., *lib. cit.*, p. 608, ♂.

♂ Head and thorax black ; abdomen piceous, with the 1st segment and the two sutures pale. Head large ; oral parts and palpi pale. Antennæ 13-jointed, stout, longer than the body, somewhat moniliform, black, with the two basal joints brown. Mesothoracic furrows not entirely effaced ; an additional longitudinal channel is traced between the two. Scutellum and metathorax somewhat piceous, the latter convex, smooth, without carinæ or areæ. Wings hyaline ; squamulæ, radicles, stigma, and nervures pale cinereous ; basal nervures attenuated, indistinct ; 1st cubital areolet open on the under side, and so effaced. Legs fuscescent ; trochanters and knees pale. Abdomen as long as the head and thorax, and narrower than the latter ; 1st segment stramineous, three times as long as broad, linear, with minute tubercles before the middle. Length, $\frac{3}{8}$; exp. 1 line nearly.

Found by Bignell, once only, on a nettle ; the smallest species known.

47. *Aphidius callipteri*, Marshall

♂ Head and thorax black ; abdomen piceous, with the 1st segment yellowish white. Oral parts and palpi testaceous. Antennæ

13-jointed, as long as the body, blackish, with 3 or 4 of the basal joints pale brownish. Mesothoracic furrows obsolete ; metathorax carinated in the middle. Wings hyaline ; squamulæ and radicles dull testaceous ; stigma hyaline, slightly cinereous ; basal nervures brownish, very fine ; exterior nervures effaced. Fore legs pale testaceous, their femora and tibiæ streaked above with fuscous ; 4 posterior fuscescent ; hind coxæ, trochanters, and knees, pale brownish. Abdomen spathulate, as long as the head and thorax ; 1st segment linear, $2\frac{1}{2}$ times as long as broad, almost white, its tubercles situated before the middle ; 2nd and following segments piceous, with the 2nd suture and a median line on the 2nd segment pale. Length, $\frac{1}{2}$; exp. $1\frac{1}{4}$ lines.

Reared once by Bignell out of *Callipterus quercus*, Kalt., one of the pucerons of the oak, *Quercus robur*.

Doubtful Species.

Two more species belonging to this genus have been published as British, but my attempts to verify them have not been successful. Their descriptions are here reproduced for the sake of completeness. That the number of indigenous *Aphidii* vastly exceeds the 47 above described, there can be little doubt. I possess a great quantity taken promiscuously in the course of years, but the mere description of their external appearance, without those facts of their economy which alone can give some interest to such a subject, and in the impossibility of correctly pairing the sexes, would be both illusory and wearisome.

Aphidius lutescens, Haliday.

A. lutescens, Hal., Ent. Mag., ii. 99 ; Marsh., Species des Hym. d'Eur. et d'Algér. Bracon., vol. ii, p. 614, ♀.

♀ Yellow ; eyes and antennæ black, scape yellowish ; vertex, 3 spots on the mesonotum, scutellum, metathorax, 1st abdominal segment, and transverse spots on some of the following segments, infuscated. Legs entirely yellow. Size and proportions of *A. rosæ* (sp. 10) ; cf. *loniceræ* (sp. 11). ♂ Unknown. Length, $1\frac{1}{2}$; exp. 3 lines.

The author adds, in a note : "I should have been in-

clined to consider this as an immature variety of *A. rosæ* but that individuals of this last have assumed their characteristic tints before they are disclosed from the puparium."

Aphidius rapæ, Curtis.

A. (*Trionyx*) *rapæ*, Curt., Farm. Ins., 73; cf. McIntosh, Book of the Garden, ii, 194, fig.; Marsh., *lib. cit.*, p. 615, ♀.

Sex not stated, but the figure represents a ♀. Head and thorax black, shining, abdomen piceous, with pale sutures; 1st segment yellowish. Oral parts yellow. Antennæ shorter than the body, 14-jointed, the 1st joint yellow beneath; according to Buckton they are 16-jointed, and I counted the same number in the specimen sent to me, which was a ♀. Wings hyaline; stigma narrow, brown; costal areolet complete; cubital nervure extending to the end of the 1st cubital areolet; radial nervure inchoate; the rest of the neuration effaced. Legs yellow, diversified with fuscous. Abdomen lanceolate. ♂ Unknown. Length, $1\frac{1}{4}$; exp. $2\frac{1}{3}$ lines.

Curtis himself, as stated in the Book of the Garden, perceived that his insect did not belong to the genus *Trionyx* (i.e. *Toxares*), and the figure there given clearly represents an *Aphidius*. The same is true of the coloured figure in Buckton's Monograph of the Aphidæ. Mr. Buckton obligingly sent me a specimen of the insect to serve as a type; but this was a microscopic preparation, colourless, and flattened between two pieces of glass; it was therefore only serviceable in showing the genus. According to Curtis this parasite destroys the pucerons of *Brassica rapa*, the turnip; and we are informed, in Buckton's work, that the latter belong to the species *Aphis brassicæ*, L. The same aphis attacks several kinds of cruciferous plants, especially *Brassica oleracea*, the cabbage; the vermin which swarm upon the leaves of this plant are often considerably thinned, even to the extent of nine tenths, by parasites. It will be noticed that there are indications of a mixture of two species, with similar habits, in the published accounts of *A. rapæ*. The individuals with 14-jointed antennæ may possibly belong to *A. brassicæ* (sp. 35); as to the others, with 16-jointed antennæ, I can offer no opinion.

VII. DYSCRITUS, Marshall.

Marsh., *lib. cit.*, p. 617.

Head semicircular above, hardly wider than the thorax, somewhat flattened, much produced behind the eyes; occiput not margined; clypeus not discrete from the face, closing the mouth. Palpi short. Antennæ inserted in the upper part of the face, slender, filiform, as long as the body; 3rd joint twice as long as the 4th. Mesothoracic furrows complete; a smooth foveola before the scutellum; mesopleuræ smooth, their furrow obsolete; metathorax short, truncate posteriorly, areated, the disc slightly inclined, separated from the posterior declivity by a transverse carina; 5 areæ are distinguishable, 2 basal, separated by a carina, a postero-median complete, pointed at the base, and one on each side of the vertical portion. Wings ample, having the neuration of *Praon*, except that the 1st cubital areolet is confounded with the 1st discoïdal; basal nervures distinct, exterior nervures subobsolete; no intercubital nervures, so that there is but a single cubital areolet; stigma rather large, triangular, attenuated at both ends, emitting the radius from the middle; the latter gently curved without any angle, reaching the tip of the wing, dark and distinct for one third of its length, afterwards very fine and hardly visible to the extremity; cubital nervure very fine; recurrent nervure very oblique; anal nervure not interstitial: 2nd discoïdal areolet incompletely closed at both ends. Abdomen sessile, as long as the head and thorax, strongly compressed posteriorly from the base of the 3rd segment; 1st segment rectangular, longer than broad, with well developed tubercles placed in the middle; viewed sideways, the abdomen is claviform and flattened. Terebra very short, its valves stout.

The insect which is here introduced differs from *Praon* by the unusual form of the head, the confluence of the 1st cubital and 1st discoïdal areolets, the complete areation of the metathorax, and the strong compression of the abdomen. Although the habits of the single species, and the corresponding male, are unknown, I have no hesitation in joining it to the Aphidian group; its external forms indeed forbid any other allocation.

Dyscritus planiceps, Marshall, *l. c.*

♀ Flavotestaceous; stemmaticum, dorsum of the thorax and of the abdomen in the middle, fuscous. Smooth, shining. Mandibles

blackish at the points; middle of the occiput black; palpi yellow. Antennæ 24-jointed, the first five joints yellow, the rest black, the 3rd and 4th narrowly black at the extremity; the 5th less clearly yellow than those preceding it. Prothorax yellow; mesonotum blackish on the 3 lobes, rufescent near the scutellum, in the middle; the latter also rufescent, convex, forming an elongate triangle; metathorax brownish at the base, the posterior declivity and the sides testaceous; it is feebly quadridenticulate posteriorly. Wings hyaline; squamulæ pale yellow; nervures brownish; stigma yellowish; radial areolet ample, elongate-oval, reaching the tip of the wing, but at first sight appearing incomplete, owing to the tenuity of the radial nervure. Legs yellow; tips of the tarsi fuscous. First abdominal segment yellowish, with a median rugulose elevation, which is infuscated; 2nd and following segments yellowish, 3–5 surmounted by a large, common, piceous patch; apical segments yellow. Valves of the terebra black. ♂ Unknown. Length, $1\frac{1}{4}$; exp. 3 lines.

A single specimen was taken by Bignell in the neighbourhood of Plymouth.

VII. PACHYLOMMATIDÆ.

This division was omitted in Trans. Ent. Soc. 1885, p. 11, as not belonging to the Braconidæ. I possessed at that time no specimens, and relied upon the opinions of some of the best authorities in excluding the single and remarkable genus *Pachylomma* from the subject of these papers. The history of the genus shows how crucially it has tested the discretion of systematists, and what different situations have been assigned to it by some of the most eminent writers on entomology. De Brebisson, the author of the genus, referred it to the *Ichneumonidæ*: Latreille, Westwood, and Haliday, placed it among the *Evaniidæ*: Förster, Curtis, Ratzeburg, Nees v. Esenbeck, Brullé, Giraud, Ashmead, and Haliday himself (in his later writings), united it to the Braconidæ. There appears then to be a preponderance of testimony in favour of this last opinion, which induces me to introduce *Pachylomma* in this place as a supplementary group, remarking at the same time that its association with any one of the three families is not wholly free from objections, some of which may here be briefly stated:

From the *Ichneumonidæ* it is distinguished by wanting

the 2nd recurrent nervure (an essential and invariable character of that family), and by the insertion of the abdomen somewhat above the hind coxæ: from the *Evaniidæ*, by almost every character available for classification, except the insertion of the abdomen, which character however is but feebly represented: from the *Braconidæ*, by the neuration, nothing similar to which is found in the entire family, and by the structure of the abdomen, in which the 2nd suture is diarthrodial or penetrating, as in the *Ichneumonidæ*. Lastly, the insects composing the genus *Pachylomma* are parasites of ants, in which habit there is nothing to show an affinity to one more than another of the above-mentioned families,—except only the case of *Elasmosoma* among the *Braconidæ*, also parasitic upon ants, but totally different in external structure.

It is not worth while to multiply objections, which it would be easy to do; enough has been stated to show that *Pachylomma* represents a very small isolated group, having no near relation to any other parasitic Hymenoptera. The connecting links have been lost in long ages, through some obscure causes which oppose unfavourable conditions to the propagation of certain forms. Several of these abortive offshoots from the primitive type are well known in other orders of insects, and among the Hymenoptera occur some of the most conspicuous; such are* *Stephanus*, *Monomachus*, *Pelecinus*, *Elasmosoma*, etc., whose position in any artificial system has always been, and must continue to be, based upon fanciful analogies, or altogether indeterminate.

Two species only of the *Pachylomma*-group are at present known in Europe, one of which occurs in the British islands. In America three more have been made known by Provancher and Ashmead, viz. *Eupachylomma rileyi*, Ashm., *E. flavocincta*, Ashm., and *Ropronia pediculata*,

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* Nees v. Esenbeck commences his monograph of the *Braconidæ* with the genus *Stephanus*. This genus is now regarded as a separate family, *Stephanidæ*, to which Schletterer has lately added *Stenophasmus*, Westw., a genus taken from the *Braconidæ*, and allied to *Spathius*, of which it has all the forms, with exaggeration, and a neuration absolutely identical, but widely different from that of *Stephanus*. The result of this is that the group of *Spathius* enjoys a double representation, figuring among the Braconidæ as *Spathius*, and among the *Stephanidæ* as *Stenophasmus*.

Prov. These insects, or at least two of them, differ materially from those of Europe by their habits, being parasites of Aphides; *flavocincta* is of unknown origin. It is therefore not without reason that the transatlantic entomologists have regarded them as generically distinct from *Pachylomma*. This genus, to which our attention must now be confined, has been treated as a near relation of *Aphidius*, and this idea seems based upon the fact that two of the American insects just mentioned are parasites of pucerons, resembling in that single respect the extensive tribe represented by *Aphidius*. Notwithstanding similarity of parasitism, which by itself is plainly insufficient to prove affinity, I venture to think that, in comparing *Pachylomma* with *Aphidius*, authors have suffered themselves to be misled by a merely illusory resemblance. Admitting that, at first sight, the general form of *Pachylomma* may possibly suggest that of an Aphidian, yet a closer inspection of structural details must lead immediately to the abandonment of the idea. An ordinary lens, applied to a *Pachylomma*, reveals the following primary characters: oral parts produced into a rostrum; wings equipped with a complete neuration, not only different from that of *Aphidius*, but from that of all other Hymenoptera; the insertion of the abdomen upon the metathorax, faintly suggestive of the structure of *Evania*; the articulation between the 2nd and 3rd segments, which is effected by imbrication, and not by juxtaposition; finally, the form of the hind legs, elongate, with lengthened coxæ and incrassated tarsi. These peculiarities constitute a distinct facies, of which not the smallest trace is to be found in any genus of the Aphidian group. I fail, therefore, to perceive any analogy between *Pachylomma* and *Aphidius*. Mr. Ashmead is of a different opinion; he expresses himself much struck by the similarity of these two genera,* without however particularising the points

* See Proc. Ent. Soc. Washington, 1894, vol. iii. no. 1, "Notes on Pachylommatoidæ." According to the description of *Eupachylomma rileyi*, it appears that that insect scarcely differs from *Pachylomma*. The writer of this interesting memoir has done well in correcting the original mistake of assigning his *Eupachylomma* to the tribe *Euphoridæ* and genus *Wesmaëlia*, Först., which is quite out of the question. I may remark also that, in speaking of the mode of insertion of the abdomen of *Pachylomma*, Mr. Ashmead quotes, as an example of the same peculiarity, *Cænocœlius*, Hal., which is quite correct; but he is mistaken in supposing that my genus *Promachus*

of resemblance, which would perhaps be more difficult than to point out their differences. Wesmael has indeed attempted the former task, but with very indifferent success.

The characters of this division are comprised in those of the single genus *Pachylomma*.

PACHYLOMMA, De Brebisson.

Paxylomma, De Breb., Enc. Méth., x, p. 23 (1825). Variously spelt by authors *Paxillomma*, *Paxylomma*, *Paxylloma*; first corrected by Förster.

Head large, transverse, wider than the thorax; eyes and ocelli very large; face narrow, somewhat concave; clypeus carinated, porrected above the mandibles in form of a rostrum; palpi short, the maxillary with 4, the labial with three joints. Antennæ ♂ ♀ 13-jointed, filiform, shorter than the body in the ♀, nearly as long as the body in the ♂. Thorax very short and gibbous; prothorax concealed above; mesonotum without visible furrows; a shallow fovea before the scutellum; metathorax very short, excavated at the insertion of the abdomen, which is situated at an appreciable distance above the hind coxæ; sternum gibbous. Neuration of wings distinct and complete; 2 cubital areolets; radial areolet narrowly triangular, remote from the tip of the wing; stigma narrow, elongate, lanceolate, emitting the radial nervure near its base; 1st abscissa longer than the thickness of the stigma; 2nd very short, often punctiform or nullified (*P. buccata*) or else longer than the first (*P. cremieri*); cubital nervure springing abnormally either from the point of junction of the two abscissæ (*P. buccata*) or from the outer extremity of the 2nd (*P. cremieri*); hence the two cubital areolets either touch at one point, or are separated by an isthmus; no intercubital nervures; 1st cubital areolet confounded with the 1st discoïdal; 2nd discoïdal almost as large as the 1st; anal nervure not interstitial; recurrent nervure considerably rejected; no recurrent nervure in the hind wings. Four anterior legs long and slender; the hind pair very long, their coxæ elongate, the tarsi dilated, flattened, the 1st joint as long as, or longer than, the others united. Abdomen much longer than the head and thorax, falciform,

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was a synonym of *Cænocœlius*. In fact the name *Promachus* was never published, for I found it to be preoccupied, and substituted another word *Dolops*. *Dolops* is widely different from *Cænocœlius*, see Tr. Ent. Soc. Lond. 1889, p. 206. The orthography of this last name should be as here written, and not *Cenocœlius*, which is mere gibberish.

viewed sideways clavate; 1st segment very narrow, cylindric, with the tubercles nearly in the middle; 2nd one half longer than the 1st, narrow, subcylindric; the following segments shorter, narrow on the dorsum, widened and compressed laterally. Terebra in repose not exceeding the tip of the abdomen; when exserted, it is as long as the 3 or 4 apical segments, slightly curved upwards, acute, with the valves flattened, spathulate. The ♂ is known by its longer antennæ, by the somewhat prominent sheath of the sexual organ, and a lateral emargination of the 3rd segment, more strongly marked than in the ♀.

The singularity of the neuration is explained by the displacement of the cubital nervure, which instead of starting from the præbrachial transverse (as in other Hymenoptera) originates at the flexure of the radial, causing thereby some derangement of the rest of the system. Giraud describes the head as "petite," by an evident lapsus calami; it is on the contrary remarkably large. Förster has made a separate genus *Eurypterna* for the second European species *P. cremieri*, De Romand; it is founded on the different length, in the two species, of the isthmus connecting the cubital areolets; other differences there are none. Fallén's genus *Hybrizon*, published in 1813, ought to take precedence of *Pachylomma*, if it were adequately described; but the definition is so loose that, as remarked by Nees, it includes a number of other insects, and even the whole tribe of Aphidians. Curtis was the first to notice in Great Britain the species about to be described; he established in 1833 the genus *Plancus* for its reception.

Pachylomma buccata, De Brebisson.

Paxylomma buccata, De Breb., *loc. cit.*
Hybrizon latebricola, Nees, Mon., i, 28, ♀.
Plancus apicalis, Curt., Ent. Mag., i, Charactt. of undescr. Gen. and Spp. etc. ♀.
P. buccata, Ratz., Ichn. d. Först., ii. 53, pl. ii, fig. 23 (wing); Wesm., Nouv. Mém. Ac. Brux. 1835, p. 90, ♀, pl. ii, (wing); Marsh., Species des Hym. d'Eur. et d'Alg. Bracon., vol. ii. p. 623, ♂ ♀, pl. xix, fig. 8; Giraud, Verh. d. zool.-bot. Vereins in Wien. 1857, p. 11.

♀ Black, or piceous in various degrees; base of antennæ, abdominal sutures, and legs, testaceous. Head black; clypeus, palpi,

and mandibles, testaceous. Antennæ one fourth shorter than the body; joints 1–2 equal, testaceous, the 2nd rounded; 3rd very long, cylindric, blackish like all the following. Mesonotum sometimes rufescent; a fulvous spot is sometimes visible beneath the wings; metathorax carinated on its posterior half, the carina bifurcate anteriorly, showing a tendency to areation. Wings subhyaline or slightly infumated; squamulæ and radicles fulvous; stigma and neuration fuscous; cubital nervure springing from the point of junction of the two cubital areolets, which point represents the 2nd abscissa. Legs, including the coxæ, testaceous; the hind pair somewhat more highly coloured, or fulvous. Abdomen more or less broadly cinctured with testaceous along the sutures, sometimes almost wholly testaceous, blackish at the extremity; 1st segment linear, faintly striolate, forming about $\frac{1}{6}$ of the abdomen; 2nd similarly striolate at the base, widened posteriorly; 3rd and following short, compressed, the 3rd emarginate on either side. Terebra usually concealed or hardly exserted; its valves black. ♂ Similar; antennæ hardly shorter than the body, broadly testaceous at the base, thence to the apex dull fulvous (in my specimen); abdomen longer than that of the ♀, and less claviform. Length, $1\frac{1}{4}$–2; exp. 2–$3\frac{1}{5}$ lines.

Generally distributed throughout Europe, wherever the ubiquitous ants of the genus *Myrmica* are established. I have met with it in the Jura mountains, at Ajaccio, and three times in England, chiefly at Freshwater Bay, Pembrokeshire, where the ♀s were lurking in great abundance among the rushes on the sand-hills, in company with *Myrmica scabrinodis*, Nyl. I have never had the chance of observing the manœuvres of the species in activity, vaulting over the nests of the ant, and pouncing down upon the workers in order to deposit an egg in each of them. Such are the habits of the larger and much handsomer species *Cremieri*, observed by Dr. Giraud (*loc. cit.*), from whom I extract the following passage:—"Dans une excursion que je fis, le 6 juillet, dans les environs de Vienne, mon attention se porta sur un tronçon de saule en partie vermoulu, sur lequel se promenait une société de très petites fourmis dont je regrette de n'avoir pas déterminé l'espèce. Au dessus d'elles planait un nombre assez considérable de petits hyménoptères; j'en mis une quinzaine dans un flacon, et je les apportai vivants chez moi. Après m'être assuré que j'avais affaire à la *P. buccata*, je les plaçai dans une boîte vitrée qui me per-

mettait d'observer leurs mouvements : le lendemain, vers dix heures, je vis à ma grande satisfaction, que leur réclusion ne mettait pas obstacle à leurs ébats amoureux ; une paire était accouplée," *etc.* Ratzeburg conjectured that *P. buccata* was a parasite of the beetle *Throscus dermestoides*, L., a specimen having been taken hovering about that insect, but after the observations of *P. cremieri* which have been made, and which certainly apply equally well to the present closely allied species, proving the connection which exists between *Pachylomma* and *Myrmica*, we are authorised in rejecting all statements to the contrary.

A short supplement of fresh discoveries is required to complete the subject.

Explanation of Plate I.

[*See explanation facing the* Plate.]

II. Asilidæ *from Aden and its neighbourhood.*

By F. M. van der Wulp.

[Read November 2nd, 1898.]

Plates II. and III.

Colonel J. W. Yerbury, being desirous to increase our knowledge of the fauna of the countries bordering on the gulf of Aden, made during his residence there a rather large collection of Diptera. He has been kind enough to send me the Asilids, and has at the same time communicated to me the results of his preliminary examination, results which prove him to be by no means a tyro in dipterology.

The localities in which the Asilids have been collected are: Huswah, across Aden harbour on the sea-shore; Shaik Othman, 6 miles from Aden; Lahej, 15 miles inland from Aden; and Haithalhim, 19 miles from Aden. There were no specimens from the opposite (African) coast of the gulf of Aden. Nevertheless the collection shows a decided African character and a total want of East-Indian forms.

The following species, belonging for the most part to genera almost exclusively African, are represented in it.

Dasypoginæ.

1. *Saropogon melampygus*, Löw.

Saropogon melampygus, Löw, Bemerkungen über die Asiliden, p. 10; and Systematischre Beschreibung, i, p. 90.

Several specimens of both sexes from Lahej and Shaik Othman. Löw has described only the female; his specimens were from Syria. All the females before me have the mystax yellow; even the lateral bristles which, according to Löw, are sometimes black. In one of the males the whole mystax is likewise yellow, but the other male specimens have a black mystax, often with some pale bristles in it. I see no other difference, and I think all belong to one species. Some of the females agree fully with Löw's ample description. In most specimens the

basal joints of the antennæ are rufous with only the third joint blackish, but sometimes the basal joints are also infuscated. The coloration of the abdomen is somewhat variable, the black picture being more or less extended. The male genitalia are swollen, shining black at the sides and with brown hairs beneath. One of the females shows at the tip of the abdomen some small black spines, which in the others are inconspicuous in the pilosity.

2. *Saropogon incisuratus*, n. sp. ♂.

Thorax grey with black stripes; abdomen black with white incisions; mystax yellow; legs yellow; the tarsi, the hind tibiæ, and a spot on the hind femora, black; wings subhyaline.

Length 7.5 mm.

Front black, with yellow dust; face and mystax yellow; occiput dark grey with grey hairs. Antennæ brown, on the inner side somewhat lighter and more rufous, the tip and the rather distinct terminal style black; the basal joints of equal length, the third joint one and a half times as long as the basal joints together; the second joint with black bristles at the tip on the underside. Proboscis shining black; palpi black with black bristles. Ground-colour of the thorax yellowish-grey; the thoracic dorsum covered with short yellow hairs and with three broad blackish stripes, the median one divided in two by a pale line; pleuræ black, with irregular yellowish spots; prothorax on the upper side with erect yellow hairs; posterior part of the thorax with yellow bristles, which are directed towards the scutellum; scutellum brownish-grey, with a narrow whitish hind border and two pale yellow bristles; metanotum grey, on each side with a whitish spot; the bristles before the halteres yellow. Abdomen shining black; the second, third and fourth segments with a narrow white hind border; genitalia rufous (in one specimen black), with brown hairs on the underside. Coxæ black, the fore and middle ones with a yellowish spot; in the fore and middle pairs of legs the femora and tibiæ are pale yellow, the tarsi rufous-brown, lighter towards the base; in the hind pair the femora are yellow with the tip and a large spot on the upperside black, the tibiæ and tarsi black, the end of the tibiæ and the first tarsal joint often somewhat rufous; the spur at the end of the fore tibiæ minute, ending in a black spine; bristles of the fore and middle tibiæ yellow and black mixed; those of the hind tibiæ all black; bristles of the tarsi and likewise the foot-claws black. Halteres yellow. Wings (Plate II, fig. 1) greyish-hyaline, slightly infuscated at the tip; small cross-vein on the middle or a little beyond the middle of the

discal cell ; fourth posterior cell narrowed towards the end, but not closed ; third basal cell narrowly open at the margin of the wing.

Five male specimens from Lahej.

3. *Saropogon pulverulentus*, n. sp. ♂♀.

(Plate II, fig. 2.)

Thorax grey ; abdomen yellowish-rufous, with black lateral spots ; mystax, antennæ and legs yellow ; wings hyaline.

Length 12.5 mm.

Front covered with grey dust ; the ocelli black ; face golden yellow ; mystax pale yellow ; occiput grey, with whitish hairs ; ocellar bristles also whitish. Antennæ yellowish-rufous, the tip of the third joint black ; second joint a little longer than the first, with yellow bristles ; the third longer than the two basal joints together. Proboscis black ; palpi rufous with yellow hairs. Thorax black, but in well preserved specimens the thoracic dorsum thickly clothed with a clear grey dust ; the shoulders and pleuræ yellow ; the prothorax and the posterior part of the thorax with many long, pale yellow bristles ; scutellum and metanotum yellowish-rufous ; the bristles before the halteres yellow ; on the hind border of the scutellum two yellow bristles crossing one another. Abdomen rufous ; base of the first and second segments black ; the following segments with black lateral spots, which sometimes extend along the front borders ; first segment on each side with yellow bristles ; male genitalia short, on the sides and beneath with long yellow hairs. Legs yellowish-rufous ; the bristles of the tibiæ yellow ; those of the tarsi mostly black ; the spur at the end of the front tibiæ and all the foot-claws black. Halteres brown. Wings hyaline with yellow or pale veins ; fourth posterior cell and third basal cell closed at the hind margin of the wing.

Several specimens of both sexes from Huswah and Shaik Othman.

This species is closely allied to *Saropogon* (*Dasypogon*) *vestitus*, Wied. (Aussereur. Zweifl. ii, 406. 65), but it differs in its somewhat larger size, the want of yellow stripes on the thoracic dorsum and of the black tip to the hind femora, and in the brown halteres.

4. *Saropogon rubriventris*, n. sp. ♀.

Thorax yellowish with black stripes ; abdomen brownish-red ; antennæ and legs rufous ; mystax yellow ; wings subhyaline with grey tip.

Length 11 mm.

Front black, with yellowish dust; face pale yellow; mystax yellow; occiput grey. Antennæ rufous with black tip; second joint hardly as long as the first; third joint about one and a half times as long as the two basal joints together; the second joint with some black bristles. Proboscis black, rufous at the base; palpi rufous with yellow bristles. Thorax greyish-yellow, with two black dorsal stripes and a broad, dark-brown lateral band; the hind border and the scutellum rufous; prothorax with yellowish bristles; similar bristles, directed backwards on the posterior part of the thorax; scutellum with two yellow bristles; the bristles before the halteres also yellow. Abdomen as broad as the thorax, with parallel sides, brownish-red; the first segment black, the others with a small, black, lateral spot; the second and third segments with a very narrow, whitish hind border; the terminal segments shining; laterally the basal segment with several yellow bristles. Legs yellowish-rufous; the coxæ blackish; hind femora with a brownish tip; tibiæ with some short black bristles, and others, which are longer and yellow; tarsal bristles and foot-claws black. Halteres rufous. Wings greyish-hyaline, the tip bordered with dark grey, extending from the end of the second vein to beyond the fourth posterior cell; this cell is narrowed towards the margin of the wing, but not closed; small cross-vein nearly on the middle of the discal cell.

A single female from Lahej.

This species also comes near *Saropogon vestitus*, Wied., and might even be identified with it, if Schiner (Verh. Zool. bot. Ges. Wien, xvi, p. 680) had not stated that in the typical specimens the fourth posterior cell is closed.

5. *Leptogaster nitidus*, Wied.

Leptogaster nitidus, Wied. Auss. Zweifl. i, 535; Löw, Dipt. fauna Süd Afrika's, p. 102.

A single female specimen from Lahej.

This specimen may be referred to the above species, though it differs in some respects from Löw's ample description. The second and third abdominal segments do not show the large, well limited blackish spot, mentioned by him, but all the segments are rather equally blackish brown, with a grey hind border, which becomes narrower on the terminal segments. The fore femora are not in-

fuscated at the tip, and the fore and middle tibiæ have not a brownish stripe. The wings (Plate II, fig. 3) are strongly iridescent; the third basal cell and all the posterior cells are open; the small cross-vein stands distinctly before the middle of the discal cell.

6. *Rhadinus ungulinus*, Löw.

Rhadinus ungulinus, Löw, Neue Beitr. zur Kenntn. der Dipteren, iv, p. 38.

Five specimens (1 ♂, 4 ♀) from Aden. The species is common, sitting on the sand.

The basal part of the tibiæ is sometimes to a great extent rufous; in the male specimen the base of the hind femora is of the same colour. On Plate II, I give a sketch of the head in profile (fig. 4), the front leg (fig. 5) and the neuration of the wing (fig. 6).

7. *Rhadinus megalonyx*, Löw.

Rhadinus megalonyx, Löw, Neue Beitr. zur Kenntn. der Dipteren, iv, p. 39.

Five specimens (1 ♂, 4 ♀) from Aden; common in the same places and in company with the preceding species.

The specimens vary in size (5 to 6.5 mm.); in the male and in three of the females the mystax is white, in one of the females only is it yellow. The male, which was unknown to Löw, agrees fully with the female.

Löw has described both species from Egyptian specimens.

Psilinus, nov. gen.

(ψιλὸς, bare.)

Belongs to the Dasypoginæ without terminal spur to the front tibiæ and without pulvilli.

Small, slender, not hairy. Front very slightly excavated; ocelli distinct; face flattened, narrower than the eyes, with parallel sides; mystax ascending to one third of the face; eyes large, prominent. Antennæ slender; the third joint much longer than the basal joints together, pointed at the tip; terminal style distinct, elongate, two-jointed. Thorax and scutellum without bristles; the abdomen long and slender; the anal segment (♀) with some small spines. Legs moderately long, the hind pair scarcely longer and somewhat more

robust than the others ; first tarsal joint as long as the two or three following joints together ; foot-claws long ; pulvilli absent. In the wings all the posterior cells are open and not constricted ; the fourth posterior cell issues from the second basal cell ; the third basal cell is closed at the margin of the wing.

This genus is related to *Rhadinus*, but differs in the mystax, which does not ascend to the antennæ ; the total want of bristles on the thorax and scutellum ; the less excavated front, the more elongate antennæ, and the not closed fourth posterior cell. From *Leptogaster* it differs in the hind legs, which are less elongate and of which the femora and tibiæ are not club-shaped, the tibiæ being gradually and only slightly enlarged towards the tip.

8. *Psilinus cinerascens*, n. sp. ♀.

(Plate II, fig. 7.)

Grey ; antennæ, incisions and terminal segment of the abdomen, and legs, black.

Length 8 mm.

Head (figs. 8 and 9) greyish-white ; mystax yellow ; beard whitish. Antennæ, proboscis and palpi black. Thorax and scutellum grey ; thoracic dorsum somewhat brownish-rufous pollinose, with two blackish stripes, which do not reach the hind border, laterally on each side two black spots ; with the exception of a row of fine, yellow, erect hairs before the halteres, the whole thorax is bare. Abdomen cinereous, with blackish incisions ; anal segment a little shorter than the preceding segments, shining black, with four or five very small spines. Legs black, the base of the tibiæ slightly rufous ; the front coxæ, the femora on the underside, the tibiæ, and tarsi with whitish hairs and bristles. Halteres yellow, proportionately large. Wings greyish hyaline, with black veins ; small cross-vein on the middle of the discal cell.

A single female specimen from Aden.

9. *Sisyrnodytes brevis*, Macq.

Acnephalum breve, Macq., Dipt. exot. i, 2, p. 52, Tab. 4, f. 3.

Sisyrnodytes floccus, Löw, Neue Beitr. zur Kenntn. der Dipteren, iv, p. 40.

Dasypogon contrarius, Walk., Entomologist, v, p. 257.

A single female specimen from Aden.

I have no doubt that the above-quoted descriptions are all founded on the same species. Macquart's specimens were from the Cape, those of Löw from Egypt, and those of Walker from Mount Sinai.

The genus *Sisyrnodytes*, Löw, differs from nearly all other Asilids by having the costal vein not prolonged round the whole circumference of the wing, but terminated a little beyond the end of the upper branch of the third vein (see Pl. II, fig. 10). *Dasythrix* is the only genus among the *Laphrinæ* that shows this peculiarity.

10. *Acnephalum futile*, n. sp. ♂ ♀.

Black ; thorax with white stripes and spots ; abdominal segments with white front borders ; tibiæ and base of the tarsi rufous.

Length 5–6 mm.

Head greyish ; mystax white or whitish yellow, ascending to the antennæ ; beard, and hairs of the occiput white. Antennæ black ; the basal joints with whitish hairs. Proboscis shining black. Thorax, scutellum and abdomen shining black ; on the thoracic dorsum three longitudinal stripes, the sides, and some lateral transverse stripes, whitish ; pleuræ with a large whitish spot beneath the shoulders and some others further behind ; the thorax is clothed with short whitish hairs and has posteriorly many bristles of the same colour ; the bristles before the halteres yellowish-white ; the abdominal segments have white front borders ; on each side of the first segment is a tuft of yellowish bristles ; male genitalia small, somewhat pointed, rufous, with yellow hairs ; anal segment of the female truncate. Legs rather robust ; coxæ and femora black ; the tip of the femora, the tibiæ and the first tarsal joint rufous, the following joints of the tarsi gradually darker ; the hairs and bristles of the legs, even those of the tarsi, yellowish-white. Halteres pale yellow. Wings (Pl. X, fig. 11) hyaline, iridescent, with black veins ; all the posterior cells open, the third slightly enlarged and the fourth narrowed towards the margin of the wing ; small cross-vein on the middle of the discal cell ; third basal cell closed at the margin.

A pair in coitu, from Aden.

This species is closely allied to *Dasypogon* (*Acnephalum*) *andrenoides*, Wied. (Auss. Zweifl. i, p. 403), but differs in its smaller size, black antennæ, abdomen not punctured nor reddish at the sides, and its hyaline wings without brownish picture.

11. *Holocephala punctulata*, n. sp. ♂.

Thorax cinereous with black points ; abdomen and legs rufous ; antennæ and tarsi black ; wings brown.

Length 5 mm.

Head (Pl. II, figs. 12 and 13) grey ; front and face nearly as broad as the eyes ; ocellar tubercle and a spot above the oral margin, black ; mystax yellowish, limited to the oral margin. Antennæ black ; third joint cylindrical, much longer than the basal joints ; terminal style as thick and nearly as long as the third joint. The short proboscis and palpi black. Thorax and scutellum cinereous ; thoracic dorsum with hardly any indication of dark stripes, but with six distinct, slightly excavated, shining black points ; the thorax is strongly convex and has a very short, yellow pilosity, but no bristles ; scutellum likewise without bristles. Abdomen elongate, subcylindrical, rufous, with erect yellow hairs ; genitalia rather small. Legs rufous ; tip of the femora and tibiæ, and the whole tarsi, black ; the tibiæ and the underside of the femora with whitish bristly hairs ; first joint of the hind tarsi slightly enlarged, clothed on the underside with a compact, short, golden-yellow pilosity. Halteres rufous. Wings (fig. 14) blackish-brown, more obscure at the base and along the costa ; auxiliary vein elongate, terminating in the costa at a short distance from the end of the first vein ; second vein straight ; all the posterior cells open ; the fourth posterior cell unusually broad ; small cross-vein before the middle of the discal cell ; third basal cell narrowly open at the margin of the wing.

Two male specimens from Aden.

12. *Stichopogon inconstans*, Wied.

Thereva inconstans, Wied. Auss. Zweifl. i, p. 558.

A single female specimen from Haithalhim.

Wiedemann wrongly placed this species in the genus *Thereva*, but before the publication of his book discovered his error, as in the index (p. 596) he brings it into *Dasypogon*. His description is quite applicable to the specimen before me ; the only ground for doubt as to the correctness of this identification being his reference regarding the neuration of the wings to a figure in Meigen's System. Beschr. vol. ii, Tabl. 15, f. 8, repre-

senting a *Thereva*-species. In this figure the fourth posterior cell is closed at the margin of the wing, whereas in the specimen before me (see my figure, Pl. III, fig. 1) it is open.

Wiedemann's description was based on Nubian and Egyptian specimens.

13. *Habropogon senilis*, n. sp. ♂.

Cinereous ; thorax with brownish stripes ; abdomen, antennæ and legs rufous ; wings hyaline.

Length 8 mm.

Head broader than high ; front and face slightly narrower than the eyes ; front not excavated ; face pale yellow, flattened ; mystax yellowish, very compact, but confined to the oral margin. Antennæ rufous, as long as the head ; basal joints with some pale bristles ; third joint elliptical, as long as the basal joints together ; terminal style very short, but distinct. Proboscis black, pointed towards the tip ; palpi rufous, with yellow hairs. Thorax, scutellum and metanotum cinereous ; thoracic dorsum with three broad brown stripes ; the median stripe anteriorly divided by a lighter line ; posterior part of the thorax with pale yellow bristly hairs ; a row of similar hairs at the hind border of the scutellum ; the hairs before the halteres likewise pale yellow. Abdomen cylindrical, rufous, without hairs and bristles, but in well preserved specimens with some greyish dust, which, however, does not much modify the ground-colour ; the front border of the first and sometimes also of the second segment blackish ; genitalia little developed. Legs rufous ; coxæ cinereous ; a streak on the upperside of the hind femora, the tip of the hind tibiæ, and the hind tarsi, brown ; the legs are rather robust, the hind tibiæ very slightly enlarged towards the tip ; the first tarsal joint of the fore and middle pair is not longer than the second joint ; in the hind tarsi it is somewhat enlarged and as long as the two or three following joints together ; the legs have a whitish pubescence and weak yellow bristles ; on the underside of the hind femora the bristles are shorter ; the foot-claws are black. Halteres pale yellow. Wings hyaline ; the veins at the base and near the costa rufous ; all the posterior cells open ; third basal cell narrowed towards the margin of the wing ; small cross-vein a little before the middle of the discal cell.

Three male specimens from Aden.

LAPHRINÆ.

14. *Hoplistomera caliginosa*, n. sp. ♀.

Brownish-black ; abdomen with yellow or white hind borders of the segments ; tibiæ and tarsi rufous ; wings slightly infuscated at the tip.

Length 13–14.5 mm.

Face grey, thickly clothed with whitish hairs ; mystax pale yellow, hardly reaching the middle of the face ; front and occiput grey, with whitish bristles ; beard white. Antennæ as long as the head ; the basal joints brownish-rufous ; third joint black, lighter towards the base, as long as the basal joints together. Proboscis shining black ; palpi black, with whitish hairs. Thoracic dorsum brown, but on account of a short white pilosity appearing cinereous ; the shoulders, the sides and the pleuræ whitish ; a brown stripe from the shoulders to the root of the wings ; scutellum cinereous ; the bristles before the halteres are whitish, and there are no other bristles on the thorax or scutellum. Abdomen conical, convex, brownish-black ; the hind borders of all the segments are white, in some lights showing yellow or brownish-yellow reflections ; on the sides of each segment are some very short, yellow bristles ; ovipositor shorter than the preceding segment, partly shining rufous, with yellow hairs. Legs robust, the femora, especially the hind pair, incrassated ; fore coxæ densely white-haired ; femora black ; in the fore and middle pair the underside and tip, in the hind pair the base and tip are rufous ; tibiæ and tarsi rufous ; all this coloration more or less altered by a short white pilosity ; bristles of the legs, including the tarsi, yellowish ; some short black spines on the underside of the hind femora. Halteres pale yellow. Wings (Pl. III, fig. 2) greyish-hyaline, the tip and the terminal portion of the hind margin slightly infuscated ; small cross-vein at a short distance from the base of the discal cell.

Two female specimens, from Haithalhim and Lahej.

15. *Hoplistomera leucocoma*, n. sp. ♂ ♀.

Greyish-cinereous ; antennæ and legs rufous ; wings hyaline.

Length 9.5–11 mm.

Front and occiput grey ; face densely clothed with white hairs ; the similarly coloured mystax densely covering the oral margin ; beard and the hairs on the occiput likewise white. Antennæ yellowish-rufous ; the second joint with some long, pale bristles ;

third joint as long as the preceding joints together, attenuated towards the base. Proboscis shining black; palpi rufous. Thorax and scutellum cinereous, with a short whitish pilosity; the bristles before the halteres white. Abdomen in the male cinereous, at the sides whitish; in some lights the front borders of the segments become darker and the hind borders lighter; male genitalia rufous, with yellow hairs. The abdomen of the female has a more rufous ground-colour, which, however, in well-preserved specimens is very inconspicuous owing to the whitish pilosity; sometimes the segments appear with a brownish-rufous front border and a white hind border; the ovipositor is very small. In both sexes some yellow bristles are present on the sides of the first segment. Legs yellowish-rufous; in the male the femora on the upperside and the apical half of the hind tibiæ are brown; hind femora slightly incrassated, without spines on the underside, but with weak yellow bristles such as are generally to be found all over the legs; foot-claws black. Halteres yellow. Wings hyaline; neuration as in the preceding species.

Five specimens (2 ♂, 3 ♀) from Shaik Othman.

16. *Dasythrix ruficornis*, n. sp. ♂ ♀.

Grey; clothed with white and greyish hairs; abdominal segments with blackish hind borders; antennæ rufous; legs black.

Length 11.5 mm.

Head wholly and densely clothed with white hairs, which are longer and more bristly towards the oral margin. Antennæ yellowish-rufous; first joint beneath with long whitish hairs; second joint small, often somewhat infuscated; third joint as long as the first, elliptical; the very short terminal style black. Proboscis shining black; palpi rufous, with white bristles. Ground-colour of the thorax and scutellum black, but on account of the dense covering of whitish hairs they have a grey aspect; on the hind margin of the latter these hairs become long erect bristles. Abdomen conical, blackish-brown, clothed on the sides and front borders of the segments with whitish hairs, so that large spots or cross-bands of the dark colour remain on the hind borders; the male genitalia and the ovipositor of the female small and covered with whitish hairs. Legs black, with white hairs and bristles, which are present also on the tarsi; in some specimens the base of the tibiæ is slightly rufous; foot-claws black, with a rufous base; pulvilli pale yellow. Halteres yellowish-rufous. Wings (Pl. III, fig. 3) hyaline with a slight yellowish-grey tinge and with all the veins black except the auxiliary

vein, which is rufous ; the costal vein is not prolonged round the hind margin of the wing, but terminates just beyond the upper branch of the third vein ; the first basal cell and the first posterior cell are very narrow ; the latter is closed near the margin of the wing ; the second and third posterior cells are imperfect, as the veins separating them do not reach the margin ; the small cross-vein stands upon the first third part of the discal cell.

Several specimens of both sexes, from Aden and Shaik Othman.

This species seems to be closely allied to *D. brachyptera*, Löw (Dipt. faun. S. Afrika's, p. 126), but I cannot unite them, the hairs and bristles in the Aden species being without exception whitish, whereas in *D. brachyptera* black bristles are mingled with the white.

Asilinæ.

17. *Promachus rectangularis*, Löw.

Promachus rectangularis, Löw, Neue Beitr. zur Kenntn. der Dipteren, ii, p. 5.

* ? Syn. *Erax cinctipes*, Walk., Entomologist, v, p. 258.

Four specimens (2 ♂, 2 ♀) from Aden, Lahej, Shaik Othman and Haithalhim.

They agree fully with Löw's description. The synonymy of *Erax cinctipes*, Walk. was already stated by Löw (Zeitschr. f. d. ges. Naturwiss. xlii, p. 108). I give a sketch of the wing, Pl. III, fig. 4.

Löw's specimens were from Massawa, those of Walker from Wadi Ferran (in Arabia).

18. *Philodicus gracilis*, n. sp. ♂ ♀.

Cinereous ; thorax with brown stripes ; abdomen with black dorsal spots ; tibiæ rufous ; wings hyaline with the tip grey.

Length 19–22 mm.

Head whitish ; face clothed with white hairs ; mystax white or pale yellow, confined to the oral margin, sometimes with one or two black bristles at the sides ; beard snow-white ; occiput grey with

* *Erax cinctipes* is not amongst those types of Walker which are preserved in the British Museum Collection ; the type specimen of *E. cinicolor* is a *Promachus* and according to Löw is identical with *P. ruppelli* Löw. The two species are very near together and may possibly be identical.—J. W. Yerbury.

white hairs and bristles. Antennæ short; first and second joints brownish-rufous, with white and black hairs; third joint blackish, elliptical, shorter than the first joint. Proboscis black; palpi rufous with whitish hairs. Thorax cinereous; the usual brown picture very conspicuous; the middle band widening to the front and divided by a clear median stripe; the lateral bands interrupted and forming a row of three spots; thoracic dorsum with very short, blackish hairs, posteriorly with several long black bristles; similar bristles at the sides; on the lower part of the prothorax long whitish hairs; scutellum cinereous, on the hind margin with two long, usually black but sometimes yellow bristles (in one of the specimens the right bristle is black, the left one yellowish); the bristles before the halteres whitish. Abdomen elongate, attenuated towards the apex, cinereous, each segment with a large blackish dorsal spot; in the male the eighth segment wholly black, shorter than the preceding; the genitalia small, ovate, with whitish hairs; in the female the eighth segment shining, black or dark rufous, as long as the preceding; the ovipositor short, black, with some very short spines on each side; in both sexes the first and second abdominal segments have whitish bristles towards the sides. Legs slender; coxæ grey; femora blackish, the fore and middle ones rufous on the underside; tibiæ yellowish-rufous; tarsi brown; but all this coloration more or less modified by a white pilosity; fore tibiæ towards the apex with long whitish hairs; bristles of the legs generally white, but some of them black; those of the tarsi black; foot-claws black; pulvilli orange-yellow. Halteres yellowish-rufous. Wings (Pl. III, fig. 5) much shorter than the abdomen, hyaline, with the tip greyish; veins black; small cross-vein on the middle or a little before the middle of the discal cell, which is proportionately narrow.

Some specimens of both sexes, from Lahej and Haithalhim.

Fairly common. I have examined six specimens (3 ♂ and 3 ♀). One of them was captured preying on a butterfly (*Lycæna gaika*).

19. *Apoclea femoralis*, Wied.

Asilus femoralis, Wied. Aussereur. Zweifl. i, p. 466.

Several specimens of both sexes, from Huswah, Shaik Othman and Lahej. One of them was captured preying on a butterfly (*Synchloe glauconome*).

Wiedemann's description is quite applicable, but as it

was based only on the male sex and the species of *Apoclea* are difficult to distinguish, I give here a full description.

Antennæ yellowish-rufous; the first and second joints with whitish hairs; third joint shorter than the first, pointed towards the tip. Mystax and likewise the hairs on the face, front, and occiput white. Proboscis black; palpi rufous with white hairs. Thorax, scutellum and abdomen greyish-cinereous; the thorax with more or less distinct darker stripes and spots; the very short hairs and the bristles on the sides and before the scutellum whitish; scutellum with erect whitish hairs and a row of whitish bristles at its hind margin. Abdomen often with an indication of black incisions; in the male there are some whitish bristles on the sides of each segment; in the female these only exist on the first and second segments; male genitalia ovate, usually chesnut-brown; in the female the eighth segment is cylindrical, twice as long as the preceding segment, shining black or piceous; the ovipositor black, with a row of short spines. Legs yellowish-rufous; on the upperside of the fore and middle femora a blackish stripe; the hind femora wholly black; the tarsi and often also the tips of the tibiæ infuscated; the coloration of the legs, however, is not conspicuous, the legs being covered with white hairs, which gives them a greyish aspect; the bristles of the legs, even those of the tarsi, are likewise white. Halteres yellowish-rufous. Wings (Pl. III, fig. 6) hyaline; the veins blackish, except those near the costa, which are rufous; the upper branch of the third vein at its base with a short recurrent stump, which, however, is wanting in some specimens; the small cross-vein is placed at, or a little before, the middle of the discal cell.

Length 17–23 mm.

Wiedemann's specimens were from Egypt.

20. *Apoclea heteroclita*, n. sp. ♂.

Cinereous; thorax with black stripes; abdomen with blackish spots; legs partly rufous; wings hyaline, with grey apex; first posterior cell open.

Length 16 mm.

Head cinereous; clothed with yellowish hairs; mystax yellowish, confined to the oral margin; beard white; occiput with whitish hairs and with a row of black bristles above. Antennæ brownish-rufous; the basal joints with some black bristles; the third joint shorter than the first, pointed towards the tip. Proboscis piceous. Thorax, scutellum and abdomen cinereous; the blackish median band of the thorax broad, indistinctly divided by a lighter line;

laterally with blackish spots, one before and another behind the transverse suture; the thoracic dorsum with short black hairs, posteriorly and on each side before the root of the wings with several black bristles. Pleuræ grey; scutellum with yellowish hairs; its hind margin with a row of yellowish bristles. Abdomen elongate, narrower than the thorax, each segment with two blackish-brown spots, which in some lights appear to be united, forming dark front borders on the segments; laterally there are some yellowish bristles; on the eighth segment these bristles are black; genitalia ovate, piceous. Coxæ greyish-cinereous; femora blackish above, rufous at the underside; tibiæ rufous with brownish tip; tarsi brownish; the legs are clothed with short, whitish hairs, on the fore coxæ and on the underside of the fore femora these hairs become longer and more bristly; tibiæ with scattered, mostly black bristles; those on the innerside of the fore tibiæ are yellowish; the bristles of the tarsi black, some only on the fore tarsi pale; foot-claws black; pulvilli yellow. Halteres yellow. Wings (Pl. III, fig. 7) hyaline, with black veins; the upperbranch of the third vein has a short recurrent stump at the base; the first posterior cell is slightly narrowed at the tip, but not closed; the small cross-vein is situated a little before the middle of the discal cell.

A single male specimen from Shaik Othman.

21. *Protophanes costalis*, n. sp. ♂.

Cinereous; thorax with a black stripe; abdomen with black dorsal spots; mystax white; antennæ and legs black; wings with a narrow brown costal border.

Length 12.5 mm.

Head (Pl. III, fig. 8) broader than the thorax; face narrow, not prominent, wholly covered by the large white mystax, in the upper part of which, under the antennæ, some black bristles are mixed; front black, with black bristles, those on the vertex rather long, curved forward; beard white. Antennæ black; the basal joints with whitish bristles beneath and some black ones above; third joint as long as the basal joints together, but distinctly narrower, and gradually passing into the rather short and thick arista. Proboscis black, pointed towards the tip. Thorax cinereous, with a very distinct black dorsal stripe; the usual lateral stripes inconspicuous; thoracic dorsum with short black hairs and along the median stripe with black bristles, which posteriorly are intermixed with whitish hairs; pleuræ grey; the bristly hairs before the halteres, whitish.

Scutellum cinereous, densely clothed with erect whitish bristles. Abdomen cinereous, elongate, slightly narrowed behind ; each segment with a blackish spot on the front border ; a row of erect whitish bristles on the hind margin of the first segment and a row of similar bristles, directed backwards, on the front margin of the second segment ; at the sides these bristles are concentrated into a tuft ; the tip of the second and third segments with two or three whitish bristles at the sides ; genitalia (fig. 9) black. Legs black, but appearing somewhat greyish on account of a short, dense, white pilosity ; knees and the base of the tibiæ rufous-piceous ; most of the bristles on the femora and tibiæ are whitish, but at the tip of the femora and on the front-side of the fore tibiæ there are some black ones ; the bristles of the tarsi are as a rule black, some only on the fore tarsi being white ; foot-claws black ; pulvilli yellow. Halteres yellow. Wings (fig. 10) greyish-hyaline ; the costa, from the middle to the tip, with a narrow brown border ; veins black ; small cross-vein a little beyond the middle of the discal cell.

Two male specimens from Aden.

22. *Itamus sodalis*, n. sp. ♂ ♀.

Thorax cinereous with black stripes ; abdomen black with grey hind borders of the segments ; antennæ black ; legs rufous ; wings brownish-hyaline.

Length 15–18 mm.

Head cinereous ; face with white reflections, slightly narrowed towards the antennæ ; mystax yellowish-white, not ascending above the oral margin ; beard white ; occiput with whitish hair, and with a row of black bristles above. Antennæ brownish-black ; the basal joints with some black bristles ; third joint as long as the first, pointed towards the tip. Proboscis and palpi black, the palpi with pale hairs. Thorax and scutellum cinereous ; thoracic dorsum with distinct, broad, black stripes, the median stripe double, the lateral ones interrupted on the transverse suture ; pleuræ grey ; some strong black bristles on the posterior part of the thorax and laterally behind the suture ; the bristly hairs before the halteres yellowish ; scutellum without hairs or bristles. Abdomen velvety black, without any metallic reflection ; the lateral and hind borders of the segments and the whole ventral surface grey ; yellowish bristly hairs situated laterally on the first and second segments ; the male genitalia (Pl. III, fig. 11) shining black, proportionally large, the forceps with white hairs beneath ; ovipositor (fig. 12) of the female elongate, black, formed by the sixth, seventh and eighth segments. Legs

rufous; the tips of the femora and tibiæ, and the second and following joints of the tarsi, more or less brownish; the bristles of the tarsi and some scattered bristles on the femora and tibiæ, black. Halteres yellow. Wings (fig. 13) slightly brownish, more obscure at the tip and hind margin, with the central parts of the cells sometimes clearer; small cross-vein placed distinctly beyond the middle of the discal cell.

A single pair, from Haithalhim and Lahej.

23. *Ommatius tenellus*, n. sp. ♂ ♀.

Cinereous; antennæ black; legs rufous; the tip of the femora and tibiæ, and the tarsi black; wings hyaline.

Length 7 mm.

Head (Pl. III., fig. 14) broader than the thorax; face white, narrow; mystax whitish, in the males with some long bristly hairs of the same colour above it (in the single female these hairs are blackish). Front and occiput grey; the ocellar tubercle black. Antennæ black; third joint ovate; arista long, with a row of rather long hairs on the underside. Proboscis black. Thorax and scutellum cinereous; thoracic dorsum with distinct brown or blackish stripes; the median stripe double; the lateral ones interrupted on the transverse suture, thus forming two spots; pleuræ and metanotum grey; on the posterior part of the thorax and on the sides behind the suture several whitish bristles; the bristles before the halteres white. Abdomen somewhat flattened, with parallel sides; cinereous with white incisions; male genitalia small, dark rufous, laterally with black hairs; ovipositor of the female very short. Legs yellowish-rufous; the coxæ grey; the tips of the femora and tibiæ, to a more or less extent, and the tarsi, with the exception of the basal joint, brownish or black; some weak yellowish hairs and bristles on the tibiæ and on the underside of the femora; bristles of the tarsi black. Halteres pale yellow. Wings (fig. 15) pure hyaline; small cross-vein on the middle or a little beyond the middle of the discal cell. In one of the specimens the space between the costal vein and the first vein is brownish, and the small cross-vein stands a little before the middle of the discal cell; but I see no other difference.

Fairly common. Several specimens from Haithalhim and Lahej.

In its small size and the coloration of the legs this species is allied to the East-Indian *O. argyrochirus*,

v. d. W. and *suffusus*, v. d. W. From the first it differs in the total want of silvery pilosity on the fore legs of the male; and from *O. suffusus* in its hyaline wings. *O. flavipes*, Löw, from South Africa, certainly belongs to the same group, but it has yellow legs without brown tips to the femora and tibiæ.

Plates II. and III.

[*See Explanations facing the* Plates.]

III. *Lepidoptera Heterocera from Northern China, Japan, and Corea.* By John Henry Leech, B.A., F.L.S., F.Z.S., &c.

Part II.

[Read December 7th, 1898.]

In this portion of my paper the subject is continued to the end of the "Bombyces." Some three hundred and forty species are considered, and these are distributed among seven families as under :—

Limacodidæ 34	Lymantriidæ 70
Lasiocampidæ 21	Hypsidæ 5
Pterothysanidæ 1	Arctiidæ 193
Agaristidæ 18	

Thirty-four species have not, so far as I am aware, been previously described, and this proportion of novelties corresponds closely to that shown among the species enumerated in the first part of this paper. In addition to these there are thirty-seven other species belonging to the above families which I have described elsewhere, thus making a total of seventy-one, or very nearly one-fifth of the entire number of species now discussed.

Family LIMACODIDÆ.

Genus Scopelodes.

Westwood, Nat. Libr. 37 (Ent. vii), p. 222 (1841).

354. *Scopelodes venosa.*

Scopelodes venosa, Walk., Cat. Lep. Het., v, p. 1105 (1855); Hampson, Fauna Brit. Ind., Moths, i, p. 374 (1892).

Scopelodes ursina, Butl., Ill. Typ. Lep. Het., vi, p. 3, pl. ci, figs. 7, 8 (1886).

Three male specimens and one female from Moupin,

and one example of each sex from Omei-shan, taken in June and July.

Distribution. Sikhim; Sylhet; Moulmein; Ceylon (*Hampson*); Western China; Japan.

355. *Scopelodes contracta.*

Scopelodes contracta, Walk., Cat. Lep. Het., v, p. 1105 (1855); Hampson, Fauna Brit. Ind., Moths, i, p. 375 (1892).

I obtained an example of a *Scopelodes* at Tsuruga in July 1886, which appears to be a female of *S. contracta*. It is rather larger than the male type and is somewhat paler in colour.

Distribution. North China; Sikhim; Japan.

Genus Hyphorma.

Walker, Cat. Lep. Het., xxxii, p. 493 (1865).

356. *Hyphorma minax.*

Hyphorma minax, Walk., Cat. Lep. Het., xxxii, p. 493 (1865); Hampson, Fauna Brit. Ind., Moths, i, p. 375 (1892).

A specimen received from Moupin, where it was taken in June, appears to be a male of this species. The antennæ are pectinated three-fourths of their length and the legs are hairy. Expanse 34 millim.

Distribution. Sikhim (*Hampson*); Northern and Western China.

357. *Hyphorma sericea*, sp. n.

Antennæ pectinated to the tips. Head, thorax, and abdomen yellowish, the metathorax and adjoining segment of body brownish.

Primaries silky dark brown with an oblique, plumbeus edged, black line from apex to inner margin; a second black line starts from same point and runs parallel with outer margin, the space between these lines is slightly paler than rest of the wing. Secondaries silky, cinnamon brown, fringes preceded by a dark brown line.

Under surface paler than above and without lines on primaries ; legs and body silky golden-brown.

Expanse 36 millim.

One male specimen from Omei-shan, taken in June or July.

Habitat. WESTERN CHINA.

Genus BOMBYCOCERA.

Felder, Reise Nov., Lep., iv, pl. lxxxiii, fig. 13 (1874).

358. *Bombycocera sinensis.*

Setora sinensis, Moore, Ann. and Mag. Nat. Hist., (4) xx, p. 93 (1877).

One male specimen from Chang-yang, taken in June ; one female from Wa-shan, taken in May.

Moore's type was from Shanghai.

Habitat. EASTERN, CENTRAL and WESTERN CHINA.

Genus SUSICA.

Walk., Cat. Lep. Het., v, p. 1113 (1855).

359. *Susica pallida.*

Susica pallida, Walk., Cat. Lep. Het., v, p. 1114 (1855) ; Butl., Ill. Typ. Lep. Het., vi, p. 6, pl. cii, fig. 4 (1886) ; Hampson, Fauna Brit. Ind., Moths, i, p. 377 (1892).

Tadema sinensis, Walk., Cat. Lep. Het., vii, p. 1759 (1856).

Walker's type was from Shanghai ; my collectors did not meet with this species.

Distribution. EASTERN CHINA ; NEPAL ; SIKHIM ; MOULMEIN.

Genus THOSEA.

Walk. ; Hampson, Fauna Brit. Ind., Moths, i, p. 377 (1892).

360. *Thosea sinensis.*

Anzabe sinensis, Walk., Cat. Lep. Het., v, p. 1093 (1855).

Thosea sinensis, Hampson, Fauna Brit. Ind., Moths, i, p. 379 (1892).

I obtained a male specimen at Gensan in July.

Distribution. HONG KONG ; FORMOSA ; CACHAR ; PEGU ; JAVA (*Hampson*) ; COREA.

361. *Thosea sericea.*

Aphendala sericea, Butl., Trans. Ent. Soc. Lond., 1881, p. 595.

One female example taken at Hakodate by Mr. Andrews.

The species was described from a Tokio specimen.

Habitat. JAPAN and YESSO.

Genus ARCTIOBLEPSIS.

Feld., Wien. ent. Mon., vi, p. 33 (1862).

362. *Arctioblepsis rubida.*

Arctioblepsis rubida, Feld., Wien. ent. Mon., vi, p. 33 (1862).

Described from Ningpo.

Habitat. NORTH-EASTERN CHINA.

Genus PHRIXOLEPIA.

Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 476 (1877).

363. *Phrixolepia sericea.*

Phrixolepia sericea, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 476 (1877); Ill. Typ. Lep. Het., iii, p. 11, pl. xliii, fig. 6 (1879).

Limacodes castaneus, Oberth., Etud. d'Entom., v, p. 41, pl. i, fig. 11 (1880).

Heterogenea sericea, Staud., Rom. sur Lép., vi, p. 297 (1892).

Specimens from Yokohama, Oiwake and Yesso in Pryer's collection. I obtained the species at Nagasaki in June.

Distribution. AMURLAND; ASKOLD; JAPAN; YESSO; KIUSHIU.

Genus NATADA.

Walk.; Hampson, Fauna Brit. Ind., Moths, i, p. 380 (1892).

364. *Natada conjuncta.*

Limacodes (?) *conjuncta*, Walk., Cat. Lep. Het., v, p. 1150 (1855).
Heterogenea conjuncta, Fixsen, Rom. sur Lép., iii, p. 338, pl. xv, fig. 9 (1887).
Miresa conjuncta, Kirby, Cat. Lep. Het., i, p. 549 (1892).
Natada conjuncta, Hampson, Fauna Brit. Ind., Moths, i, p. 381 (1892).

I obtained two male specimens at Gensan in July, and Fixsen also records the species from Corea.

Distribution. FORMOSA; SIKHIM; RANGOON; E. PEGU (*Hampson*); NORTH CHINA; COREA.

Genus PHOCODERMA.

Butler, Ill. Typ. Lep. Het., vi, p. 4 (1886).

365. *Phocoderma velutina.*

Gastropacha velutina, Koll. Hügel, Kasch., iv (2), p. 473 (1844).
Phocoderma velutina, Butl., Ill. Typ. Lep. Het., vi, p. 4, pl. cii, fig. 1 (1886).
Natada rugosa, Walk., Cat. Lep. Het., v, p. 1109 (1855).
Natada velutina, Hampson, Fauna Brit. Ind., Moths, i, p. 382 (1892).

Two male specimens from Chia-ting-fu, one from the province of Kwei-chow, and one example of each sex from Omei-shan.

Distribution. HIMALAYAS; SIND; POONA; BENGAL; CACHAR; BURMA (*Hampson*); WESTERN CHINA.

Genus MONEMA.

Walker, Cat. Lep. Het., v, p. 1112 (1855).

366. *Monema flavescens.*

Monema flavescens, Walk., Cat. Lep. Het., v, p. 1112 (1855); Butl., Ill. Typ. Lep. Het., ii, p. 14, pl. xxv, fig. 5 (1878).
Miresa flavescens, Staud., Rom. sur Lép., vi, p. 300 (1892).

There were specimens from Yokohama in Pryer's collection and I have received examples from Hakodate,

taken in June and July. I obtained the species at Gensan in June and my collectors met with it at Ichang in August.

Distribution. Amurland; Japan; Yesso; Central and Northern China; Corea.

Genus Miresa.

Walker, Cat. Lep. Het., v, p. 1123 (1855).

367. *Miresa inornata.*

Miresa inornata, Walk., Cat. Lep. Het., v, p. 1125 ♀ (1855); Butl., Cist. Ent., iii, p. 120 ♂ (1885); Hampson, Fauna Brit. Ind., Moths, i, p. 386 (1892).

Hercogenea flavidorsalis, Staud., Rom. sur Lép., iii, p. 195, pl. xi, fig. 7 (1887).

Two specimens from Chang-yang taken in June. There was one example in Pryer's collection and a native collector obtained one at Hakodate in June or July. One of these specimens, which is most certainly referable to *M. inornata*, Dr. Staudinger has identified as his *flavidorsalis*.

The Chinese specimens are rather paler in ground colour and the thorax is more tawny.

Distribution. North-Western Himalayas; Nágas (*Hampson*); Amurland; Japan; Yesso; Northern and Central China.

368. *Miresa decedens.*

Miresa decedens, Walk., Cat. Lep. Het., v, p. 1125 (1855); Butl., Ill. Typ. Lep. Het., vi, p. 5, pl. cii, fig. 3 (1886); Hampson, Fauna Brit. Ind., Moths, i, p. 387 (1892).

One male specimen from Ichang in August.

Distribution. Assam; Nilgiris (*Hampson*); Central China.

369. *Miresa* (?) *pallivitta.*

Miresa pallivitta, Moore, Ann. and Mag. Nat. Hist., (4) xx, p. 93 (1877).

One female specimen from Ningpo, taken in June. The type was from Shanghai.

Habitat. North-Eastern China.

370. *Miresa* (?) *fuscicostalis.*

Heterogenea flavidorsalis var. *fuscicostalis*, Fixsen, Rom. sur Lép., iii, p. 337, pl. xv, fig. 10 (1885).
Miresa fuscicostalis, Staud., *op. cit.*, vi, p. 301 (1892).

Fixsen describes this species from Corea. It does not appear to have anything to do with *M. flavidorsalis*. Dr. Staudinger suggests that it is not a *Miresa* and that the figure has the aspect of a *Plusia*.

Distribution. COREA; AMURLAND.

Genus PARASA.

Moore, Cat. Lep. E.I.C., p. 413 (1859).

371. *Parasa consocia.*

Parasa consocia, Walk., Cat. Lep. Het., Suppl. ii, p. 484 (1865).
Parasa humeralis, Swinhoe, Cat. Lep. Het., Oxford, p. 230 (1892).
Parasa tessellata, Moore, Ann. and Mag. Nat. Hist., (4) xx, p. 93 (1877).
Heterogenea princeps, Staud., Rom. sur Lép., iii, p. 199 (1887).
Neæra princeps, Staud., *l. c.*, pl. xv, fig. 7.

There was a specimen in Pryer's collection. I obtained the species at Gensan in July and I have received it from Chang-yang.

Dr. Staudinger has identified my Corean specimen as his *princeps*, and this together with the other two specimens agree well with the figure (*l. c.*).

Distribution. AMURLAND; JAPAN; COREA; NORTHERN and CENTRAL CHINA.

372. *Parasa hilarata.*

Heterogenea hilarata, Staud., Rom. sur Lép., iii, p. 298 (1887).
Neæra sinica, Staud., *op. cit.*, vi, p. 298 (1892).

I received this species from Chang-yang and Ichang, taken in July; these specimens agree well with a long series of bred specimens from Amurland.

This species cannot be regarded as synonymous with

H. sinica, Moore, the latter having dark secondaries as in *hilarula*, Staud., of which I have also specimens from Amurland.

Distribution. Amurland; Central China.

373. *Parasa sinica.*

Parasa sinica, Moore, Ann. and Mag. Nat. Hist., (4) xx, p. 93 (1877).

Heterogenea hilarula, Staud., Rom. sur Lép., iii, p. 197 (1887).

Nœrasa hilarata, Staud., Rom. sur Lép., vi, p. 298 (1892).

H. sinica appears to be separable from *H. hilarata* by the uniform fuscous secondaries. The hind marginal border of primaries is variable in width and also in the depth of the indentation. In one Gensan specimen the band is very narrow and not in the least indented.

I have examples from Hakodate and Gensan, and there were specimens from Yokohama in Pryer's collection.

Distribution. Amurland; Japan; Yesso; Corea.

374. *Parasa lepida.*

Noctua lepida, Cram., Pap. Exot., ii, pl. cxxx, fig. E. (1777).

Limacodes graciosa, Westw., Cab. Orient. Ent., p. 50, pl. xxiv, fig. 4 (1848).

Parasa lepida, Hampson, Fauna Brit. Ind., Moths, i, p. 388 (1892).

One female specimen from Pu-tsu-fong, taken in July, and two examples of the same sex from Ichang, taken in August.

Distribution. Throughout India and Ceylon; Java (*Hampson*); Central and Western China.

375. *Parasa bicolor.*

Nœara bicolor, Walk., Cat. Lep. Het., v, p. 1142 (1855).

Parasa bicolor, Butl., Ill. Typ. Lep. Het., vi, p. 7, pl. cii, fig. 11 (1886); Hampson, Fauna Brit. Ind., Moths, i, p. 390 (1892).

One male specimen from Omei-shan taken in June or July.

Distribution. Sikhim; throughout Continental India and Burma (*Hampson*); Western China.

376. *Parasa prasina.*

Parasa prasina, Alph., Deuts. Ent. Zeit. 1895 (Iris, viii), p. 186 (1895).

Alphéraky describes a male specimen from Ta-tsien-lou, where it was taken in June by Potanine. He states that it is distinguished from all other species of the genus by its green secondaries.

Habitat. WESTERN CHINA.

Genus CANIA.

Walk., Cat. Lep. Het., v, p. 1177 (1855).

377. *Cania bilinea.*

Nœæra bilinea, Walk., Cat. Lep. Het., v, p. 1142 (1855).
Cania sericea, Walk., Cat., v, p. 1178 (1855); Butl., Ill. Typ. Lep. Het., vi, p. 8, pl. cii, fig. 7 (1886).
Cania bilinea, Kirby, Cat. Lep. Het., i, p. 550 (1892); Hampson, Fauna Brit. Ind., Moths, i, p. 395 (1892).

One female specimen taken in June or July at Omei-shan.

Distribution. DHARMSÁLA; SIKHIM; MANIPUR; GANJAM; S. INDIA; MALACCA; JAVA (*Hampson*); WESTERN CHINA.

Genus RHAMNOSA.

Fixsen, Rom. sur Lép., iii, p. 339 (1887).

378. *Rhamnosa angulata.*

Rhamnosa (?) *angulata*, Fixsen, Rom. sur Lép., iii, p. 339 (1887).
Ramesa (?) *angulata*, Fixsen, *l. c.*, pl. xv, fig. 1.

Described from Corea. I have not seen an example of it.

Habitat. COREA.

Genus MICROLEON.

Butl., Cist. Ent., iii, p. 121 (1885).

379. *Microleon longipalpis.*

Microleon longipalpis, Butl., Cist. Ent., iii, p. 121 (1885); Leech, Proc. Zool. Soc. Lond., 1888, p. 610.

There were specimens from Yokohama in Pryer's

collection. I met with the species in Satsuma in May, at Fujisan in June, and at Tsuruga in July.

Distribution. Japan; Kiushiu; Corea.

380. *Microleon divisa.*

Setora divisa, Leech, Entom., xxiii, p. 83 (1890).

Described from a female specimen taken at Chang-yang in June. In the original description the type was stated to be a male, this was an error which I now take the opportunity of correcting.

Habitat. Central China.

Genus Heterogenea.

Knoch, Beitr. Ins., iii, p. 60 (1793).

381. *Heterogenea uncula.*

Heterogenea uncula, Staud., Rom. sur Lép., iii, p. 197, pl. xi, fig. 9 (1887).

Specimens from Yokohama, Oiwake, and Yesso in Pryer's collection: one example from Ichang taken in August.

Distribution. Amurland; Japan; Yesso; Central China.

382. *Heterogenea testudina.*

Heterogenea testudina, Alph., Rom. sur Lép., vi, p. 15 (1892).

Alphéraky describes this species from Ou-piu in the province of Kan-sou, and suggests that it may probably be a local race of *H. limacodes*, Hufn. (= *Apoda avellana*, Kirby, Cat. Lep. Het., i, p. 552).

Habitat. Western China.

383. *Heterogenea* (?) *obliqua.*

Heterogenea obliqua, Leech, Entom., xxiii, p. 83 (1890).

One male specimen from Chang-yang, taken in July.

Habitat. Central China.

384. *Heterogenea* (?) *dentatus.*

Limacodes dentatus, Oberth., Etud. d'Entom., v, p. 42, pl. i, fig. 10 (1880).

Heterogenea dentatus, Staud., Rom. sur Lép., vi, p. 298 (1892).

Apoda dentatus, Kirby, Cat. Lep. Het., i, p. 552 (1892).

I have one example from Gensan taken in July.

Distribution. AMURLAND; ASKOLD; COREA.

Genus NAROSA.

Walk., Cat. Lep. Het., v, p. 1151 (1855).

385. *Narosa culta.*

Narosa culta, Butl., Ann. and Mag. Nat. Hist., (5) IV, p. 356 (1879).

Four specimens from Yokohama in Pryer's collection. My native collector obtained one example at Gensan in August.

Distribution. JAPAN; COREA.

386. *Narosa fulgens.*

Heterogenea fulgens, Leech, Proc. Zool. Soc. Lond., 1888, p. 609, pl. xxx, fig. 18.

The male type was from Ningpo and measures 20 millim. in expanse; Gensan females are 22 millim. Two female specimens received from Chang-yang are much larger, one is 28 millim. and the other 32 millim. The species occurs in July.

Distribution. NORTH-EASTERN and CENTRAL CHINA; COREA.

Genus BELIPPA.

Walk., Cat. Lep. Het., xxxii, p. 508 (1865).

387. *Belippa horrida.*

Belippa horrida, Walk., Cat. Lep. Het., xxxii, p. 509 (1865).

One female specimen from Kiukiang taken in June.

Habitat. CENTRAL and SOUTHERN CHINA.

Family LASIOCAMPIDÆ.

Genus DENDROLIMUS.

Germar, Syst. Gloss. Prodr., p. 48 (1812).

388. *Dendrolimus pini.*

Bombyx pini, Linn., Syst. Nat., i, p. 498 (1758).
Dendrolimus pini, Kirby, Cat. Lep. Het., i, p. 813 (1892).

Œona punctata, Walk., Cat. Lep. Het., vi, p. 1418 (1855).
Lasiocampa remota, Walk., *l. c.*, p. 1439.
Lebeda hebes, Walk., *l. c.*, p. 1462.
Odonestis superans, Butl., Ill. Typ. Lep. Het., ii, p. 19, pl. xxvii, fig. 4 (1878).
Œona spectabilis, Butl., *l. c.*, p. 19, pl. xxvii, fig. 3.
Œona segregata, Butl., *l. c.*, p. 20, pl. xxvi, figs. 6, 7.
Eutricha dolosa, *fentoni*, and *zonata*, Butl., Trans. Ent. Soc. Lond., 1881, pp. 16, 17.
Eutricha pini, Leech, Proc. Zool. Soc. Lond., 1888, p. 627.
Eutricha remota, Leech, *l. c.*, p. 628.

As I have now a very much larger amount of material than when dealing with these insects in my former paper, I have been obliged to considerably alter my views respecting them. I am inclined to the opinion that all the above are simply forms of *D. pini*.

A series of sixty-four specimens from Japan compared with a series of sixty-three from Europe show an almost equal amount of variation.

Distribution. Europe.—Amurland; Japan; Yesso; Northern China.

389. *Dendrolimus flavcola.*

Bombyx flavcola, Motsch., Bull. Mosc., xxxix, p. 192 (1866).
Dendrolimus flavcola, Kirby, Cat. Lep. Het., i, p. 813 (1892).

Motschulsky described this species from Japan, but I am unable to identify it from the description with any species of *Dendrolimus* from Japan in my collection.

Habitat. Japan.

390. *Dendrolimus undans.*

Lebeda undans, Walk., Cat. Lep. Het., vi, p. 1458 (1855).
Metanastria undans, Hampson, Fauna Brit. Ind., Moths, i, p. 410 (1892).
Bombyx fasciatella, Mén. Bull. de l'Acad. Pétersb., xvii, p. 218 (1858); Schr. Amur. Reisen, p. 55, pl. iv, fig. 8 (1859); Fixsen, Rom. sur Lép., iii, p. 344 (1877).
Dendrolimus fasciatella, Kirby, Cat. Lep. Het., i, p. 813 (1892).

Odonestis excellens, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 481 (1877); Ill. Typ. Lep. Het., ii, p. 19, pl. xxvi, figs. 4, 5 (1878).

Odonestis excellens, var. *unicolor*, Oberth., Etud. d'Entom., v, p. 38 (1880).

A fine series from Yokohama.

The specimens vary in size and also in the intensity of the markings; most of them are of the type form (*undans* = *excellens*), but a few females are referable to the faintly marked form *unicolor*, Oberth.

Distribution. AMURLAND; JAPAN; COREA; SYLHET.

Genus BHIMA.

Moore, Proc. Zool. Soc. Lond., 1888, p. 405.

391. *Bhima potanini.*

Pyrosis potanini, Alph., Iris, viii, p. 186 (1895).

Bhima potanini, Alph., Rom. sur Lép., ix, p. 133 (1897).

Alphéraky records this species, which appears to be closely allied to "*Pyrosis*" *eximia*, Oberth., and "*Pyrosis*" *idiota*, Graeser, from the Kham country.

Habitat. WESTERN CHINA.

Genus CLISIOCAMPA.

Stephens, Ill. Brit. Ent., Haust., ii, p. 48 (1829).

392. *Clisiocampa neustria.*

Bombyx neustria, Linn., Syst. Nat., i, p. 500 (1758); Staud., Rom. sur Lép., vi, p. 314 (1892).

Clisiocampa testacea, Motsch., Etud. Ent., 1860, p. 32.

Specimens from Yokohama, Oiwake and Yesso in Pryer's collection. I obtained the species at Nagasaki in June and at Gensan in July, and my native collector took some examples at Nikko. A few specimens were bred at Chung-King in the month of May, and others were captured at Kiukiang and Pu-tsu-fong in June and July.

My series of this species from Eastern Asia is very variable; in one male example there are no transverse lines and in another specimen only one line is indicated; in a third example of the same sex the colour is darker than that proper to the female.

Distribution. EUROPE.—AMURLAND; JAPAN; YESSO; COREA; NORTHERN, CENTRAL, and WESTERN CHINA.

Genus Pœcilocampa.

Steph., Ill. Brit. Ent., Haust., ii, p. 43 (1828).

393. *Pœcilocampa subpurpurea.*

Pœcilocampa subpurpurea, Butl., Trans. Ent. Soc. Lond., 1881, p. 18.

Described from Tokio.

Habitat. Japan.

Genus Kosala.

Moore, Proc. Zool. Soc. Lond., 1897, p. 407.

394. *Kosala sanguinea.*

Kosala sanguinea, Moore, Proc. Zool. Soc. Lond., 1879, p. 408, pl. xxxiii, fig. 8; Hampson, Fauna Brit. Ind., Moths, i, p. 418 (1892).

One specimen was received from Omei-shan, it was taken in June or July.

Distribution. Sikhim; Khásis (*Hampson*); Western China.

Genus Crinocraspeda.

Hampson, Fauna Brit. Ind., Moths, i, p. 420 (1892).

395. *Crinocraspeda ? inexperta*, sp. n.

Primaries greyish brown with a slight violet tinge; the medial area of the wing traversed by two blackish lines, the first crenulate and curved, the second indented and angled below costa, then curved and recurved to inner margin, where it is outwardly edged with whitish; the basal area, limited by the first line, is brown; there is a small white discal spot, a black mark, bordered on each side with whitish, on the inner margin between second line and outer angle; submarginal line blackish but indistinct. Secondaries fuliginous brown with greyish scales on costal area. Fringes dark grey chequered with whitish. Under surface fuliginous brown; all the wings have a dusky medial band, and the primaries have two patches of iridiscent greenish scales at the apex.

Thorax dark brown, patagia greyish: abdomen dark brown.

Expanse 42 millim.

One male specimen taken by myself in the Snowy Valley near Ningpo in April.

Habitat. North-Eastern China.

I have referred this species doubtfully to *Crinocraspeda*; but a new genus will probably have to be made for it. Vein 8 of secondaries is connected with vein 7 by a bar, but there are no accessory veinlets as in the *Odonestis* section of Lasiocampidæ, and the cell is open. The outer margins of the primaries are slightly crenulate, but those of the secondaries are not.

Genus Trabala.

Walker, Cat. Lep. Het., vii, p. 1785 (1856).

396. *Trabala vishnu.*

Gastropacha vishnu, Lef., Zool. Journ., iii, p. 207 (1827).
Gastropacha sulphurea, Koll., Hügel's Kaschmir, iv, p. 471 (1848).
Amydona basalis, Walk., Cat. Lep. Het., vi, p. 1415 (1855).
Trabala vishnu, Hampson, Fauna Brit. Ind., Moths, i, p. 421 (1892).

I have a male specimen from Ichang, and a female from Kiukiang, both taken in August.

Distribution. Throughout India, Ceylon, and Burma (*Hampson*); Central China.

Genus Odonestis.

Germar, Prodr. Syst. Lep., ii, p. 49 (1812).

397. *Odonestis potatoria.*

Bombyx potatoria, Linn., Syst. Nat., xii, p. 813.
Odonestis potatoria, var. *askoldensis*, Oberth., Etud. d'Entom., v, p. 38 (1881).
Philudoria potatoria, Kirby, Cat. Lep. Het., i, p. 820 (1892).
Odonestis albomaculata, Brem., Lep. Ost-Sib., p. 42, pl. iv, fig. 6 ♂, iii, fig. 20 ♀ (1864).
Odonestis potatoria, Leech, Proc. Zool. Soc. Lond., 1888, p. 628.

There were specimens from Yokohama in Pryer's collection, and I obtained examples at Hakone and Gensan.

I think that if Dr. Staudinger had had an opportunity of seeing a good and variable series of this species from Japan he would not have been inclined to uphold *albo-*

maculata, Brem., as a distinct species (Rom. sur Lép., vi, p. 317); he says that it may be distinguished from *O. potatoria* by its smaller size, but this certainly does not apply to Japanese specimens.

In some examples of the dark form of the female from Japan the white spots on primaries are large and confluent, whilst in one specimen of each sex there is but one spot, and this is only faintly indicated. Between the extremes representing *potatoria* and *albomaculata* all the connecting grades are shown in my series.

Distribution. EUROPE.—AMURLAND; JAPAN; COREA.

398. *Odonestis directa.*

Odonestis directa, Swinhoe, Cat. Lep. Het., Oxford, p. 261, pl. vi, fig. 4 (1892).

Probably a form of *O. potatoria*. The name *directa* cannot stand, as the species described by Walker as "*Megasoma*" *directa* is an *Odonestis*.

Habitat. JAPAN.

399. *Odonestis læta.*

Amydona læta, Walk., Cat. Lep. Het., vi, p. 1416 (1855).
Odonestis læta, Hampson, Fauna Brit. Ind., Moths, i, p. 425 (1892).
Philudoria læta, Kirby, Cat. Lep. Het., i, p. 820 (1892).

I have a male specimen from Tsuruga, which I believe is the only example recorded from Japan, and three females from Kiukiang; the latter were taken in May and June, and the former was captured by myself in July.

Distribution. AMURLAND; JAPAN; COREA; CENTRAL CHINA.

400. *Odonestis inobtrusa.*

Lasiocampa inobtrusa, Walk., Trans. Ent. Soc. Lond., (3) i, 1862, p. 85.
Odonestis læta (part) Hampson, Fauna Brit. Ind., Moths, i, p. 425 (1892).

I have a fine bred series of this species from Chia-ting-fu and one example from Ta-chien-lu. The specimens are much redder in colour and the spots on primaries are sometimes golden-yellow and rather larger than in the

type. In seven of the fourteen males the discal spot is black. One cocoon was also received, this is whitish in colour, thickly covered with reddish-brown hairs, and very pointed towards each extremity.

I would propose that this form of *O. inobtrusa* should bear the varietal name *chinensis*.

Distribution. INDIA; WESTERN CHINA.

401. *Odonestis brevivenis.*

Chrostogastria brevivenis, Butl., Cist. Ent., iii, p. 119 (1885).
Odonestis brevivenis, Kirby, Cat. Lep. Het., i, p. 811 (1892).

Two specimens taken by a native collector at Hakodate in June; there was one example from Nikko in Pryer's collection, and Butler's type was from the same locality.

Habitat. JAPAN.

402. *Odonestis pruni.*

Bombyx pruni, Linn., Syst. Nat., i, p. 498 (1758); Hübn., Bomb., fig. 186 (1804 ?).
Odonestis pruni, Kirby, Cat. Lep. Het., i, p. 811 (1892); Alph., Rom. sur Lép., ix, p. 133 (1897).

Specimens in Pryer's collection from Yokohama and Nikko. I took one example at Hakodate, and have received one from Pu-tsu-fong, taken in June or July. Alphéraky records a male example taken in August at Li-fan-fou, province of Sé-Tchouen.

Distribution.—EUROPE.—AMURLAND; JAPAN; YESSO; WESTERN CHINA.

403. *Odonestis hampsoni*, sp. n.

Primaries reddish brown; transverse lines similar as regards position to those of *O. inobtrusa*, but not clearly defined. At the outer extremity of the cell there is a pale golden bar and a dot of the same colour above it. Secondaries fuscous brown becoming reddish brown towards outer margin. Under surface reddish brown with indications of the discal bar on primaries.

Expanse 40 millim.

Two male specimens from Pu-tsu-fong, taken in June or July. In one example the bar at the end of the cell of primaries is represented by two dots.

Habitat. WESTERN CHINA.

Genus Arguda.

Moore; Hampson, Fauna Brit. Ind., Moths, i, p. 412 (1892).

404. *Arguda bipartita*, sp. n.

Head and thorax pale brown, the head and prothorax striped with reddish brown: abdomen clothed with long silky reddish brown hair, anal tuft rather paler.

Primaries warm cinnamon brown tinged with cinereous on basal half, and less strongly on the outer marginal area; there are three oblique transverse lines, the first cinnamon brown, the second of the same colour but externally edged with greyish and rather wavy, the third is dusky and irregular. Secondaries warm cinnamon brown tinged with cinereous on abdominal margin. Fringes of all the wings slightly darker than the ground colour. Under surface pale brownish; the primaries are reddish brown along the costa, there is a narrow brown transverse band beyond the middle and this is followed by a reddish brown transverse shade; the secondaries have an irregular reddish brown band before the middle and the outer marginal area is tinged with brown and clouded with darker.

Expanse 70 millim.

One male specimen from Pu-tsu-fong, captured in June or July.

Habitat. Western China.

Genus Gastropacha.

Ochs., Schmett., Eur., iii, p. 239 (1810).

405. *Gastropacha quercifolia.*

Bombyx quercifolia, Linn., Syst. Nat., p. 497 (1758); Hübn., Bomb., figs. 187, 188 (1804?).

Gastropacha quercifolia, var. *cerridifolia*, Feld., Wien. ent. Mon., vi, p. 35 (1862).

Occurs at Yokohama and Fujisan. A specimen that I reared from a larva obtained at Gensan is pale, but the Japanese examples are richly coloured.

Distribution. Europe.—Amurland; Japan; Corea; North-Eastern China.

406. *Gastropacha populifolia.*

Bombyx populifolia, Esp., Schmett., iii, p. 62, pl. vi, figs. 3, 4, pl. vii, fig. 1 (1782).

Gastropacha angustipennis, Walk., Cat. Lep. Het., vi, p. 1394 (1855).

I obtained a specimen at Hakodate in August.

The type of *G. angustipennis* is in the National Collection at South Kensington. The specimen is from "N. China," and is in poor condition.

Distribution. EUROPE.—AMURLAND; YESSO; COREA; NORTH CHINA.

Genus PHYLLODESMA.

Hübner, Verz. bek. Schmett., p. 190 (1822 ?).

407. *Phyllodesma ilicifolia.*

Bombyx ilicifolia, Linn., Faun. Succ., p. 293 (1761).
Gastropacha ilicifolia, var. *japonica*, Leech, Proc. Zool. Soc. Lond., 1888, p. 628.
Phyllodesma ilicifolia, Kirby, Cat. Lep. Het., i, p. 824 (1892).

A male specimen and two females from Yesso in Pryer's collection.

In the Japanese form, var. *japonica*, all the wings are pale reddish brown, and all the violet-tinged white markings are well defined.

Distribution. EUROPE.—AMURLAND; YESSO.

Genus MALACOSOMA.

Hübner, Verz. bek. Schmett., p. 192 (1822 ?).

408. *Malacosoma ? flavomarginata.*

Bombyx flavomarginata, Pouj., Bull. Soc. Ent. Fr., (6) vi, p. xcii (1886).
Malacosoma flavomarginata, Kirby, Cat. Lep. Het., i, p. 819 (1892).

A male and two females from Moupin are noted by Poujade.

Habitat. WESTERN CHINA.

Family PTEROTHYSANIDÆ.

Genus PTEROTHYSANUS.

Walker, Cat. Lep. Het., ii, p. 401 (1854).

408? *Pterothysanus lanaris.*

Pterothysanus lanaris, Butl., Ann. and Mag. Nat. Hist., (5) xiv, p. 406 (1884).

Described from "Shanghai?" As there appears to be some uncertainty about the locality I am inclined to think that if the insect came from China at all, it must have been from the southern part of that country.

Hampson, Fauna Brit. Ind., Moths, i, p. 430, refers *P. lanaris* to *P. laticilia*, Walk., as a form of that species.

Kirby (Cat. Lep. Het., i, p. 427) places *Pterothysanus* in *Nyctemeridæ*.

Habitat. EASTERN CHINA?

Family LYMANTRIIDÆ.

Genus ORGYIA.

Ochs., Schmett., Eur., iii, p. 208 (1810).

409. *Orgyia gonostigma.*

Bombyx gonostigma, Fabr., Syst. Ent., p. 585 (1775), Hübn., Bomb., fig. 78.

Notolophus gonostigma, Kirby, Cat. Lep. Het., i, p. 493 (1892).

Orgyia approximans, Butl., Trans. Ent. Soc. Lond., 1881, p. 10.

Orgyia gonostigma, Leech, Proc. Zool. Soc. Lond., 1888, p. 626.

One example from Oiwake in Pryer's collection.

Distribution. EUROPE.—AMURLAND; JAPAN.

410. *Orgyia thyellina.*

Orgyia thyellina, Butl., Trans. Ent. Soc., 1881, p. 10, ♂; Leech, Proc. Zool. Soc. Lond., 1888, p. 625, pl. xxxi, figs. 7, 7A ♀.

Notolophus thyellinus, Kirby, Cat. Lep. Het., i, p. 495 1892).

Occurs at Yokohama, Oiwake, and Tokio.

The series in Pryer's collection comprised eight males and seven females, four of the latter have well developed wings, but the other three have dwarfed wings, although the markings thereon are a reproduction in miniature of those on the wings of the fully-developed females.

Habitat. JAPAN.

411. *Orgyia leechi.*

Orgyia prisca, Leech, Entom., xxiii, p. 111 (1890).
Notolophus leechii, Kirby, Cat. Lep. Het., i, p. 495 (1892).

Appears to be common at Chang-yang; I also received specimens from Ship-y-shan and Ichang, and from most of the localities in Western China that were visited by my collectors.

As "*prisca*" had been previously used in *Orgyia,* Mr. Kirby has renamed this species. Staudinger (Rom. sur Lép., vi, p. 303) states that he has an example from Tschi-fu of a species allied to *O. ericæ*; this may be identical with the above.

Habitat. CENTRAL and WESTERN CHINA.

Genus AROA.

Walk., Cat. Lep. Het., iv, p. 791 (1855); Hampson, Fauna Brit. Ind., Moths, i, p. 437 (1897).

412. *Aroa socrus.*

Gynæphora socrus, Geyer., Hübn. Zutr., v, p. 12, figs. 837, 838.
Aroa substrigosa, Walk., Cat. Lep. Het., iv, p. 794 (1855); Butl., Ill. Typ. Lep. Het., v, p. 54, pl. xc, fig. 5 (1881).
Aroa socrus, Hampson, Fauna Brit. Ind., Moths, i, p. 439 (1892).

Female. Wings rather longer than those of the male, and more thinly scaled.

Male specimens were received from Ta-chien-lu, Chow-pin-sa, Pu-tsu-fong, Wa-ssu-kow, Chia-ting-fu, Huang-mu-chang, Chia-kou-ho, the province of Kwei-chow, Ichang, and Ship-y-shan. Those from the two localities last named are bright reddish orange.

Of the female, which sex has not been previously described so far as I can ascertain, I have four specimens

from Chia-kou-ho, Chia-ting-fu, and Ichang. The specimen from the locality last named is pinkish, streaked with fuscous on primaries, one from Chia-kou-ho is pale pinkish, and the other two are whitish with a faint ochreous tinge.

Distribution. Assam; Khásis; Nága; and Karen Hills; Java (*Hampson*); Central and Western China.

413. *Aroa flavicollis.*

Crinola flavicollis, Leech, Entom., xxiii, p. 111 (1890).

Twelve male specimens from Chang-yang, taken in June and July, and two females from Chia-kou-ho, obtained in July. These last are entirely whitish, and the thorax is of the same colour as the collar.

Habitat. Central and Western China.

414. *Aroa* (?) *jonasi.*

Aroa jonasii, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 402 (1877); Ill. Typ. Lep. Het., ii, pl. xxiii, fig. 11 (1878); Leech, Proc. Zool. Soc. Lond., 1888, p. 647.

A fine series from Yokohama and Oiwake in Pryer's collection. I obtained specimens in Satsuma in May, at Nagasaki in June, Gensan in July, and Hakone in August.

I have left this species in *Aroa* although it does not appear to be rightly placed therein, and a new genus will probably have to be made for its reception.

Habitat. Japan.

Genus Lælia.

Steph.; Hampson, Fauna Brit. Ind., Moths, i, p. 440 (1892).

415. *Lælia cœnosa.*

Bombyx cœnosa, Hübn., Bomb., figs. 218, 323–325 (1804).

Lælia sinensis, Walk., Cat. Lep. Het., iv, p. 829 (1855); Butl., Ill. Typ. Lep. Het., iii, pl. xliii, fig. 8 (1879); Fixs., Rom. sur Lép., iii, p. 342 (1887).

Leucoma brevicornis, Walk., *op. cit.*, vii, p. 1729 (1856).

Lælia sangaica, Moore, Ann. and Mag. Nat. Hist., (4) xx, p. 92 (1877).
Lælia cœnosa, Leech, Proc. Zool. Soc. Lond., 1888, p. 621.

There were several specimens (both sexes) from Yokohama in Pryer's collection. I took a male at Ningpo in April, another was taken by a native in July, and one at Gensan, also in July. Four males were received from Chang-yang. Three of the examples from the last locality are silky white, one of them almost immaculate, I propose the name *candida* for this form; the fourth is identical with the type of *sangaica*, Moore. The Ningpo specimens are darker and have larger black spots than those from Japan, which latter, together with the Gensan example, agree very well with the European type.

Distribution. EUROPE.—AMURLAND; JAPAN; CENTRAL and NORTHERN CHINA; COREA.

416. *Lælia gigantea.*

Lælia gigantea, Butl., Cist. Ent., iii, p. 117 (1885).

One male specimen and five females from Oiwake in Pryer's collection.

Probably only a large form of *L. cœnosa*.

Habitat. JAPAN.

Genus PANTANA.

Walk.; Hampson, Fauna Brit. Ind., Moths, i, p. 443 (1892).

417. *Pantana sinica.*

Pantana sinica, Moore, Ann. and Mag. Nat. Hist., (4) xx, p. 92 (1877).

I have a typical male taken by myself at Foochau in April and an example of the same sex from Chang-yang, taken in July. The last agrees with the Foochau specimen so far as regards the primaries, but the secondaries are pure white with a broad outer marginal band extending from costa almost to anal angle.

Habitat. EASTERN and CENTRAL CHINA.

418. *Pantana nigrolimbata*, sp. n.

Male. Head and palpi yellowish-orange; thorax and abdomen fuscous, the latter yellowish beneath. Primaries white and suffused with blackish on basal area and dusted with the same colour beyond;

outer area with a blackish band which is broadest on costa and interrupted by a spur of the ground colour below vein 2; a small black spot at lower angle of cell and two rather larger ones below cell. Secondaries white dusted with blackish on basal area; outer marginal band black, extending from costa to vein 3.

Female. Primaries ochreous white with black spots as in the male, but without blackish bands on outer margin; secondaries sordid white, without marking.

Expanse 48–54 millim.

Ten male specimens and three females from Moupin taken in June.

Habitat. Western China.

Allied to *P. terminata*, Walk.

419. *Pantana simplex*, sp. n.

Primaries pale fuscous brown, the venation is pale brown to the outer marginal area; the costa is streaked with pale brown to the end of the cell, where there is a lunulated mark of the same colour; the inner marginal area is pale brown; fringes and costa dark fuscous. Secondaries white. Head and thorax same colour as primaries, palpi golden brown; abdomen paler.

Expanse 34–40 millim.

Nine male specimens from Chia-kou-ho and three from Chia-ting-fu.

Occurs in June.

Habitat. Western China.

In four specimens from Chia-kou-ho the primaries are pale fawn colour very slightly suffused with fuscous.

420. *Pantana pluto.*

Gynæphora pluto, Leech, Entom., xxiii, p. 111 (1890).

Two male specimens from Ichang, one from Moupin and one from the province of Kwei-chow. July.

Habitat. Central and Western China.

Genus Cifuna.

Walk.; Hampson, Fauna Brit. Ind., Moths, i, p. 446 (1892).

421. *Cifuna locuples.*

Cifuna locuples, Walk., Cat. Lep. Het., v, p. 1173 (1855); Butl., Ill. Typ. Lep. Het., ii, pl. xxvii, fig. 6 (1878); Hampson, Fauna Brit. Ind., Moths, i, p. 446 (1892).

Artaxa confusa, Brem., Lep. Ost.-Sib., p. 42, pl. iv, fig. 5 (1864).

A fine series from Yokohama and Oiwake in Pryer's collection. I have two specimens from Hakodate, one taken in June, and one from Gensan taken in July. The species occurs also at Chang-yang and Chia-ting-fu in June and July.

One example from Oiwake is referable to var. *confusa*, Brem., which is darker than the type.

Distribution. KHÁSIS; NÁGAS (*Hampson*); AMURLAND; JAPAN; YESSO; CENTRAL and WESTERN CHINA; COREA.

422. *Cifuna eurydice.*

Porthetria eurydice, Butl., Cist. Ent., iii, p. 118 ♂ (1885); Leech, Proc. Zool. Soc. Lond., 1888, p. 632.
Cifuna eurydice, Kirby, Cat. Lep. Het., i, p. 459 (1892).
Dasychira amata, Staud., Rom. sur Lép., iii, p. 206, pl. xii, fig. 2 ♀ (1887).

One example of each sex from Ohoyama in Pryer's collection.

Graesar (Berl. Ent. Zeit., 1888, p. 123) states that the larva feeds in June on *Vitis amurensis*.

C. jankowskii, Oberth., seems to be a very close ally of *C. eurydice*.

Staudinger (Rom. sur Lép., vi, p. 305) states that he has a female "*Amata*" from Japan which agrees well with his Amurland specimens, and he adds that I do not record this species from Japan. Reference to my former paper (*l. c.*) will show that "*D.*" *amata*, Staud., was merged by me as the female of *C. eurydice*, with which his subsequent description of the male agrees.

Distribution. AMURLAND; JAPAN.

Genus DASYCHIRA.

Steph.; Hampson, Fauna Brit. Ind., Moths, i, p. 447 (1892).

423. *Dasychira argentata.*

Dasychira argentata, Butl., Trans. Ent. Soc. Lond., 1881, p. 12.
Calliteara abietis, Leech, Proc. Zool. Soc. Lond., 1888, p. 631.

Calliteara argentata, Kirby, Cat. Lep. Het., i, p. 470 (1892).

Four male specimens and one female from Nikko in Pryer's collection.

This appears to be the Japanese representative of the European *C. abietis*, from which species it differs principally in its much darker coloration.

Habitat. JAPAN.

424. *Dasychira pudibunda.*

Bombyx pudibunda, Linn., Syst. Nat., x, p. 303.
Dasychira pudibunda, Kirby, Cat. Lep. Het., i, p. 482 (1892).
Dasychira pudibunda, ab. *concolor*, Staud., Cat. Lep. Eur., p. 29 (1861).

Two male specimens that I took at Ningpo in April agree very well with var. *concolor*, Staud., and a female taken by a native at Hakodate is almost exactly identical with typical European examples, and has none of the characteristics of *pryeri*, Butl., or *pudica*, Staud.

Distribution. EUROPE.—YESSO; NORTH-EAST CHINA; ? AMURLAND.

425. *Dasychira grotei.*

Dasychira grotei, Moore, Cat. Lep. E.I.C., p. 338 (1859).
Dasychira horsfieldi, Hampson, Fauna Brit. Ind., Moths, i, p. 448 (1892).

One female specimen taken at Moupin in July.

Distribution. INDIA; WESTERN CHINA.

426. *Dasychira pseudabietis.*

Calliteara pseudabietis, Butl., Cist. Ent., iii, p. 118 ♂ (1885).
Calliteara abietis, Leech, Proc. Zool. Soc. Lond., 1888, p. 631.
Dasychira pryeri, Butl., Cist. Ent., iii, p. 1190 (1885).
Dasychira pudica, Staud., Rom. sur Lép., iii, p. 204 (1887).
Dasychira modesta, Kirby, Cat. Lep. Het., i, p. 483 (1892).
? *Orgyia punctatella*, Motsch., Etud. Entom., 1860, p. 32.

Two male specimens and three females from Yokohama and Nikko in Pryer's collection. I obtained a male

example at Gensan in June, and my native collector took one in the island of Kiushiu.

Butler, *l. c.*, described the male of this species as *pseudabietis* and the female as *pryeri*. Staudinger subsequently redescribed the species, of which he had both sexes, as *pudica*, which name, being pre-occupied, Kirby altered to *modesta*.

The differences between *D. pseudabietis* and *D. pudibunda* as mentioned by Staudinger (Rom. sur Lép., iii, p. 204) appear to be constant so far as my Japanese and Corean specimens are concerned.

Distribution. AMURLAND; JAPAN; KIUSHIU; COREA.

427. *Dasychira lunulata.*

Dasychira lunulata, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 403 (1877); Ill. Typ. Lep. Het., ii, pl. xxiv, fig. 8 ♂ (1878).

Dasychira acronycta, Oberth., Etud. d'Entom., v, p. 35, pl. v, fig. 7 ♂ (1881).

Dasychira solitaria, Staud., Rom. sur Lép., iii, pl. xii, fig. 1 ♀ (1887).

Occurs in Japan at Yokohama and Oiwake.

The male specimens agree perfectly with the type in the National Museum and also with Oberthür's excellent figure of *acronycta* ♂. The females agree very well with Staudinger's figure of *solitaria*. Dr. Staudinger objects to *acronycta*, Oberth. being considered synonymous with *lunulata*, Butl., because the figure of the latter, which it may be remarked is a very bad one, does not agree with that of the former. He also says that as I did not mention Amurland specimens, I probably had not seen examples from the region; this is true, but then the figures of *acronycta* and *solitaria* are both from Amurland specimens and exactly represent the sexes of *lunulata* from Japan, so that it was not possible to consider the Amurland insect specifically distinct from the Japanese.

Distribution. AMURLAND; ASKOLD; JAPAN.

428. *Dasychira bhana.*

Dasychira bhana, Moore, Proc. Zool. Soc. Lond., 1865, p. 804.

Dasychira tenebrosa, Walk., Cat. Lep. Het., xxxii, p. 361 (1865).

Mardaria feminula, Hampson, Ill. Typ. Lep. Het., viii, p. 58, pl. cxli, figs. 1, 7 (1891).

I have specimens from Moupin, Ta-chien-lu, Pu-tsu-fong, Chia-kou-ho, Wa-shan and Omei-shan. The examples from the first two localities are paler than the others which are of the typical and *tenebrosa* forms.

One male specimen from the province of Kwei-chow, which seems to be referable to this species, has the ground colour greyish and the dark markings are confluent, forming clouds and patches.

Distribution. Sikhim; Nilgiri plateau (*Hampson*); Western China.

Genus Mardara.

Walk.; Hampson, Fauna Brit. Ind., Moths, i, p. 454 (1892).

429. *Mardara catocaloides*, sp. n.

Primaries fuscous brown, discal area tinged with yellowish, traversed by black or blackish, basal, ante and post medial, submarginal and marginal, wavy lines; the antemedial line is preceded by a pale, angulated, line commencing in a small greenish patch on costa; there is a similar patch about the middle of costa and another at the costal extremity of post medial line; the discal cell is closed by a reniform mark outlined in black; outer marginal area tinged with green; fringes orange and suffused and marked with fuscous. Secondaries orange, broadly bordered with black on costa and outer margin; there is a long cuneiform streak of the same colour from base to black outer marginal border, and a diffuse one on abdominal area; a broad sinuous black mark at outer end of cell, interrupting the cuneiform streak; fringes orange. Under surface orange; all the wings have the costa and outer margin bordered with blackish; discal mark black and conspicuous; abdominal half of secondaries suffused with fuscous, and there is an interrupted wavy blackish line before the outer marginal border.

Expanse 46 millim.

One male specimen from Moupin, taken in June; and one from Ta-chien-lu, captured in July.

Habitat. Western China.

Genus Numenes.

Walker, Cat. Lep. Het., iii, p. 662 (1855).

430. *Numenes disparilis.*

Numenes disparilis, Staud., Rom. sur Lép., iii, p. 200, pl. xi, figs. 2 *a*, *b* (1887).

Numenes disparilis, var. *separata*, Leech, Entom., xxiii, p. 112 (1890).

Pseudomesa disparilis, Kirby, Cat. Lep. Het., i, p. 456 (1892).

Lymantria albofascia, Leech, Proc. Zool. Soc. Lond., 1888, p. 629, pl. xxxi, fig. 8.

A form of the male, which I have previously described as a distinct species under the name *albofascia*, is without any white on the secondaries, and the band on primaries is broader than in male *disparilis*. The type of this form was from Ohoyama, and I have received a similar specimen from Moupin. As all the forms of *disparilis* have a fascia on primaries, perhaps it would be well to substitute *simplex* for *albofascia*.

The type and cotype of var. *separata* ♂ are from Chang-yang; one of these has a white spot on the costa of primaries near the base, and both have a yellowish white streak from the centre of the fascia to apex of the wing. One female from Chia-kou-ho has the primaries of the type-form, but the secondaries are marked as in *separata*, with three additional black spots on the middle of the outer margin. The female type of var. *separata* is from Chang-yang, and I have other examples of the same sex of this form from Moupin and Kiukiang; there were three examples in Pryer's collection, probably from Ohoyama.

All these are larger than the female figured by Staudinger. None of my specimens of either sex have the venation yellow, as it is represented to be in the figure of the male and female of *disparilis*.

Distribution. AMURLAND; JAPAN; CENTRAL and WESTERN CHINA.

Genus LOCHARNA.

Moore, Lep. Atk., p. 53 (1879).

431. *Locharna strigipennis.*

Locharna strigipennis, Moore, Lep. Atk., p. 53, pl. iii, fig. 11 (1879).

Pida strigipennis, Hampson, Fauna Brit. Ind., Moths, i, p. 457 (1892).

One female specimen from Chang-yang, taken in July, and one from Ichang, taken in August.

So far as I am aware, only the female sex has been described or figured. I have an example from Omei-shan which I believe to be the male of this species, and of which I append the following description :—

Primaries whitish, heavily striated with blackish over the whole area; fringes black marked with whitish at ends of the nervules. Secondaries fuliginous black, fringes yellow. Under surface fuliginous black; the costa of primaries, and the costal area and the fringes of secondaries yellowish; the neuration is also yellowish towards the outer margin on all the wings. Head blackish, palpi yellowish; thorax dark greyish with some yellowish brown hairs on the front segment; abdomen fuliginous black above, yellowish beneath. Expanse 46 millim.

Distribution. SIKHIM; KHÁSIS; CENTRAL and WESTERN CHINA.

Genus DAPLASA.

Moore, Lep. Atk., p. 51 (1879).

432. *Daplasa irrorata.*

Daplasa irrorata, Moore, Lep. Atk., p. 52, pl. ii, fig. 17 (1879); Hampson, Fauna Brit. Ind., Moths, i, p. 458 (1892).

Two male specimens from Omei-shan, taken in June or July.

Distribution. SIKHIM; WESTERN CHINA.

Genus LYMANTRIA.

Hübn.; Hampson, Fauna Brit. Ind., Moths, i, p. 459 (1892).

433. *Lymantria mathura.*

Lymantria mathura, Moore, Proc. Zool. Soc. Lond., 1865, p. 806; Hampson, Fauna, Brit. Ind. Moths, i, p. 464 (1892).

Lymantria aurora, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 403 (1878); Ill. Typ. Lep. Het., ii, pl. xxiv, fig. 5 (1878).

Lymantria aurora, var. *fusca*, Leech, Proc. Zool. Soc. Lond., 1888, p. 629.

There were specimens from Oiwake, Yokohama, Yesso, Loochoo, and the Kurile Isles, in Pryer's collection. I obtained the species at Nagahama, Tsuruga, Sendai, and Gensan. Seven female examples were received from Omei-shan, where they were captured in June and July.

The male varies in depth of colour, the darkest, of which I have three specimens from Nagahama and one from Pryer's collection, I have named var. *fusca*.

Dr. Staudinger (Rom. sur Lép., vi, p. 312) states that in the Atkinson collection there was a row of *grandis*, all females, and a row of *mathura*, all males, and that as the latter closely resembled *aurora* ♂ he concluded that they represented the sexes of the same species. He is further of opinion that the specimen Butler figures (Ill. v, pl. xci, fig. 1) as *grandis* ♂, which nearly resembles the female of that species in appearance, is probably the male of another species, perhaps *carneola*, Moore.

Hampson (Moths Brit. Ind., i, p. 465) describes the male of *grandis* (=*maculosa*, Walk.) as having white primaries, and states that the female differs from *mathura* in the frons being blackish and the 2nd joint of palpus having a black spot. He gives Ceylon as the habitat of the species.

Possibly the females referred to by Staudinger as *grandis* are really *mathura*. In a series of eight examples of *grandis* in the late Otto Möller's Darjeeling collection only one is of the male sex, and this has all the wings white, the primaries have the markings of the female faintly indicated, the bands being reduced to lunules. There are no specimens representing male *aurora* in Möller's collection.

Distribution. North-West Himalayas; Sikhim (*Hampson*); Amurland; Japan; Yesso; Kurile Isles; Loochoo; Corea; Northern and Western China.

434. *Lymantria beatrix.*

Bombyx beatrix, Stoll., Cram. Suppl. Pap. Exot., v, p. 173, pl. xl, fig. 2 (1790).

Lymantria marginata, Walk., Cat. Lep. Het., iv, p. 877 (1855); Butl., Ill. Typ. Lep. Het., v, pl. xc, fig. 12 (1892).

Lymantria nigra, Moore, Proc. Zool. Soc. Lond., 1888, p. 399.
Lymantria beatrix, Hampson, Fauna Brit. Ind., Moths, i, p. 463 (1892).

Six female specimens from Chang-yang and Moupin, taken in July, and one male example from Moupin.

Distribution. Throughout INDIA and CEYLON; JAVA (*Hampson*); CENTRAL and WESTERN CHINA.

435. *Lymantria monacha.*

Bombyx monacha, Linn., Syst. Nat., x, p. 501 (1758); Hübn., Schmett, ii, fig. 74 (1800 ?).
Lymantria monacha, Kirby, Cat. Lep. Het., i, p. 477 (1892).

A series of specimens from Oiwake and Yesso in Pryer's collection; these are rather larger than European examples, but are otherwise quite typical.

Distribution. EUROPE.—AMURLAND; JAPAN; YESSO.

436. *Lymantria dispar.*

Bombyx dispar, Linn., x, p. 501 (1758).
Porthetria dispar, Kirby, Cat. Lep. Het., i, p. 475 (1892).
Liparis dispar, var. *japonica*, Motsch., Etud. Ent., 1860, p. 31.
Porthetria umbrosa, Butl., Trans. Ent. Soc. Lond., 1881, p. 10.
Porthetria hadina, Butl., *l. c.*, p. 11.
Lymantria dispar, Leech, Proc. Zool. Soc. Lond., 1888, p. 630.

Occurs in Japan at Yokohama, Fushiki, Nagahama, Tokio and Hakodate. Specimens were received from Kiukiang and the province of Kwei-chow, and I obtained the species at Gensan. As I remarked in my previous paper, the colour of Eastern Asian *L. dispar* ranges, in the male, from whitish or pale whity-brown through greyish-brown up to a dark fuliginous, and in all forms the transverse lines and shades, as also the discal spots of primaries, may be either well defined, or more or less obliterated. The female varies from white to pale fuscous, and the markings are subject to modification as in the male. In size the specimens range from 37 millim. (♂) to 114 millim. (♀).

Distribution. EUROPE.—AMURLAND; JAPAN; YESSO; COREA; NORTH, CENTRAL, and WESTERN CHINA.

437. *Lymantria fumida.*

Lymantria fumida, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 402 (1877); Ill. Typ. Lep. Het., ii, pl. xxiv, fig. 4, ♀ (1878).
Porthetria fumida, ♂, Butl., Trans. Ent. Soc. Lond., 1881, p. 11.

I have a long series (8 ♂, 7 ♀) from Yokohama.
Habitat. JAPAN.

438. *Lymantria sinica.*

Lymantria sinica, Moore, Proc. Zool. Soc. Lond., 1879, p. 403.
Porthetria sinica, Kirby, Cat. Lep. Het., i, p. 476 (1892).

Moore described this species from North China.

439. *Lymantria lutescens.*

Porthetria lutescens, Butl., Trans. Ent. Soc. Lond., 1881, p. 11.

Occurs at Tokio, Ohoyama, and Oiwake; there were two male specimens from the latter locality in Pryer's collection.
Habitat. JAPAN.

440. *Lymantria obsoleta.*

Lymantria obsoleta, Walk., Cat. Lep. Het., iv, p. 880 (1855).
Lymantria albolunulata, Moore, Proc. Zool. Soc. Lond., 1879, p. 403.

One male specimen from Moupin, and one from Omei-shan, taken in June. The example from the last named locality is smaller than that from Moupin, and the white mark at inner angle is not so well defined.
Distribution. NORTH-WESTERN HIMALAYAS (*Hampson*); WESTERN CHINA.

Genus OCNERIA.

Hübner, Verz., bek. Schmett., p. 158 (1822 ?).

441. *Oeneria furva.*

Oeneria furva, Leech, Proc. Zool. Soc. Lond., 1888, p. 631, pl. xxxi, fig. 10.

I have series of this species from Oiwake and from Chang-yang and Ichang. The Chinese specimens only differ from the Japanese examples in the absence of pale scales, and the less pronounced character of the black spots on primaries.

Distribution. Japan; Central China.

Genus Gazalina.

Walker, Cat. Lep. Het., xxxii, p. 398 (1865).

442. *Gazalina chrysolopha.*

Liparis chrysolopha, Koll., Hügel's Kashmir, iv, p. 470 (1848).

Dasychira antica, Walk., Cat. Lep. Het., iv, p. 867 (1855).

Gazalina antica, Butl., Ill. Typ. Lep. Het., v, p. 49, pl. lxxxix, fig. 4 (1881).

Gazalina chrysolopha, Hampson, Fauna Brit. Ind., Moths, i, p. 469 (1892).

Five male specimens and three females from Chang-yang, Wa-shan, Pu-tsu-fong, and the provinces of Kwei-chow, all taken in July and August.

Distribution. North-West Himalayas; Sikhim (*Hampson*); Central and Western China.

Genus Euproctis.

Hübn., Hampson, Fauna Brit. Ind., Moths, i, p. 470 (1892).

443. *Euproctis bimaculata.*

Euproctis bimaculata, Walk., Cat. Lep. Het., iv, p. 836 (1855); Moore, Lep. Ceylon, p. 89, pl. cxii, figs. 6, 6b (1883); Hampson, Fauna Brit. Ind., Moths, i, p. 472 (1892).

Euproctis lutescens, Walk., *l. c.*, p. 387; Butl., Ill. Typ. Lep. Het., v, p. 51, pl. lxxxix, fig. 10 (1881).

Euproctis immaculata, Moore, Trans. Ent. Soc. Lond., 1884, p. 358.

Specimens were received from Ship-y-shan, Omei-shan,

Wa-shan, and Chia-kou-ho, and a series comprising five males and six females, bred in May at Chung-King, from larvæ obtained in that locality. All the intergrades between the white type and var. *lutescens* are represented. In one male from Chia-kou-ho the black spot on primaries is almost absent, and approaches var. *immaculata*, and one male from Chung-King has an obscure fuscous post-medial band similar to that of *Chærotricha immaculata*, Butl., which Hampson considers to be a form of *Euproctis plana*, Walk.

Cramer (Pap. Exot., iv, cccxcviii, fig. E.) represents a specimen under the name *albina*? from Japan which may possibly be a form of the species under consideration. The same remark applies to *helladia*, Cram., *l. c.*, fig. H.

Distribution. PHILIPPINES; SIKHIM; CANARA; CEYLON; BURMA; MERGUI; ANDAMANS; JAVA (*Hampson*); CENTRAL and WESTERN CHINA.

444. *Euproctis inconspicua*, sp. n.

Head, thorax, and abdomen ochreous; anal tuft golden brown.

Primaries ochreous, with a faint blackish dot at the outer extremity of the cell, and an ill defined transverse patch of golden brown scales from about middle of inner margin to median nervure. Secondaries white with some ochreous hairs on abdominal margin. Under surface sordid white, without markings.

Expanse 46 millim.

One female specimen taken in July at Chia-ting-fu, and one from Omei-shan, captured in the same month.

Habitat. WESTERN CHINA.

445. *Euproctis staudingeri.*

Chærotricha staudingeri, Leech, Proc. Zool. Soc. Lond., 1888, p. 624, pl. xxxi, fig. 6.

Nygmia staudingeri, Kirby, Cat. Lep. Het., i, p. 447, 1892.

Eight males and the same number of females from Yokohama.

Habitat. JAPAN.

446. *Euproctis niphonis.*

Chærotricha niphonis, Butl., Trans. Ent. Soc. Lond., 1881, p. 9 ♂; Leech, Proc. Zool. Soc. Lond., 1888, p. 624.

Nygmia niphonis, Kirby, Cat. Lep. Het., i, p. 447 (1892).
Chærotricha squamosa, Butl., *l. c.* ♀.
Porthesia raddei, Staud., Rom. sur Lép., iii, p. 207, pl. xvii, fig. 3 (1887).

Occurs at Yokohama, Oiwake, Tokio, Yesso, Gensan. In the figure of *raddei*, Staud. the base and outer area of primaries are rather more yellow than in Japanese *niphonis*. Staudinger suggests that, as Fixsen's Corean specimens exhibit differences, they might be known as var. *coreana*. I do not find in Staudinger's remarks (Rom. sur Lép., vi, p. 311) any reference to the synonomy or note of this species as given by me in my former paper.

Distribution. Amurland; Japan; Yesso; Corea; Northern China.

447. *Euproctis divisa.*

Euproctis divisa, Walk.; Hampson, Fauna Brit. Ind., Moths, i, p. 471 (1892).

Two male specimens from Omei-shan, one example of each sex from Moupin, two males and a female from Wa-shan. June and July.

In all the Chinese male specimens the prothorax is decidedly fulvous.

Distribution. Sikhim; Nágas (*Hampson*); Western China.

448. *Euproctis chrysorrhœa.*

Bombyx chrysorrhœa, Linn., Syst. Nat., i, p. 502 (1758); Hübn., Bomb., figs. 67, 248, 249 (1800?).
Porthesia chrysorrhœa, Leech, Proc. Zool. Soc. Lond., 1888, p. 622.
Euproctis chrysorrhœa, Kirby, Cat. Lep. Het., i, p. 442 (1892).

One rather worn female specimen taken at Nagahama in July appears to be referable to this species.

Distribution. Europe; Japan.

449. *Euproctis montis.*

Artaxa montis, Leech, Entom., xxiii, p. 111 (1890).

One male (the type) from Chang-yang, and an example of each sex from Chia-kou-ho.

The primaries of the female are rather paler in colour than those of the male.

Habitat. CENTRAL and WESTERN CHINA.

450. *Euproctis piperita.*

Leucoma subflava, var. *piperita*, Oberth., Etud. d'Entom., v, p. 35 (1880).

Porthesia snelleni, Staud., Rom. sur Lép., iii, p. 207, pl. xii, fig. 3 (1887).

There were two specimens from Oiwake in Pryer's collection, and I have received a long series from Ichang, Chang-yang, Omei-shan, and Chow-pin-sa. Occurs from May to July.

There is a good deal of variation in the amount of the dark diffusion of primaries, and in the submarginal spots; these last are not so conspicuous in any of my specimens as they are represented in Staudinger's figure of *P. snelleni*.

Distribution. AMURLAND; ASKOLD; JAPAN; CENTRAL and WESTERN CHINA.

451. *Euproctis intensa.*

Artaxa intensa, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 402 (1877); Ill. Typ. Lep. Het., ii, pl. xxiii, fig. 12 (1878).

A fine series from Yokohama and Oiwake in Pryer's collection. I obtained the species at Gensan in July, and my native collector met with it at Nikko. A long series was received from Moupin, also specimens from Ichang, Chang-yang, Chia-kou-ho, and the province of Kwei-chow. June and July.

The Japanese specimens are deeper in colour, especially on secondaries, than the Chinese examples, and the central fascia is more clearly defined in the former than in the latter. Some specimens in both sets are without the sub-apical black spot, and in others both spots are absent.

Distribution. JAPAN; CENTRAL and WESTERN CHINA; COREA.

452. *Euproctis straminea*, sp. n.

Head and thorax pale yellow, face whitish, palpi fuscous; abdomen pale fuscous, anal tuft white merging into orange in the male and brown in the female.

Primaries lemon-yellow with a fuscous central band, interrupted by the venation, and bifurcated above median nervure, but not extending to the costa; there are no apical or submarginal spots. Secondaries silky white. Under surface white; the primaries have an interrupted fuscous subcostal streak, and a fuscous mark on vein 3.

Expanse ♂ 33–40 millim., ♀ 42–48 millim.

Two male specimens from Chia-kou-ho, one female from Omei-shan, and one from Ichang; these were all taken in July.

The smaller male is without fuscous marking on the under surface of primaries.

Habitat. Western and Central China.

Allied to *E. intensa*, Butl.

453. *Euproctis unipuncta*, sp. n.

Primaries pale yellowish, with indications of a fuscous median band, only distinct towards inner margin; subapical spot black. Secondaries white. Under surface white. Abdomen tinged with fuscous; anal tuft orange in male, fuscous in female.

Expanse ♂ 30–33 millim., ♀ 44–46 millim.

Two male specimens and two females from Wa-shan, and the same number of examples of each sex from Chia-kou-ho. June and July.

Habitat. Western China.

454. *Euproctis plana.*

Euproctis plana, Walk., Cat. Lep. Het., vii, p. 1731 (1856); Hampson, Fauna Brit. Ind., Moths, i, p. 479 (1892).

Chœrotricha plana, Butl., Ill. Typ. Lep. Het., v, pl. lxxxix, fig. 13 (1881).

Adlullia plana, Swinhoe, Cat. Lep. Het., Oxford, p. 185 (1892).

Nygmia plana, Kirby, Cat. Lep. Het., i, p. 447 (1892).

Euproctis mülleri, Snell., Tijds. v. Ent., xx, p. 13, pl. i, fig. 5 ♂, 6 ♀ (1877).

One female specimen from Omei-shan and one from the province of Kwei-chow, taken in June or July. These agree with the female figure of *mülleri*, Snell., except that

they have a black discal spot as in the male, and there is no dark suffusion on the under surface of the wings.

Distribution. KÁNGRA; SIKHIM; BURMA; ANDAMANS (*Hampson*); WESTERN CHINA.

455. *Euproctis immaculata* ?

Chœrotricha immaculata, Butl., Ill. Typ. Lep. Het., v, p. 52, pl. lxxxix, fig. 14 (1881).
Nygmia immaculata, Kirby, Cat. Lep. Het., i, p. 447 (1892).
Euproctis plana, Hampson, Fauna Brit. Ind., Moths, i, p. 479 (1892).

A specimen in Pryer's collection appears to be the male of *E. immaculata*, Butler, which seems to be a species quite distinct from *E. plana*, Walk., with which Hampson has placed it.

Distribution. DARJILING; JAPAN.

456. *Euproctis flavinata.*

Artaxa flavinata, Walk., Cat. Lep. Het., xxxii, p. 331 (1865).
Euproctis flavinata, Hampson, Fauna Brit. Ind., Moths, i, p. 475 (1892).

Walker described this species from Shanghai; my collectors did not meet with it in any part of China that they went through.

Distribution. Throughout INDIA; CEYLON and BURMA; BORNEO (*Hampson*); NORTH CHINA.

457. *Euproctis varians.*

Artaxa varians, Walk., Cat. Lep. Het., iii, p. 796 (1855).
Euproctis varians, Hampson, Fauna Brit. Ind., Moths, i, p. 475 (1892).

Occurs at Chang-yang, Ichang, Ship-y-shan, Moupin, and Chia-kou-ho, in June and July.

Distribution. FORMOSA; throughout INDIA; CEYLON and BURMA (*Hampson*); CENTRAL and WESTERN CHINA.

458. *Euproctis endoplagia.*

Euproctis endoplagia, Hampson, Journ. Bomb. N. H. Soc., xi, p. 295 (1897).

Primaries pale ochreous yellow, with an ill defined fuscous patch on inner marginal area just beyond the middle. Secondaries paler.

Expanse ♂ 23 millim., ♀ 29 millim.

One male specimen from Ichang and one from Moupin, the latter taken in June and the former in July; one female from Ship-y-shan obtained in September.

Habitat. CENTRAL and WESTERN CHINA.

The fuscous patch is only faintly indicated in the female.

459. *Euproctis pauperata*, sp. n.

Male. Primaries pale buff, with a fuscous blotch on inner area before the middle. Secondaries paler. Undersurface as above in colour, but tinged with blackish on costal area of primaries.

Female. Diaphanous; sordid white, primaries with an ochreous-grey tinge.

Expanse ♂ 31–35 millim., ♀ 40–44 millim.

Two specimens of each sex from Moupin, taken in June.

The fuscous blotch in one example of each sex is well defined, but in the other pair it is much reduced in size in the male, and barely traceable in the female.

Habitat. WESTERN CHINA.

460. *Euproctis recurvata*, sp. n.

Primaries yellow, basal area darker limited by a pale curved line; beyond the middle of the wing there is a curved and recurved, fuscous, transverse band; this is interrupted by the venation and inwardly edged by a pale line. Secondaries paler. Undersurface pale ochreous.

Expanse 26–32 millim.

Three male specimens from Chang-yang, and one from Ningpo.

In the Ningpo specimen, which is the largest, the basal area of primaries does not appear to be darker than the ground colour, and the undersurface of all the wings is deeper in colour than in the Chang-yang examples.

Habitat. NORTHERN and CENTRAL CHINA.

461. *Euproctis bipunctapex*.

Somena bipunctapex, Hampson, Ill. Typ. Lep. Het., viii, p 57, pl. cxl, fig. 13 (1891).

Euproctis bipunctapex, Fauna Brit. Ind., Moths, i, p. 484 (1892).

Arna bipunctapex, Swinhoe, Cat. Lep. Het., Oxford, p. 191 (1892).
Artaxa bipunctapex, Kirby, Cat. Lep. Het., i, p. 453 (1892).

I have several specimens of this species from Ichang, Chang-yang, Ship-y-shan, Moupin, Wa-shan, and the province of Kwei-chow. It occurs in June, July, and August.

Distribution. KÁNGRA; NÁGAS; NILGIRIS; BURMA (*Hampson*); CENTRAL and WESTERN CHINA.

462. *Euproctis scintillans.*

Somena scintillans, Walk., Cat. Lep. Het., vii, p. 1734 (1856); Kirby, Cat. Lep. Het., i, p. 454 (1892).
Artaxa scintillans, Butl., Ill. Typ. Lep. Het., v, p. 90, pl. xc, fig. 1 (1881).
Artaxa limbata, Butl., *l. c.*, p. 53, pl. xc, fig. 3.
Euproctis scintillans, Hampson, Fauna Brit. Ind., Moths, i, p. 483 (1892).
Arna scintillans, Swinhoe, Cat. Lep. Het., Oxford, p. 191 (1892).

Specimens were received from Chang-yang, Moupin, and Omei-shan, taken in June and July. I obtained the species at Ningpo in April, and my native collector obtained it at Gensan in August.

The Gensan and Ningpo examples are of the *limbata* form, *i.e.*, the secondaries are fuscous-brown, with a yellow hind marginal border, but in all the other specimens the whole of the outer half of secondaries is yellow, and the upper spur of ground colour on primaries is absent, whilst the lower one is very short.

Distribution. Throughout INDIA and CEYLON; BURMA; ANDAMANS (*Hampson*); CENTRAL, WESTERN, and NORTH-EASTERN CHINA; COREA.

463. *Euproctis argentata*, sp. n.

Primaries orange-yellow, basal three-fourths powdered with brownish and limited outwardly by an irregular series of brownish spots, which are sprinkled with silvery scales; the series is interrupted between veins 5 and 6, and does not extend beyond vein 7. Secondaries ochreous-white. Undersurface pale ochreous.

Expanse 24 millim.

One male specimen in Pryer's collection, exact locality not indicated.

Habitat. JAPAN.

464. *Euproctis conspersa.*

Artaxa conspersa, Butl., Cist. Ent., iii, p. 117 (1885).

A long series from Yokohama in Pryer's collection.

There are two forms of the male: one of these is of a dark chocolate colour, but the other is of the female coloration, *i.e.*, ochreous or pale yellow; the latter is the typical form.

Habitat. JAPAN.

465. *Euproctis pulverea.*

Artaxa pulverea, Leech, Proc. Zool. Soc. Lond., 1888, p. 623, pl. xxxi, fig. 5.

I obtained two examples of each sex in Satsuma in May, and two males at Nagasaki in June; my collector obtained one male at Gensan, and there were three males and two females from Loochoo in Pryer's collection. A male specimen, also in Pryer's collection but without locality, which I referred to this species in my former paper, I now find to be distinct and have described it as *E. argentata.*

Distribution. JAPAN; KIUSHIU; COREA; LOOCHOO.

466. *Euproctis torasan.*

Artaxa torasan, Holl., Trans. Amer. Ent. Soc., xvi, p. 73 (1889).

Described from Japan, but the description does not seem to apply to any species of *Euproctis* that I have seen from that country.

Habitat. JAPAN.

Genus PORTHESIA.

Steph.; Hampson, Fauna Brit. Ind., Moths, i, p. 484 (1892).

467. *Porthesia similis.*

Phalæna similis, Fuessl., Verz. Schweiz. Ins., p. 35 (1775).

Bombyx auriflua, Hübn., Bomb., figs. 68, 69 (1800).
Bombyx chrysorrhœa, Esp., Schmett., iii, pl. xxxix, figs. 1, 2 (1785).
Porthesia auriflua, Leech, Proc. Zool. Soc. Lond., 1888, p. 622; Hampson, Fauna Brit. Ind., Moths, i, p. 484 (1892).
Leucoma similis, Kirby, Cat. Lep. Het., v, p. 445 (1892).

There were specimens from Yokohama, Oiwake, and Yesso in Pryer's collection. I obtained examples at Fushiki in the month of July, and I have received the species from Gensan, Ship-y-shan, Omei-shan, Chia-kou-ho, and the province of Kwei-chow.

Some of the males have two fuscous spots on the inner margin of primaries; others have a third spot placed on costa immediately over, and almost uniting with, that nearest the base on inner margin; one example has a fourth spot (subapical). Some of the females also have one or both spots on inner margin, but these are not so well defined as in the males.

P. virguncula, Walk., which Hampson (*l. c.*, p. 485) includes as a form of *P. xanthorrhœa*, Koll., is probably only a form of *P. similis*.

Distribution. EUROPE.—AMURLAND; JAPAN; YESSO; COREA; NORTHERN, CENTRAL, and WESTERN CHINA.

468. *Porthesia marginalis.*

Euproctis marginalis, Walk., Cat. Lep. Het., vii, p. 1731.
Porthesia marginalis, Butl., Ill. Typ. Lep. Het., v, p. 51, pl. lxxxix, fig. 12 (1881).
Porthesia xanthorrhœa, Hampson, Fauna Brit. Ind., Moths, i, p. 485 (1892).

Two male specimens from Moupin taken in June. These have the pectinations of the antennæ almost black, and agree in other respects with *P. marginalis*, which Hampson considers to be a form of *P. xanthorrhœa*.

Distribution. INDIA; CEYLON; BURMA; JAVA (*Hampson*); WESTERN CHINA.

Genus STILPNOTIA.

Westwood and Humphreys, Brit. Moths, i, p. 90 (1841 ?).

469. *Stilpnotia salicis.*

Bombyx salicis, Linn., Syst. Nat., i, p. 502 (1758); Hübn., Bomb., fig. 70 (1800 ?).
Stilpnotia salicis, Kirby, Cat. Lep. Het., p. 433 (1892).
Leucoma salicis, var. *candida*, Staud., Rom. sur Lép., vi, p. 308 (1892).

I have examples of this species from Yesso, Ichang, Kiukiang, Moupin, Wa-shan, Pu-tsu-fong, and the province of Kwei-chow. All these have the wings more densely scaled, thus giving the insects a more silvery appearance: they are referable to var. *candida*, Staud.

Distribution. EUROPE.—AMURLAND; YESSO; CENTRAL, WESTERN, and NORTH-EASTERN CHINA; COREA.

470. *Stilpnotia sericea.*

Stilpnotia sericea, Moore, Lep. Atk., p. 45 (1879).
Caviria sericea, Hampson, Fauna Brit. Ind., Moths, i, p. 490 (1892).

One male specimen from Omei-shan taken in July.

Distribution. SIKHIM; WESTERN CHINA.

471. *Stilpnotia ochripes.*

Stilpnotia ochripes, Moore, Lep. Atk., p. 45 (1879).
Caviria ochripes, Hampson, Fauna Brit. Ind., Moths, i. p. 490 (1892).

One male specimen from Moupin, taken in June.

Staudinger (Rom. sur Lép., vi, p. 309) records *Leucoma ochropoda*, Eversm., from Amurland, and states that it differs from *ochripes*, Moore, in the pectinations of the antennæ being black instead of yellowish-brown.

Distribution. SIKHIM; NÁGA HILLS; MOMEIT; BURMA (*Hampson*); WESTERN CHINA.

Genus LEUCOMA.

Steph.; Hampson, Fauna Brit. Ind., Moths, i, p. 487 (1892).

472. *Leucoma cymbicornis.*

Redoa cymbicornis, Butl., Ill. Typ. Lep. Het., v, p. 48, pl. lxxxix, fig. 2 (1881).

Leucoma subvitrea (part), Leech, Proc. Zool. Soc. Lond., 1888, p. 621.
Laria l-nigrum, Leech, Trans. Ent. Soc. Lond., 1889, p. 127.
Redoa nigricilia, Swinh., Trans. Ent. Soc. Lond., 1891, p. 478.

Four male specimens from Ichang, two from Omei-shan, and one from Pu-tsu-fong, one female from Kiukiang, and one in Pryer's collection; the latter was included in a series under the name *Leucoma subvitrea*, Walk.

The smallest male in my series is from Ichang, and expands 30 millim. The females are each 50 millim. in expanse. One example of the male from Ichang is without the typical black dot on primaries, and the fringes are black at the tips; this is referable to *nigricilia*, Swinh.

Distribution. SIKHIM; BORNEO (*Hampson*); JAPAN; CENTRAL and WESTERN CHINA.

473. *Leucoma moorei.*

Redoa alba, Moore, Ann. and Mag. Nat. Hist., (4) xx, p. 92 (1877).

Three male specimens from Ichang, one female from Chang-yang; five males from Moupin, two males and a female from Omei-shan, and one example of each sex from Wa-shan. Occurs from May to August.

This species is similar to *L. cymbicornis*, Butl., but the wings are shorter and the outer margins rounder. The shafts of the antennæ are black, except at the base.

The name *alba* being already occupied in *Leucoma*, I have changed it to *moorei* for this species.

Habitat. CENTRAL, EASTERN, and WESTERN CHINA.

474. *Leucoma alba.*

Aroa alba, Brem., Lep. Ost-Sib., p. 41, pl. iii, fig. 18 (1864).
Redoa sinensis, Moore, Ann. and Mag. Nat. Hist., (4) xx, p. 92 (1877).

I obtained both sexes of this species at Fusan and Gensan, and have received male specimens from Ichang and Chang-yang. Occurs in June and July. The black dot at end of the cell of primaries is generally minute, but sometimes it is entirely absent. In Moore's types, which

are from Shanghai, the spot is only faintly indicated in the male.

The ochraceous spot referred to by Bremer in his description of *alba* is not present in any of my examples.

Distribution. CENTRAL and EASTERN CHINA; COREA; AMURLAND.

475. *Leucoma diaphana.*

Redoa diaphana, Moore, Lep. Atk., i, p. 46 (1879).
Leucoma diaphana, Hampson, Fauna Brit. Ind., Moths, i, p. 488 (1892).

One male specimen from Omei-shan and two from Chang-yang, taken in June.

Distribution. SIKHIM; BERNARDMYO: BURMA (*Hampson*); CENTRAL and WESTERN CHINA.

476. *Leucoma subvitrea.*

Leucoma subvitrea, Walk., Cat. Lep. Het., xxxii, p. 344 (1865).
Kanchia subvitrea, Moore, Lep. Ceyl., ii, p. 93, pl. cxiii, fig. 5 (1882).

I have examples from Moupin, Omei-shan, and the province of Kwei-chow. The species occurs in June and July.

I seem to have wrongly identified the specimens referred to *L. subvitrea* in my former paper.

Distribution. HONG-KONG; BENGAL; NILGIRIS; CEYLON (*Hampson*); WESTERN CHINA.

Genus ARCTORNIS.

Germar, Syst. Gloss. Prodr., p. 18 (1810).

477. *Arctornis auripes.*

Leucoma auripes, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 402 (1877); Ill. Typ. Lep. Het., ii, p. 9, pl. xxiv, fig. 1 (1878); Leech, Proc. Zool. Soc. Lond., 1888, p. 622.
Arctornis auripes, Kirby, Cat. Lep. Het., i, p. 432 (1892).
Leucoma denudata, Walk.; Swinhoe, Cat. Lep. Het., Oxford, p. 202 (1892).

Specimens from Yokohama and Yesso were in Pryer's collection. I obtained the species in June at Gensan, where it was flying commonly among fir-trees in the daytime. One male example was received from Omei-shan, taken by a native collector in June or July; this is slightly suffused with fuscous on primaries and apical area of secondaries, and the costa is distinctly black.

Distribution. JAPAN; YESSO; WESTERN CHINA; COREA.

478. *Arctornis l-nigrum.*

Bombyx l-nigrum, Muell., Faun. Fridr., p. 40 (1764).
Bombyx v-nigrum, Fabr., Syst. Ent., p. 577 (1775).
Laria l-nigrum, Leech, Proc. Zool. Soc. Lond., 1888, p. 622 (part).
Arctornis l-nigrum, Kirby, Cat. Lep. Het., i, p. 432 (1892).

One typical female specimen in Pryer's collection.

Distribution. EUROPE.—AMURLAND; JAPAN; COREA.

Family HYPSIDÆ.

Genus HYPSA.

Hübn.; Hampson, Fauna Brit. Ind., Moths, i, p. 498 (1892).

479. *Hypsa marmorea.*

Hypsa marmorea, Walk., Cat. Lep. Het., vii, p. 1674 (1856); Butl., Ill. Typ. Lep. Het., v, p. 43, pl. lxxxvii, figs. 10, 11 (1881); Hampson, Fauna Brit. Ind., Moths, i, p. 498 (1892).
Neochera marmorea, Kirby, Cat. Lep. Het., i, p. 390 (1892).

One female specimen from the province of Kwei-chow, taken in June or July.

Distribution. Throughout N.E. INDIA and BURMA; JAVA (*Hampson*); WESTERN CHINA.

480. *Hypsa clavata.*

Hypsa clavata, Butl., Trans. Ent. Soc. Lond., 1875, p. 317; Hampson, Fauna Brit. Ind., Moths, i, p. 500 (1892).

Not uncommon at Chang-yang in June, July, and August. It also occurs at Ichang, Moupin, Omei-shan,

Wa-shan, Ni-tou, Chia-ting-fu, Chia-kou-ho, and in the province of Kwei-chow.

Chinese specimens have most of the veins of primaries white; there is an extra postmedial spot on secondaries, above anal angle, and the first spot of this series is often double.

Distribution. Hong-Kong; Cachar; Sylhet (*Hampson*); Central and Western China.

481. *Hypsa tortuosa.*

Neochera tortuosa, Moore, Proc. Zool. Soc., 1872, p. 570, pl. xxxiii, fig. 2.

Hypsa tortuosa, Hampson, Fauna Brit. Ind., Moths, i, p. 501 (1892); Kirby, Cat. Lep. Het., i, p. 389 (1892).

Two specimens taken at Moupin in June; these agree with an example from Kulu sent to me by Captain Young.

Distribution. Sikhim (*Hampson*); Kulu; Western China.

482. *Hypsa paliura.*

Hypsa paliura, Swinhoe, Ann. and Mag. Nat. Hist., (6) xii, p. 214 (1892).

Described from China, probably from some southern locality.

Genus Digama.

Moore, Cat. Lep., E. I. Co., p. 297 (1859).

483. *Digama abietis.*

Digama abietis, Leech, Trans. Ent. Soc. Lond., 1889, p. 126, pl. ix, fig. 5.

I found this species commonly in the Snowy Valley, Ningpo, in April 1886. It rests on the trunks of fir trees, but it is difficult to capture, as it is quickly alarmed and flies wildly from tree to tree. One male specimen has been received from Kiukiang.

Distribution. Northern and Central China.

Family ARCTIIDÆ.

Subfamily *ARCTIINÆ.*

Genus Spilosoma.

Steph.; Hampson, Fauna Brit. Ind., Moths, p. 3 (1894).

484. *Spilosoma lubricipeda.*

Bombyx lubricipeda, Linn., Syst. Nat., i, p. 506 (1758).
Spilarctia lutea, Kirby, Cat. Lep. Het., i, p. 229 (1892).
Spilosoma lubricipedum, Hampson, Fauna Brit. Ind., Moths, ii, p. 3 (1894).

I obtained specimens in July at Gensan, and have received one from Chia-kou-ho.

Distribution. Europe.—Amurland; Corea; Western China.

485. *Spilosoma seriatopunctata.*

Arctia seriatopunctata, Motsch., Etud. Ent., ix, p. 32 (1860).
Spilarctia seriatopunctata, Kirby, Cat. Lep. Het., i, p. 230 (1892).
Spilarctia ione, Butl., Cist. Ent., ii, p. 41 (1875); Ill. Typ. Lep. Het., iii, p. 6, pl. xlii, fig. 6 (1879).
Spilarctia rosacea, Butl., Ann. and Mag. Nat. Hist., (5) iv, p. 352 (1879).
Spilarctia basilimbata, Butl., Trans. Ent. Soc. Lond., 1881, p. 6.
Spilosoma seriatopunctata, Leech, Proc. Zool. Soc. Lond., 1888, p. 618.

Widely distributed in Japan, but the majority of specimens in my series were taken at Hakodate. The species occurs in June, July, and August, and is an exceedingly variable one; some of the specimens are very similar to European *S. lubricipeda,* others agree with *rosacea,* or *basilimbata,* Butl., and there are intermediate links between all these forms.

Distribution. Japan; Yesso; Amurland; Corea.

486. *Spilosoma mandarina.*

Spilosoma mandarina, Moore, Ann. and Mag. Nat. Hist., (4) xx, p. 88 (1877).

Spilarctia mandarina, Kirby, Cat. Lep. Het., i, p. 231 (1892).

One male specimen from Wa-shan and one from Pu-tsu-fong, taken in July. Moore's type was from Shanghai.

Probably not specifically distinct from *S. seriatopunctata*.

Habitat. EASTERN and WESTERN CHINA.

487. *Spilosoma bisecta.*

Spilosoma bisecta, Leech, Proc. Zool. Soc. Lond., 1888, p. 618, pl. xxxi, fig. 3.

I took one male specimen at Hong-Kong in March, and one at Nagasaki in May. My collectors obtained two female examples at Moupin, and two others at Omei-shan, all taken in June.

In the female the terminal segments of the abdomen are scarlet and not buff as in the male; the secondaries have larger black spots towards anal angle and an additional one just above vein 5, and in two specimens there is a black spot towards costa.

Staudinger (Rom. sur Lép., vi, p. 287) says that he agrees with Snellen in considering *bisecta* to be a form of *S. seriatopunctata*. I am at a loss to understand how any one having made himself acquainted with the differential characters referred to in my description of *S. bisecta*, viz. the buff colour of primaries, pale buff of secondaries and a conspicuous black transverse line on thorax, could possibly suggest its specific identity with *S. seriatopunctata*. I may add that Dr. Staudinger had a specimen of *S. bisecta* in his possession at the time when I compared my examples with the *S. seriatopunctata* in his collection.

Distribution. KIUSHIU; EASTERN and WESTERN CHINA.

488. *Spilosoma howqua.*

Spilosoma howqua, Moore, Ann. and Mag. Nat. Hist., (4) xx, p. 88 (1877).

Moore described this species from Shanghai. It agrees with my *S. bisecta* in having a black mark on the thorax, but not in other respects.

Habitat. EASTERN CHINA.

489. *Spilosoma mollicula.*

Spilarctia mollicula, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 395 (1877); Ill. Typ. Lep. Het., iii, pl. xli, fig. 7 (1879).

Described from Hakodate. Staudinger considers that it is simply a form of *S. seriatopunctata*, Motsch.

Habitat. JAPAN.

490. *Spilosoma subcarnea.*

Spilosoma subcarnea, Walk., Cat. Lep. Het., iii, p. 675 (1855).

Spilarctia subcarnea, Butl., Ill. Typ. Lep. Het., iii, p. 6, pl. xlii, fig. 8 (1879).

Aloa leucothorax, Feld., Wien. ent. Mon., vi, p. 36 (1862).

I have received this species from Chia-kou-ho, Che-tou, and Ichang. There were specimens in Pryer's collection from Loochoo and Yokohama, and I captured the species at Gensan.

Some of the specimens are entirely devoid of spots, whilst other examples have from one to six spots on primaries.

Distribution. NORTH, CENTRAL, and WESTERN CHINA; JAPAN; COREA; LOOCHOO.

491. *Spilosoma bifrons.*

Aloa bifrons, Walk., Cat. Lep. Het., iii, p. 705 (1855).

Spilosoma erubescens, Moore, Ann. and Mag. Nat. Hist., (4) xx, p. 89 (1877).

Spilarctia erubescens, Kirby, Cat. Lep. Het., i, p. 231 (1892).

Spilosoma rybakowi, Alph., Rom. sur Lép., ix, p. 171, pl. x, fig. 9 ♂ (1897).

There were three specimens in Pryer's collection, and I have received the species from Moupin and Omei-shan.

Distribution. JAPAN; NORTHERN and WESTERN CHINA.

492. *Spilosoma robustum*, sp. n.

Male. Primaries creamy white, a black spot at upper angle of the cell, one on each side of vein 1, about one third from outer angle, and traces of a black dot towards outer margin and near vein 6.

Secondaries whitish with a black spot at upper angle of the cell and indications of a spot towards anal angle and between veins 2 and 3. Under surface as above.

Head and thorax colour of primaries, a black spot on the tegulæ; abdomen orange-crimson above, whitish beneath, with dorsal and lateral series of black spots, terminal segments whitish.

Female. Agrees with the male, but the tegulæ are without black spots.

Expanse ♂ 60 millim., ♀ 70 millim.

One example of each sex from Moupin, taken in June.
Habitat. WESTERN CHINA.

493. *Spilosoma punctaria.*

Bombyx punctaria, Cram., Pap. Exot., iv, p. 233, pl. cccxcviii, fig. D. (1782).
Bombyx menthastri, Esp., Schmett., iii, p. 334, pl. lxvi, figs. 6—10 (1786).
Spilosoma lubricipeda, Kirby, Cat. Lep. Het., i, p. 227 (1892).
Arctia punctigera, Motsch., Etudes Ent., ix, p. 31 (1860).
Spilosoma sangaica, Walk., Cat. Lep. Het., xxxi, p. 294 (1864); Butl., Ill. Typ. Lep. Het., iii, p. 5, pl. xlii, fig. 5 (1879).
Spilosoma sangaicum, Hampson, Fauna Brit. Ind., Moths, ii, p. 3 (1894).
Spilosoma roseiventer, Snell., v. Voll. Tjidsk. v. Ent., xi, p. 143 (1863).
Spilosoma dornesii, Oberth., Diagnoses, pl. 6 (1879).
Spilosoma dærriesi, Oberth., Etud. d'Ent., v, p. 31, pl. i, fig. 7 (1881).

In Pryer's collection there were specimens from Oiwake and Yokohama. I obtained the species at Gensan in June, and my native collector at Hakodate and Nikko. A nice series was received from Chang-yang, Moupin, Wa-shan, Omei-shan, Chia-kou-ho, and the province of Kwei-chow, June and July.

The specimens vary in the colour of primaries which may be either white or pale buff; some examples are heavily spotted, but others are almost devoid of marking, at the same time there are all gradations between these extremes. The abdomen is sometimes of the normal yellow

colour of typical *menthastri*, but there are all intermediate tints between this and the vermilion of *punctaria*.

Alphéraky (Rom. sur Lép., ix, p. 127) notes two small male specimens from Guan-Sian in the province of Sé-Tchouen; these he states were taken in August, and agree with certain European examples of *menthastri*.

Distribution. EUROPE.—AMURLAND; JAPAN; YESSO; COREA; EASTERN, CENTRAL, and WESTERN CHINA; MURREE.

494. *Spilosoma niveus.*

Dionychopus niveus, Mén., Bull. de l'Acad. Pétr., xvii, p. 218 (1859); Schr. Amur. Reisen, Lep., p. 52, pl. iv, fig. 6 (1859); Leech, Proc. Zool. Soc., 1888, p. 620.

Spilosoma (?) *niveus*, Kirby, Cat. Lep. Het., i, p. 229 (1892).

Occurs at Yokohama, Oiwake, Hakodate, Sendai, Hakone, Gensan, Chang-yang, and Ta-chien-lu. July and August.

The markings of the abdomen are subject to modification, and the black discal spot of secondaries is sometimes absent.

Distribution. JAPAN; YESSO; COREA; AMURLAND; CENTRAL and WESTERN CHINA.

495. *Spilosoma purum*, sp. n.

Head, thorax, and wings white, the latter without markings but with the venation prominent on the upper surface, and the discocellulars on the under surface are black. Abdomen with a dorsal series of somewhat triangular marks and a lateral series of black spots, the area between the series is orange-yellow. Pectus and front of the femora orange-yellow.

Expanse 60 millim.

I have twelve male and four female specimens; they were obtained at Omei-shan, Chia-kou-ho, and in the province of Kwei-chow, where they occurred in July.

Allied to *S. niveus*.

The shape of the dorsal spots on abdomen is subject to modification; in the majority of the specimens they are as described, but in one or two examples they are bar-like. and in one individual, small and almost round.

Habitat. WESTERN CHINA.

496. *Spilosoma lativitta.*

Spilosoma lativitta, Moore, Proc. Zool. Soc. Lond., 1865 p. 809.
Spilarctia lativitta, Kirby, Cat. Lep. Het., ii, p. 232 (1892).
Alphæa biguttata (part), Hampson, Fauna Brit. Ind., Moths, ii, p. 23 (1894).

Three male specimens from Pu-tsu-fong, taken in June or July. These differ from the typical form in the colour of the abdomen, which is bright crimson. The colour of the primaries is rather paler than in Indian examples, and there are no markings about the apex and outer margin. I propose the name *carnea* for this form.

Distribution. SIKHIM; WESTERN CHINA.

497. *Spilosoma soror*, sp. n.

Male. Primaries yellowish-buff with an oblique, dusky, macular band between veins 1, 2, and 5, which attains its greatest width between veins 1 and 2. Secondaries whitish and rather silky, with two black dots towards anal angle, these are often absent. Under surface as above. Thorax colour of primaries, head slightly paler; abdomen crimson with dorsal and lateral rows of black dots, anal segment with white hairs; femora of fore-legs crimson.

Female. The dusky band of primaries has a curved extension to the costa and an additional spot on inner margin; terminal segments of the abdomen white.

Expanse 42 millim.

Two males from Chia-kou-ho, one from Chia-ting-fu, one from Ta-chien-lu, and a female from Che-tou. July.

The blackish dots on secondaries are only present in one example.

Allied to *S. jankowskii*, Oberth., but differs from that species in its deeper colour, in the absence of discal spots on either wing, and of the apical spots on primaries.

Habitat. WESTERN CHINA.

498. *Spilosoma lacteata.*

Spilarctia lacteata, Butl., Ill. Typ. Lep. Het., v, p. 31, pl. lxxxv, fig. 10 (1881).
Spilosoma lacteatum, Hampson, Fauna Brit. Ind., Moths, ii, p. 10 (1894).

One male specimen from Omei-shan, and a female from Ni-tou. July.

Distribution. Dharmsála; Sikhim (*Hampson*); Western China.

499. *Spilosoma rubidum.*

Dionychopus rubidus, Leech, Entom., xxiii, p. 111 (1890).
Spilosoma rubidus, Kirby, Cat. Lep. Het., i, p. 229 (1892).
Spilosoma leucoptera, Alph., Rom. sur Lép., ix, p. 170, pl. x, fig. 8 ♀ (1897).

Two specimens from Chang-yang, and three from Moupin. July and August.

Alphéraky describes this species from Corea.

The spots on secondaries vary in number, and in some examples there are several spots on primaries.

Distribution. Central and Western China; Corea.

500. *Spilosoma bifasciata.*

Spilarctia bifasciata, Butl., Trans. Ent. Soc. Lond., 1881, p. 7.

Butler's type was from Tokio. There were three specimens from Nikko in Pryer's collection, and I received one from Mr. Manley of Yokohama.

In one of the Nikko examples the medial portion of the sub-basal band on primaries is absent, and the central band is interrupted.

Habitat. Japan.

Kirby (Cat. Lep. Het., i, p. 232) mentions *S. bifasciata*, Hampson, and gives the locality as "China," but Hampson (Fauna Brit. Ind., Moths, ii, 9) refers to the species as from the "Nilgiris." I have not seen anything from China to agree with Hampson's description of *S. bifasciata*.

501. *Spilosoma imparilis.*

Spilarctia imparilis, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 394 ♂ (1877); Ill. Typ. Lep. Het., ii, p. 4, pl. xxii, fig. 4 ♂ (1878); A.M.N.H., (5) iv, p. 351 ♀ (1879); Fixsen, Rom. sur Lép., iii, p. 334 (1887).

Four male specimens and four females from Yesso in Pryer's collection; Mr. Smith took one female example at Hakone. Butler's type was from Yokohama.

The black maculation is a variable character in the female; one example of this sex from Yesso is devoid of marking, with the exception of a black dot on the left primary.

Habitat. JAPAN and YESSO.

502. *Spilosoma flammeolus.*

Alpenus flammeolus, Moore, Ann. and Mag. Nat. Hist., (4), xx, p. 89 (1877).

There was a specimen in Pryer's collection. I obtained the species at Nagasaki in June, and at Shimonoseki in July; a native collector took one example at Ningpo, and I received one from Kiukiang, where it was captured in June.

Distribution. JAPAN; KIUSHIU; NORTH-EASTERN and CENTRAL CHINA.

503. *Spilosoma flaveolum*, sp. n.

Yellowish-buff the primaries and abdominal area of secondaries tinged with fulvous. Primaries have a black dot at end of cell and a curved and slightly wavy line thence to inner margin. Secondaries have a dusky discal dot. Under surface yellowish-buff; all the wings have a blackish discal dot. Abdomen reddish, anal segments buff.

Expanse 44 millim.

Allied to *S. flammeolus*, Moore.

One female specimen from Chia-ting-fu, taken in June or July.

Habitat. WESTERN CHINA.

Genus RHYPARIA.

Hübner, Verz. bek. Schmett., p. 183 (1822?).

504. *Rhyparia purpurata.*

Bombyx purpurea, Linn., Syst. Nat., i, (2) p. 128 (1769); Hübn., Bomb., pl. xxxiii, fig. 142.

Rhyparia purpurata, Kirby, Cat. Lep. Het., i, p. 260 (1892).

One example from Oiwake in Pryer's collection. I bred one example in 1886 from a larva obtained at Gensan.

Distribution. EUROPE.—AMURLAND; JAPAN; COREA.

Genus Rhyparioides.

Butler, Ann. and Mag. Nat. Hist., (4) xx, p. 395 (1877).

505. *Rhyparioides metalkana.*

Nemeophila metalkana, Led. Wien. Mon., v, p. 162, pl. iii, fig. 12 ♀ (May, 1861).
Chelonia flavida, Brem., Bull. Acad. Pétr., iii, p. 477 (1861); Lep. Ost-Sib., p. 39, pl. iv, fig. 4 (1864).
Rhyparioides metalkana, Kirby, Cat. Lep. Het., i, p. 249 (1892).

There were specimens from Yesso and the Loochoo Islands in Pryer's collection. I obtained one example at Gensan in June.

Distribution. Europe.—Amurland; Japan; Yesso; Corea.

506. *Rhyparioides subvaria.*

Diacrisia subvaria, Walk., Cat. Lep. Het., iii, p. 637 (1855); Butl., Ill. Typ. Lep. Het., ii, pl. xxiii, fig. 3 (1878).
Nemeophila (*Diacrisia*) *subvaria*, Alph., Rom. sur Lép., ix, p. 131 (1897).

I have specimens from Ichang, Chang-yang, Ningpo, and Moupin, all taken in June and July. Alphéraky records a male specimen from Tao-pin in the province of Sé-Tchouen.

Distribution. North-Eastern, Central, and Western China.

507. *Rhyparioides amurensis.*

Chelonia rubescens, var. *amurensis*, Brem., Lep. Ost-Sib., p. 39, pl. iii, fig. 16 (1864).
Rhyparioides rubescens (part), Leech, Proc. Zool. Soc. Lond. 1888, p. 616.

There were two specimens, without exact locality, in Pryer's collection, and I have a male taken by Mr. Manley at Yokohama, and a female obtained at Hakodate by Mr. Andrews. My collectors met with the species in June and July, at Kiukiang, Chang-yang, Moupin, Chia-kou-ho, Pu-tsu-fong, and Wa-shan.

The female is more strongly marked than the male; in

some examples of the latter sex the primaries are without any spots whatever.

Distribution. Amurland; Eastern Siberia; Japan; Yesso; Central and Western China.

508. *Rhyparioides nebulosa.*

Rhyparioides nebulosa, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 396 (1877); Ill. Typ. Lep. Het., ii, p. 5, pl. xxiii, fig. 2 (1878).
Rhyparioides simplicior, Butl., Trans. Ent. Soc. Lond., 1881, p. 6.
Rhyparioides rubescens (part), Leech, Proc. Zool. Soc. Lond., 1888, p. 616.

There were specimens from Yokohama, Oiwake, and Yesso in Pryer's collection; I have also received one example from Hakodate, and I obtained two males at Hakone in August.

The males (*simplicior*) are always much less suffused than the females (*nebulosa*).

In a former paper I treated *amurensis*, *nebulosa*, and *simplicior* as forms of *rubescens*, Walk., but I now find that the first three have nothing to do with the last named species; I have also been able to discover good differences between *amurensis*, Brem., and *nebulosa*, Butl., the most important of which is connected with the antennæ; these are pectinated in *amurensis*, but serrated in *nebulosa*.

Habitat. Japan and Yesso.

Genus Diacrisia.

Hübner, Verz. bek. Schmett., p. 169 (1822 ?).

509. *Diacrisia russula.*

Bombyx sannio, Linn., Syst. Nat., i, p. 506 ♂ (1758).
Bombyx russula, Linn., Syst. Nat., i, p. 510 ♀; Hübn., Bomb., pl. xxix, figs. 124, 125.
Diacrisia sannio, Kirby, Cat. Lep. Het., i, p. 249 (1892).
Nemeophila russula, Alph., Rom. sur Lép., vi, p. 13 (1892).
Diacrisia russula, var. *amuri*, Staud., Rom. sur Lép., vi, p. 277 (1892).

There were examples of both sexes from Oiwake in

Pryer's collection, and I obtained a female specimen at Gensan.

Alphéraky records a typical female from Ou-pin.

As the Eastern Asian specimens of this species differ slightly from European examples, Dr. Staudinger has named the form *amuri*. He records a specimen from Amurland which is without markings on secondaries; this appears to be referable to *D. irene*, Butl.

Distribution. EUROPE.—AMURLAND; JAPAN; COREA; WESTERN CHINA.

510. *Diacrisia irene.*

Diacrisia irene, Butl., Trans. Ent. Soc. Lond., 1881, p. 6.

Probably only an aberration of *D. russula*. I have a German example of the latter species which is without black marking on both surfaces of the secondaries.

Habitat. JAPAN.

Genus *Nemeophila.*

Stephens, Ill. Brit. Ent., Haust., ii, p. 72 (1828).

511. *Nemeophila plantaginis.*

Bombyx plantaginis, Linn., Syst. Nat., i, p. 501 (1758).
Parasemia plantaginis, Kirby, Cat. Lep. Het., i, p. 250 (1892).
Nemeophila macromera, Butl., Trans. Ent. Soc. Lond., 1881, p. 5.
Nemeophila macromera, var. *leucomera*, Butl., *l. c.*
Nemeophila macromera, var. *melanomera*, Butl., *l. c.*
Parasemia macromera, Kirby, Cat. Lep. Het., i, p. 250 (1892).

Dr. Staudinger states that this species in Amurland is exceedingly variable, and that the males always have white secondaries. Graeser described a form under the name *floccosa*, of which I have received four males and two females from Nicolajefsk. *Leucomera*, Butl., resembles var. *hospita* on the secondaries, but approaches more nearly to var. *matronalis* on the primaries. *Macromera*, Butl., is a large modification of the type form, the secondaries in both sexes being of the usual pale yellow. *Melanomera*, Butl., is the Japanese representative of the European var. *matronalis*.

Distribution. EUROPE.—ALTAI; AMURLAND; JAPAN.

Genus THYRGORINA.

Walk.; Hampson, Fauna Brit. Ind., Moths, ii, p. 11 (1894).

512. *Thyrgorina rhodophila.*

Spilosoma rhodophila, Walk., Cat. Lep. Het., xxxi, p. 294 (1864).
Icambosida rhodophila, Butl., Ill. Typ. Lep. Het., v, p. 29, pl. lxxxv, fig. 4 (1881).
Icambosida dorsalis, Moore, Proc. Zool. Soc. Lond., 1888, p. 394.
Thyrgorina rhodophila, Hampson, Fauna Brit. Ind., Moths, ii, p. 15 (1894).
Thyrgorina dorsalis, Alph., Rom. sur Lép., vi, p. 15 (1892).

Two male specimens from Moupin, three from Omei-shan, one from Pu-tsu-fong, and one from Chang-yang; one female example from Moupin. June, July, and August. Alphéraky records a female specimen taken in July in the Heï-ho valley.

Distribution. NORTH-WEST HIMALAYAS; SIKHIM; NÁGAS; MANIPUR (*Hampson*); CENTRAL and WESTERN CHINA.

513. *Thyrgorina costimacula*, sp. n.

Differs from *T. rhodophila* in having on primaries an oblique line direct from the apex to middle of inner margin, a distinct spot at end of the cell, and two blackish spots on the costa. The palpi are blackish and without pink fringe.

Expanse 40—42 millim.

One example of each sex from Moupin, one male from Wa-shan, and one female from Chia-ting-fu. Occurs in June and July.

The female specimen from Chia-ting-fu has only one spot on the costa.

Habitat. WESTERN CHINA.

514. *Thyrgorina melanosoma.*

Thyrgorina melanosoma, Hampson, Fauna Brit. Ind., Moths, ii, p. 15 (1894).

I have one female specimen from Wa-shan, where it was captured in July, which appears to be referable to

this species, but the abdomen is more densely clothed with white hair, and the wings are less diaphanous.

Distribution. KULU; SIKHIM; KHÁSIS (*Hampson*); WESTERN CHINA.

515. *Thyrgorina inæqualis.*

Spilarctia inæqualis, Butl., Ann. and Mag. Nat. Hist., (5) iv, p. 351 (1879).

A fine series from Ohoyama and Fujisan in Pryer's collection. I obtained the species at Hakone and have received one male specimen from Chang-yang, where it was taken in June. There is a good deal of variation, not only in tone of colour, but also in the intensity of the black markings.

Distribution. JAPAN; CENTRAL CHINA.

516. *Thyrgorina phasma*, sp. n.

Head and thorax whitish, front of prothorax yellowish-buff, tegulæ with a blackish dot; abdomen yellow with dorsal and lateral series of black spots.

Primaries whitish with a discal spot and five macular, pale fuscous bands, the first and fifth not extending to inner margin; there is a blackish spot at the base and two, or three, along the costa. Secondaries whitish, with a rather broad pale fuscous, antemedial band which does not extend to the costa. Undersurface similar to above.

Expanse 30 to 32 millim.

One male specimen from Pu-tsu-fong, and one from the province of Kwei-chow. June and July.

Habitat. WESTERN CHINA.

Genus ARCTIA.

Schrank., Hampson, Fauna Brit. Ind., Moths, ii, p. 15 (1894).

517. *Arctia caia.*

Bombyx caia, Linn., Syst. Nat., i, p. 500 (1758).
Hypercompa caia, Kirby, Cat. Lep. Het., i, p. 258 (1892).
Euprepia phæosoma, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 395 (1877); Ill. Typ. Lep. Het., iii, p. 7, pl. xlii, fig. 10 (1879).

E. phæosoma, var. *auripennis*, Butl., Trans. Ent. Soc., 1881, p. 7.
Hypercompa phæosoma, Kirby, *l. c.*, p. 259.
Euprepia caia, Leech, Proc. Zool. Soc. Lond., 1888, p. 617.
Arctia orientalis, Moore, Ann. and Mag. Nat. Hist., (5) i, p. 230 (1878); Hampson, Fauna Brit. Ind., Moths, ii, p. 16 (1892).

Appears to be generally distributed in Japan; and Alphéraky records it from Corea. *Orientalis*, Moore, is not worth retaining even as a varietal name. *Auripennis*, Butl., is a form with the secondaries yellow instead of scarlet. Some of the Japanese examples are exceptionally large.

Distribution. EUROPE.—AMURLAND; JAPAN; YESSO; COREA; HIMALAYAS.

518. *Arctia mirifica.*

Chelonia mirifica, Oberth., Etud. d'Entom., xvi, p. 8, pl. i, fig. 7 (1892).

I have two specimens from the high plateau to the north of Ta-chien-lu.

Habitat. WESTERN CHINA.

Genus THANATARCTIA.

Butler, Ann. and Mag. Nat. Hist. (4) xx, p. 395 (1877).

519. *Thanatarctia infernalis.*

Thanatarctia infernalis, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 395 (1877); Ill. Typ. Lep. Het., iii, p. 7, pl. xlii, fig. 9 (1879).

One male specimen from Nikko and one from Oiwake in Pryer's collection. I obtained one example of the same sex, and my collector another, at Hakodate in August.

Distribution. JAPAN; YESSO.

Genus ARCTINIA.

Eichwald, Zool. Spec., ii, p. 195 (1831).

520. *Arctinia cæsarea.*

Bombyx cæsarea, Goeze, Ent. Beytr., iii, (3) p. 63 (1781).
Bombyx luctifera, Esp., Schmett., iii, p. 222, pl. xliii, figs. 1–5 (1784).

Atolmis japonica, Walk., Cat. Lep. Het. Suppl., i, p. 223 (1864).
Arctinia cæsarea, Kirby, Cat. Lep. Het., i, p. 276 (1892).
Estigmene mœrens, Butl., Cist. Ent., iii, p. 114 (1885).

I took one example of the type form at Nagasaki in June, and there was one from Oiwake in Pryer's collection; there were also two specimens of *mœrens*, Butl., from Oiwake and Yokohama, in the same collection. In this form the yellow anal patch of secondaries is almost or quite absent, and the wings generally are more opaque; I have exactly similar specimens in my European series of the species.

Distribution. EUROPE.—AMURLAND; NORTH-EASTERN CHINA.

Genus OCNOGYNA.

Rambur, Cat. Lép. And., ii, p. 255 (1866).

521. *Ocnogyna y-albulum.*

Arctia y-albulum, Oberth., Etud. d'Entom., xi, p. 31, pl. v, fig. 29 (1886); Alphéraky, Rom. sur Lép., ix, p. 127 (1897).
Arctia y-albulum, var. *lugubris*, Oberth., *l. c.*
Apantesis y-albulum, Kirby, Cat. Lep. Het., i, p. 269 (1892).

Of the typical form I have received four male specimens and one female from Ta-chien-lu, two females from Moupin and one female from Pu-tsu-fong. Of var. *lugubris*, which has the secondaries entirely black, I have two male examples from Ta-chien-lu. Two other male specimens from the last-named locality, and one from Moupin have the ground colour of secondaries crimson instead of golden-yellow as in the type. I propose the name *rubida* for this form. Alphéraky records a female example from Tâ-Tsien-loû, which seems to be referable to var. *rubida*; he also notes a male, with orange-yellow secondaries, from Va-ssou-Kóou.

Habitat. WESTERN CHINA.

Genus PHRAGMATOBIA.

Stephens, Ill. Brit. Ent. Haust., ii, p. 73 (1828).

522. *Phragmatobia fuliginosa.*

Bombyx fuliginosa, Linn., Syst. Nat., i, p. 509 (1758).
Spilosoma fuliginosa, var. *pulverulenta*, Alph., Rom. sur Lép., v, p. 84 (1889).
Phragmatobia fuliginosa, Kirby, Cat. Lep. Het., i, p. 244 (1892).

Two examples of the form *borealis*, Staud., in Pryer's collection.

Distribution. EUROPE.—AMURLAND; JAPAN.

Genus ALPHÆA.

Walker, Cat. Lep. Het., iii, p. 683 (1855).

523. *Alphæa fulvohirta.*

Alphæa fulvohirta, Walk., Cat. Lep. Het., iii, p. 684 (1855); Butl., Ill. Typ. Lep. Het., v, p. 31, pl. lxxxv, fig. 8 (1881).

One specimen from Chia-kou-ho and one from Wa-shan, both taken in July.

Distribution. SIKHIM (*Hampson*); WESTERN CHINA.

524. *Alphæa lewisii.*

Seriarctia lewisii, Butl., Cist. Ent., iii, p. 115 (1885).

Eight specimens from Oiwake in Pryer's collection, two received from Mr. Manley of Yokohama; and one from Ta-chien-lu; the latter was taken in July.

Distribution. JAPAN; WESTERN CHINA.

Closely allied to *A. quadriramosa*, Koll., from the North-west Himalayas.

Genus AREAS.

Walker, Cat. Lep. Het., iii, p. 658 (1855).

525. *Areas galactina.*

Chelonia galactina, Hoev., Tijdschr. Nat. Gesch. Phys., vii, p. 280, pl. vi, figs. 5, 56 (1840).
Areas orientalis, Walk., Cat. Lep. Het., iii, p. 658 (1855).
Neumenes trigonalis, Voll., Tijd. v. Ent., vi, p. 140, pl. x, fig. 1 (1863).

Areas galactina, Hampson, Fauna Brit. Ind., Moths, ii, p. 25 (1894).

I received one female specimen from each of the following localities—Moupin, Omei-shan, Chia-kou-ho. They were all taken in June.

Distribution. HIMALAYAS; KHÁSIS; NÁGAS; WESTERN CHINA; BORNEO; JAVA.

Genus CREATONOTUS.

Hübn., Hampson, Fauna Brit. Ind., Moths, ii, p. 26 (1894).

526. *Creatonotus interruptus.*

Phalæna interrupta, Linn., Syst. Nat. Phal., i, v, p. 2553.
Creatonotus interruptus, Hampson, Fauna Brit. Ins., Moths, ii., p. 26 (1894).

Two specimens from Ichang, taken in August.

Distribution. Throughout INDIA, CEYLON, and BURMA (*Hampson*); CENTRAL CHINA.

527. *Creatonotus lactineus.*

Aloa lactinea, Cram., Pap. Exot., ii, p. 58, pl. cxxxiii, fig. D (1777).
Bombyx sanguinolenta, Fabr., Ent. Syst., iii, p. 473 (1793).
Aloa lactinea, Walk., Cat. Lep. Het., iii, p. 702.
Rhodogastria lactinea, Leech, Trans. Ent. Soc. Lond., 1889, p. 124.
Creatonotus lactineus, Hampson, Fauna Brit. Ind., Moths, ii, p. 27 (1894).

There were specimens from Yokohama and Oiwake in Pryer's collection, and I have received others from Ichang and Chia-ting-fu, the latter taken in July and August.

The species varies considerably in the maculation of secondaries.

Distribution. Throughout INDIA, CEYLON, and BURMA; JAVA (*Hampson*); JAPAN; NORTHERN, WESTERN, and CENTRAL CHINA.

Genus PHISSAMA.

Moore, Cat. Lep. E. I. C., p. 362 (1858).

528. *Phissama vacillans.*

Amphissa vacillans, Walk., Cat. Lep. Het., iii, p. 685 (1855).
Phissama vacillans, Butl., Ill. Typ. Lep. Het., iii, p. 5, pl. xlii, fig. 4 (1879).
Phissama transiens, Hampson, Fauna Brit. Ind., Moths, ii, p. 29 (1894).

One male specimen from Ichang, taken in August.

Rather smaller than examples in my collection from Kulu, and the primaries are a trifle paler in colour.

Distribution. India; Central China.

Genus Nicæa.

Nikæa, Moore, Lep. Atk., p. 11 (1879).
Nicæa, Hampson, Fauna Brit. Ind., Moths, ii, p. 30 (1894).

529. *Nicæa longipennis.*

Hypercompa longipennis, Walk., Cat. Lep. Het., ii, p. 655 (1855).
Nikæa longipennis, Butl., Ill. Typ. Lep. Het., v, p. 18, pl. lxxxii, fig. 7 (1880); Alph., Rom. sur Lép. ix, p. 128 (1897).
Nicæa longipennis, Hampson, Fauna Brit. Ind., Moths, ii, p. 30 (1894).

A long series received from Chang-yang, taken in June and July. I have also one or more specimens from each of the following localities—Ichang, September; Wa-ssu-kow and Omei-shan, June; Moupin, June and August; Wa-shan, July. Alphéraky records the species from Taï-Sian-Guan, province of Sé-Tchouen.

Distribution. Kumaun; Sikhim; Silhet (*Hampson*); Central and Western China.

Genus Camptoloma.

Felder, Reise Novara, Lep. iv, p. 2 (1875).

530. *Camptoloma interioratum.*

Numens interiorata, Walk., Cat. Lep. Het. Suppl., i, p. 290 (1864).

Camptoloma interioratum, Kirby, Cat. Lep. Het., i, p. 359 (1892); Hampson, Fauna Brit. Ind., Moths, ii, p. 31, (1894).

There was a very fine series from Yokohama in Pryer's collection. My collectors did not meet with the species in any part of China that they visited.

Distribution. EASTERN CHINA; JAPAN.

Genus CALPENIA.

Moore, Proc. Zool. Soc. Lond., 1872, p. 571.

531. *Calpenia zerenaria.*

Euprepia zerenaria, Oberth., Etud. d'Entom., xi, p. 30, pl. iii, fig. 17 (1886).

Callimorpha zerenaria, Kirby, Cat. Lep. Het., i, p. 912 1892).

I have two specimens from Chang-yang, four from Chia-kou-ho, one from Moupin, and one from Omei-shan. Occurs in June and July.

Variation is exhibited in the size and intensity of the black markings, and also in the tone of the yellow of secondaries.

Habitat. CENTRAL and WESTERN CHINA.

Genus CALLIMORPHA.

Fabr.; Hampson, Fauna Brit. Ind., Moths, ii, p. 34 (1894).

532. *Callimorpha principalis.*

Euprepia principalis, Koll., Hugel's Kasch., iv, (2) p. 465, pl. xx, fig. 2 (1844).

Hypercompa principalis, var. *regalis*, Leech, Trans. Ent. Soc. Lond., 1889, p. 125, pl. ix, fig. 4.

Callimorpha principalis, Kirby, Cat. Lep. Het., i, p. 255 (1892); Hampson, Fauna Brit. Ind., Moths, ii, p. 35 (1894).

Euprepia equitalis, Koll., Hugel's Kasch., p. 465, (2) pl. xx, fig. 3 (1848).

Callimorpha equitalis, Hampson, Fauna Brit. Ind., Moths, ii, p. 36 (1894).

Callimorpha equitalis, var. *ochricolor*, Alph., Rom. sur Lép., ix, p. 128 (1897).

The typical form of this species does not appear to occur in China, but it is represented in the Central and Western parts of the country by var. *regalis*. Var. *equitalis* is common throughout the same area, and there are all intergrades between this form and that which I have described as *regalis*. One example taken at Wa-ssu-kow seems to agree with the description of *nyctemerata*, Moore, from Sikhim.

Var. *ochricolor*, Alph., which has the secondaries yellowish-ochre in colour, is described from the Kham mountains.

Distribution. Himalayas; Khásis; Burma; Central and Western China.

533. *Callimorpha nepos*, sp. n.

Head yellow, palpi marked with black, a black spot on the frons and two at the back of the head; collar black edged with yellow; thorax yellow, the prothorax and tegulæ marked with black; abdomen yellow with dorsal and lateral series of black spots, those of dorsal series large.

Primaries blackish, with white markings placed as follows—three small spots between the cell and the costa; a blotch from the yellowish base to vein 2, this is widest towards the base and is only separated from an oblong spot in the cell by the median nervure; a large round spot at end of the cell with a dot above it; a transverse series of seven large spots, the fifth oblong and extending almost to the outer margin; a submarginal series of four small spots, one in each interspace above the oblong spot of median series, and a large one below it which extends to the outer margin and is intersected by vein 2; the inner margin is narrowly white. Secondaries white, with much interrupted, macular, median, and submarginal black bands, the first composed of four small spots and the latter of four larger spots; there are some black dots at the ends of the veins before the white fringes. Undersurface as above.

Expanse 72 millim.

One male specimen from Chia-ting-fu, taken in June or July.

Habitat. Western China.

Allied to *C. nyctemerata*, Moore, and *C. equitalis*, Koll., from each of which, however, it may be distinguished by the different arrangement of the four apical spots, the large spot above the outer angle, and the elongate double spot at base of the primaries.

534. *Callimorpha histrio.*

Hypercompa histrio, Walk., Cat. Lep. Het., iii, p. 654 (1855); Fixsen, Rom. sur Lép., iii, p. 333, pl. xv, 2 (1887); Alph., Rom. sur Lép., ix, p. 129 (1897).
Callimorpha histrio, Kirby, Cat. Lep. Het., i, p. 256 (1892).

I took specimens at Ningpo in April, and two at Gensan in July; I have also received examples from Moupin, Omei-shan, Chia-ting-fu, and the province of Kwei-chow; all the latter were obtained in June and July.

In the Ningpo and Gensan specimens the spots on primaries are rather larger, and those on outer area more or less confluent.

Alphéraky records a specimen, taken in September, from Tâ-choui-van, province of Sé-Tchouen.

Distribution. NORTH-EASTERN and WESTERN CHINA; COREA.

535. *Callimorpha (?) miranda.*

Chelonia miranda, Oberth., Etud. d'Entom., xix, p. 33, pl. vi, fig. 50 (1894).

Described by Oberthür from a male specimen obtained in June at Moenia (Thibet); my collectors do not appear to have met with the species in any part of Western China that they visited.

Habitat. THIBET.

Genus PELOCHYTA.

Hübn., Hampson, Fauna Brit. Ind., Moths, ii, p. 38 (1894).

536. *Pelochyta astrea.*

Sphinx astreus, Drury, Ins., ii, pl. xxviii, fig. 4 (1773).
Rhodogastria astræa, Moore, Lep. Ceyl., ii, p. 76, pl. cviii, figs. 1, 1a (1882).
Pelochyta astrea, Hampson, Fauna Brit. Ind., Moths, ii, p. 38 (1894).

One example from Chia-kou-ho, taken in June, and one from Ta-chien-lu, taken in July.

Distribution. FORMOSA; throughout INDIA, CEYLON, and BURMA (*Hampson*); WESTERN CHINA.

Genus CALLARCTIA, nov.

Palpi porrect, hairy, third joint minute. Antennæ fully ciliated. Proboscis of moderate length. Primaries rather long and narrow; veins 3 and 4 from lower angle of cell, 5 from above angle or sometimes from middle of the discocellulars; 6, 7, 8, 9, and 10 stalked. Secondaries with veins 3 and 4, also 6 and 7 stalked. Hind tibiæ with two pairs of spurs, the terminal pair short.

In the female vein 3 of primaries is from angle of cell, and 4 and 5 from just above angle.

Type, *C. bieti*, Oberthür.

537. *Callarctia bieti.*

Chelonia bieti, Oberth., Bull. Soc. Ent. Fr., (6) iii, p. xliii, (1883); Etud. d'Entom., ix, p. 20, pl. ii, fig. 11 (1884).

Arctia bieti, Kirby, Cat. Lep. Het., i, p. 260 (1892).

I have twenty-five examples from the following localities —Ta-chien-lu, Omei-shan, Wa-shan, Pu-tsu-fong, and Wa-ssu-kow.

Some of the specimens have very pale yellow secondaries and are referable to var. *sulphurea*, Oberth., but none of them seem to quite agree with var. *albescens* of the same author. In some specimens the costal band of primaries is quite separate from the oblique band beyond, and the subapical is almost round. On the secondaries the discal spot is not always present, and there is considerable aberration from the type, as figured, in the black marking of outer margin. In one example from Pu-tsu-fong the secondaries are devoid of marking, whilst another from Wa-ssu-kow has an almost uninterrupted black outer marginal border and an irregular central band of the same colour.

Habitat. WESTERN CHINA.

538. *Callarctia pratti.*

Chelonia bieti, var. *pratti*, Leech, Entom., xxiii, p. 111 (1890).

I find that this insect, which I formerly considered to be a form of *C. bieti*, differs in some slight structural details from that species. In both sexes vein 6 of primaries is not stalked with 7, 8, 9, and 10, but has independent

origin at the upper angle of cell, whilst in the female veins 3 and 4 are not stalked.

The original comparative description was made from three Chang-yang female examples taken in June; I have since received two male specimens from Chia-kou-ho, where they were obtained in July.

The male differs from the female in having the costal band of primaries narrow, and the oblique band represented only by a more or less oval spot before inner angle.

Habitat. CENTRAL and WESTERN CHINA.

Subfamily *LITHOSIINÆ.*

Genus ELIGMA.

Hübn.; Hampson, Fauna Brit. Ind., Moths, ii, p. 43 (1894).

539. *Eligma narcissus.*

Bombyx narcissus, Cram., Pap. Exot., i, pl. lxxiii, figs. E, F (1775).

Eligma narcissus, Leech, Trans. Ent. Soc. Lond., 1889, p. 127; Hampson, Fauna Brit. Ind., Moths, ii, p. 43 (1894).

Specimens were received from Moupin, Omei-shan, Chia-kou-ho, Wa-shan, Ichang, and Chang-yang. The species occurs in July and August.

Kirby (Cat. Lep. Het., i, p. 383) refers this species to the *Hypsidæ.*

Distribution. GANJAM; S. INDIA; CEYLON; PENANG; JAVA (*Hampson*); WESTERN and CENTRAL CHINA.

Genus NYCTEMERA.

Hübn.; Hampson, Fauna Brit. Ind., Moths, ii, p. 46 (1894).

540. *Nyctemera plagifera.*

Nyctemera plagifera, Walk., Cat. Lep. Het., ii, p. 400 (1854); Hampson, Fauna Brit. Ind., Moths, ii, p. 47 (1894).

Trypheromera plagifera, Butl., Ill. Typ. Lep. Het., v, p. 45, pl. lxxxviii, fig. 3 (1881); Kirby, Cat. Lep. Het., i, p. 423 (1892).

Occurs in July at Wa-shan, Huang-mu-chang, Chia-

kou-ho, Chia-ting-fu, and Omei-shan; also in the province of Kwei-chow, and at Kiukiang. There were specimens from Loochoo in Pryer's collection.

Distribution. Throughout INDIA (*Hampson*); CENTRAL and WESTERN CHINA; LOOCHOO.

541. *Nyctemera* (?) *trigona*, sp. n.

Primaries yellow, streaked with blackish along costal and inner marginal areas, the costal streak has a spot-like projection before apex; there is a triangular blackish spot on outer margin connected with the broad apical extremity of the costal streak by a narrow line of the same colour; a large triangular, blackish spot on the disc has its base on a level with the inner margin. Secondaries orange, with three blackish streaks from the base, and a series of large blackish spots on the outer margin; the two upper streaks extend only to the median area of the wing, but the lower one unites with the last spot of outer marginal series. Head and thorax black marked with yellow; abdomen black with the segmental divisions and hairs at anal extremity yellow.

Expanse 36 millim.

Var. *nigra*. Markings of primaries fuliginous black and wider than in the type, especially the triangular mark on central area, which becomes cuneiform in shape; secondaries entirely fuliginous black.

Sixteen examples of the typical form and five of the variety were received from the high plateau to the north of Ta-chien-lu. All are males.

Habitat. WESTERN CHINA.

Genus DEIOPEIA.

Steph.; Hampson, Fauna Brit. Ind., Moths, ii, p. 54 (1894).

542. *Deiopeia pulchella*.

Tinea pulchella, Linn., Syst. Nat., i, 2, p. 884 (1767).
Utetheisa pulchella, Kirby, Cat. Lep. Het., i, p. 346 (1892).
Deiopeia pulchella, Hampson, Fauna Brit. Ind., Moths, ii, p. 55 (1894).

There were four specimens in Pryer's collection, two of which are from Loochoo. My native collector obtained a male in the Island of Kiushiu which measures only 25 millim. in expanse.

I have seven examples from Wa-shan, one from Ni-tou, and one from Pu-tsu-fong, all taken in July.

Distribution. Throughout INDIA and CEYLON; PHILIPPINES; MALAY ARCHIPELAGO; NEW GUINEA; AUSTRALIA and the PACIFIC GROUPS (*Hampson*); EUROPE; ASIA MINOR; AFRICA; JAPAN; WESTERN CHINA.

Genus BIZONE.

Bizone, Walk., Cat. Lep. Het., ii, p. 548 (1854).
Cyana, Hampson, Fauna Brit. Ind., Moths, ii, p. 56 (1894).

543. *Bizone hamata.*

Bizone hamata, Walk., Cat. Lep. Het., ii, p. 549 (1854); Elwes, Proc. Zool. Soc. Lond., 1890, p. 391.
Bizone puella, Fixsen (*nec* Drury), Rom. sur Lép., iii, p. 332 (1887).

The specimens in Pryer's collection were from Yokohama, Oiwake, and Yesso; a native collector obtained the species at Gensan and in the island of Kiushiu, and my collectors in China sent examples from Kiukiang, Chang-yang, Ichang, Wa-shan, Chow-pin-sa, Chia-kou-ho, Moupin, and the province of Kwei-chow. Occurs in May, June, and July.

Distribution. JAPAN; YESSO; KIUSHIU; COREA; NORTH-EASTERN, CENTRAL and WESTERN CHINA.

544. *Bizone sanguinea.*

Calligenia sanguinea, Brem. and Grey, Motsch. Etud. Ent., i, p. 63 (1852); Schmett. nörd. China, p. 14 (1853).
Bizone sanguinea, Kirby, Cat. Lep. Het., i, p. 302 (1892).

I am not able to identify this species from the description; the specimens I referred to *B. sanguinea* in a former paper (Trans. Ent. Soc. Lond., 1889, p. 126) are examples of *B. cruenta.*

Habitat. NORTH CHINA.

545. *Bizone cruenta.*

Bizone cruenta, Leech, Entom., xxiii, p. 49 (1890).
Bizone dubenskii, Alph., Rom. sur Lép., vi, p. 11, pl. i, fig. 5 (1892); *op. cit.*, ix, pp. 129, 130 (1897).

A long series from Chang-yang and another from Moupin. I have also received the species from Ichang, Wa-shan, Ni-tou, Chia-ting-fu, Chia-kou-ho, Chow-pin-sa, and Wa-ssu-kow. Occurs in May, June, July, and August, but the majority of my examples were obtained in May and June. Alphéraky describes this species from specimens taken in July near the river Heï-hò.

In most of the specimens from Western China the colour of the secondaries and of the markings of the primaries is less vivid than those from Central China.

Habitat. Central and Western China.

546. *Bizone fasciola.*

Bizone fasciola, Leech, MS.; Elwes, Proc. Zool. Soc. Lond., 1890, p. 391.

A fine series from Ichang and Chang-yang; the specimens were taken in June and July. I have also received one example from Wa-shan.

Habitat. Central and Western China.

547. *Bizone unipunctata.*

Bizone unipunctata, Leech, MS.; Elwes, Proc. Zool. Soc. Lond., 1890, p. 392.

One male specimen and two females taken by myself in Satsuma in May, 1886; two males and four females from the Loochoo islands in Pryer's collection.

One of the females from Satsuma has yellow bands on primaries.

Distribution. Kiushiu; Loochoo Islands.

548. *Bizone adita.*

Bizone adita, Moore, Lep. E. I. Co., ii, p. 306, pl. viia, fig. 11 (1858).
Bizone bifasciata, Pouj., Bull. Soc. Ent. Fr., (6) vi, p. cxxiv, (1886).

Poujade's type, a female, was from Moupin, and I have one example of the same sex from that locality.

In his paper (Proc. Zool. Soc. Lond., 1890, pp. 378–400), Mr. Elwes does not mention *bifasciata*, Poujade, but the insect he figures as *B. signa* ♀ ? var. (Plate xxxii, fig. 7) may be referable to it.

Hampson (*l.c.*) includes *adita*, Moore, under *B. signa*, Walk.

Distribution. HIMALAYAS; WESTERN CHINA.

549. *Bizone ariadne.*

Bizone ariadne, Leech, MS.; Elwes, Proc. Zool. Soc. Lond., 1890, p. 394.

Seven male specimens and one female from Chang-yang taken in June, and one female from Chia-ting-fu.

Habitat. CENTRAL and WESTERN CHINA.

550. *Bizone pratti.*

Bizone pratti, Elwes, Proc. Zool. Soc. Lond., 1890, p. 394.

A fine series, mostly male specimens, from Chang-yang and Ichang. Occurs in June and July.

Habitat. CENTRAL CHINA.

551. *Bizone interrogationis.*

Bizone interrogationis, Pouj., Bull. Soc. Ent. Fr., (6) vi, p. cxxv, (1886).

Occurs at Kiukiang, Chang-yang, Moupin, and Ni-tou in June and July; I have specimens from each of these localities and also from Ningpo.

Mr. Elwes does not mention this species in his paper previously referred to.

Habitat. CENTRAL, WESTERN, and NORTHERN CHINA.

552. *Bizone sikkimensis.*

Bizone sikkimensis, Elwes, Proc. Zool. Soc. Lond., 1890, p. 395, pl. xxxii, fig. 6 ♂, 5 ♀; Hampson, Fauna Brit. Ind., Moths, ii, p. 59 (1894).

One example of each sex from Pu-tsu-fong, taken in June or July.

Distribution. SIKHIM (*Hampson*); WESTERN CHINA.

553. *Bizone phædra.*

Bizone phædra, Leech, Trans. Ent. Soc. Lond., 1889, p. 126, pl. ix, fig. 6.

The type, a female, was from Kiukiang; I have since received specimens from Chang-yang, Chow-pin-sa, Ta-chien-lu, and Wa-ssu-kow.

I have also received a long series of specimens from Moupin which differ from the typical form in having the bands of primaries and the coloration of secondaries dull orange varying to lemon-yellow. For this local race I propose the varietal name *moupinensis.*

This species in the typical form varies greatly in the width of the transverse bands on primaries; in one example nearly the whole of the wing is suffused with pink.

Habitat. CENTRAL and WESTERN CHINA.

554. *Bizone alba.*

Bizone alba, Moore, Proc. Zool. Soc. Lond., 1878, p. 28.

Described from "North China." My collectors did not obtain the species in any part of China that they explored.

Genus MACRONOLA.

Kirby, Cat. Lep. Het., i, p. 299 (1892).

555. *Macronola decipiens.*

Cyana decipiens, Butl., Ann. and Mag. Nat. Hist., (5), iv, p. 352 (1879).

Macronola decipiens, Kirby, Cat. Lep. Het., i, p. 300 (1892).

Described from Japan. There were no specimens of the species in Pryer's collection, and I did not meet with it in any part of Japan that I visited.

Habitat. JAPAN.

Genus KERALA.

Moore, Proc. Zool. Soc., 1881, p. 329 (1894).

556. *Kerala macroptera.*

Leptina macroptera, Oberth., Etud. d'Entom., v, p. 68, pl. vii, fig. 2 (1880).
Kerala macroptera, Alph., Rom. sur Lép., vi, p. 18 (1892).

Alphéraky records one example of this species from the province of Sé-Tchouen. Taken in August.

Distribution. AMURLAND; ASKOLD; WESTERN CHINA.

Genus MELANÆMA.

Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 397 (1877).

557. *Melanæma venata*

Melanæma venata, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 397 (1877); Ill. Typ. Lep. Het., ii, p. 6, pl. xxii, fig. 5 (1878).

There were specimens from Oiwake and Yokohama in Pryer's collection, and I have received others taken in the latter locality from Mr. Manley. The species is recorded from several places in Amurland.

Distribution. JAPAN; AMURLAND.

Genus AGRISIUS.

Walk., Cat. Lep. Het., iii, p, 723 (1855).

558. *Agrisius guttivitta.*

Agrisius guttivitta, Walk., Cat. Lep. Het., iii, p. 723 (1855); Butl., Ill. Typ. Lep. Het., v, p. 40, pl. lxxxvii, fig. 2 (1881).

Appears to be fairly common at Chang-yang in July. I have also received specimens from Moupin, Wa-shan, Ni-tou, and Chia-ting-fu.

Distribution. SIKHIM (*Hampson*); CENTRAL and WESTERN CHINA.

559. *Agrisius fuliginosus.*

Agrisius fuliginosus, Moore, Proc. Zool. Soc. Lond., 1872, p. 571, pl. xxxiii, fig. 3; Hampson, Fauna Brit. Ind., Moths, ii, p. 65 (1894).
Agrisius japonicus, Leech, Proc. Zool. Soc. Lond., 1888, p. 598, pl. xxx, fig. 10.

One specimen from Satsuma, taken in May, and one from the province of Kwei-chow, captured in June or July.

Distribution. "INDIA" (*Hampson*); JAPAN; WESTERN CHINA.

Genus MACROBROCHIS.

Herr-Schäff.; Hampson, Fauna Brit. Ind., Moths, ii, p. 66 (1894).

560. *Macrobrochis prasena.*

Tripura prasena, Moore, Cat. Lep., E.I.Co., p. 299, pl. viia, fig. 6 (1859).
Macrobrochis prasena, Hampson, Fauna Brit. Ind., Moths, ii, p. 66 (1894).

One male specimen from Ta-chien-lu, taken in July.

Distribution. DALHOUSIE; DHARMSÁLA; SIKHIM; NÁGA HILLS (*Hampson*); WESTERN CHINA.

Genus SIDYMA.

Walker; Hampson, Fauna Brit. Ind., Moths, ii, p. 67 (1894).

561. *Sidyma remelana.*

Lithosia remelana, Moore, Proc. Zool. Soc. Lond., 1865, p. 798.
Crambomorpha remelana, Butl., Trans. Ent. Soc. Lond., 1877, p. 357.
Vamuna remelana, Moore, Proc. Zool. Soc. Lond., 1878, p. 10.
Gnophria quadrimaculata, Möschler, Stett. Ent. Zeit., 1872, p. 352.
Sidyma remelana, Hampson, Fauna Brit. Ind., Moths, ii, p. 68 (1894).

One example taken in June or July at Chia-ting-fu.

Distribution. SIKHIM; KHÁSIS (*Hampson*); WESTERN CHINA.

Genus PARAONA.

Moore, Proc. Zool. Soc. Lond., 1878, p. 8.

562. *Paraona staudingeri.*

Paraona staudingeri, Alph., Rom. sur Lép., ix, p. 168, pl. xii, fig. 8 ♀ (1897).

I have one male specimen from Omei-shan which was taken in June or July. Alphéraky's types, two females, were from Corea.

The collar is deeper yellow, and my example does not exhibit any trace of the transverse pale line indicated in the figure of the type.

Distribution. Corea; Western China.

Genus Gnophria.

Steph.; Hampson, Fauna Brit. Ind., Moths, ii, p. 69 (1884).

563. *Gnophria collitoides.*

Ghoria collitoides, Butl., Cist. Ent., iii, p. 115 (1885).

There was a series of specimens from Oiwake and Nikko in Pryer's collection. This species is very close to "*Lithosia*" *gigantea*, Oberth., but may be distinguished by the frons, which is black instead of yellow, and the costal stripe is not continued to apex.

Habitat. Japan.

564. *Gnophria sericeipennis.*

Ghoria sericeipennis, Moore, Proc. Zool. Soc. Lond., 1878, p. 13.

Gnophria sericeipennis, Hampson, Fauna Brit. Ind., Moths, ii, p. 69 (1894).

One male from Chang-yang, and one example of each sex from Pu-tsu-fong, taken in July.

Distribution. Sikhim (*Hampson*); Central and Western China.

565. *Gnophria albocinerea.*

Ghoria albocinerea, Moore, Proc. Zool. Soc. Lond., 1878, p. 13, pl. i, fig. 10.

Gnophria albocinerea, Hampson, Fauna Brit. Ind., Moths, ii, p. 70 (1894).

One example of each sex from Pu-tsu-fong, taken in June or July.

Distribution. Sikhim (*Hampson*); Western China.

566. *Gnophria vittata*, sp. n.

Head and collar orange; thorax black, tegulæ yellow; abdomen colour of secondaries, but darker towards the anal extremity, and also beneath. Primaries black, costa and inner margin narrowly yellow; there is a paler yellow stripe from the base of the wing to middle of the outer margin; fringes blackish to just below stripe, remainder yellowish. Secondaries pale ochreous tinged with fuscous. Under surface ochreous tinged with fuscous, the primaries clouded with blackish.

Expanse 44 millim.

Two male specimens from Ni-tou, and one from Omei-shan, taken in July.

Habitat. Western China.

567. *Gnophria* (?) *sinensis*, sp. n.

Primaries pale brown with a black dot on the middle of submedian nervure, and a dusky one in the cell. Secondaries creamy whitish. Under surface as above, but the discal area of the primaries is suffused with fuscous, and the costa of secondaries is pale ochreous. Antennæ with short cilia and bristles. Head and thorax colour of primaries; abdomen whitish.

Expanse 34 millim.

One male specimen from Chia-kou-ho, taken in July.

Habitat. Western China.

Genus Œonistis.

Hübner, Verz., p. 165 (1818).

568. *Œonistis quadra.*

Noctua quadra, Linn., Syst. Nat., i, p. 511 (1758).
Bombyx quadra, Hübn., Bomb., figs. 101, 102 (1800).
Œonistis dives, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 398 (1877); Ill. Typ. Lep. Het., ii, p. 7, pl. xxii, fig. 11 (1878).
Œonistis quadra, Leech, Proc. Zool. Soc. Lond., 1888, p. 598; Hampson, Fauna Brit. Ind., Moths, ii, p. 73 (1894).

Some Japanese male specimens are rather darker than European examples, and some of the females are brighter yellow; but otherwise there is no important difference

between the individuals from each region. One female specimen in Pryer's collection is without the usual black spots on primaries, and I have seen similar varieties of the species in English collections.

Distribution. EUROPE.—AMURLAND; COREA; JAPAN; SIKHIM.

569. *Œonistis nigricosta.*

Œonistis nigricosta, Leech, Proc. Zool. Soc. Lond., 1888 p. 598, pl. xxx, fig. 11.

The specimen described was in Pryer's collection, but the exact locality where it was taken was not indicated.

Habitat. JAPAN.

570. *Œonistis subnigra*, sp. n.

Primaries pale stramineous, with two black spots similar to those of female *Œ. quadra*, Linn., but the lower one is not well defined. Secondaries paler. Under surface coloured as above, but the basal area of primaries is black.

Expanse 34 millim.

One male specimen from Wa-shan, taken in July.

Habitat. WESTERN CHINA.

Genus THYSANOPTYX.

Hampson, Fauna Brit. Ind., Moths, ii, p. 74 (1894).

571. *Thysanoptyx tetragona.*

Lithosia tetragona, Walk., Cat. Lep. Het., ii, p. 510 (1854).
Teulisna tetragona, Butl., Trans. Ent. Soc. Lond., 1877, p. 355; Ill. Typ. Lep. Het., v, p. 39, pl. lxxxvi, fig. 14 (1881).
Thysanoptyx tetragona, Hampson, Fauna Brit. Ind., Moths, ii, p. 75 (1894).

A male specimen from Wa-shan and one from Chia-ting-fu, both taken in July.

Distribution. SIKHIM; SILHET; NÁGAS; NILGIRIS; BORNEO (*Hampson*); WESTERN CHINA.

572. *Thysanoptyx signata.*

Lithosia signata, Walk., Cat. Lep. Het., ii, p. 495 (1854).
Teulisna signata, Kirby, Cat. Lep. Het., p. 317 (1892).

Thisanoptyx brevimacula, Alph., Rom. sur Lép., ix, p. 130, pl. xiii, fig. 5 ♀ (1897).

Occurs at Moupin, Omei-shan, Chia-kou-ho and Chang-yang, in June. *Brevimacula*, Alph., described from a female specimen taken at Ta-choui-van, is a form of *T. signata*, Walk., in which, judging from the figure, the abdominal area of the secondaries is paler than the outer area. Two of my specimens from Chang-yang have the lower spot on primaries elongated, and in one example from Moupin the upper or costal spot is absent from left primary, and very small on the right primary.

Distribution. Eastern, Western and Central China.

573. *Thysanoptyx directa*, sp. n.

Primaries greyish stramineous, with a black spot on the costa beyond the middle, and an upright, elongated mark of the same colour on the inner margin. Secondaries rather yellower. Under surface yellower than above, the discal area of primaries suffused with blackish. Head stramineous; thorax and abdomen colour of primaries, but the terminal segments of the latter are yellowish and the thorax is marked with blackish.

Expanse 38 millim.

Two female specimens from Chang-yang, taken in June.

Habitat. Central China.

Allied to *T. signata*, Walk., but the mark on the inner margin of primaries is narrower, and is placed more directly under the costal spot.

Genus Prabhasa.

Moore, Proc. Zool. Soc. Lond., 1878, p. 25.

574. *Prabhasa costalis.*

Prabhasa costalis, Moore, Proc. Zool. Soc. Lond., 1878, p. 26.

Moore described this species from North China. I have one specimen from Moupin.

Habitat. Northern and Western China.

Genus Lithosia.

Fabr.; Hampson, Fauna Brit. Ind., Moths, ii, p. 79 (1894).

575. *Lithosia griseola.*

Bombyx griseola, Hübn., Bomb., pl. xxiii, fig. 97 (1800).
Lithosia adaucta, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 398 (1877); Ill. Typ. Lep. Het., ii, p. 6, pl. xxiii, fig. 6 (1878).
Lithosia ægrota, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 397 (1877).
Collita ægrota, Butl., Ill. Typ. Lep. Het., iii, pl. xlii, fig. 13, (1879).
Lithosia griseola, Leech, Proc. Zool. Soc. Lond., 1888, p. 599; Hampson, Fauna Brit. Ind., Moths, ii, p. 80 (1894).
Lithosia griseola, var. *amurensis*, Staud., Rom. sur Lép., vi, p. 268 (1892).

This very variable species occurs at Nikko, Oiwake, Hakone, Hakodate, Tsuruga, Gensan, Chang-yang, Moupin, Chia-ting-fu, Chia-kou-ho, and Wa-ssu-kow. Staudinger describes a form from Amurland under the name *amurensis*, and two of my examples from Japan seem to agree with this description. The descriptions of *adaucta* and *ægrota* apply rather to individual specimens than to constant forms.

Distribution. EUROPE.—AMURLAND; JAPAN; YESSO; COREA; CENTRAL and WESTERN CHINA; NEPAL; SIKHIM.

[*Lithosia caniola*, Hübn. Felder (Wien. ent. Mon., vi, p. 36) records this species from Ningpo. I have not seen *L. caniola* from any part of Eastern Asia, and am inclined to suppose that the specimen referred to this species by Felder is probably a form of *L. griseola*.]

576. *Lithosia cinerea.*

Lithosia cinerea, Pouj., Bull. Soc. Ent. Fr. (6), vi, p. cl. (1886).

I have a long series from Pu-tsu-fong and Ni-tou, but no variation is exhibited. The type was from Moupin.

Habitat. WESTERN CHINA.

577. *Lithosia vetusta.*

Lithosia vetusta, Walk., Cat. Lep. Het., ii, p. 506 (1854).

I have one example from Hakone and one from Gensan. The type was from Shanghai.

Distribution. EASTERN CHINA; COREA; JAPAN.

578. *Lithosia lenta.*

Lithosia lenta, Leech, Entom., xxiii, p. 81 (1890).

The type, a male, was taken in July at Ichang, and I received another male from Chang-yang, captured in June.

Habitat. CENTRAL CHINA.

579. *Lithosia coreana.*

Lithosia coreana, Leech, Proc. Zool. Soc. Lond., 1888, p. 600, pl. xxx, fig. 13.

The type from Gensan, taken in June. I have five specimens from Kiukiang and one from Ichang, taken in June and July.

Distribution. COREA; CENTRAL CHINA.

580. *Lithosia affineola.*

Lithosia affineola, Brem., Lep. Ost-Sib., p. 97, pl. viii, fig. 5 (1864).

Occurs at Hakodate, Kiushiu, Gensan, Chang-yang, Ichang, Moupin, and Chia-ting-fu in June and July.

Distribution. AMURLAND; JAPAN; KIUSHIU; COREA; CENTRAL and WESTERN CHINA.

581. *Lithosia japonica.*

Lithosia japonica, Leech, Proc. Zool. Soc. Lond., 1888, p. 600, pl. xxx, fig, 12.

Two specimens in Pryer's collection.

This species is closely allied to *L. depressa*, Esp., but may be distinguished therefrom by the dark secondaries.

Habitat. JAPAN.

582. *Lithosia debilis.*

Lithosia debilis, Staud., Rom. sur Lép., iii, p. 190, pl. x, fig. 12 (1887); Fixsen, op. cit., p. 331.

Described from Kultuk (Government of Irkutsk).

A nice series in Pryer's collection, comprising specimens from Yokohama, Oiwake, and Nikko. I have one ex-

ample from Gensan which seems to be referable to this species; Fixsen records specimens from Corea.

Some of the Japanese specimens only measure 22 millim. in expanse.

Distribution. CENTRAL SIBERIA; AMURLAND; COREA; JAPAN.

583. *Lithosia fumidisca.*

Lithosia fumidisca, Hampson, Fauna Brit. Ind., Moths, ii, p. 80 (1894).

I am informed by Sir George Hampson that this species has been received from Shanghai by M. l'Abbé J. de Joannis.

Distribution. SIKHIM; TENASSERIM; EASTERN CHINA (*Hampson*).

584. *Lithosia pavescens.*

Lithosia pavescens, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 398 (1877); Ill. Typ. Lep. Het., ii, pl. xxiii, fig. 5 (1878).

Lithosia lævis, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 398 (1877); Ill. Typ. Lep. Het., ii, pl. xxii, fig. 12 (1878).

Specimens in Pryer's collection from Yesso, Oiwake and Yokohama. I received one example from Chang-yang, captured in June.

This species is closely allied to *L. helveola,* Ochs. ? = *L. deplana,* Esp.

Hampson (Fauna Brit. Ind., Moths, ii, p. 84) gives *L. lævis,* Butl., as a synonym of *L. nigrifrons,* Moore.

Distribution. JAPAN; YESSO; CENTRAL CHINA.

585. *Lithosia suffusa,* sp. n.

Primaries stramineous, suffused with purplish grey on the basal three-fourths; the basal third of costa is yellowish. Secondaries stramineous. Under surface as above, but the suffusion on the primaries is blackish. Head, thorax, and terminal segments of abdomen yellowish, other portion of abdomen stramineous tinged with fuscous.

Expanse 48 millim.

Four male specimens from the north of Ta-chien-lu.

Habitat. WESTERN CHINA.

586. *Lithosia moorei.*

Katha moorei, Leech, Entom., xxiii, p. 81 (1890).
Pelosia moorei, Kirby, Cat. Lep. Het., i, p. 329 (1892).

The type of this species was from Chang-yang. I have also a specimen taken at Ningpo in July and examples from Moupin, Omei-shan, and Chia-ting-fu.

Distribution. Eastern, Central, and Western China.

587. *Lithosia immaculata.*

Katha immaculata, Butl., Proc. Zool. Soc. Lond., 1880, p. 671.
Pelosia immaculata, Kirby, Cat. Lep. Het., i, p. 329 (1892).

There were specimens in Pryer's collection, probably from Yokohama; I obtained the species at Nagasaki in June and at Gensan in July.

Distribution. Japan; Kiushiu; Corea.

588. *Lithosia aprica.*

Katha aprica, Butl., Cist. Ent., iii, p. 115 (1885).
Pelosia aprica, Kirby, Cat. Lep. Het., i, p. 329 (1892).
Lithosia aprica, Leech, Proc. Zool. Soc. Lond., 1888, p. 599.

Occurs at Ohoyama and Yesso, and in the Loochoo Islands.

Distribution. Yesso; Japan; Loochoo.

589. *Lithosia præcipua.*

Lithosia præcipua, Walk., Cat. Lep. Het., ii, p. 229 (1864).
Pelosia præcipua, Kirby, Cat. Lep. Het., i, p. 329 (1892).

Described from North China. I have specimens from Chang-yang, Ichang, and the province of Kwei-chow. June and July.

Distribution. North, Central, and Western China.

590. *Lithosia nigripoda.*

Lithosia nigripoda, Brem. and Grey, Motsch. Etud. Ent., i, p. 63 (1852); Schmett. nörd. China, p. 14 (1853).
Pelosia nigripoda, Kirby, Cat. Lep. Het., i, p. 329 (1892).

Described from North China. I am not acquainted with this species.

591. *Lithosia palliatella.*

Lithosia unita, Hübn., var. *aridcola*, Herr.-Schäff., Fixsen, Rom. sur Lép., iii, p. 331 (1887).

Fixsen records the above form of *L. unita* from Corea. I have not seen an example of *Lithosia* from any part of the region here treated that I could refer to *L. palliatella*, Scop. = *unita*, Hübn.

Distribution. EUROPE.—? COREA.

592. *Lithosia cribrata.*

Lithosia cribrata, Staud., Rom. sur Lép., iii, p. 189, pl. x, fig. 11 (1887).
Pelosia cribrata, Kirby, Cat. Lep. Het., i, p. 328 (1892).
Dolgoma cribrata, Kirby, *l. c.*, p. 332.

One specimen from Nikko in Pryer's collection; I received one from Kiushiu and two from Chang-yang. Staudinger's type was from the isle of Askold.

Distribution. AMURLAND; JAPAN; KIUSHIU; CENTRAL CHINA.

593. *Lithosia costipuncta.*

Lithosia costipuncta, Leech, Entom., xxiii, p. 82 (1890).

One male specimen taken in June at Chang-yang.

Habitat. CENTRAL CHINA.

594. *Lithosia alba.*

Lithosia alba, Moore, Ann. and Mag. Nat. Hist., (4) xx, p. 87 (1877).
Tarika alba, Kirby, Cat. Lep. Het., i, p. 322 (1892).
Systropha nivosa, Butl., Ann. and Mag. Nat. Hist., (5) iv., p. 353 (1879).

The type of *alba*, Moore, was from Shanghai, and that of *nivosa*, Butl. from Yokohama. There were specimens in Pryer's collection.

Distribution. EASTERN CHINA; JAPAN.

595. *Lithosia insolita.*

Lithosia insolita, Walk., Cat. Lep. Het., ii, p. 497 (1854).
Capissa insolita, Kirby, Cat. Lep. Het., i, p. 331 (1892).

Described from Shanghai. I am unable to identify this with any species that I have from China.

Habitat. EASTERN CHINA.

Genus Teulisna.

Walk.; Hampson, Fauna Brit. Ind., Moths, ii, p. 86 (1894).

596. *Teulisna fimbriata.*

Tegulata fimbriata, Leech, Entom., xviii, p. 81 (1890).

The type was from Chang-yang, taken in July.
Habitat. Central China.

Genus Samera.

Wallengren, Wien. Ent. Mon., vii, pp. 146, 147 (1863).

597. *Samera muscerda.*

Phalæna muscerda, Hufn., Berl. Mag., iii, (4) p. 400 (1767).
Samera muscerda, Kirby, Cat. Lep. Het., i, p. 321 (1892).

Specimens from Yesso and Oiwake in Pryer's collection. I met with the species at Gensan.
Distribution. Europe.—Amurland; Japan; Yesso; Corea.

598. *Samera obtusa.*

Paidia obtusa, Herr.-Schæff, Schmett. Eur., vi, p. 53, fig. 161 (1847).
Samera obtusa, Kirby, Cat. Lep. Het., i, p. 321 (1892).
Gampola noctis, Butl., Trans. Ent. Soc. Lond., 1881, p. 8.
Paida obtrita, Staud., Rom. sur Lép., iii, p. 183, pl. x, fig. 8 (1887).
Paidina obtrita, Staud., Rom. sur Lép., vi, p. 262 (1892).

The specimens in Pryer's collection were from Yokohama; these, as I remarked in a former paper, are darker than the coloured figure of *obtrita*, Staud., but agree exactly with a specimen in the National Museum which was received from Dr. Staudinger.

"*Gampola*" *noctis*, Butl., from Tokio, is, as kindly pointed out to me by Sir George F. Hampson, certainly identical with *obtrita*, Staud., and both are referable to *obtusa*, H.-S.
Distribution. Europe.—Amurland; Yesso; Japan.

599. *Samera angusta.*

Paida angusta, Staud., Rom. sur Lép., iii, p. 182, pl. x, fig. 7 (1887).
Paidina angusta, Staud., Rom. sur Lép., vi, p. 260 (1892).

Six specimens taken by a native collector at Gensan in August. Possibly a form of *S. obtusa*.
Distribution. AMURLAND; COREA.

Genus ÆMENE.

Walk., Cat. Lep. Het., ii, p. 541 (1854).
Hampson, Fauna Brit. Ind., Moths, ii, p. 91 (1894).

600. *Æmene tæniata.*

Æmene tæniata, Fixsen, Rom. sur Lép., iii, p. 327, pl. xv, fig. 6.

Described from Corea. Fixsen states that he also has a specimen from Amurland.
Distribution. COREA; AMURLAND.

601. *Æmene punctatissima.*

Æmene punctatissima, Pouj., Bull. Soc. Ent. Fr., (6), vi, p. clix (1886).

I have a fine series, comprising specimens from Ichang, Chang-yang, Wa-shan, Omei-shan, Chia-ting-fu, Wa-ssu-kow, Che-tou, and Ni-tou. There is a good deal of variation in the markings, and some examples are heavily suffused with fuscous.
Habitat. CENTRAL and WESTERN CHINA.

602. *Æmene modesta.*

Æmene modesta, Moore, Proc. Zool. Soc. Lond., 1878, p. 34.

Of this species, which Moore described from Formosa, I have received one male specimen from Ichang, where it was captured in August, and Captain Young sent me an example from Sultanpore, Kulu.
Distribution. FORMOSA; CENTRAL CHINA; KULU.

603. *Æmene punctigera*, sp. n.

Primaries greyish white ; there are five black spots on the costa, two in the cell, and three along the course of the submedian nervure ; postmedial and submarginal lines irregular, and composed of black dots ; fringes preceded by black points. Secondaries paler, with an indistinct discal dot. Under surface of primaries suffused with fuscous, fringes paler.

Expanse 24–26 millim.

I have seven specimens from Wa-shan, Pu-tsu-fong, Chia-ting-fu, and Ichang ; taken in June and July.

Habitat. CENTRAL and WESTERN CHINA.

Allied to *Æ. modesta*, Moore.

604. *Æmene fasciata.*

Æmene fasciata, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 399 (1877) ; Ill. Typ. Lep. Het., ii, p. 7, pl. xxii, fig. 9 (1878).

The specimens in Pryer's collection were from Yokohama, Nikko, and Oiwake. I obtained the species at Hakodate in August, and my native collector in the island of Kiushiu.

Staudinger (Rom. sur Lép., vi, p. 263) refers *Æ. fasciata*, Butl., to *Æmene* (*Nudaria*) *altaica*, Lederer.

Habitat. JAPAN ; YESSO and KIUSHIU.

605. *Æmene minuta.*

Æmene minuta, Butl., Trans. Ent. Soc. Lond., 1881, p. 595.

There were specimens from Yokohama in Pryer's collection.

Habitat. JAPAN.

606. *Æmene* (?) *maculata.*

Siccia maculata, Leech, Proc. Zool. Soc. Lond., 1888, p. 605, pl. xxx, fig. 16.

The type was from Satsuma.

Habitat. KIUSHIU.

Genus NARASODES.

Moore, Lep. Ceyl., iii, p. 535 (1887).

607. *Narasodes punctana.*

Tospitis punctana, Walk., Cat. Lep. Het., xxviii, p. 431 (1863).

Narasodes punctana, Moore, Lep. Ceyl., iii, pl. 211, fig. 7 (1887); Hampson, Fauna Brit. Ind., Moths, ii, p. 95 (1894).

Sir George Hampson has identified examples of this species among some insects received from Shanghai by M. l'Abbé J. de Joannis.

Distribution. CEYLON; EASTERN CHINA (*Hampson*).

Genus EUGOA.

Walker, Cat. Lep. Het., xii, p. 768 (1857).

608. *Eugoa grisea.*

Eugoa grisea, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 399 (1877); Ill. Typ. Lep. Het., ii, p. 8, pl. xxiii, fig. 1 (1878).

The specimens in Pryer's collection were from Yokohama. I obtained the species at Gensan in July.

Distribution. JAPAN; COREA.

609. *Eugoa* (?) *obscura.*

Eugoa (?) *obscura*, Leech, Proc. Zool. Soc. Lond., 1888, p. 604, pl. xxx, fig. 15.

The type was in Pryer's collection, but without locality.

Habitat. JAPAN.

Genus HYPEUGOA, nov.

Hampson MS. (Type *H. flavogrisea*, sp. n.)

Proboscis aborted and minute; palpi porrect, short, and not reaching beyond the frons; antennæ of male with bristles and cilia; tibiæ with the spurs rather long; abdomen smoothly scaled.

Primaries rather narrow, the costa arched near the base, then nearly straight ; the termen obliquely rounded ; vein 2 from middle of cell, oblique ; vein 3 from cell before angle ; veins 4, 5, from angle ; 6, 7, stalked ; 8, 9, stalked ; 10, 11, free. Secondaries with vein 2 from middle of cell ; 3 from before angle ; 4, 5, from angle ; 6, 7, shortly stalked ; 8 from middle of cell.

610. *Hypeugoa flavogrisea*, sp. n.

Primaries whitish, dusted with greyish scales ; there is a broad greyish central band, limited by blackish irregular lines ; submarginal band greyish, diffuse, and dotted with blackish. Secondaries yellowish-buff, finely dusted with greyish on central and marginal areas. Under surface yellowish-buff, the discal area of primaries suffused with fuliginous. Head and thorax agree in colour with primaries, and the abdomen with secondaries.

Expanse 46 millim.

One male specimen taken by a native collector to the north of Ta-chien-lu.

Habitat. WESTERN CHINA.

Genus MILTOCHRISTA.

Hübn., Hampson, Fauna Brit. Ind., Moths, ii, p. 107 (1894).

611. *Miltochrista miniata.*

Geometra miniata, Forst., Nov. Spec. Ins., p. 75 (1771).
Calligenia miniata, Auctt.
Miltochrista miniata, Kirby, Cat. Lep. Het., i, p. 311 (1892).
Miltochrista rosaria, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 397 (1877) ; Ill. Typ. Lep. Het., ii, pl. xxii, fig. 8 (1878).

A series in Pryer's collection comprised specimens from Yokohama, Oiwake, and Yesso. I obtained one example in Satsuma in May, one at Nagasaki in June, one at Nagahama, and two at Gensan in July. My native collector took the species at Nikko.

In var. *rosaria*, which is the only form represented in Japan and Corea, the discal area of the primaries is yellower than in the type, and the secondaries are less tinged with rosy. I have an aberrant example from Germany which has the primaries entirely yellow and other

specimens in my European series are almost identical with Japanese examples.

Distribution. EUROPE.—AMURLAND; COREA; JAPAN; YESSO.

612. *Miltochrista aberrans.*

Miltochrista aberrans, Butl., Ann. and Mag. Nat. Hist., (4), xx, p. 397 (1877); Ill. Typ. Lep. Het., ii, p. 5, pl. xxii, fig. 7 (1878).
Calligenia askoldensis, Oberth., Étud. d'Entom., v, p. 30 (1880).
Miltochrista bivittata, Butl., Cist. Ent., iii, p. 116 (1885).

Specimens from Yokohama in Pryer's collection. I have received one example from Chang-yang, where it was taken in June.

Dr. Staudinger considers *askoldensis* to be only a modification of *aberrans*, and that *bivittata* is identical with it; in this I quite concur.

Distribution. JAPAN; CENTRAL CHINA; AMURLAND.

613. *Miltochrista undulata*, sp. n.

Closely allied to *M. miniata*, from Europe, but smaller and more rosy in colour; the first black line of primaries only indicated by a dot on the costa, and the second line more deeply undulated and terminating nearer the middle of the inner margin.

Expanse 22 millim.

In some specimens the lines are very faint, and in others entirely absent.

Four males and two females, taken in June, and two males and one female, taken in August, at Chang-yang.

Habitat. CENTRAL CHINA.

614. *Miltochrista pallida.*

Calligena pallida, Brem., Lep. Ost.-Sib., p. 97, pl. viii, fig. 7 (1864).
Miltochrista pallida, Kirby, Cat. Lep. Het., i, p. 312 (1892).

I took this species at Ningpo in April, and met with it again in June at Fusan, and in July at Gensan. I have also received the species from Ningpo.

The black submarginal markings of primaries are subject to variation; in one example they are entirely absent.

Distribution. Amurland; Corea; North-Eastern China.

615. *Miltochrista butleri.*

Miltochrista butleri, Leech, Proc. Zool. Soc. Lond., 1888, p. 603, pl. xxx, fig. 14.

I obtained one example of each sex at Nagasaki in June, and there was one specimen from Loochoo and one without locality in Pryer's collection. My native collector met with the species in the island of Kiushiu.

Distribution. Japan; Kiushiu; Loochoo.

616. *Miltochrista rivalis.*

Miltochrista rivalis, Leech, Entom., xxiii, p. 82 (1890).
Sesapa rivalis, Kirby, Cat. Lep. Het., i, p. 311 (1892).

Appears to be not uncommon at Chang-yang and Moupin, and I have also specimens from Ichang and Omei-shan. Occurs in June.

Habitat. Central and Western China.

617. *Miltochrista inscripta.*

Sesapa inscripta, Walk., Cat. Lep. Het., ii, p. 547 (1854).
Sesapa ziczac, Walk., *l. c.* vii, p. 1681 (1856).
Sesapa erubescens, Butl., Trans. Ent. Soc. Lond., 1877, p. 345.
Miltochrista inscripta, Butl., Ill. Lep. Het., iii, p. 7, pl. xlii, fig. 11 (1879).

I captured one specimen at Foochau in April, and I have received examples from Gensan, Chang-yang, Ichang, and the province of Kwei-chow, taken in June.

Distribution. Corea; Northern, Central, and Western China.

618. *Miltochrista rhodophila.*

Barsine rhodophila, Walk., Cat. Lep. Het., Suppl., i, p. 254 (1864).
Miltochrista rhodophila, Butl., Ill. Typ. Lep. Het., iii, p. 5, pl. xlii, fig. 12 (1879).

Sesapa rhodophila, Kirby, Cat. Lep. Het., i, p. 311 (1892).
Miltochrista torrens, Butl., Ann. and Mag. Nat. Hist., (5) iv, p. 353 (1879).

I have specimens from Yokohama, Gensan, Ichang, and Wa-shan, taken in July.

Distribution. AMURLAND; JAPAN; COREA; NORTH, CENTRAL, and WESTERN CHINA.

619. *Miltochrista calamina.*

Miltochrista calamina, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 396 (1877); Ill. Typ. Lep. Het., ii, pl. xxii, fig. 10 (1878).
Sesapa calamina, Kirby, Cat. Lep. Het., i, p. 310 (1892).
Calligenia lutea, Staud., Rom. sur Lép., iii, p. 188 (1887); vi, p. 265 (1892).

A series from Oiwake in Pryer's collection; I have also received specimens from Nagasaki, Nagahama, Fushiki and Hakodate. Occurs in June, July and August.

Distribution. AMURLAND; JAPAN; YESSO; KIUSHIU.

620. *Miltochrista sinica.*

Miltochrista sinica, Moore, Ann. and Mag. Nat. Hist., (4) xx, p. 87 (1877).
Sesapa sinica, Kirby, Cat. Lep. Het., i, p. 311 (1892).
Miltochrista strigipennis, Hampson, Fauna Brit. Ind., Moths, ii, p. 111 (1894).

I have received specimens from Chang-yang, Ichang, Omei-shan, and the province of Kwei-chow. Occurs in June and July.

Moore's type was from Shanghai.

Habitat. NORTHERN, WESTERN, and CENTRAL CHINA.

621. *Miltochrista rufa.*

Miltochrista rufa, Leech, Entom., xxiii, p. 82 (1890).

Six specimens taken in June at Chang-yang.

Habitat. CENTRAL CHINA.

622. *Miltochrista inflexa.*

Barsine inflexa, Moore, Proc. Zool. Soc. Lond., 1878, p. 29, pl. iii, fig. 17.

Miltochrista inflexa, Hampson, Fauna Brit. Ind., Moths, ii, p. 118 (1894).

One example from Chia-kou-ho, taken in July.

Distribution. Sikhim (*Hampson*); Western China.

623. *Miltochrista striata.*

Lithosia striata, Brem. and Grey, Motsch. Etud. Ent., i, p. 63 (1852); Schmett. nörd. China, p. 14 (1853).
Miltochrista striata, Leech, Proc. Zool. Soc. Lond., 1888, p. 602.
Hypoprepia lanceolata, Walk., Cat. Lep. Het., vii, p. 1680 (1856).
Barsine striata, Kirby, Cat. Lep. Het., p. 306 (1892).
Miltochrista gratiosa, Hampson, Fauna Brit. Ind., Moths, ii, p. 118 (1894).

I obtained specimens at Nagasaki in May and at Gensan in July. There was a series from Yokohama and Oiwake in Pryer's collection, and I have received examples from Moupin, Omei-shan, Chia-ting-fu and Chow-pin-sa.

The markings are subject to considerable modification. In some female specimens the rose-coloured streaks are almost eliminated and the grey spots are very indistinct.

Distribution. Throughout the hills of India, Ceylon and Burma (*Hampson*); Japan; Kiushiu; Corea; Northern and Western China.

624. *Miltochrista pulchra.*

Miltochrista pulchra, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 396 (1877); Ill. Typ. Lep. Het., ii, pl. xxii, fig. 6 ♀ (1878).
Calligenia pulchra, var. *pulcherrima*, Staud., Rom. sur Lép., iii, p. 187 (1887).
Barsine pulchra, Kirby, Cat. Lep. Het., i, p. 306 (1892).
Miltochrista mactans, Butl., Trans. Ent. Soc. Lond., 1877, p. 340; Ill. Typ. Lep. Het., v, pl. lxxxv, fig. 13 ♂ (1881).

Specimens from Yokohama and Yesso in Pryer's collection. I have received the species from Chang-yang, and I took examples at Gensan in July.

Hampson includes this species with *M. striata* under

M. gratiosa. I think that both the former are distinct from the latter, and I cannot regard *pulchra*, Butl., as a form of *striata*, Brem. The two species last named can be readily separated from each other by the direction and character of the outer band of primaries, which in *striata* is angled instead of curved and has a projection from angle to apex.

Distribution. JAPAN; YESSO; COREA; CENTRAL CHINA.

625. *Miltochrista carnea.*

Calligenia carnea, Pouj., Bull. Soc. Ent. Fr., (6) vi, p. cxliii (1886).
Miltochrista carnea, Kirby, Cat. Lep. Het., i, p. 312 (1892).

Occurs at Moupin, Omei-shan, Wa-shan, Chia-ting-fu, and Chia-kou-ho, in June and July.

Varies in the intensity of the markings of primaries; in some specimens these, with the exception of a spot on inner margin, are absent.

Habitat. WESTERN CHINA.

626. *Miltochrista rubricans.*

Setina rubricans, Leech, Entom., xxiii, p. 82 (1890).

A fine series, including both sexes, from Chang-yang, and one female from Ichang. June and July.

Habitat. CENTRAL CHINA.

627. *Miltochrista unipuncta.*

Setina unipuncta, Leech, Entom., xxiii, p. 82 (1890).

Since describing the two sexes of this species I have received a second male from Chang-yang, also one from Moupin and a female from Kia-ting-fu.

All these specimens agree with the female example described as the type of that sex, and it would appear therefore that reddish orange is the typical colour of the species, and that yellow is an aberrant colour.

The Western Chinese specimens are rather larger than the examples from Chang-yang.

Habitat. CENTRAL and WESTERN CHINA.

628. *Miltochrista nigrivena*, sp. n.

Primaries crimson-pink, rather paler on discal area; there are three blackish dots on the basal area, one near the base, one above the cell and one in the interno-interspace; a larger black spot is placed at the outer extremity of the cell, and the venation beyond is streaked with black. Secondaries rather paler. Under surface pale crimson-pink, the discal area of primaries strongly suffused with blackish.

Expanse 32 millim.

One male specimen from Omei-shan, taken in June or July.

Habitat. WESTERN CHINA.

629. *Miltochrista flexuosa*, sp. n.

Primaries crimson-pink, paler on discal area; the curved antimedial and very strongly denticulated post-medial lines blackish, the latter followed by black spots opposite the extremity of each tooth; medial line waved and brownish; just beyond this is a black longitudinal line almost parallel with the costa, but sharply angled below the point of origin which is on the costa itself; there are some black marks on basal half of the wing and also in the outer portion of the discal cell. All the markings are more or less surrounded or bordered with pale yellowish. Secondaries same colour as the discal area of primaries, outer margin crimson. Fringes whitish. Under surface paler than above; the primaries are clouded with black on basal half of the costal area, and also on the venation beyond the cell.

Allied to *M. nigrivena*, but apart from differences on the upper surfaces, the under surface of primaries is much less suffused with black.

Expanse 28–30 millim.

One male specimen from Ni-tou, one from Moupin, and a female from Omei-shan. June and July.

Habitat. WESTERN CHINA.

630. *Miltochrista acerba*, sp. n.

Primaries orange-red with a few isolated dusky dots on the neuration representing transverse lines; the venation towards the outer margin is faintly streaked with blackish. Secondaries paler. Under surface of all the wings paler than above and without markings.

Head and thorax agree in colour with the primaries, and the abdomen is similar in colour to the secondaries.

Expanse 34 millim.

One male specimen taken in June at Moupin.

Habitat. WESTERN CHINA.

631. *Miltochrista fasciata*, sp. n.

Primaries creamy white ; a black spot at the base and one at end of the cell ; there are three black transverse lines about the median area of the wing, the first two are rather curved, the third straight, and all are more or less interrupted and very close together ; beyond the discal spot there is a bidentate black transverse line and the venation is streaked and spotted with black. Secondaries creamy white, yellower towards abdominal margin, venation is marked with black on outer margin. Under surface of primaries similar to above, but the secondaries have a black submarginal line.

Head and thorax yellowish ; abdomen dusky with a yellowish tinge.

Expanse 24 millim.

One female specimen from Omei-shan, taken in June or July.

Allied to *M. radians*, Moore, but distinguished from that species by the different character of transverse lines.

Habitat. WESTERN CHINA.

632. *Miltochrista decussata.*

Miltochrista decussata, Moore, Ann. and Mag. Nat. Hist., (4) xx, p. 87 (1877).

Barsine decussata, Kirby, Cat. Lep. Het., i, p. 307 (1892).

Described from Shanghai. The species is somewhat similar to *M. radians*, Moore, from Calcutta.

Habitat. EASTERN CHINA.

633. *Miltochrista artaxidia.*

Miltochrista artaxidia, Butl., Trans. Ent. Soc., 1881, p. 8.

Nudaria nubilosa, Staud., Rom. sur Lép., iii, p. 186, pl. x, fig. 10 (1887).

Lyclene artaxidia, Kirby, Cat. Lep. Het., i, p. 305 (1892).

Nudina artaxidia, Staud., Rom. sur Lép., vi, p. 264 (1892).

Specimens from Ohoyama in Pryer's collection, I took one example at Gensan in July, and I have received one from Moupin, where it was taken in June.

Distribution. JAPAN; COREA; WESTERN CHINA; AMURLAND.

634. *Miltochrista carnipicta.*

Ammatho carnipicta, Butl., Trans. Ent. Soc. Lond., 1877, p. 342.

Described from Mongolia. I have one male specimen from Omei-shan, taken in June or July.

Distribution. WESTERN CHINA; MONGOLIA.

635. *Miltochrista delineata.*

Hypoprepia delineata, Walk., Cat. Lep. Het., ii, p. 487 (1854).
Ammatho figuratus, Walk., Cat. Lep. Het., iii, p. 759 (1855).
Ammatho delineata, Kirby, Cat. Lep. Het., i, p. 308 (1892).
Cyme chinensis, Feld Wien. Ent. Mon., vi, p. 36 (1862).
Ammatho fuscescens, Butl., Trans. Ent. Soc. Lond., 1877, p. 343.

This very variable species was met with by my collectors in all the localities in Western China that they visited, and also at Chang-yang and Ichang.

Fuscescens, Butl., is a strongly suffused form.

Distribution. NORTHERN, CENTRAL, and WESTERN CHINA; MONGOLIA.

636. *Miltochrista palmata.*

Lyclene palmata, Moore, Proc. Zool. Soc. Lond., 1878, p. 31, pl. iii, fig. 5.
Miltochrista palmata, Hampson, Fauna Brit. Ind., Moths, ii, p. 110 (1894).

The type was from North-east Bengal. I have three specimens from Chia-ting-fu, where they were captured in June or July; these are rather larger than Indian examples.

Distribution. SIMLA; KÁNGRA; ASSAM (*Hampson*); WESTERN CHINA.

Genus SETINOCHROA.

Felder, Reise Novara, Lep., iv, pl. 106, fig. 16 (1874).

637. *Setinochroa sanguinea.*

Setinochroa sanguinea, Moore, Ann. and Mag. Nat. Hist., (4) xx, p. 87 (1877).

A nice series, including both sexes, from Chang-yang, and one female specimen from Ichang. June and August.

The type was from Shanghai.

Habitat. EASTERN and CENTRAL CHINA.

Genus SETINA.

Schrank, Fauna Boica, ii (2), p. 165 (1802); Stephens, Ill. Brit. Ent. Haust., ii, p. 98 (1829).

638. *Setina flava.*

Setina flava, Brem. and Grey, Motsch. Etud. Ent., i, p. 63 (1852); Schmett., nörd. China, p. 15 (1853); Lep., Ost.-Sib., pl. viii, fig. 6 (1864).

Setina sinensis, Walk., Cat. Lep. Het., ii, p. 520 (1854).

Setina ochracea, Led., Verh., Zool.-bot. Ver. Wien., 1855, p. 115, pl. i, fig. 4.

Stigmatophora flava, Leech, Proc. Zool. Soc. Lond., 1888, p. 601.

Setina leacrita, Swinh., Ann. and Mag. Nat. Hist., (6) xiv, p. 438 (1894).

Specimens were obtained by myself at Hakodate, Sakata and Gensan, and there were examples from Oiwake and Yesso in Pryer's collection. In his "Catalogue," Pryer gives Yokohama as a locality for *S. sinensis*, Walk.

I have received the species from Moupin, Omei-shan, Wa-shan, Chia-ting-fu, Chia-kou-ho, Ichang, Chang-yang, and Ningpo. Occurs in June and July.

Varies in depth of colour and also in the definition of the black spots.

Distribution. ALTAI; AMURLAND; JAPAN; YESSO; COREA; NORTHERN, WESTERN and CENTRAL CHINA.

639. *Setina calamaria.*

Setina calamaria, Moore, Proc. Zool. Soc. Lond., 1888, p. 392.

Setina (?) punctata, Elwes, Proc. Zool. Soc. Lond., 1890, p. 389, pl. xxxii, fig. 18.

I took one example at Foochau in April, and I have received specimens from Moupin, Ta-chien-lu, Ni-tou, and Chia-kou-ho; taken in June and July. All these are without marking other than the basal dot and the spot at end of cell on primaries. The species appears to be quite distinct from *S. dasara*, Moore, with which Hampson unites it (Fauna Brit. Ind., Moths, ii, p. 115).

Distribution. INDIA; EASTERN and WESTERN CHINA.

640. *Setina dasara.*

Setina dasara, Moore, Cat. Lep. Mus., E.I.C., ii, p. 303 (1859); Butl., Ill. Typ. Lep. Het., vii, pl. xxxii, figs. 7, 8 (1889).

Setina nebulosa, Moore, Proc. Zool. Soc., Lond., 1878, p. 35.

Miltochrista humilis, Hampson, Fauna Brit. Ind., Moths, ii, p. 115 (1894).

I received specimens from Ta-chien-lu and Omei-shan; these agree with the form described as *nebulosa*, Moore.

Distribution. PUNJAB; SIKHIM; NÁGAS; NILGIRIS MOULMEIN; JAVA (*Hampson*); WESTERN CHINA.

641. *Setina modesta*, sp. n.

Primaries yellow, with a black dot at the base and a larger one at the outer end of the cell, between these there is a dot towards costa and one below it above inner margin; a submarginal series of black spots is curved outwards from costa to vein 4, thence recurved to inner margin. Secondaries paler, without marking. Under surface similar to above, but the black spots are absent towards inner margin of primaries.

Head and thorax colour of primaries, abdomen colour of secondaries.

Expanse ♂ 32 millim, ♀ 36 millim.

One male specimen and two females from the province of Kwei-chow, taken in June or July.

There is a very similar, unnamed, example from Pekin in the National collection at South Kensington, but this is without spots on basal area.

Habitat. NORTH-WESTERN CHINA.

642. *Setina griseata*, sp. n.

Pale brownish grey. Primaries have a black spot at the base and one at the outer extremity of the cell; there are two transverse series

of black spots, the first (subbasal) is slightly curved, and the second (submarginal) is irregular ; there is also a transverse, dusky, medial band. Fringes slightly paler, those of primaries preceded by black dots. Under surface of primaries fuliginous, paler towards outer margin. Thorax brownish grey spotted with black.

Expanse 40 millim.

Ten male specimens and one female example from Wa-ssu-kow, taken in July.

Habitat. WESTERN CHINA.

643. *Setina* (?) *nictitans.*

Lithosia nictitans, Brem. and Grey, Schmett. nörd. China, p. 14 (1853).
Setina (?) *nictitans*, Kirby, Cat. Lep. Het., i, p. 358 (1892).

This species, with which I am not acquainted, was described from Pekin.

Habitat. NORTH CHINA.

Genus STIGMATOPHORA.

Staudinger, Stett. Ent. Zeit., xlii, p. 399 (1881).

644. *Stigmatophora micans.*

Setina micans, Brem. and Grey, Motsch. Etud. Ent., i, p. 26 (1852) ; Schmett., nörd. China, p. 15 (1853).
Stigmatophora micans, Staud., Stett. Ent. Zeit., xlii, p. 400 (1881) ; Kirby, Cat. Lep. Het., i, p. 259 (1892).
Setina alboscricea, Moore, Ann. and Mag. Nat. Hist., (4) xx, p. 87 (1877).

I obtained a series at Gensan and one example at Fusan. July and August.

Distribution. CENTRAL ASIA ; AMURLAND ; COREA ; NORTH CHINA.

Genus NUDARIA.

Haw. ; Hampson, Fauna Brit. Ind., Moths, ii, p. 122 (1894).

645. *Nudaria mundana.*

Tortrix mundana, Linn., Faun. Suec., p. 349 (1761).
Bombyx nuda, Hübn., Bomb., figs. 63, 64 (1800).

Nudaria mundana, Steph., Ill. Brit. Ent. Haust., ii, p. 83 (1829).

One example from Gifu and one from Yesso in Pryer's collection.

Distribution. EUROPE.—YESSO; JAPAN.

646. *Nudaria muscula.*

Nudaria muscula, Staud., Rom. sur Lép., iii, p. 185, pl. x, figs. 9 *a*, *b* (1887).

Nudaria senex, Leech, Proc. Zool. Soc. Lond., 1888, p. 605.

Four male and three female specimens from Oiwake in Pryer's collection. These specimens, which I formerly referred to *N. senex*, are rather paler in colour than the figure of *N. muscula*, but they agree in every other respect.

Distribution. AMURLAND; JAPAN.

647. *Nudaria apicalis.*

Setina apicalis, Walk., Cat. Lep. Het., ii, p. 521 (1854).

Nudaria apicalis, Kirby, Cat. Lep. Het., i, p. 361 (1892); Hampson, Fauna Brit. Ind., Moths, ii, p. 123 (1894).

I do not know this species, which probably comes from Southern China.

Distribution. CHINA; BURMA (*Hampson*).

Subfamily *NYCTEOLINÆ.*

Genus SINNA.

Walker, Cat. Lep. Het., xxxii, p. 641 (1865).

648. *Sinna extrema.*

Deiopeia extrema, Walk., Cat. Lep. Het., ii, p. 573 (1854).

Teinopyga reticularis, Feld., Reise Nov. Lep., iv. pl. cvi, fig. 18 (1875).

Sinna fentoni, Butl., Trans. Ent. Soc. Lond., 1881, p. 8; Cist. Ent., iii, p. 129 (1885).

Sinna clara, Butl., *l. c.* (1881).

Sinna ornatissima, Alph., Rom. sur Lép., ix, p. 131, pl. ix, fig. 9 ♀ (1897).

Several specimens in Pryer's collection, some of which were from Yesso. I obtained the species at Hakodate in August, and I have received examples from Chang-yang, Ichang, Moupin, Wa-shan, Omei-shan, and Wa-ssu-kow.

Some of the Chinese and also one or two of the Hakodate specimens agree with the figure of *S. ornatissima*, Alph. The types of *fentoni*, Butl., and *clara*, Butl., were from Tokio, and there were examples agreeing with these, together with intermediate forms in Pryer's collection.

Distribution. AMURLAND; JAPAN; YESSO; EASTERN, CENTRAL, and WESTERN CHINA.

Genus ARIOLICA.

Walker; Hampson, Fauna Brit. Ind., Moths, ii, p. 129 (1894).

649. *Ariolica pulchella.*

Chionomera pulchella, Elwes, Proc. Zool. Soc., 1890, p. 387, pl. xxxii, fig. 15; Kirby, Cat. Lep. Het., i, p. 284 (1892).

Ariolica pulchella, Hampson, Fauna Brit. Ind., Moths, ii, p. 130 (1894).

Ten specimens from Omei-shan, and three from Chiating-fu. Occurs in June and July.

Distribution. SIKHIM; E. PEGU (*Hampson*); WESTERN CHINA.

650. *Ariolica argentea.*

Chionomera argentea, Butl., Trans. Ent. Soc. Lond., 1881. p. 18; Kirby, Cat. Lep. Het., i, p. 284 (1892).

I received a fine series from Mr. Manley of Yokohama, and one or two examples taken at Nikko by a native collector. The species is also recorded from Tokio and Fusiyama.

Habitat. JAPAN.

Genus TYANA.

Walker, Cat. Lep. Het., xxxv, p. 1776 (1866).

651. *Tyana pustulifera.*

Tyana pustulifera, Walk., Cat. Lep. Het., xxxv, p. 1773 (1866); Butl., Ill. Typ. Lep. Het., vi, pl. cv, fig. 7 (1886).

One male specimen from Omei-shan, and two female examples from Pu-tsu-fong. These are probably referable to this species.

Distribution. NEPAL (*Hampson*); WESTERN CHINA.

Genus HALIAS.

Treitschke; Hampson, Fauna Brit. Ind., Moths, ii, p. 132 (1894).

652. *Halias prasinana.*

Tortrix prasinana, Linn., Faun, Succ., p. 342 (1761).
Halias prasinana, Hampson, Fauna Brit. Ind., Moths, ii, p. 132 (1894).
Hylophila sylpha, Butl., Ill. Typ. Lep. Het., iii, p. 10; pl. xliii, fig. 10 (1879).
Hylophila prasinana, Leech, Proc. Zool. Soc. Lond., 1888, p. 606.

Occurs at Yokohama and Oiwake; there were two specimens in Pryer's collection.

Distribution. EUROPE.—AMURLAND; JAPAN.

653. *Halias magnifica.*

Hylophila magnifica, Leech, Entom., xxiii, p. 83 (1890).

Described from a specimen received from Chang-yang, where it was taken in May.

Habitat. CENTRAL CHINA.

654. *Halias* (?) *buddhæ.*

Hylophila buddhæ, Alph., Rom. sur Lép., ix, p. 132, pl. ix, fig. 8 (1897).

The type of this species, a male, was taken in May at Da-bo-sian in the province of Sé-Tchouen.

Habitat. WESTERN CHINA.

Genus EARIAS.

Hübn.; Hampson, Fauna Brit. Ind., Moths, ii, p. 132 (1894).

655. *Earias chromataria.*

Earias chromataria, Walk., Cat. Lep. Het., xxvii, p. 204 (1863); Hampson, Fauna, Brit. Ind., Moths, ii, p. 133 (1894).

Earias limbana, Snellen, Tijdschr. Ent., xxii, p. 97, pl. viii, fig. 2 (1879).

There was a nice series from Yokohama in Pryer's collection; I took the species at Gensan in July, and have received it from Ichang and Moupin.

Distribution. Throughout AFRICA, INDIA, and CEYLON (*Hampson*); JAPAN; COREA; CENTRAL and WESTERN CHINA.

656. *Earias roseifera.*

Earias roseifera, Butl., Trans. Ent. Soc. Lond., 1881, p. 18.

Specimens from Yokohama and Gifu in Pryer's collection, and one from Oiwake; the latter has the whole of the central area of primaries suffused with pink. The type was from Tokio.

Habitat. JAPAN.

657. *Earias pudicana.*

Earias pudicana, Staud., Rom. sur Lép., iii, p. 174, pl. viii, fig. 10 (1887).

I took this species at Ningpo in April, at Nagasaki in May, and at Tsuruga in July; there were some specimens in Pryer's collection.

Distribution. AMURLAND; JAPAN; KIUSHIU; NORTH CHINA.

Genus GABALA.

Walker, Cat. Lep. Het., xxxiv, p. 1220 (1865).

658. *Gabala argentata.*

Gabala argentata, Butl., Ill. Typ. Lep. Het., ii, p. 56, pl. xxxix, fig. 3 (1878).

There were a number of specimens in Pryer's collection, but without exact locality. I met with the species in Satsuma in May, at Nagasaki in June, and at Fushiki in July; and I have received it from Gensan and Chow-pin-sa.

Distribution. JAPAN; KIUSHIU; COREA; WESTERN CHINA.

Genus Siglophora.

Butler, Proc. Zool. Soc. Lond., 1892, p. 123.

659. *Siglophora sanguinolenta.*

Chionomera sanguinolenta, Lep. Atk., p. 285 (1888).
Siglophora sanguinolenta, Hampson, Fauna Brit. Ind., Moths, ii. p. 135 (1894).

One specimen taken by a native collector at Omei-shan in June or July.

Distribution. Sikhim (*Hampson*); Western China.

660. *Siglophora* (?) *ferruginea*, sp. n.

Somewhat similar to *S. sanguinolenta*, Moore, but the markings of primaries are ferruginous brown in colour, and the internal edge of the outer half is angulated and extends along costa to within one-fourth of the base. Secondaries whitish, tinged with yellow merging into rusty brown on outer marginal area. Under surface silky white, tinged with pale purplish brown on outer marginal area of primaries.

Expanse 24 millim.

One male specimen from the island of Kiushiu.

There is a deep depression, hidden by tufts of yellow and ferruginous-brown hairs, just below the middle of costa. As this is not a character of *Siglophora*, it is possible that a new genus will have to be made for the species now placed provisionally in this genus.

Habitat. Kiushiu.

Subfamily *NOLINÆ.*

Genus Nola.

Leach; Hampson, Fauna Brit. Ind., Moths, ii, p. 138 (1894).

661. *Nola fumosa.*

Nola fumosa, Butl., Ill. Typ. Lep. Het., iii, p. 9, pl. xliii, fig. 2 (1879).
Nola strigulosa, Staud., Rom. sur Lép., iii, p. 180, pl. x, fig. 4 (1887); *op. cit.*, vi, p. 256 (1892).

A series from Yokohama in Pryer's collection. I took specimens at Fushiki in July.

Distribution. Amurland; Japan; Corea.

662. *Nola flexuosa.*

Nola flexuosa, Pouj., Bull. Soc. Ent. Fr., (6) vi, p. clxvii, (1886).

Described from a female specimen taken by M. l'Abbé A. David at Moupin.

Habitat. WESTERN CHINA.

663. *Nola gigas.*

Nola gigas, Butl., Ann. and Mag. Nat. Hist., (5) xii, p. 274 (1884).

There were four specimens in Pryer's collection.

Habitat. YESSO.

664. *Nola confusalis.*

Rœselia confusalis, Herr.-Sch., Schmett. Eur., ii, p. 164 (1851).

Nola cristulalis, Dup., Hist. Nat. Lép., viii, pl. ccxxvii, figs. 6, 7 (1831).

Nola confusalis, Hampson, Fauna Brit. Ind., Moths, ii, p. 140 (1894).

Pryer obtained this species at Oiwake and Yokohama, and I have received two specimens from Chang-yang.

Distribution. EUROPE.—AMURLAND; JAPAN; CENTRAL CHINA; SIKHIM.

665. *Nola costimacula.*

Nola costimacula, Staud., Rom. sur Lép., iii, p. 182, pl. x, fig. 6 (1887).

There was one example in Pryer's collection without exact locality.

Distribution. AMURLAND and JAPAN.

666. *Nola centonalis.*

Pyralis centonalis, Hübn., Pyral., fig. 15 (1796).

Glaphyra atomosa, Brem., Bull. de l'Acad. Pétersb., 1861, iii, Lep. Ost.-Sib., p. 55, pl. v, fig. 16 (1864).

Nola ærugula, Hübn.; Kirby, Cat. Lep. Het., i, p. 374 (1892).

Nola centonalis, Hb. var. a. *atomosa*, Brem.; Alph., Rom. sur Lép., iii, p. 327 (1887).

Occurs in Japan at Yokohama and Oiwake. I took the species at Gensan and Fusan.

Nearly all these specimens agree with the pale form described by Bremer as *atomosa*.

Distribution. EUROPE.—AMURLAND; JAPAN; COREA; NORTH CHINA.

667. *Nola ceylonica.*

Nola ceylonica, Hampson, Ill. Typ. Lep. Het., ix, p. 88, pl. clviii, fig. 13 (1893); Fauna Brit. Ind., Moths, ii, p. 141 (1894).

Examples of this species (and also of *N. pumila*, Snellen) were noted by Sir George Hampson among the insects received by M. l'Abbé J. de Joannis from Shanghai.

Distribution. CEYLON; EASTERN CHINA.

668. *Nola albulalis.*

Pyralis albulalis, Hübn., Pyral., fig. 14 (1796).
Nola albula, Den. and Schiff.; Kirby, Cat. Lep. Het., i, p. 374 (1892).

I took a specimen in Satsuma in May, and one at Gensan in June. There was one example from Oiwake in Pryer's collection.

Distribution. EUROPE.—AMURLAND; JAPAN; KIUSHIU; COREA.

669. *Nola longiventris.*

Nola longiventris, Pouj., Bull. Soc. Ent. Fr. (6), vi, pl. cli, (1886).

Poujade's type was a male specimen taken by M. l'Abbé David at Moupin.

Habitat. WESTERN CHINA.

670. *Nola minutalis.*

Nola minutalis, Leech, Proc. Zool. Soc. Lond., 1888, p. 607 pl. xxx, fig. 17.

Described from an example of each sex. These specimens were in Pryer's collection, but the exact locality from which they came was not indicated.

The species comes very near to *N. subchlamydula*, Staud., from South Europe, but it is a much smaller insect, and the markings are narrower.

Habitat. JAPAN.

671. *Nola triangulalis.*

Nola triangulalis, Leech, Proc. Zool. Soc. Lond., 1888, p. 608, pl. xxxi, fig. 12.

Described from a specimen taken by myself in Satsuma in May.

Habitat. KIUSHIU.

672. *Nola flexilineata.*

Nola flexilineata, Hampson, Journ. Bomb. Nat. Hist. Soc., xi, p. 440 (1898).

Described from a specimen from Khásis in the National Collection at South Kensington.

I have one example of the species from Omei-shan and two from Foochau; the latter were obtained by myself in April, and the former was taken in June or July.

Distribution. KHÁSIS (*Hampson*); WESTERN and SOUTHERN CHINA.

673. *Nola candida.*

Nola candida, Butl., Ill. Typ. Lep. Het., iii, p. 9, pl. xliii, fig. 3 (1879).

Argyrophyes candida, Kirby, Cat. Lep. Het., i, p. 378 (1892).

I obtained specimens at Ningpo in April; there was a series from Yokohama in Pryer's collection, and I have four examples from Ichang; the latter were taken in August.

Dr. Staudinger (Rom. sur Lép., vi, p. 258) describes an allied species, *N. candidalis*, from Amurland.

Distribution. JAPAN; NORTHERN and CENTRAL CHINA.

674. *Nola microphasma.*

Nola microphasma, Butl., Cist. Ent., iii, p. 117 (1885).

Lebena microphasma, Kirby, Cat. Lep. Het., i, p. 379 (1892).

Five specimens from Yokohama in Pryer's collection (Nos. 86 and 90 Cat.).

Habitat. JAPAN.

675. *Nola* (?) *maculata.*

Nudaria maculata, Pouj., Bull. Soc. Ent. Fr. (6), vi, p. cl. (1886).

One example from Chia-kou-ho. The type was from Moupin.

Habitat. WESTERN CHINA.

Genus MIMERASTRIA.

Butl., Ann. and Mag. Nat. Hist., (5) vii, p. 236 (1881).

676. *Mimerastria mandschuriana.*

Erastria mandschuriana, Oberth., Etud. d'Entom., v, p. 83, pl. ii, fig. 9 (1880).
Nola mandschuriana, Leech, Proc. Zool. Soc. Lond., 1888, p. 609.
Mimerastria mandschuriana, Butl., Ann. and Mag. Nat. Hist., (5) vii, p. 236 (1881).
Nola albula, Hb., var. a. *mandschurica*, Oberth.; Fixsen, Rom. sur Lép., iii, p. 327 (1887).

Two specimens in Pryer's collection, one of which is from Oiwake.

Oberthür's type was from the Isle of Askold.

Distribution. AMURLAND; JAPAN: COREA.

Family AGARISTIDÆ.

Genus EUSEMIA.

Dalm.; Hampson, Fauna Brit. Ind., Moths, ii, p. 149 (1894).

677. *Eusemia lectrix.*

Noctua lectrix, Linn., Mus. Ulr., p. 389 (1764).
Bombyx lectrix, Cram., Pap. Exot., ii, pl. cxcii, fig. C (1779); Don., Ins. China, pl. xliii, fig. 2 (1798).
Episteme lectrix, Kirby, Cat. Lep. Het., i, p. 26 (1892).
Eusemia lectrix, Hampson, Fauna Brit. Ind., Moths, ii, p. 149 (1894).

My collectors met with this species at Chang-yang and in most of the localities that they visited in Western China.

There is a good deal of variation in the size of the medial spots on primaries, and in two or three examples these are united, whilst in two others the upper medial spot and the spot at basal end of the cell are confluent.

Habitat. CHINA.

678. *Eusemia irenea.*

Eusemia irenea, Boisd., Revue et Mag. de Zool., 1874, p. 84; Hampson, Fauna Brit. Ind., Moths, ii, p. 153 (1894).
Eusemia distincta, Butl., Ann. and Mag. Nat. Hist., (4) xv, p. 140 (1875); Ill. Typ. Lep. Het., v, p. 17, pl. lxxxii, fig. 3 (1881).

Specimens were received from Moupin and Omei-shan, where they were obtained in June and July.

Alphéraky (Rom. sur Lép., ix, p. 126) records *E. irenea* from Tâ-tsien-loû, also one male example from the Kham country, the latter taken in June.

Possibly only forms of *E. lectrix*, Linn.

Distribution. SIKHIM; KHÁSIS; NÁGAS; SUMATRA (*Hampson*); WESTERN CHINA.

679. *Eusemia amatrix.*

Eusemia amatrix, Westw., Cab. Orient. Ent., p. 68, pl. xxxiii, fig. 4 (1848); Hampson, Fauna Brit. Ind., Moths, ii, p. 149 (1892).
Episteme amatrix, Kirby, Cat. Lep. Het., i, p. 28 (1892).
Eusemia aruna, Moore, Cat. Lep. E.I.Co., p. 288 (1859).

One male specimen from Chia-ting-fu, and one from Omei-shan, both taken in June or July.

Distribution. SIKHIM; WESTERN CHINA.

680. *Eusemia adulatrix.*

Eusemia adulatrix, Koll., Hügel's Kasch., iv, p. 464, pl. xx, fig. 1 (1848); Hampson, Fauna Brit. Ind., Moths, ii, p. 152 (1894).
Episteme adulatrix, Kirby, Cat. Lep. Het., i, p. 26 (1892).

I have specimens, taken in June or July, from Moupin, Omei-shan, and the province of Kwei-chow.

Distribution. The whole of INDIA and BURMA (*Hampson*); WESTERN CHINA.

Genus CHELONOMORPHA.

Motsch., Etud. Ent., ix, p. 30 (1860).

681. *Chelonomorpha japona.*

Chelonomorpha japona, Motsch., Etud. Ent., p. 30 (1860).
Eusemia villicoides, Butl., Ann. and Mag. Nat. Hist., (4) xv, p. 141, pl. xiii, fig. 2 (1875).

Recorded by Pryer from Yesso, Nikko, and Nambu. It is common at Hakodate in June and July, and I have one specimen from Kiukiang.

Distribution. Japan; Yesso; Central China.

Genus Phalænoides.

Lewin, Lep. N. S. Wales, p. 2 (1822); Hampson, Fauna Brit. Ind., Moths, ii, p. 154 (1894).

682. *Phalænoides vithoroides.*

Eusemia vithoroides, Leech, Entom., xxiii, p. 110 (1890); Oberth., Etud. d'Entom., xvi, p. 8, pl. i, fig. 4 (1892).
Episteme vithoroides, Kirby, Cat. Lep. Het., i, p. 29 (1892).

The type was from Chang-yang. I have received specimens from Wa-shan, Wa-ssu-kow, and Pu-tsu-fong. Occurs in June and July. Oberthür records the species from the country to the north of Tâ-Tsien-Loû.

Habitat. Central and Western China.

Genus Zalissa.

Zalissa, Walker, Cat. Lep. Het., xxxiii, p. 936 (1865); Hampson, Fauna Brit. Ind., Moths, ii, p. 155 (1894).
Seudyra, Stretch., Cist. Ent., ii, p. 19 (1875).

683. *Zalissa venusta.*

Seudyra venusta, Leech, Proc. Zool. Soc. Lond., 1888, p. 614, pl. xxxi, fig. 2.

Described from a Gensan specimen. The species also occurs at Chang-yang and Ta-chien-lu. July.

Distribution. Corea; Central and Western China.

684. *Zalissa flavida.*

Seudyra flavida, Leech, Entom., xxiii, p. 110 (1890).

The type and two cotypes were from Chang-yang. Since describing the species I have received specimens

from Moupin, Wa-ssu-kow, Chow-pin-sa, and Chia-kou-ho. These Western examples are in finer condition than the three from Central China, but are identical in pattern.

Habitat. CENTRAL and WESTERN CHINA.

685. *Zalissa mandarina.*

Seudyra mandarina, Leech, Entom., xxiii, p. 110 (1890).

The type, a male and the only example of the species that I have seen, was from Chang-yang, where it was taken in July.

Habitat. CENTRAL CHINA.

686. *Zalissa subalba.*

Seudyra subalba, Leech, Entom., xxiii, p. 110 (1890).

Five male specimens from Chang-yang, and one example of the same sex from Ichang.

Habitat. CENTRAL CHINA.

687. *Zalissa noctuina.*

Seudyra noctuina, Butl., Ent. Mo. Mag., xiv, p. 206 (1878); Ill. Typ. Lep. Het., ii, p. 3, pl. xxii, fig. 1 (1878).

A fine series from Yokohama and Yesso in Pryer's collection; the species has been recorded from Nikko, Oiwake and Hakodate. June and July.

Habitat. JAPAN and YESSO.

688. *Zalissa subflava.*

Seudyra subflava, Moore, Ann. and Mag. Nat. Hist., (4) xx, p. 85 (1877).

Zalissa jankowskii, Alph., Rom. sur Lép., ix, p. 151, pl. xi, fig. 20 (1897).

There was a short series from Yokohama in Pryer's collection, and I took one example at Gensan in July. Moore's type was from Chekiang; and I have specimens from Ichang and the province of Kwei-chow, the latter taken in July and August. Alphéraky re-describes this species from Sidemi. The differences he refers to as separating his *jankowskii* from *subflava* do not hold good.

Distribution. AMURLAND; JAPAN; COREA; EASTERN, CENTRAL, and WESTERN CHINA.

688A. *Zalissa albifascia.*

Zalissa albifascia, Walk., Cat. Lep. Het., xxxiii, p. 933 (1865); Hampson, Fauna Brit. Ind., Moths, ii, p. 157 (1894).

Distribution. North China; Sikhim; Canara; Moulmein; Rangoon; Andamans (*Hampson*).

Genus Mimeusemia.

Butl., Ann. and Mag. Nat. Hist., (4) xv, p. 397 (1875).

689. *Mimeusemia persimilis.*

Mimeusemia persimilis, Butl., Ann. and Mag. Nat. Hist., (4) xv, p. 397 (1875); Ill. Typ. Lep. Het., ii, pl. xxii, fig. 2 (1878).

There was a series in Pryer's collection from Oiwake and Yesso. I obtained specimens at Gensan in July, and have received one from Omei-shan. Staudinger (Rom. sur Lép., vi, p. 275) records the species from Suifun.

Distribution. Amurland; Japan; Yesso; Corea; Western China.

Genus Syfania.

Oberth., Etud. d'Entom., xviii, p. 19 (1893).

690. *Syfania bieti.*

Agarista bieti, Oberth., Bull. Soc. Ent. Fr., (6) v, p. ccxxviii (1886); Etud. d'Entom., xi, p. 29, pl. ii, fig. 12 (1886).
Androloma ? bieti, Kirby, Cat. Lep. Het., i, p. 35 (1892).

A long series, comprising specimens from Ta-chien-lu, Che-tou and How-kow. Occurs in June and July.

Habitat. Western China.

691. *Syfania déjeani.*

Syfania déjeani, Oberth., Etud. d'Entom., xviii, p. 19, pl. v, fig. 68 (1893).

Two male specimens taken at Ta-chien-lu in July.

Habitat. Western China.

692. *Syfania giraudeaui.*

Syfania giraudeaui, Oberth., Etud. d'Entom., xviii, p. 19, pl. v, fig. 74 (1893).

One female specimen from How-kow and one from Wassu-kow, both taken in July. Oberthür records the species from Oua-Se, Yu-Tong and Kitchang-Kow.

Habitat. WESTERN CHINA.

693. *Syfania oberthuri.*

Syfania oberthuri, Alph., Iris, viii, p. 184 (1895); Rom. sur Lép., ix, p. 126, pl. ix, fig. 5 (1897).

Described from the Kham country.

Differs chiefly from *S. giraudeaui,* Oberth., in having the white spots of secondaries confluent; possibly only a form of that species.

Habitat. NORTH-WESTERN CHINA.

694. *Syfania dubernardi.*

Syfania dubernardi, Oberth., Etud. d'Entom., xix, p. 21, pl. viii, fig. 70 (1894).

Described by Oberthür from Tchang-kou.

Habitat. WESTERN CHINA.

APPENDIX

Family NOTODONTIDÆ.

Genus STENOLOBA.

Staudinger, Rom. sur Lép., vi, p. 381 (1892).

101. *Stenoloba jankowskii.*

Dichagyris jankowskii, Oberth., Etud. d'Entom., x, p. 28, pl. iii, fig. 5 (1884).
Edema nivilinea, Leech, Proc. Zool. Soc. Lond., 1888, p. 638, pl. xxxii, fig. 1; Trans. Ent. Soc. Lond., 1898, p. 300.
Stenoloba jankowskii, Staud., Rom. sur Lép., vi, p. 381 (1892).

Distribution. AMURLAND; ASKOLD; JAPAN.

122A. *Stauropus nigrilinea*, sp. n.

Head, collar, and tuft on prothorax blackish; tegulæ greyish; thorax and abdomen fuscous grey.

Primaries greyish, sparingly sprinkled with black scales; a narrow black streak runs from costa in an oblique direction to the end of discal cell, thence longitudinally to the outer margin. Secondaries fuscous grey. Under surface fuscous on primaries, rather paler on secondaries.

Expanse 66 millim.

One female specimen taken in July at Chang-yang.
Habitat. CENTRAL CHINA.

123A. *Somera pryeri*, sp. n.

Primaries greyish white, freckled and clouded with dark grey; antemedial line blackish, wavy to median nervure, thence angled and curved to inner margin, it is preceded by a blackish interrupted band which increases in width towards the inner margin, the space between line and band of the clear ground colour; post-medial line

blackish, wavy and indented, bordered internally towards costa, and externally towards inner margin, with lunules of the clear ground colour, the line is followed by an irregular, macular, dark grey band, and there is an ill-defined band of the same colour, commencing as two short blackish lines on costa midway between the antemedial and postmedial lines, and terminating on the inner margin near the former; submarginal line blackish and wavy. Fringes dark grey chequered with whitish towards outer angle. Secondaries fuscous grey, the apical area greyish white with darker grey markings; fringes paler, preceded by a brownish line. Under surface reddish-brown on primaries; the inner marginal area whitish; secondaries whitish slightly tinged with reddish-brown.

Expanse 60 millim.

One female specimen in Pryer's collection.

Habitat. JAPAN.

Genus TURNACA.

Walk.; Hampson, Fauna Brit. Ind., Moths, i, p. 136 (1892).

107A. *Turnaca delineivena.*

Turnaca delineivena, Swinhoe, Trans. Ent. Soc. Lond., 1894, p. 159.

Described from the Khasia Hills. I have one male example from the province of Kwei-chow, where it was obtained in June or July.

Distribution. KHÁSIS; WESTERN CHINA.

Subfamily *CHALCOSIINÆ.*

Genus PINTIA.

Walk., Cat. Lep. Het., ii, p. 280 (1854).

235A. *Pintia litana.*

Pintia litana, Druce, Ann. and Mag. Nat. Hist., (6) xviii, p. 235 (1896).

Described from Hunan.

Habitat. WESTERN CHINA.

Genus CORMA.

Walk.; Hampson, Fauna Brit. Ind., Moths, i, p. 268 (1892).

245a. *Corma laranda.*

Codane laranda, Druce, Ann. and Mag. Nat. Hist., (6) xviii, p. 235 (1896).

This species was described from Hunan.

I have seven male specimens and three females from Omei-shan, taken in May, June, and July.

Habitat. Western China.

260a. *Chelura glacialis.*

Chelura glacialis, Moore, Proc. Zool. Soc. Lond., 1872, p. 570; Hampson, Fauna Brit. Ind., Moths, i, p. 284 (1892).

Three male examples taken in June or July by a native collector in the province of Kwei-chow.

Distribution. Sikhim; Burma (*Hampson*); Western China.

Limacodidæ.

Phocoderma betis.

Phocoderma betis, Druce, Ann. and Mag. Nat. Hist., (6) xviii, p. 236 (1896).

Described from Hunan.

I have seen the type, and find that it is identical with the specimens from Western China which I have referred, I think correctly, to *P. vetulina*, Koll. (No. 365).

377a. *Cania hatita.*

Cania hatita, Druce, Ann. and Mag. Nat. Hist., (6) xviii, p. 236 (1896).

Described from Hunan.

Habitat. Western China.

Family URANIIDÆ.

Genus Alcidis.

Hübn.; Westwood, Trans. Zool. Soc. Lond., x, p. 524 (1879).

Alcidis zodiaca.

Nyctalemon zodiaca, Butl., Ent. Mo. Mag., v, p. 273 (1869).
Alcidia zodiaca, Westw., Trans. Zool. Soc. Lond., x, p. 524 (1879).
Alcidis zodiaca, Kirby, Cat. Lep. Het., i, p. 16 (1892).

Butler's type was stated to be from North China, and obtained in 1857 from Mr. Fortune's collection.

Distribution. NORTH CHINA?; PAPUA; NORTH AUSTRALIA.

NOTE.—Reference to this and the following species was omitted in my paper "On Lepidoptera-Heterocera from China, Japan, and Corea," published in 1897 (Ann. and Mag. Nat. Hist. (6) xix.).

Family EPIPLEMIDÆ.

Genus SCHISTOMITRA.

Schistomitra funeralis

Schistomitra funeralis, Butl., Trans. Ent. Soc. Lond., 1881, p. 4.

The examples in Pryer's collection were from Nikko and Fusiyama. Mr. Manley of Yokohama sent me a number of specimens.

Habitat. JAPAN.

Family GEOMETRIDÆ.

Psychogoës aterrima, Butl., Ann. and Mag. Nat. Hist., (4) xx, p. 400 (1877); Ill. Typ. Lep. Het., ii, p. 8, pl. xxiii, fig. 8 (1878).
Plemyria tibiale, Leech, Ann. and Mag. Nat. Hist., (6) xix, p. 569.

IV. *A Monograph of the Genus* Calisto, Hübn. By Percy I. Lathy.

[Read February 1st, 1899.]

Plate IV.

Up to the present, representatives of the Satyrid genus *Calisto* appear to have been rather scarce in collections of Exotic Lepidoptera, and consequently little is known of them. Kirby, in his "Catalogue of Diurnal Lepidoptera," p. 103, enumerates four species only, and to my knowledge none have been added since, the last described being *C. archebates*, Mén., in 1832. Recently Mr. Herbert J. Adams, F.E.S., has received several fine collections of Lepidoptera from Haiti, and I myself collected in Jamaica during the latter part of 1897 and the early part of 1898, with the result that good series of most of the species inhabiting these islands have been obtained. As two of these are new, as well as a third from the collection of the late Ed. G. Honrath of Berlin, and now in the possession of Mr. Adams, and as some of the species are very closely allied, I think that an account of the genus may be of use to Lepidopterists.

Calisto may be separated from the allied genera by the peculiar position of the 1st subcostal nervule, which leaves the nervure *after* the end of the discoidal cell. The true home of the genus appears to be the West Indies, though some are found in Central America. Kirby, in his "Catalogue," and Cramer (Pap. Exot.) give Carolina and Pennsylvania respectively as localities for *C. zangis*, Fabr., while Mr. Adams has a single female of this species from Demerara.

Genus Calisto, Hübn.

Hübn., Zutr. Ex. Schmett., p. 269, 270 (1823).
Westwood, Gen. Diurn. Lep., p. 399 (1851).

Eyes hairy. Wings rather large, various shades of dull brown on the upperside, underside of each wing with an ocellus. Fore-wings

of male usually with a silky patch. Hind-wings produced into a lobe at anal angle. Costal and median nervure dilated at base. Junction of 1st subcostal nervule with nervure beyond end of discoidal cell.

Key to the Species of Calisto.

A. Fore-wing with well-defined silky patch in centre.
1. *C. zangis*. Jamaica, Demerara.

B. Discoidal cell of underside of fore-wing without red.
a. Ocellus in underside of fore-wing large and distinct, broadly ringed with orange.
2. *C. nubila*. Porto Rico.
b. Ocellus on underside of fore-wing small and obscure, faintly ringed with yellow.
3. *C. archebates*. Haiti.
c. Underside of hind-wing crossed by conspicuous yellow band.
4. *C. pulchella*. Haiti.

C. Discoidal cell of underside of fore-wing with brick-red marking.
a. Red triangular mark in centre of cell of fore-wing.
5. *C. herophile*. Cuba.
b. Cell of underside of fore-wing filled with red.
a^1. Anal lobe ground colour, discal lines of hind-wing not bordered with whitish.
6. *C. hysius*. Haiti.
a^2. Anal lobe black, discal lines of hind-wing bordered with whitish; lower interspace of submarginal lines of hind-wing whitish.
7. *C. confusa*. Haiti.

1. *Calisto zangis*, Fabr. (Plate IV, fig. 1–2, ♂ ♀).

Papilio zangis, Fabr., Syst. Ent., p. 486, n. 193 (1775).
Papilio agnes, Cram., Pap. Ex., IV, t. 325, f. A, B (1782).

♂. Upperside—Fore-wings dark brown. A large round dark-centred silky patch, occupying most of the centre of the wing. Hind-wings dark reddish-brown, dull red and slightly iridescent at anal angle; apex darker than remainder of wing. A minute black spot, faintly ringed with yellowish, at anal angle.

Underside—Fore-wings dark brown; basal third slightly tinged with reddish. A large black, yellow-ringed ocellus above 1st median nervule. Two bluish spots within ocellus, of which the upper is the larger. Hind margin from costa to 2nd median nervule widely reddish. Two wavy dark brown submarginal lines running parallel with hind margin from costa to just beyond 2nd median nervule. An indistinct wavy dark line just before ocellus, commencing on costa, and terminating on 2nd median nervule. Hind-wings reddish brown slightly speckled with yellowish and white. A wavy dark brown line commencing on costa, crossing the centre of the cell, and terminating at inner margin not far from base; a second wavy dark brown line crossing wings just beyond cell, and two indis-

tinct wavy submarginal lines commencing at apex and terminating in a minute black spot at anal angle. A small black, faintly blue centred ocellus between 2nd and 3rd median nervules. Ocellus ringed first with yellow, then with reddish, with a minute white spot at upper end. Minute white spots occasionally between the discoidal, and 1st and 2nd median nervules. Expanse 37–43 mm.

♀. Upperside—Fore-wings dark brown, lower basal half reddish; one silky patch. Hind-wings as in ♂, but with more red at anal angle; cell also reddish, and black spot at anal angle more distinct.

Underside—Fore-wings as in ♂, but slightly paler. More red in and about cell. Hind-wings as in ♂, but paler. Expanse 42–48 mm.

Hab. JAMAICA. In Coll. Brit. Mus.; Godm. Salv.; H. J. Adams, and others. DEMERARA. In Coll. H. J. Adams. CAROLINA; PENNSYLVANIA.

This species exhibits considerable variation in the amount of red on the upperside of hind-wings, and in the ground colour and richness of markings of the underside. Specimens that I obtained at Castleton, at an elevation of from 400 to 1,000 feet, were much brighter than those I took at Cinchona on the Blue Mountains at an elevation of from 5,000 to 6,000 feet. The single female from Demerara corresponds with the lowland Jamaican form. I met with *C. zangis* very commonly in Jamaica; it frequents shady places; its flight is low, and it rarely keeps a long time on the wing, having when pursued a habit of settling among dead leaves, to whose colour it closely assimilates.

2. *Calisto nubila*, sp. nov. (Plate IV, fig. 3, ♂).

♂. Fore-wings blackish brown, paler towards hind margin. Hind-wings dark brown, paler at hind and inner margins. A black spot, bordered inwardly with reddish, at anal angle.

Underside—Fore-wings brown. Discoidal cell filled with reddish and crossed at centre by a brown line. A darkish irregular brown line crossing wings at end of cell. Two wavy submarginal lines. A large black, orange-bordered ocellus above 1st median nervule. Two bluish-white spots within ocellus. Hind-wings bright reddish brown, speckled with orange near anal angle, duller towards hind-margin. A wavy dark brown line commencing on costa, crossing cell, where it is broken on median nervure, terminating at inner margin, not far from base. A second wavy dark brown line, crossing wings just beyond cell. Two indented dark brown submarginal lines, terminating in a black spot at anal angle. A rather large

faintly orange-ringed ocellus, between 2nd and 3rd median nervules. Lower and larger part of ocellus black, remainder orange and containing a white spot. Two minute white spots, one above and one below 1st median nervule. Expanse 43 mm.

♀. Unknown.

Hab. Porto Rico. In Coll. Brit. Mus., Dr. Staudinger, and H. J. Adams, without locality.

This species beneath is very like the preceding, but it may easily be distinguished by the absence of the silky patch, and the upperside of both wings being without red. It differs in a few minor points on the underside, chiefly in the reddish cell of the fore-wings, the brighter ground colour of hind-wings, larger ocelli, and more distinct markings. *C. nubila* appears to be extremely rare; I have only seen three specimens. It is unfortunate that Honrath should not have preserved the locality of his specimen.

3. *Calisto archebates*, Mén. (Plate IV., fig. 4, ♂).

Satyrus archebates, Mén., Bull. Mosc., p. 313, n. 38 (1832).

♂. Fore-wings coppery brown. An indistinct dark silky patch extending from inner margin to cell. Hind-wings coppery brown.

Underside—Fore-wings dark brown; a very indistinct dark mark just beyond cell. Two submarginal lines only faintly indicated. Black ocellus incompletely ringed with yellow, above 1st median nervule. A minute bluish-white spot in centre of ocellus. Hind-wings, dark brown. A conspicuous yellow band, widening on inner margin, crossing centre of wings. Two indistinct wavy submarginal lines, the space between lower part of these slightly paler than ground colour. A small black orange-ringed ocellus between 2nd and 3rd median nervules. A minute bluish-white spot in centre of ocellus. Two or three minute white spots between nervules. Expanse 43 mm.

♀. Unknown.

Hab. Haiti. In Coll. Godm. Salv.

I am indebted to Mr. Godman for allowing me to describe this very distinct *Calisto* from two specimens in his collection, and for kindly lending one to be figured; it appears to be very rare, these being the only specimens I have seen. Mr. Georg Jacobsen, of St. Petersburg, informs me that they have only one example in the St. Petersburg Museum, this being Ménétries' type.

4. *Calisto pulchella,* sp. nov. (Plate IV., fig. 5, 6, 7, ♂, ♀).

♂. Fore-wings blackish brown, paler towards hind margin. A rather large and indistinct silky patch extending from inner margin to 1st median nervule. Hind-wings blackish brown; a black spot at anal angle, bordered with dull yellow.

Underside—Fore-wings blackish brown, slightly paler towards hind margin; faintly speckled with ochreous at apex and along costa. Cell faintly reddish. An indistinct blackish line commencing on costa, passing just beyond cell, and terminating at 2nd median nervule. Two indistinct dark brown wavy submarginal lines. A black ocellus, faintly ringed with ochreous, above 1st median nervule. A white spot within ocellus, and another below it, on the border. Hind-wings dark brown. An irregular blackish line, commencing on costa, crossing centre of cell, and terminating at inner margin not far from base; this line widely bordered inwardly with reddish orange, paler towards inner margin. A second wavy black line crossing wings just beyond cell. Space between these two lines reddish orange, paler towards inner margin. Two indistinct wavy blackish submarginal lines, terminating in a large black ochreous-ringed spot at anal angle. Space between these two lines and hind margin speckled with ochreous; that between the inner of these lines and the discal line speckled with orange, profusely so on border of submarginal line. A black ocellus faintly ringed first with ochreous, then reddish orange, between 2nd and 3rd median nervules. A minute white spot at upper end of ocellus. Space between ocellus and discal line orange. A series of three discal white spots, of which the lower and larger is just beyond cell. Expanse 46 mm.

♀. Fore-wings dark brown, slightly reddish about base. A large triangular pale area beyond cell, the apex of triangle on inner margin near anal angle, the base on costa. Hind-wings dark brown, with large orange-brown area at anal angle, extending as far as discoidal nervule; this area crossed by a rather indistinct wavy dark line, running parallel with hind margin. A blackish spot at anal angle bordered with ochreous.

Underside—Fore-wings as in ♂, but paler, cell more red. Hind-wings as in ♂, but with ground colour, and basal reddish-orange paler. Expanse 50 mm.

♀. *tenebrosa*, ab. nov. (Plate IV., fig. 6). Similar to typical ♀, but without the orange-brown area at anal angle of upperside of hind-wings. Expanse 50 mm.

Hab. HAITI. In Coll. Brit. Mus., ♂, ♀. Godm. Salv., ♂, ♀. H. J. Adams, ♂, ♀. Dr. Staudinger, ♂, ♀.
ab. ♀. In Coll. H. J. Adams.

5. *Calisto herophile*, Hübn. (Plate IV., fig. 8, 9, ♂, ♀).

Calisto herophile, Hübn., Zutr. Ex. Schmett, f, 269, 270 (1823).

♂. Fore-wings dark brown. A large dark silky patch about cell. Hind-wings dark brown.

Underside—Fore-wings brown. A brick-red patch bordered outwardly with a dark brown line, and in form of an inverted triangle, crossing cell. A dark brown line, slightly elbowed at 2nd median nervule, crossing wings just beyond cell. Two wavy dark submarginal lines. Above 1st median nervule, a black ocellus ringed with ochreous, and containing two whitish spots, of which the lower is on the border. Hind-wings brown. A curved wavy dark brown line crossing wings near base. Another dark brown line crossing wings just beyond cell, terminating at anal angle. Two strongly indented dark submarginal lines, terminating in a small dark brown spot at anal angle. Between 2nd and 3rd median nervules, a rather large black, ochreous-ringed ocellus, containing a bluish-white spot at its upper end. A series of three minute white discal spots. Expanse 30 mm.

♀. Upperside as in ♂, but fore-wings without silky patch.

Underside as in ♂, but paler, the ocelli larger, and four minute white spots. Expanse 35–40 mm.

Hab. CUBA. In Coll. Brit. Mus., ♂, ♀. Godm. Salv. ♂, ♀. H. J. Adams, ♂, ♀, and others.

6. *Calisto lysius*, Godt. (Plate IV., fig. 10, 11, ♂, ♀).

Satyrus hysius, Godt., Enc. Méth., ix., p. 525, n. 131 (1823).
Satyrus lysius, Mén., Bull. Mosc., p. 314, n. 39 (1832).

♂. Fore-wings dark brown. A large blackish silky patch extending from inner margin to centre of wing. Hind-wings dark brown.

Underside—Fore-wings brown speckled with ochreous. Cell filled with brick-red. A dark brown line, outwardly bordered with ochreous, crossing wings just beyond cell. Two indented dark brown submarginal lines, the inner of these widening considerably towards

inner margin. Above 1st median nervule a large black ocellus ringed with ochreous, and containing two minute bluish spots. Hind-wings brown, thickly speckled with ochreous. A slightly curved, wavy, dark brown line, faintly bordered outwardly with ochreous, crossing wings through centre of cell. A similar line just beyond cell. Two strongly indented dark brown submarginal lines, terminating separately at anal angle. Between 2nd and 3rd median nervules, a small black yellow-ringed ocellus, containing a minute bluish-white spot at its upper end. Two minute bluish-white discal spots. Expanse 24 mm.

♀. Fore-wings as in ♂, but without silky patch. Underside as in ♂, but with ocelli slightly larger; and red extending a little way beyond cell in fore-wings. Expanse 28 mm.

Hab. HAITI. In Coll. Brit. Mus.; H. J. Adams, ♂, ♀, and others.

In Dr. Staudinger's collection is a specimen labelled "Jamaica," but I think this locality is erroneous.

7. *Calisto confusa*, sp. nov. (Plate IV., fig. 12, 13, ♂, ♀).

Satyrus lysius, Mén. (nec Godt.), Bull. Mosc., p. 314, n. 39 (1832).

♂. Fore-wings dark brown, with dark silky patch as in *C. hysius*. Hind-wings dark brown, a small obscure ochreous spot just above anal lobe.

Underside—Fore-wings brown. Cell filled with deep brick-red. Just beyond cell, a straight narrow ochreous line, extending from costa to 2nd median nervule. Submarginal lines and ocellus as in *C. hysius*. Hind-wings brown, basal half speckled with ochreous. A dark line deeply bordered outwardly with white crossing wings through centre of cell. Another similar line crossing wings just beyond cell; the lower half of this line curves inwardly, and has a wider white border. Submarginal lines as in *C. hysius*, but lower interspace whitish, and they terminate in a blackish mark at anal angle. Ocellus as in *C. hysius*, but larger. Space above ocellus, and between inner submarginal and discal lines, of a lilac tint. Three or four minute white discal spots. Expanse 26 mm.

♀. Fore-wings as in ♂, but without silky patch. Underside as in ♂, but with ocelli larger, and the red extending beyond cell in fore-wings. Expanse 30 mm.

Hab. HAITI. In Coll. Brit. Mus., ♂. Godm. Salv., ♂, ♀. H. J. Adams, ♂, ♀.

Ménétries' description * is evidently of this species, although he refers it to *C. hysius*, Godt.—his name "*lysius*" being merely one of the several similar orthographical errors throughout the paper.

After having examined a long series of each species, I find that the separating characters given in the key are constant. Besides these differences, *C. confusa* differs from *C. hysius* in the following points: the much larger ocellus of the hind-wing; the white borders of the discal lines; the lilac area above ocellus, and the deeper red in cell of fore-wing.

In conclusion, I wish to express my thanks to Dr. Staudinger, who generously sent me his specimens of this genus for examination, and to the Hon. Walter Rothschild, Mr. Godman and Mr. H. Grose-Smith, who kindly allowed me to visit their collections.

* *Satyrus lysius*, Latr. et Godt., Encycl., p. 525, n. 131. Les individus d'Haïti diffèrent un peu de la description de l'Encyclopédie, en ce que les taches roussâtres du dessus des secondes ailes, ne sont visibles que chez la femelle et que ces mêmes ailes ont en dessous deux de ces lignes transversales grises. L'œil des ailes inférieures a le plus souvent, au dessous de la prunelle, un trait blanc longitudinal. Bull. Mosc., p. 314 (1832).

Explanation of Plate IV.

[*See explanation facing the* Plate.]

V. (1) *Illustrations of specific characters in the armature and ultimate ventral segments of Andrena* ♂. By the Rev. F. D. Morice, M.A., F.E.S.

[Read February 1st, 1899.]

Plates V—VII.

(1)

It is generally thought, and has been stated by well-known authors, that the characters of the ♂ genital armature and two last ventral segments—so important in many genera—are in *Andrena* too slight and troublesome to repay investigation. However, during the last few years I have carefully examined them in a large number of specimens, representing all the common Palæarctic species, and as many rarities as I could procure, the number of examples tested in each species naturally depending on the amount of material at my disposal. The result of this investigation leads me to think that the characters in question are neither so valueless, nor so hard to examine, as has been supposed. Those to which I now desire to call attention, though of course *best* seen under a compound microscope after complete extraction of the parts exhibiting them, can generally be recognised quite sufficiently after a much less elaborate preparation of the specimen, and sometimes after none at all, for specimens often occur in which the genitalia or the ventral apex, or both, are naturally protruded enough to show what is wanted. Nor do they require to be highly magnified; a "Coddington" is always more than sufficient, and some of them are visible to the naked eye.

As to their value, they seem to me to have many good points as specific characters. They are often very definite and sometimes quite conspicuous. I have found them on the whole constant through long series of specimens. They are equally apparent, whatever the condition of the specimen—however rubbed or damaged it may be; and though no doubt it is superfluous to spend time over them in the case of species which can easily be determined otherwise, I find that a single glance at them will often enable me to distinguish insects whose other differences would need a prolonged examination; to recognise abnormal

or damaged specimens and very aberrant varieties, in which the ordinary characters are wanting or obliterated; and sometimes to reach a conclusion, satisfactory to myself at least, as to the propriety or otherwise of uniting or distinguishing particular species.

More than this specific value I do not claim for them. I long cherished the hope that they might be utilised for the establishment of good natural groups or subgenera—so urgently needed in this interminable genus, with its ever increasing "*rudis indigestaque moles*" of specific descriptions.

But I have had—most unwillingly—to lay that hope aside. It does not seem to be at all the universal rule that other correspondences between species should involve agreement in the terminal characters. Nor do the latter always agree among themselves; *i.e.*, associations suggested by the type of the armature may be rendered less probable by that of the ventral segments and *vice versa*. Further, though the extreme forms are readily distinguished, so many intermediate conditions occur, that even if it were certain that the former indicated real subgeneric differences, it would be extremely difficult to fix the limits of the subgenera; and again, if every striking difference were to be treated as subgeneric, the number of subgenera required would make the system practically useless. Certainly when two species show an extreme difference in all terminal characters, it would require strong evidence to make me believe that their relationship was of the closest kind. But assuming, what seems to me almost axiomatic, that a large group of species like *Andrena* embraces many minor groups, each developed separately from an antecedent species, I see no reason why a parallel differentiation of terminal characters should not have been produced by similar causes in several groups independently.

But however this may be, the inquiry has acquainted me with much that has been new and interesting to myself, and may be so, I hope, to others. Should the publication of these notes lead some better qualified hymenopterist to examine the facts for himself, I have no doubt that he will see in them much that has escaped my notice, and will obtain more valuable results.

The characters that I have examined lie, as has been said, in the ♂ genital armature and the last two ventral segments, the 7th and 8th (not reckoning the "transferred segment"). Those of the 7th, however, do not seem likely

to be of much practical use, being difficult to examine without complete dissection, certainly less conspicuous, and I think less constant than those of the 8th. Again, in the armature I propose to confine attention to the stipites. Sometimes, no doubt, the sagittæ have specific characters, *e.g.*, basal dilatations of different extent and form. But their position, with deflexed tips, lying almost always out of sight, makes investigation of them troublesome, and on the whole I have thought it best to omit them both in descriptions and drawings. The stipites, on the contrary, show easily examined and often striking differences, as soon as the armatures are exposed and put in similar position. The direct dorsal view displays them quite satisfactorily, and I have adopted this aspect in all my figures of armatures.

The characters of the 8th segment are equally remarkable, but to realise them all, two aspects at least are required—the ventral and the lateral. Very pilose specimens require also to be viewed in a third aspect, the dorsal: *i.e.*, that which shows the interior (concave and naked) side. Otherwise the hairs conceal or disguise the actual outline of the segment, a character of great constancy and importance.

Practically then, we have to deal with (1) the stipites viewed dorsally, and (2) the 8th ventral segment or 'valvula ventralis' viewed ventrally, laterally, and sometimes dorsally also. But first a word may be said, as to the curious and interesting forms and respective situation of the armature and ventral segments in the apex of a ♂ *Andrena's* abdomen.

In the armature the two pairs of claspers (*stipites* and *sagittæ*) appear as if mounted on a cushion-like rather transverse base (the *cardo*). The stipites throughout the genus are conspicuously dilated for about half their length from the base upward, the other (apical) portion of them being comparatively very narrow. Consequently, seen dorsally, each stipes resembles a broad convex plate or 'lobe' with a 'process' attached to it; and for convenience' sake we may perhaps speak of it as consisting of a 'lobe' and a 'process,' though in fact each stipes is made all in one piece and the difference lies only in the extent of its dilatation.

The stipites do not quite meet on the ventral side; but on the dorsal side in front their 'lobes' are always more or

less adjacent, while the 'processes' are parted at their bases by a wide interval containing the sagittæ, etc., but arch over towards each other more or less strongly, so that their apices often meet or even cross, hiding the tips of the sagittæ. It may be noted, too, that this arching creases or 'dogs-ears' them in various ways, according to the particular species under examination.

The 8th segment has a transverse naked base, rather thin and transparent, especially at the sides, convex in the ventral and concave in the dorsal view. This 'basal plate,' as it may be called, lies just at the back of the stipites (to which it often adheres in dissections) and covers the gap between them. Beyond it, *i.e.*, towards the apex, the segment constricts into a sort of narrow 'process,' and at the same time descends (more or less rapidly) at first, but is afterwards usually again geniculated upwards (Plate VI, Fig. 1a *x*). At and above the geniculation the process is always more or less pilose on the ventral side, and lies exactly beneath the sagittæ, which it seems to cover and shelter from below; the deflexed apices of these organs just reach and rest upon it a little before its apex. Down the centre of the plate, and nearly all through the process, the segment is distinctly thickened (dorsally, *i.e.*, towards the armature) and also (perhaps in consequence) generally darker in colour. The thickening ends, often rather abruptly, a little before the actual apex (which is sometimes pale and transparent). Seen laterally, this produces the effect of a more or less distinct subapical tooth (Plate VI, Fig. 1a *y*).

The 7th segment is in form a transverse crescent, generally notched in the middle of its exterior or convex margin. It covers a part only of the 8th, lying across it in such a way that the constricted "process" of the 8th fits into and fills its notch, just before the geniculation, while the pilose part beyond, and most of the basal plate, are left uncovered. The sides of the "notch" bear each a little fringe or pencil of diagonally-pointing hairs, and are sometimes produced into definite teeth. This segment (except its actual apex) and the base of the 8th lie concealed under the 6th—the apical margins of the three segments in part nearly coinciding. The whole 7th segment is thin and frail, causing much trouble in dissection; it generally sticks pretty tightly to the 6th, and sometimes its notch hangs closely about the "neck" of the 8th, so that between the two it is very liable to get torn in pieces.

But when extracted properly it is a pretty and interesting microscopic object, though less so than the 8th. [Plate V, Fig. 1, shows the 7th segment in A. *coitana*, Kirby (*a*) and *labialis*, Kirby (*b*); Fig. 2 (*bimaculata*, Kirby) shows the 7th segment (white) lying inside the 6th (shaded); Fig. 3 (also *bimaculata*) shows the 7th segment (white) crossing the 8th (shaded).]

We can now turn to the specific characters of the *stipites* (Plate V), and the *valvula ventralis* (Plate V, VI, *cf.* also Plate VII illustrating the next paper). To define them a few technical terms will be required, which I will try to explain as shortly as possible by reference to my figures. Some have been used already, but I will enumerate them all together here.

In Plate V, Fig. 4*a*, a single lobe (*morio*) is shown diagrammatically with explanatory lettering. Thus *d c e f* is the 'lobe of the stipes,' *g a h b* is its 'process'; *c d* I call the 'apical outline' of the lobe, *d e*, *e f*, *f c*, its 'interior, basal, and exterior' outlines respectively; *c d e* (the inclination towards each other of the apical and interior margins) I call the 'angle.' In Fig. 6 the apical margin may be called 'straight,' in Fig. 19 it is 'strongly sinuated inwards,' in Fig. 15 it has a 'strong S-like sinuation.' In Fig. 6 the lobes are quite 'adjacent,' in Fig. 10 they are only adjacent at the base, in Fig. 11 they are 'separated at the extreme apex.'

The angle at *d* in Fig. 4*a* is 'practically a right angle,' in Fig. 6 the corresponding angle is 'acute,' in Fig. 9 'obtuse'; in Fig. 21 it is 'narrowly dentate,' in Fig. 22 'widely dentate,' in Fig. 15 it is 'rounded off;' *a h b* is the 'exterior outline' of the process, *g c* its 'interior outline' (*g i* is a part of the posterior margin of the stipes, and may generally be disregarded).

Of course the appearances of these outlines will vary when the position of the segment is shifted. It is highly necessary, therefore, in comparing two armatures to get them into the same position. It must be remembered that these outlines are not all true *margins*, but rather 'horizons,' produced by the convexity of the stipes. Still, their differences of appearance in the various species are very constant and characteristic.

In Plate VI the 'basal plate' and 'process' of the 8th segment will be easily recognised in most, if not all, of the 'ventral views,' *e.g.*, Fig. 4 shows them in a very simple

form. In several of the 'lateral views' letters are used to show *x* the 'geniculation,' and *y* the tooth-like end of the 'thickening' in the process.

In Fig. 5 the constriction of the base into the process is gradual, in Fig. 6 it is sudden, and in Plate VII, Figs. 1 and 2, it gives the basal plate a 'shouldered' appearance.

In Plate VI, Figs. 9*a* and 13*a*, the geniculation is more or less 'lobate,' the lobe in each case being indicated by the letter *x*. [By comparing in succession a series of lateral views of different species (3*a*, 6*a*, 1*a*, 13*a*, 12*a*, 11*a*, 10*a*, 9*a*), we can trace the gradual development of a hardly sensible geniculation into the conspicuous projection, which gives so curious a character to the apex of the *valvula ventralis* in many species, of which *labialis*, Kirby, is the only British example.]

Having thus defined the terms I shall have to use, I will say at once what remains to be said as to the terminal characters which my figures are meant to illustrate.

1. *The armatures* (Plate V).

What seems to me most of all to determine the general look of an *Andrena* armature is the apical outline (*c d*) of the lobe. Whenever this is deeply sinuated inwards the lobe becomes distinguishable at a glance from such simple forms of it as appear in my first two or three figures. The actual effect produced in each case depends (1) partly on the depth of the sinuation, making the tooth-like angles longer or shorter, (2) partly on the more or less near approach of the sinuation to the interior margin, making the teeth look broader or narrower, and (3) partly on the *duration* of the curve (*i.e.*, its approximation to a completed circle), making them more (Fig. 19) or less (Fig. 20) divergent. But in all these cases, the lobe 'looks dentate' to an extent which catches the eye at once after a little practice. It is instantly distinguishable from the merely acute-angled lobe with simple outline shown in Fig. 6; and still more from the right-angled, or the (rare) obtuse-angled types of lobe, of which Figs. 4 and 9 respectively are examples.

Again, a decided S-like sinuation (as in *ovina*, Klug, Fig. 15) gives the lobe an oval or dome-like character, which can be recognised at a glance. Even a slight S-like sinuation (Figs. 14 and 17) produces something of this effect.

Next to these differences in the apical outline, those of

the interior outline seem to catch the eye most easily. Any marked deviation from their usual approximation makes the armature look peculiar (see Figs. 8, 11, 19, and especially 10 *) ; and such a condition arises whenever the interior outlines of the lobes are wholly or in part exceptionally concave or convex.

The exterior outlines of the lobes seldom differ, except in their greater or less convexity and convergence towards the base. In *A. flessæ*, Panz., however (Fig. 17), the lobes swell out so that their outlines actually diverge for some way from the process downwards, and bring the broadest part of the armature much nearer to its base than in any of the other species here figured. Normally the greatest breadth of the armature is at or about the origin of the process.

While the process is usually rugose and dull, the lobes are nearly always smooth and shining. Unless very highly magnified, they seldom show much sculpture (on the disk at least) except very shallow sulcate impressions visible only in certain lights. To this there is one curious exception in *fasciata*, Nyl., where the lobes are covered with an intensely fine and close rugulosity, making them absolutely dull. The character is visible even to the naked eye, and I find it equally present in examples of this species from England, Switzerland, S. France, and Italy. In several other species the surface is more or less microscopically rugulose, but not enough to prevent it from shining.

In *chrysosceles*, Kirby, Fig. 13, and also in *lucens*, Imhoff, the lobes are so broad as to look almost spherical. These species are in this respect extraordinarily unlike any with which one would expect them to agree, such as *coitana*, Kirby, which has very sharp and divergent teeth to the lobes. In *Schencki*, Mor. (Fig. 11), the lobes are also rather dumpy, but the interior margins being concave towards the apex, give the armature a wholly different character.

Cingulata, Fab. (Fig. 8), is on the whole the most abnormal *Andrena* armature known to me. Here the lobe, instead of springing abruptly inwards from the process with

* I have only twice been able to dissect a *suerinensis* (Fig. 10) and do not know whether the gap between the lobes is always as conspicuous as in the specimen figured. But the concavity of their inner outlines evidently makes it impossible that they should ever be completely adjacent.

a bold and almost angular curve (see Fig. 4 *d c g*), begins to develop itself almost from the apex of the stipes downwards, the interior margin of the process passing so gradually into the apical outline of the lobe, that it is impossible to say whereabouts, even, one ends and the other begins. On the interior outlines, also, the lobes merely touch at one point and then instantly diverge, leaving a great gap between their bases. The little knob-like twist at the apex of each process is altogether eccentric. And finally the armature is quite enormous in proportion to the size of the insect, *e.g.*, it is twice as broad, and more than twice as long, as that of *cetii*, Schrank, in a number of examples of each species that I have measured. *Genevensis*, Schmied., a species superficially a good deal resembling it, has an utterly different, small and simple type of armature, rather resembling that in Fig. 7. *Cetii*, Schr., has a somewhat unusual form of lobe, the angles being distinctly obtuse, but its other terminal characters are not remarkable.

As to the characters of the process, they arise chiefly from the different manner in which, according to the species, it is bent or creased over inwards near the apex. The part beyond this crease forms a sort of "dog's-ear" (Fig. 4 *a g h*) which in the dorsal view faces the observer almost directly, and so looks dilated in comparison with the part below it (*h b c*), which is seen more edgewise.

When the crease is near the apex, the narrow looking part becomes long and stalk-like (Fig. 9) and the process assumes a sort of petiolate character, which is hardly to be recognised in Fig. 4., etc., where the "dog's-ear" is longer. But whatever the position of the crease, a process may look petiolated, if the lobe is so sinuated (Fig. 19) as to increase the apparent length of the process.

In the most normal forms of the process its exterior outline forms a single convex curve, and deviations from this always give a peculiar look to the armature. Thus a very abrupt creasing of the process nearly transversely (ordinarily it is *diagonal*), substitutes a distinct angle for the simple curve. I believe I could always recognise an *analis*, Panz., armature (Fig. 21) by its heptagonal look, due partly to its angled process, and partly to similar features in the exterior outline of its lobe. *Florea*, Fab., again (Fig. 7) seems to me very distinct by its nearly straight processes, with a very slight sinuation inwards, the exterior

outlines approaching each other like the sides, not of an arch, but of a triangle. And in some species (Fig. 18, so also in *fulva*, Schr. and others) there is a marked sinuation inwards of the exterior margin, because the process is creased, not *down*, but *up*. This character makes the process still more resemble a leaf with its petiole. The crease is upwards also in the extraordinary *cingulata* (Fig. 8.) In *fulvicrus*, Kirby, the process is so folded as to produce a little subapical notch in its exterior outline (Fig. 5). By this character the species can be distinguished at once. I have seen it in countless specimens from all parts of Europe, and never known it to fail.

The very elongate and narrow-looking processes of Fig. 9 *bucephala*, Steph., and Fig. 10 *suerinensis*, Friese, are conspicuous at once. In neither insect is the type of armature at all like that of other species which one would suppose to come near it. *Bucephala* ♂ is excessively like *megacephala*, Smith, in most characters, but *megacephala* has a perfectly normal armature, and, as will be seen hereafter, its 8th segment is also normal while it is very eccentric in *bucephala*. The rare *ferox*, Smith, I have never had a chance of dissecting. It would be interesting to know whether its terminal characters resemble those of *bucephala*. As to *suerinensis* its propodeal sculpture, etc., would place it near *tibialis*, Kirby, *pilipes*, Fab., etc. But these species, and also *bimaculata*, Kirby, with all its varieties (*Magrettiana*, Schmied., etc.) have the wholly different type of armature shown in Fig. 23. Here the dentate angles of the lobe are excessively sharp, divergent, and much deflexed. The sinuation of its apical margin is almost continued into a perfect circle by reason of a sort of rounded tubercle on the inner margin of the process; above which tubercle comes another semicircular sinus, the outline of the two sinuations and the tubercle together forming a sort of "figure three" (3), which alone would distinguish this type of armature from all the normal ones. The apical creasing is also quite peculiar, downwards, but *longitudinal* (not diagonal or transverse) in its direction, so that the actual "dog's-ear" is quite narrow, and the apical part of the process as a whole is so foreshortened as to look somewhat triangular. This is one of the comparatively few cases, in which a number of evidently nearly related species have one very distinct and practically identical type of terminal segments. But different as are these characters in *suerinensis*, Friese, I should

hesitate on that account to remove it from their company. So also with *ephippium*, Spin. (which in propodeal, and also in terminal characters, shows some degree of affinity to *sucrinensis*, but in the latter at least is quite unlike *pilipes*, etc.).

In a species which I believe to be *circinata*, Dours (Fig. 20), the process has a singularly constricted and hook-like tip. Exactly the same character occurs in a red species which I have taken in Algeria. According to Lucas's collections at Paris this would seem to be *rufiventris*, Lep. These two species have also similar and most abnormal 'valvulæ ventrales,' which are shown in Plate VI, Figs. 14, 15.

The 8th segment. The characters of this segment lie partly in its outlines, and partly in its pilosity. In one or both of these respects some species may be considered *normal* and others *paradoxical*.

Perhaps as simple and common a form as occurs is shown in Fig. 4, *megacephala*, Smith. Here the constriction from "plate" to "process" is uniform, causing no violent sinuation in the outline (as in Fig. 10). The process is of normal length and breadth, and equally broad throughout, except just at the base and apex, where it dilates very slightly. The moderate geniculation (only to be recognised in this view as being the base from which the pilosity springs) is about half way between the base and apex of the segment. The apex is slightly bilobed, which is the most usual condition; but this character is apt to vary within the limits of a single species. The pilosity is perfectly simple, with a regularly oval exterior outline, forming neither tufts nor separate fringes anywhere, but covering the whole process uniformly, just passing its apex, but extending a good deal further beyond its sides.

The above description would suit with little alteration all such species as I should consider *normal*. Any very conspicuous deviation from its characters marks a species as *paradoxical*. Thus, considering first the outline: I should say that a more or less paradoxical condition arises whenever the process is extremely long and thin throughout (Plate VII, Fig. 5*a*) or the reverse, or is violently dilated or constricted at any point, or has markedly divergent or convergent outlines from base to apex. So again when the constriction from plate to process is violent or uneven, causing marked sinuations or "shoulder" like projections in the outline (Plate VII, Figs. 1, 2,) or creating a long parallel-sided "neck" between the geniculation

and the transverse basal plate (Plate VI, Figs. 9 to 13). Many eccentric effects are produced by extreme development of the geniculation, which seems to absorb, as it were, the pilose part beyond and make it shorter, or at least give it a bend which foreshortens it in the ventral view. (It seems to me that whenever a geniculation is lobate, it invariably looks much nearer the apex of the segment than usual; and the length of a process is generally in inverse ratio to the strength of its geniculation.) Extremely paradoxical are the laterally-toothed (cruciform) processes shown in Plate VII, Figs. 6, 7, 8, 9 (see also Plate VI, Fig. 16). I cannot find that these have ever been described or figured, but they are surely a most striking "character." Lastly, an exaggeration of that thickening of the process on its naked side, which in Plate VI, Fig. 2*a*, *y* suggests a minute subapical tooth, gives in the lateral view a paradoxical aspect to the apex of the process in *nigro-olivacea*, Dours, and *livens*, Perez (Plate VII, Figs. 1*b*, 2*b*). And to conclude—for I see I have said "lastly" a little too soon—though a bilobed apex may disappear in some species by variation, such a development of it as appears in *bucephala*, Steph. (Plate VI, Fig. 17), is a character that may probably be trusted.

As to the pilosity—I think that even in the normal types this is principally developed near the geniculation, the hairs becoming sparser and shorter towards the apex. But in many paradoxical forms the phenomenon becomes far more conspicuous. Thus in *albicrus*, Kirby (Plate VI, Fig. 7), *argentata*, Smith and others, the pilosity is practically confined to the geniculation, which it encircles with a definite belt, the apex of the process standing up naked beyond it. In *ovina*, Klug, *suerinensis*, Friese, etc., it forms not so much a belt as a pair of lateral brushes at this point, and the rest of the process is manifestly clothed less densely. In *ephippium*, Spin. (Plate VI, Fig. 13), the lateral brushes are again conspicuous, but the process is very hairy at the apex also. In Fig. 16 (*scita*, Ev.) there is a tremendous development of hair over the whole process, but we still see the strong brushes of the geniculation asserting themselves independently. While in *bucephala*, Steph. (Fig. 17), though the sides of the process are fringed all along with hair, it is still possible to distinguish a pair of special brushes at the geniculation.

In most, if not all cases, where the geniculation is lobate the process is at least a little dilated laterally at this point (see Fig. 9*b*). This is very noticeable in Fig. 16*b* (drawn without the pilosity to emphasise the outlines), where another very curious phenomenon is to be observed, viz., that the thickened (dark) part of the process behind has an outline of its own which is cruciform (that of the process itself being hexagonal). If for any cause (as by absorption or folding inwards of its frail transparent part) the actual outline of the segment should become identical with that of the thickening, we should get exactly such a cruciform process as we find in Plate VII, Figs. 6, 7, 8, 9. Comparing these Figures, and also Figs. 10 and 11 of the same plate, with Figs. 9 to 15 of Plate VI, it appears to me that we can trace the gradual stages in a process of development, through which it is possible at least that the "cruciform process" may have arisen. I do not mean to suggest that, as a species, *scita* (Plate VI, Fig. 16*b*) is to be placed necessarily between *ovina* (or *humilis*) and *senecionis*, but only that, in this particular matter of the lateral development of the "process," it shows a condition which is certainly intermediate and *may* be transitional. *As a species* it may belong to quite a different group. But if a species, really belonging to the group of *humilis* and *senecionis*, and really transitional between the two, exists and should hereafter be discovered, I think it is highly probable that its "valvula ventralis" will resemble that of *scita*.

I have now only to add a few stray notes on sundry details in my figures (Plate VI).

Fig. 1, *thoracica*, Fab., shows a slightly paradoxical type, with strong but not lobate geniculation (1*a x*), rather short broad and cup-like process, and pilosity developed as a pair of definite lateral fringes whose outlines run somewhat parallel to the sides of the process.

A similar type, combined with strong similarity in the armature, occurs in *nitida*, Fourcr., *morio*, Brull., *albopunctata*, Rossi, etc.

Figs. 2 and 3 are introduced mainly because the species will be mentioned in the paper following this. I will here say only that they are tolerably normal forms, except that the process in *braunsiana* is wide for its length, and that the apex in *rufo-hispida*, Dours, is rounded not bilobate, at any rate in this particular specimen.

In Fig. 5, an interesting Syrian species of which M. Abeille de Perrin has kindly given me several examples, the process is dilated towards the apex, but its outlines are not otherwise abnormal; the pilosity, however, gives it a truly paradoxical appearance. A pair of thick and very long lateral brushes, starting from the geniculation, sweep round in bold semicircular curves encircling the apex, and almost meeting beyond it.

It has been suggested that *schencki*, Mor. (Fig. 6, 6*a*), is a mere colour-variety of *labialis*, Kirby (Fig. 10, 10*a*). I feel sure that any one comparing their *valvulæ ventrales* will see that this is quite impossible.

The species which in all characters (terminal included) come nearest, among those I have examined, to *labialis*, are *decipiens*, Schenck (Fig. 11), and *variabilis*, Smith. The precise agreement of these latter species in the characters of the 8th segment with *ovina*, Klug (Fig. 9), is very curious, for their general facies is extremely different, and their armatures are easily distinguished. It is hard to see how they can be brought near it in any natural system of groups.

Fig. 8. The bottle-like outline of the process in this species (*fucata*, Smith) separates it very easily from those most resembling it, *e.g.*, *varians*, *helvola*, *ambigua*, *apicata*, *lapponica*, etc. In all these the sides of the process are very gently and evenly sinuated throughout: it is about equally broad at base and apex and narrowest half way between them. Figs. 18 and 18*a* appear to show an extraordinary development of the character just noticed in *fucata*. The apex is almost ridiculously narrow and produced, but the sides of the process dilate abruptly and become convex towards the geniculation. This (*flessæ*, Panz.) is the species whose extraordinary armature is shown in Plate V, Fig. 17, with its huge lobes and meagre-looking short and narrow processes. I may note, also, that the constriction of the 8th segment between its basal plate and its process is very sudden, giving to the latter a strongly "shouldered" appearance.

Figs. 14, 14*a*, 15, 15*a*. These strange forms, with the lateral projections of the process each ending apparently in a little hook, were long utterly unintelligible to me. But by comparing their lateral views with Figs. 9*a*, 10*a*, etc., I believe I can now understand them. The hook-like tips seen in the ventral views, appear in the lateral

views (14*a*, 15*a*) as a *spiniform* development of the geniculation (*x*) answering to the *lobate* developments in 9*a*, etc. The very short and broad-based portion of the segment beyond these hooks or spines is an exaggeration of such a process, widening from the apex to the geniculation, as we see in Figs. 9*b* and 16*b*. This hypothesis to my mind accounts satisfactorily for all their peculiarities, and brings them into an intelligible relation with the other types that we have examined.

One other question I will raise, and endeavour to answer with a hypothesis. Why does the pilosity of this segment throughout the genus tend so markedly to a lateral development on each side of the geniculation? Because, I will venture to reply, the process with its pilosity serves to close from behind that gap between the stipites in which lie the sagittæ. Since the process from the geniculation towards the apex gradually approaches nearer to the back of these organs, the gap which the pilosity has to shelter gradually diminishes, and the pilosity can diminish also. It is at the geniculation that the process is most distant, both from the stipites and from the sagittæ, and it is precisely there that the pilosity seems most concentrated and developed.

I have little doubt that the general outline of the process as seen ventrally, including its pilosity, is determined in each species by that of the cavity at the back of the armature which it screens. But to prove or disprove this hypothesis completely would require a further investigation, on which I cannot enter here.

One more remark I will make, viz., that in *Andrena* as in other genera, though the armature as a whole is concealed and hairless for the most part, some pilosity (very little, however, in this genus) is developed on the apex of the stipes. This pilosity springs from what, but for the crease, would have been the ventral surface of the stipes. Owing to the crease, it is diverted or transferred to form part of the *dorsal* clothing of the insect. A few hairs also exist at the bases of the stipites posteriorly, which originate as *ventral* and remain so, combining with [the pilosity of the 8th segment, and (I may add) with the apical pencils of the 7th, to close the gap, of which so much has been said, at the back of the armature. Here, as throughout their whole structure, the parts we have considered seem, as far as we can interpret them, to be accommodated one to another

and to cooperate in some common function. When at rest, I think that function is mainly the protection of the frail sagittæ; but since all alike are capable of motion in various directions, they doubtless cooperate in some way for other purposes, and each has probably some function in the act of generation itself. Thus their curious and complicated features are an extreme instance of functional adaptation.

(2) *Notes on* Andrena taraxaci, Giraud, *and the species most resembling it, with synoptic tables, and descriptions of two new species.* By the Rev. F. D. Morice M.A., F.E.S.

(2)

In the paper preceding this, an attempt was made to describe, and partly account for, certain specific characters observable in the males of *Andrena* generally. I shall now endeavour to use some of them (those of the *valvula ventralis* or 8th ventral segment) for a practical purpose, making them contribute to the elucidation of a difficult group of species, whose similarity in most characters has caused much perplexity and disagreement among hymenopterists.

The only British species among them is that described by Mr. Saunders as *humilis*, Imhoff, but known generally on the Continent as *fulvescens*, Smith. In our limited fauna, and also, according to Thomson, in that of Scandinavia, this is a very distinct and easily recognised insect. Thomson groups it only with *fulvago*, Chr., from which it differs in many important and conspicuous characters. But further South, and especially in the Mediterranean regions, *humilis*, Imh. (as I shall call it for reasons presently to be given), is only one among a large number of more or less closely similar species. Many of them, I think, resemble it only as *fulvago* does, *i.e.*, quite superficially. But others are so like it and one another not only in general aspect, but in minute details of structure, that they are constantly mistaken for one another even by experienced hymenopterists.

Of these species I know at least ten, which both in superficial and structural characters resemble each other deceptively, but whose males can be separated with ease and certainty by the characters of the *valvula ventralis*

Two of them are well-known species, others have only recently been detected, and two, I believe, are hitherto undescribed.

In Plate VII I show this segment (equally magnified) in each of these species in three aspects, ventral (Figs. 1, 2, etc.), dorsal (Fig. 1*a*, etc.), and lateral (Fig. 1*b*, etc.); and I will now, after a very short general survey of the characters they exhibit, attempt to tabulate them in a synoptic form. Next, as far as I know them, I will give a synopsis for distinguishing the females. And I will conclude with some further notes on the insects of this group, clearing up, as I hope, some confusions in the synonymy, on the common characters of the group and its probable limits, and with descriptions of the two new species.

Looking at the segments (Plate VII) as a whole it is clear to me that Figs. 6, 7, 8, and 9 make a very definite sub-group united (*inter alia*) by the highly paradoxical tooth-like dilatations on each side of the "geniculation" (see the preceding paper). These dilatations appear in an inchoate or rudimentary form in Figs. 10*a* and 11*a* also, while they are entirely wanting in my first six figures. Again, Figs. 1 and 2 are united by (*a*) the trumpet-like dilatation of their "apical processes," (*b*) the appearance (explained in the preceding paper) of a strong subapical tooth on the dorsal (naked) side (Figs. 1*b*, 2*b*), and (*c*) by the "shouldered" outline and violent constriction of their "basal plates" towards the origin of the "processes." Figs. 3 and 4 are very like each other, but differ enough in their proportions to be specifically distinguished: and Fig. 5, while nearer to Figs. 3 and 4 than to any of the others, is separable from them at a glance. Between Figs. 10 and 11 I can see no specific difference, and I believe that the insects from which they were drawn are varieties of a single species.

The figures were drawn with camera lucida, and, to economise space, show the "basal plate" in the ventral aspect only.

Synopsis of the Valvulæ Ventrales.

Process on each side of its geniculation (base of the pilosity) simple	1.
Process on each side of its geniculation (base of the pilosity) evidently dilated	5.

1. Pilose process strongly dilated towards the apex. Seen laterally, its naked side is much curved, with a strong subapical projection. Basal plate distinctly "shouldered" ... 2.
   Process hardly if at all dilated. Seen laterally, its naked side is nearly straight, and the tooth hardly noticeable. Basal plate gradually constricting towards the process, without "shoulders" ... ... 3.
2. Pilosity long, stretching far beyond the apex of the segment. Subapical tooth less prominent ... ... 2. *livens*, Fig. 2.
   Pilosity much less developed, hardly passing the apex of the segment. Tooth very sharply prominent ... ... 1. *nigro-olivacea*, Fig. 1.
3. Process very long and narrow ... ... 5. *giraudi*, Fig. 5.
   Process ordinary ... ... 4.
4. Process rather broad throughout ... ... 3. *ferrugineicrus*, Fig. 3.
   Process slender but dilated before the apex ... 4. *truncatilabris*, Fig. 4.
5. Dilatations slight, merely angular. Pilosity confined to a pair of lateral bunches starting from the geniculation, between which projects the naked apex ... ... 10. *humilis*, Figs. 10, 11.
   Dilatations very strong, and tooth-like, making the process cruciform. Pilosity highly and paradoxically developed ... ... 6.
6. Lateral outline of pilosity simple, without separately projecting tufts on the dilatations 7.
   Dilatations with tufts which project laterally far beyond the rest of the pilosity ... ... 8.
7. Process (beyond the dilatations) very elongate. Its apex narrowly truncate. Pilosity not thick enough to conceal its outline even in the ventral view. Below the dilatations the segment is more than twice as wide as at the apex ... ... 6. *taraxaci*, Fig. 6.
   Process short and stumpy with rounded apex. Pilosity quite concealing its outline in the ventral view. Hardly wider below the dilatations than near the apex ... ... 7. *curtivalvis*, Fig. 7.
8. Process (beyond dilatations) nearly square. Pilosity excessively villose and long; seen ventrally and dorsally it projects far beyond the apex of the segment into two tufts or plumes which curl conspicuously outwards; seen laterally the hairs are as long or longer than the process, and project from it almost at right angles ... ... 8. *senecionis*, Fig. 9.
   Sides of process sinuated inwards and apex bilobed. Segment just below dilatations twice as broad as in *senecionis*. Pilosity much thinner, not hiding the outlines of the process even in the ventral view, and curling not outwards but inwards round the apex; seen laterally it is decumbent and of moderate length ... ... 9. *stabiana*, Fig. 8.

Of the above species it may be noted that the ♂ clypeus seems to be always

white in *ferrugineicrus*, *truncatilabris*, and *giraudi*:

black in *nigro-olivacea*, *livens*, *taraxaci*, *curtivalvis*, *senecionis*, and *stabiana*.

In *humilis* it may be white or black, usually the former.

I do not know the female of *giraudi*, but the other females can I think be distinguished according to the following table.

Synopsis of the Females.

Scopæ (without and within) much developed, long and thick ... ... 1.
Scopæ (especially within) much slighter and shorter ... 7.

1. Hind tibiæ and tarsi flavescent, thorax absolutely dull. 2.
Hind tibiæ and tarsi darker, thorax at least somewhat shining on the scutellum ... ... 3.
2. All pilosity longer; punctures very coarse and strong; species more æneous and larger ... ... 1. *nigro-olivacea.*
Pilosity shorter; punctures much finer; species less æneous and smaller ... ... 2. *livens.*
3. Hairs of face and vertex pale or golden... ... ... 4.
Hairs of face and vertex darker, brown or even partly black ... ... 5.
4. Species larger; more shining and finely punctured; apices of abdominal segments widely and conspicuously pale (flavescent) ... ... 8. *senecionis.*
Species smaller; puncturation stronger; apical discolorations hardly noticeable... ... ...10. *humilis.*
5. Scutellum with extremely fine punctures, hardly shining owing to an excessively regular and close (though fine) reticulation of the entire surface. Apical fimbriæ more compact and decumbent ... 9. *stabiana.*
Scutellum more strongly punctured, but decidedly shining. The reticulation is far less distinct, in places hardly visible, and nowhere so close and regular as in the last species. Apical fimbriæ more bushy and projecting ... ... 6.
6. Smaller, with darker pilosity (much of it quite black) on head and pronotum. Abdomen more elongate and parallel-sided. Punctures of mesonotum finer and more remote ... ... 7. *curtivalvis.*
Larger, pilosity of head, etc., rather brown than black, certainly more fulvous than in *curtivalvis*. Abdomen more oval and transverse. Punctures of mesonotum stronger and closer ... ... 6. *taraxaci.*
7. Punctures of abdomen stronger; scopæ orange-reddish; hairs of face dark ... ... 3. *ferrugineicrus.*
Punctures of abdomen excessively slight and shallow; scopæ pale; hairs of face white ... ... 4. *truncatilabris.*

Notes on the above Species.

1. *Nigro-olivacea*, Dours. This is a well-known species. I need only refer to Schmiedeknecht's full description of it in Apidæ Europææ, p. 560. The specimens examined are from Spain (coll. Friese), Algiers, and North Italy.

2. *Livens*, Perez. (Mellifères de Barbarie, p. 39.) I have examined a ♂ determined by the author, and both sexes in the collection of Mr. E. Saunders (taken in Algeria by the Rev. A. E. Eaton). Dr. Schmiedeknecht has kindly communicated to me both sexes from Tunis

(Ruins of Carthage), and also a ♀ from Lombardy, which he described in Apidæ Europææ as the ♀ of *taraxaci*, Giraud. It is, however, certainly not that species, and I feel sure that it is a true *livens*. I have a number of ♀ ♀ from South Italy which appear to belong to this species. They have the characteristic absolutely dull thorax and finely punctured abdomen. Their hind tibiæ, however, are only obscurely flavescent, much darker than in the normal form.

3. *Truncatilabris*, Mor. The specimens examined are from Hungary, given to me by Herr Friese. Mr. Saunders has it from Toulouse and Marseilles (ex coll. Marquet). The hairs of the face in both sexes are quite silvery, unlike those in any of the other species.

4. *Ferrugineicrus*, Dours. Herr Friese has given me ♂ ♂ and ♀ ♀ from the Balearic Islands. Mr. Saunders has, I believe, the same species from Algeria (Eaton).

5. *Giraudi*, Dours. I have only a single specimen taken by myself in Algeria, and determined for me by Herr Friese. The "valvula ventralis" is extraordinarily narrow throughout, quite unlike any other known to me in this group, but nearest to those of the two last species, with which it is also associated by the white clypeus. I can find no ♀ likely to belong to it. Probably, as in *truncatilabris* and *ferrugineicrus*, the ♀ scopæ would be comparatively little developed.

6. *Taraxaci*, Giraud (nec Schmiedeknecht). I have examined Giraud's types (taken near Vienna) in the Paris Museum, and Herr Friese has sent me many specimens exactly agreeing with them from Austria and Hungary. Frey-Gessner has found it in Switzerland, but very rarely. These are the only localities for the true *taraxaci* known to me.

Dr. Schmiedeknecht was so good as to send me the types from which he drew up his description of *taraxaci* in Apidæ Europææ. They come from Lombardy, but they do not belong to Giraud's species. The ♂ is *senecionis*, Perez, and the ♀ *livens*, Perez. This I had gathered from his descriptions; but I thought it best to see the actual types, if possible, and he was kind enough to let me do so.

7. *Curtivalvis*, n. sp. This species is so like *taraxaci* that but for the different form of the ♂ valvula ventralis,

I should hardly have detected its distinctness. Close examination, however, shows even in the ♀ ♀ differences which, though slight, seem constant and sufficient (see the Table). All my specimens (1 ♂ and many ♀ ♀) were taken by myself near Algiers last spring (1898).

8. *Senecionis*, Perez (Mellifères, p. 39), is a very distinct species. I took it in great abundance in Algeria and also in Italy. It occurs, too, at Canet in South France (coll. E. Saunders), and in Spain (Friese). The paradoxical pilosity of the valvula is usually visible without dissection, and the two outcurling flocculi at its apex will distinguish the species at a glance. The apices of the dorsal segments are widely pale—almost yellow—especially in the females. This, together with the golden pilosity and the finely punctured, almost shining body surface, gives it a decidedly brighter appearance than that of any other species in the group.

9. *Stabiana*, n. sp. I have several of both sexes from Castellamare near Naples, the ancient Stabiæ. Mr. Saunders has it also from Sicily. These are the only specimens I have seen. Until the ♂ valvula ventralis is extracted (to show the lateral teeth) it looks rather like that of *livens*, but the body surface is very unlike that species. The ♀ is superficially very like a small *taraxaci*, but the characters given in my table distinguish it easily from that or any other species.

10. *Humilis*, Imhoff. The author describes the ♂ clypeus in this species as normally black, but sometimes white. Hence it has been thought that his was a mixed species; and the name *fulvescens*, Smith, is generally employed on the Continent to denote the white-faced common form, which occurs all over the Continent and also in England. But I have found in Switzerland, Italy, and South France, along with the normal white-faced males, other males with a *black* clypeus, completely like them otherwise, and with a *valvula ventralis* which after careful examination I can only consider as specifically identical with theirs. (See Plate VII, Fig. 10, drawn from a ♂ with black clypeus, and Fig. 11 from a (British) ♂ with white clypeus, which is certainly the *fulvescens* of Smith.) I believe, then, that Imhoff was right, there being in fact two forms of the ♂ in this species: and his name being much older than that of Smith (1832, Isis ix, p. 1201) should be employed, as has been done by Mr. E.

Saunders both in his "Synopsis" and his "Hymenoptera Aculeata."

Herr Friese has sent me the same or a very similar black-faced male from Greece. I think it is possible that the short description in Perez (Mellifères, p. 40) of *A. imminuta* refers to this black-faced form of *humilis*, but I have not seen the specimens on which it was founded.

List of the above Species.

1. *Nigro-olivacea*, Dours.
2. *Livens*, Perez (=taraxaci ♀, Schmied. *nec* Giraud).
3. *Truncatilabris*, Moraw.
4. *Ferrugineicrus*, Dours.
5. *Giraudi*, Dours.
6. *Taraxaci*, Giraud.
7. *Curtivalvis*, n. sp.
8. *Senecionis*, Perez (=taraxaci ♂, Schmied. *nec* Gir.).
9. *Stabiana*, n. sp.
10. *Humilis*, Imh. E. Saunders, var. *fulvescens*, Smith.

Characters possessed in common by all these species are—a rather copious fulvous pilosity with fulvous ♀ scopæ and abdominal fimbriæ; the dorsal segments of the abdomen without definite 'fasciæ' at their apices; a finely rugulose surface, dull or slightly shining, with "raised" punctures;* a long 3rd antennal joint in both sexes (about as long as the two next together in the ♂ and the three next in the ♀); stipites with broad-looking "processes," and a strongly sinuated apical outline of the lobes making them evidently dentate (Plate V, Fig. 22); the ♂ head (mandibles, etc.) always of normal structure; the propodeum with short striæ at the extreme base, the rest of it slightly rugulose.

These characters are evidently not all of the same importance, but when several species share in all of them it seems likely that they belong to the same natural group. That such a group exists, I have little doubt, though I am not prepared to fix its precise limits. Probably it embraces, besides the above, several other species with which I have not dealt, because they do not resemble *humilis*, etc., enough to create confusion: such

* '*Puncta elevata*' (Schmiedeknecht), '*puncta subgranosa*' (Thomson). They look rather like the backs of holes made by pushing a pin *diagonally* through a sheet of paper.

(*e.g.*) as have most of the characters mentioned above, but dark ♀ scopæ, etc. (*schmiedeknechti*, Magr., is one of these). On the other hand it probably does not include species like *fulvago*, Christ, *rufula*, Perez, *rufohispida*, Dours, etc., which have a short 3rd antennal joint, a different type of male genitalia (see Fig. 6 in Plate V), and a different style of surface and puncturation. *Braunsiana* and another species which Herr Friese has determined for me as *leucolippa* agree in several points with *humilis*, etc., but their surface seems to me different, and they have quite another type of ♂ armature resembling that of *hattorfiana*, (Plate V, Fig. 18); *circinata*, Dours, is very like a small *humilis* superficially, but the punctures are utterly different and the abdomen clearly fasciated; it is probably nearer to *labialis* than to the present group, though not very near to that.

It may seem to some readers illogical to discuss whether or not particular species should be admitted to a group, which I own myself unable to define. But I do not think it is really so. There seem to be two conceivable methods of breaking up a genus into subgenera. One is deductive throughout. Some particular characters are assumed to be of superior importance, and on these categories are based, and species parcelled out accordingly. The other is at first inductive. We observe a number of species to be more or less similar. We might examine into and take stock of their points of agreement and difference, not so much asking "In what *one* point do all these agree?" as "What are the points in a majority of which they agree?" and "Among these points which, or what combination of them, can we think likely to indicate any real connection between the species, and to separate them from the general mass?" Thus, by degrees, we might arrive at the conception of a group, founded not on *one* character, but on a preponderance of characters. And we should then have to consider whether some of these species which had given us our first crude conception of the group should not after all be rejected from it, and the conception of it modified accordingly. Subgenera formed in this way must at first be tentative and elastic, all species being, as it were, admitted to them on probation. But, if there were any real connection between any of the latter, step by step we might hope to trace it out, and define our group more and more in accordance with the facts. And if there were

no such connection, at worst we should find it out, and have to drop our group, and look out (with the advantage of an experience gained) for a fresh one.

Whether or not this method is possible in dealing with the subdivision of *Andrena* into groups, the other at least has not led us, and seems unlikely to lead us, to satisfactory results. All kinds of characters have been tried separately, as the basis of groups; and all alike lead to results, which it is impossible to accept as corresponding to the relations between the species which really exist. The categories of "Apidæ Europææ," based on pilosity-characters, throw *albicrus*, Kirby, into one section and *argentata*, Smith, into another, and remove *pilipes*, F., from its place near *bimaculata*, etc., to group it with species differing essentially in structure both from it and from one another—*morio*, *flessæ*, *cineraria*, and so forth. Surely most unnatural results! Yet this is the nearest approach that has been made to a natural grouping of the Palæarctic species. It might be thought that a system could be founded on some one obvious difference of structure—the male head and mandibles, the sculpture of the thorax, etc. But species which are evidently nearly related would be thrown into different sections if we made, say, the form of the mandibles, or the size of the head, or the length of the antennal joints, our sole criterion. The character of a strongly rugose and enclosed propodeum, no doubt, associates a certain number of species which may reasonably be thought near allies. Yet it is at least open to question whether *ephippium* or *albicans* have really such an affinity with *tibialis*, *bimaculata*, etc., as undoubtedly exists between the latter species. Neither *ephippium* nor *albicans* has the characteristic *tibialis* armature or ventral segments, nor in this respect do they at all resemble each other, and the unlikeness of their puncturation and general appearance is extreme. I have dwelt on this case as the one in which, on the whole, the attempt to rest a group on a single character leads to the least undesirable results. But even if we acknowledged it to have been successful, it would be the sort of "exception that proves the rule": for no other tolerably natural group has yet been founded on a detail of structure. And as to colour, whether of pilosity or integument, it cannot be trusted even to separate species —far less groups.

Such being the present state of the classification of

species in *Andrena*, I think it would be premature to speak at all positively about the limits of the group to which *humilis* belongs, though hypothetically I would include in it the ten species with which we are dealing at present, and would also suggest a special closeness of relation between—

(*a*) *nigro-olivacea* and *livens*.
(*b*) *truncatilabris*, *ferrugineicrus* and (?) *giraudi*.
(*c*) *taraxaci*, *curtivalvis*, *senecionis*, *stabiana* and (?) *humilis*.

Descriptions of the New Species.

Andrena curtivalvis, n. sp. *A. taraxaci*, Giraud simillima sed minor.

Differt ab ea ♂ valvula ventrali multo breviore apice haud truncato sed rotundato ♀ pilis capitis ac pronoti magis nigricantibus, punctis mesonoti levioribus magisque dispersis, abdomine graciliore. (Algeria.)

Andrena stabiana, n. sp. Species præcedenti simillima.

Differt et ab ea et ab *A. taraxaci* Giraud ♂ valvula ventrali in apicem bilobatum dilatata, pilorum eiusdem dispositione alia (his scilicet qui segmenti processus laterales vestiunt ultra reliquam pilositatem longe excurrentibus), apice ipso segmenti pæne nudo : ♀ scutello propter reticulationem distinctissimam opaciore, fimbriis analibus abdominis minus erectis.

VI. *A Contribution to the Life-history of* Micropteryx (Eriocephala) ammanella, Hb.

By Thomas Algernon Chapman, M.D., F.Z.S.

[Read February 15th, 1899.]

I found specimens of a *Micropteryx*, that has been named *Micropteryx ammanella*, Hb., by Lord Walsingham, per Mr. Tutt, in early April in both 1897 and 1898, flying in several spots in the Esterels at a height of about 500 feet. They flew about and settled on the leaves of various trees—hollies, evergreen oaks, and especially cork-oaks. Their object in doing so was apparently feeding, but on what I could not detect. The oak catkins were not fully open, and a brown fungus on the underside of the leaves did not seem likely pabulum. Those I placed on flowers in captivity did not seem to understand them at all, still less deal with them in the business-like way of *M. calthella*. One consequence was, that the moths did not increase in bulk in captivity, or live many days. Assuming that the moths do feed like *M. calthella*, *M. seppella*, *M. aureatella*, &c., I am for the present quite in the dark as to what their food is. On the steep slopes of the Esterels, where *M. ammanella* flew, the ground is usually very arid, but I generally found not far off a damper shady place, with a good deal of coarse moss growing. Unless it fed on this moss, or something else, in these damper spots, it is difficult to understand how it could exist at all, as even these were very dry and parched in comparison with any other *Micropteryx* (*Eriocephala*) habitat I know of.

I placed about a score of moths in different vessels with portions of moss brought from the Esterels and some flowers. As far as I could see, the flowers were absolutely neglected, and the moths died early, and I thought at first I had got no eggs. I think, in fact, only some three or four moths did lay; they laid freely enough, but hid their eggs amongst the moss. They were probably mature and ready to lay when captured; I did not see any moths pairing in my jars, an occurrence of great frequency with

M. calthella. The eggs were laid deep in amongst the wet moss, in two instances quite out of sight till the moss was separated, and, in another, on the bottom of the jar beneath the moss. They were laid in batches of about thirty in three instances, and in one of between forty and fifty eggs. They are laid rather closely but irregularly together, with a tendency for the long axes of the eggs to be parallel, this obtaining throughout the whole of one group; in others the space available seems to have necessitated movement of the moths, thus frustrating this design.

Unlike the eggs of *Micropteryx* (*Eriocephala*) I have previously examined, these eggs are not spherical, as those of *M. calthella*, *M. aureatella*, and *M. seppella* are, absolutely or approximately, but distinctly ovoid. The long axis being about $\frac{1}{50}$th inch (·47 mm.), the transverse about $\frac{3}{5}$th of the length (·32 mm.); both ends appear to be alike, so that the longitudinal section would be an ellipse, and any transverse section a circle. They are nearly white, translucent, and opalescent, with the same snow-like coating as in the other species. This consists of upright rods with swollen ends, tolerably close together, of varying thicknesses, and of a length equal to about one-fourth of the diameter of the egg, but occasionally equal to nearly half the diameter. This snowy coating is formed of a very flimsy transparent evanescent material, that perishes on very slight interference.

The moths were placed in confinement on April 8th; eggs were found on April 12th, and they did not hatch till early in May.

The young larvæ did not eat any of the moss that they were amongst, so that I doubt its being their proper food. They are rather smaller than those of *M. aureatella*, but I could detect no difference between them and those of the other species examined. The suranal setæ are well marked. The jaws have four large teeth and a slight notch.

VII. *On Sexual Dimorphism in Beetles of the family* Rutelidæ. By Gilbert J. Arrow, F.E.S.

[Read March 1st, 1899.]

The recorded examples of Sexual Dimorphism among Coleoptera, other than those which consist in simple differences of development of various parts, such as the legs, antennæ, or mandibles, are at present very few. This is no doubt partly owing to the sexes having been regarded as distinct species through the attention of Coleopterists not having been sufficiently directed to the matter, and it is therefore well that observations, however incomplete, upon the occurrence of this interesting phenomenon in any group should be recorded in order to direct the attention of other workers to it, and thus at least diminish the serious complication of nomenclature which results from its neglect. This is of special importance in a great and heterogeneous assemblage such as the genus *Anomala*, whose swollen ranks already include considerably more than 500 described species of many different types, the merging of which into a single genus has proved extremely inconvenient to systematists.

A subdivision of the genus largely based upon the structure of the claws is at present in use, but facts which will be pointed out in this paper render this classification inadequate and even misleading. It has long been recognised that the degree of development of the claws of the anterior legs usually distinguishes the sexes in this group, and careful attention to this point will greatly increase the value of systematic work; but the occurrence of an entire difference of claw-structure between the sexes has only very recently been discovered. Sexual differences in coloration in species of *Anomala* have also been pointed out by Burmeister and Fairmaire, and the object of the present paper is to bring together the recorded instances of sexual dimorphism in the genus and to supplement them by others which have been revealed in the course of a revision of the specimens of *Anomala* in the British Museum collection.

The first case of sexual disparity of claw-structure was noticed by Mr. Gahan, who described a species in 1896 under the name of *Anomala egregia* in which the outer claws of the first two pairs of legs are cleft in the female, while in the male they are quite simple; and Herr Kolbe has since described the representative of another group exemplifying a similar interesting phenomenon. In this also the female has the claws of the first two pairs of legs divided, which is the most prevalent condition in the genus, but the male has those of the first pair only divided. Of each of these conditions I shall record additional examples, and also describe the representative of a third condition in which the female has the claw of the front tarsus only divided and the male all the claws undivided.

Belonging to the *egregia* group is *A. kersteni*, Gerst., in which, although it has hitherto been overlooked, the claws are all simple in the male sex, while in the female they are of the typical structure. Of a series of eleven specimens in the British Museum, from Somaliland, Masailand and British East Africa, two are males.

To these two species I propose to add a third belonging to the same group.

A. disparilis, sp. n.

A. Egregiæ et *kersteni* affinis: elongata, cylindrica, nitida, flavotestacea, tibiis tarsisque rufis; clypeo quadrato fere emarginato, margine valde reflexo, tenuiter punctato; prothorace transverso, polito, minutis sime punctato; elytris fortiter punctato-striatis. Long. 17 mm.

♂. Unguiculis omnibus simplicibus, clypeo testaceo, margine nigro.

♀. Pedum anteriorum et mediorum unguiculis externis fissis, corpore magis robusto, prothorace breviore, clypeo infuscato.

Hab. Lagos.

This is smaller and more shining than either of the allied species and differs conspicuously by the form of the clypeus, which is straight and angular with the margin sharply reflexed, as in Burmeister's section *Heteroplia*. The prothorax is transverse, but less so in the male than in the female, and is very finely and distantly punctured. The elytra are coarsely punctate-striate with the intervals uniformly finely punctured. The pygidium is coarsely punctured.

As in both the preceding species the males are much less numerous than the females.

The type of the second group, in which the outer claw of the front tarsus only is cleft in the male, is *A. rufa*, Kolbe, described in the recently-published Vol. IV of Deutsche Ost-Afrika. Several other African species hitherto undescribed exhibit the same structure, which it is interesting to notice is that characteristic of the related genus *Popillia*.

A. solida, sp. n.

Ovali-cylindrica, robusta, testacea; capite parvo, clypeo rufo, rotundato, dense punctato; prothorace basi lato, ad apicem regulariter attenuato, lateribus arcuatis, cum scutello vix punctatis; elytris convexis, striato-punctatis; pygidio rugoso; corpore subtus cum pedibus longe fulvo-villosis, tibiis anticis acute bidentatis, posticis tarsisque omnibus rufis, his longis et robustis. Long. 17 mm.

♂. Pedum anteriorum unguiculis inequaliter fissis, tibiarum dentibus inferioribus brevibus et curvatis; clypei margine reflexo.

♀. Pedum anteriorum et mediorum unguiculis equaliter fissis, tibiarum anteriorum dentibus inferioribus longis et rectis tarsisque brevioribus et tenuioribus; clypeo densissime et profunde punctato.

Hab. South Africa, Interior.

The rather narrow head, robust form densely hairy beneath, and strong hairy legs are the most prominent characteristics of this species. The thorax increases regularly in width from apex to base and is not angulated in the middle of the sides. The elytra are rather coarsely, but not deeply, striate-punctate.

A. clypeata, sp. n.

Præcedenti valde affinis sed paulo major; clypeo subtruncato, latitudine maxima ad marginem anteriorem, prothoracis margine laterali in medio subangulato; pygidio grosse punctato. Long. 17—19 mm.

♂. Pedum anteriorum unguiculis inequaliter fissis, tibiarum dentibus inferioribus brevibus et curvatis tarsisque longis et robustis.

♀. Pedum anteriorum et mediorum unguiculis equaliter fissis tibiarum anteriorum dentibus inferioribus longis et rectis tarsisque brevioribus et tenuioribus.

Hab. South Africa, Adelaide.

This is closely allied to *A. solida*, but is distinguished by the shape of the clypeus, which is widest at its extremity.

A. transvalensis, sp. n.

Elongato-ovata, robusta, testacea, tibiis (anterioribus partim) tarsisque rufis; clypeo brevi rotundato-quadrato rugoso, fronte dense punctato; prothorace antrorsum arcuate vix angulariter contracto, cum scutello dense punctatis; elytris profunde lineato-punctatis; pygidio subtiliter striolato-punctato; tibiis anticis acute bidentatis; sterno longe fulvo-hirto. Long. 16—18 mm.

♂. Clypeo utrinque subexcavato, margine valde reflexo, pedum anteriorum unguiculis externis inequaliter fissis, dentibus tibialibus inferioribus brevibus et curvatis.

♀. Paulo major; clypei margine vix reflexo; pedum anteriorum et mediorum unguiculis externis equaliter fissis, tibiarum anteriorum dentibus inferioribus longis et rectis; elytris geminato-lineato-punctatis.

Hab. TRANSVAAL, Pretoria (*Distant*).

The head is relatively broader than in the two preceding species, and the clypeus is shorter.

A. distanti, sp. n.

Præcedenti valde affinis sed minus distincte punctata, prothorace subtilissime punctato, antice fortiter contracto, marginis anterioris emarginatione angustato; elytris parum profunde lineato-punctatis; corpore subtus parce hirto, tibiis posticis tarsisque omnibus rufis. Long. 18 mm.

♂. Pedum anteriorum unguiculis externis inequaliter fissis, tibiarum anteriorum dente inferiore brevi et curvato.

♀. Paulo major, pedum anteriorum et mediorum unguiculis externis equaliter fissis, tibiarum anteriorum dentibus inferioribus longis et rectis.

Hab. TRANSVAAL, Pretoria (*Distant*).

This species exactly resembles the preceding one in size and coloration, but is distinguished by its less distinct puncturation, the narrower emargination of the prothorax, the paler colour of the middle tibiæ and the less abundant pubescence upon the sternum. I have only separated them after a careful comparison of many specimens from various collections.

A. denuda, sp. n.

Cylindrica, vix convexa, testacea, clypeo tibiis tarsisque nigris; tibiis anticis obtuse bidentatis; capite dense punctato, clypeo brevi, rotundato-quadrato; prothorace subplanato, nitido, cum scutello

subtilissime punctulato; elytris subtiliter punctato-striatis, lateribus parallelis medio vix ampliatis; sterno breviter et parce hirto, abdomine nitidissimo, interdum infuscato. Long. 17 mm.

♂. Prothorace paulo elongato; dente tibiali inferiore brevi, tarsorum anteriorum unguiculis externis inequaliter fissis.

♀. Prothorace valde transverso; dente tibiali inferiori paulo longiore, tarsorum anteriorum et mediorum unguiculis externis equaliter fissis.

Hab. Old Calabar.

This species strongly resembles the West African *A. disparilis* in size and form, but is easily distinguishable by its black legs and short rounded clypeus. It is more cylindrical and much less hairy beneath than the other species of this group and the puncturation of the elytra is more regular.

The following new species is the representative of the third type of claw-structure already referred to:—

A. calcarata, sp. n.

Breviter ovata, flavo-testacea; capite lævi, vertice bimaculato, clypeo impunctato, margine valde reflexo; prothorace parvo antice fortiter contracto, parum punctato, medio linea impressa; scutello brevi obtuse angulato, laxe punctato, apice profunde impresso; elytris irregulariter punctato-striatis, versus extremitates ampliatis; corpore subtus cum pedibus longe ac dense villosis, tibiis anticis fortiter bidentatis, posticis brevibus triangulariter crassatis, extremitatibus latissimis, calcaribus duobus longis singulo armatis; tarsis elongatis. Long. 16 mm.

♂. Corpore brevi; clypeo lato; unguiculis omnibus simplicibus.

♀. Corpore magis elongato; clypeo minus lato; pedum anteriorum unguiculis externis apice emarginatis.

Hab. South Africa, Cape of Good Hope (*Reiche*).

This species occupies an isolated position in the genus by its many structural peculiarities. It is shorter and more ovate than any other testaceous species known to me. The head and clypeus have only a few scattered punctures. The thorax is broad behind and strongly lobed in the middle. The elytra are coarsely punctured, the punctures, which are sometimes confluent, being chiefly arranged in irregularly placed striæ. The hind tibiæ are short, very slender at the base and regularly

thicken to the extremity, where they are very wide and furnished with two strong spurs, the upper one very long.

The very distinctive structure of the legs of this insect will probably be found to require the ultimate formation of a new genus for it, but in the present comprehensive state of the genus *Anomala* this does not appear advisable.

Several cases of difference in coloration between the sexes in species of *Anomala* were mentioned by Burmeister, and M. Fairmaire has recently called attention to two other instances; and although one or two of these cases must be regarded as doubtful, it will probably be found that this form of sexual dimorphism is by no means rare in the genus.

The species contained in Burmeister's Handbuch of which the sexes are stated to show differences of coloration are the two common species *A. lucicola*, Fabr., and *A. vidua*, Newm., from North and Central America respectively, the S. European *A. aurata*, Fabr., *A. trivittata*, Perty, and *A. irrorella*, Cast., from Java. Of these, however, the last must be excepted, as M. Lansberge has pointed out that the form regarded by Burmeister as the male is another species, to which he has given the name of *A. burmeisteri*.

The same author's statement that the colour differences of *A. vidua* are sexual has been controverted by Mr. H. W. Bates, who has stated that two of the three varieties of the species are represented by both sexes in the Central American collection of Messrs. Godman and Salvin. I have carefully examined the specimens in this collection now in the British Museum, and find that every individual of the light form is a female, and those of the dark forms males, with a single exception. The exceptional case of the second form was probably in Mr. Bates' own collection, or he may possibly have been mistaken, upon a cursory examination, as to the sex; but notwithstanding its liability to exception, there is amply sufficient evidence that Burmeister was justified in pronouncing this a case of sexual dimorphism. Of nearly 70 specimens of the species which I have minutely examined, the single female mentioned above is the only exception to the rule that the form with pale elytra is the female and those with black elytra are males.

The closely related insect described by Bates under the name of *A. nutans* must be regarded as a partially dimorphic species, the entirely black variety consisting of both sexes apparently in about equal numbers, while the specimens with red elytra are females and those in which they are more or less bordered with black are males. This species is very much more variable than the preceding one, the varieties being much less constant, and as it is in other respects less specialised than *A. vidua* it may possibly be regarded as representing the ancestral form of the latter in which the separation of the sexes has not been entirely completed.

Another example is *A. oblivia*, Horn, a North American species, which, as is shown by his description of the claws, Dr. Horn has described from the male sex only. Specimens of the female in the British Museum are entirely testaceous in colour, the metallic lustre only being rather more apparent on the thorax, which is also somewhat more elongate. The outer anterior claw, as is usual in this sex, is approximately equally cleft, and the lower tibial tooth long and curved.

The fourth New World example is the common North American *A. lucicola*, Fabr., in which the female is either wholly testaceous, or testaceous with a very narrow black external margin to the elytra, and the male either entirely black or testaceous with the thorax wholly or partially black and a black suture and margin to the elytra.

Of the next species the two forms have been described by M. Fairmaire under the names of *Popillia exarata* and *cinnabarina*, and although I have only been able to examine three specimens, the characters mentioned by the author leave little doubt that the forms are sexual and not merely varieties. M. Fairmaire's *P. exarata* is an insect of a deep bluish or greenish black colour of which I have seen two individuals, both of them males; and the description given of the front tarsus of which the "fourth" joint (obviously intended for the fifth) is inflated, and the enlarged outer claw, clearly shows that M. Fairmaire's specimens are also of that sex. Subsequently an insect similarly coloured but with its elytra of a bright brick-red was described from the same locality (Yunnan, in S.W. China), and this from a specimen before me proves to be the female of *exarata*. The slightly larger size and relatively shorter elytra (due to a lateral expansion peculiar to the

females of these insects) mentioned by the describer confirm my view.

The comparison of this species with Redtenbacher's *Popillia sulcata* is unfortunate, as that insect is a true *Popillia*, whereas the present one, as indicated by the naked pygidium and the claws of the middle feet divided in both sexes, has not any affinity with that genus. It belongs to the group of *Anomalas* represented by *A. iris*, Candèze, and is intermediate between that species and *A. lateralis*, Hope. It is also interesting as a link between the Asiatic and American *Anomalas*, showing an evident relationship both in structure and appearance, as well as in the fact of dimorphism, with the Mexican insects just described.

This insect has been made by Dr. Kraatz the type of a new genus, under the name of *Ischnopopillia exarata*, upon the strength of characters which differentiate it from the genus *Popillia*, but in no way distinguish it from *Anomala*. *Popillia rugicollis*, Newm., also referred to *Ischnopopillia* by Kraatz, is the insect, *Anomala lateralis*, Hope, mentioned above.

The name *exarata* is pre-occupied in the genus *Anomala*, and this species must accordingly be called *A. cinnabarina*. This name has been more recently given by M. Fairmaire to another insect which must therefore be re-named. I propose to call it *Anomala fairmairei*.

In 1891 M. Fairmaire announced that *Anomala rufozonula* and *A. rufopartita*, which had been described on two different occasions by himself, were the male and female of the same species. The British Museum contains a long series of this insect, showing an almost uninterrupted gradation from the form *rufozonula*, in which the insect is wholly black with the exception of an orange band across the elytra, to one in which the elytra and prothorax are wholly orange except a very narrow black sutural line and patch in the centre of the thorax, *rufopartita* being intermediate between these forms. Both sexes appear equally variable, the dark *rufozonula* being represented in the national collection by females as well as males, whilst the extreme light form referred to, and one of the intermediate varieties connecting it with *rufopartita* (considered by M. Fairmaire to be the female) are males. The only colour difference exhibited by all our specimens is in the abdomen, which in all the males is entirely black, whilst in none of the females has the orange quite disappeared, but even

this in such an extremely variable species cannot be stated as absolutely invariable.

The other species of Fairmaire's referred to above is *Anomala 6-oculata* from Tibet, in which the elytra are pale yellow in the female and brown in the male; and this exemplifies the general rule for those species which exhibit colour differences, the female being characterised by a less development of the colouring matter, which in the male takes the form of darker markings of greater or less extent, or when at its maximum may suffuse the entire surface with black.

Closely related to *A. 6-oculata*, and showing the same sexual difference, is *A. straminea*, Semenow, an insect from North China, which in the female is uniformly straw-coloured, while in the male the elytra are more or less deeply fuscous and the thorax and head marked with patches of the same colour. In his description of this species, the author speaks of it as "maculis nonnunquam evanescentibus," showing that he had the female, but regarded it as merely a variety.

In *A. mutans*, Blanch., on the contrary, the male form has been described as the variety and the female, which is pale, with the exception of a dark-red head, scutellum and suture, as the typical form. The male of this species (the author's "var. tota nigro-picea") is a shining black over the whole upper surface with the exception of a narrow margin to the thorax and sometimes a fine median line.

The following new species is remarkable as presenting, as well as a similar disparity in coloration, a peculiar difference in the sculpture of the upper surface, the elytra of the male being shining while those of the female are very densely rugose and opaque, thus recalling a somewhat similar sexual difference which occurs in certain of the Water Beetles.

A. rugosa, sp. n.

Breviter ovata, rufo-testacea; capite rufo-fusco, dense punctato, clypeo semicirculariter arcuato, margine paulo reflexo; prothorace brevi, convexo, nitido, punctato, lateribus valde arcuatis, angulis posticis rotundatis, disco bimaculato, maculis triangularibus, basibus in disci medio approximatis, nonnunquam confluentibus; scutello rufo vel fusco, grosse punctato; subtus cum pedibus rufis, tarsorum anteriorum et mediorum unguiculis fissis. Long. 14 mm.

♂. Elytris nigris, interdum maculis parvis humeralibus, lateralibus et apicalibus punctato-striatis, interstitiis subtiliter punctatis ; tibiis anticis tridentatis, tarsorum anticorum unguiculi divisione inferiore majore.

♀. Elytris rufo-testaceis, obsolete striatis, densissime rugosis, marginibus vittaque obliqua ab humero fere ad apicem decurrente nigris; tibiis anticis bidentatis, tarsorum anticorum unguiculi divisione superiore majore.

Hab. N. INDIA: Punjab, Himalayas.

This species is similar in form and marking to *A. varicolor*, Gyllenh., but is very distinct by the sexual differences referred to. The female bore the unpublished name of *A. rugosa* in Reiche's collection. Burmeister has very briefly described a species, *A. ruficapilla*, from the same locality, which resembles the female of *A. rugosa*, but the description applies, according to the author, to both sexes. In his species, moreover, the front tibia is three-toothed, and the sculpture of the elytra differs from that of *A. rugosa*.

Another new species differs from those preceding in the fact that the sexes exhibit an entire difference in the colour itself and not merely in its distribution. In the male the colour is a rich deep purple and in the female a rather dark metallic green. Even in immature specimens in which the colour is undeveloped the sexes may be readily distinguished by a slight reddish or greenish lustre.

A. imperialis, sp. n.

Oblongo-ovata, subdepressa, æneo-testacea ; capite punctato-rugoso, clypeo semicirculariter arcuato ; prothorace pallide marginato, crebre punctato, profunde longitudinaliter sulcato, lateribus angulato arcuato, angulis posticis obtusis ; scutello testaceo, punctato ; elytris costatis, subtiliter punctatis ; pedibus longissimis. Long. 16 mm.

♂. Capite, prothoracis disco elytrisque purpureis ; pygidio testaceo, tumido, strigato-punctato, apice obtuso.

♀. Fronte, prothoracis disco elytris pygidioque viridibus; prothorace latiore ; pygidio subplano, subtiliter rugoso, acuminato.

Hab. NORTH CHINA (*Fortune*).

This species is allied to *A. aulax*, Wied., which it resembles in size, form and sculpture, but it is rather more depressed and less densely punctured. The furrow on the thorax is broader and the elytral costæ rounded. The

male appears to be rather more abundant than the female, and is quite unmistakable from its deep purple hue.

Two peculiar insects were described by Blanchard under the generic name *Adoretosoma* and placed after the genus *Adoretus*, but these appear in the Munich Catalogue in the genus *Anomala*. These are *A. elegans* and *A. fulviventre*, both Indian species. At least three closely related species have been described from China by M. Fairmaire, who has assigned them to the genus *Phyllopertha* under the names of *chromatica*, *tenuelimbata* and *virgulata*. It is possible that others of the new species placed in the same genus by M. Fairmaire may be congeneric, but in the absence of structural characters this cannot be determined from the descriptions. *P. tenuelimbata* and a closely related new species afford further examples of sexual dimorphism, and it seems likely that all the species mentioned above have been described from representatives of one sex only, but with the exception of these two I have not been able to find both sexes of any of them.

There can be no doubt as to the advisability of restoring this group to generic rank, and the addition of the sexual characters to those given by Blanchard will render the genus very easily recognisable.

Adoretosoma, Blanch., Cat. Col. Ent. Paris, 1860, p. 234.

Unguiculis gracilibus et longissimis, pedum anteriorum mediorumque externis fissis, ♀ anteriorum regulariter curvatis, apice equaliter divisis; ♂ pedum anteriorum tarsis incrassatis, unguiculo externo quam interno multo longiore, recto, post medium spino minutissimo armato, tibiis anterioribus brevioribus dentibusque minoribus valde approximatis.

Phyllopertha tenuelimbata, Fairm., referred to above was described in the Ann. Soc. Ent. Franc. for 1889, p. 24; and in the Comptes Rendus, Soc. Ent. Belg., 1891, p. cciii, M. Fairmaire described another new species under the same name. From this our species must be carefully distinguished. As the first species will become *Adoretosoma tenuelimbatum*, the second may perhaps be allowed to retain the name inadvertently given to it. M. Fairmaire's description of the former insect applies to the female only, which is a pale yellow insect with a very narrow green sutural line and a large green spot in the middle of the thorax. The male has the vertex of the head, the disc of

the thorax, the scutellum and the elytra, with the exception of a pale longitudinal vitta upon each bordering the suture and usually extending to half the breadth, of a deep green. The suture is narrowly green. The thorax is narrower than in the female and is rather more sharply angulated in the middle of the sides.

The following is a closely related species.

Adoretosoma metallicum, sp. n.

Cylindricum, rufotestaceum, nitidissimum, pedum intermediorum et posticorum tarsis tibiarumque extremitatibus nigris; capite rugoso, vertice nitido vix punctato; prothorace distincte marginato vix punctato, lateribus angulatis, angulis anticis acutis, posticis rectis; elytris grosse lineato-punctatis.

♂. Capitis vertice, prothoracis medio elytrisque viridibus vel viridicœruleis. Long. 13 mm.

♀. Major, capite prothoraceque rubris, elytris viridibus vel viridicœruleis. Long. 15 mm.

Hab. North China, Shanghai.

This is a larger species than *A. tenuelimbatum* and has not the deeply striated elytra of that and the two original species of the genus, approaching in this respect and in colour *A. chromaticum*. The male is similarly coloured to that of *A. tenuelimbatum*, but the dark colour extends over the whole of the elytra, and the patch on the thorax reaches the front and hind margins. In the female the elytra are also wholly green or blue, but the head and thorax are a metallic red. The thoracic mark is sometimes represented by a pair of faint dark marks in the middle of the base of the thorax.

In the neighbouring genus *Popillia* sexual dimorphism appears again. Fabricius described an insect belonging to this genus of which the upper surface is black under the name of *Cetonia rufipes*, and two other forms, red and green respectively, were described by Newman, who, however, suggested the possibility of all three being varieties of a single species. Attention to the form of the abdomen and legs shows at once that the metallic green insects (*Popillia æneas* of Newman) are females and the black individuals males, those with the elytra more or less red being also males and probably only immature. Burmeister associated the three forms, but announced that the black and green colours were most

often found in the females and the red in the males. He may have been misled by the examination of an aberrant female, for one of many which I have examined is gynandromorphous, showing the black coloration proper to the males; or, as he nowhere mentions the principal sexual characters of the genus, it is possible that he was entirely mistaken as to the sexes of his specimens. These characters have not been fully pointed out by subsequent monographers, so that it may be well to describe them here.

The tibiæ, tarsi and claws of the male are all considerably stouter than in the female, and the teeth on the front tibiæ are short, sharp and conical, whereas in the female the anterior one is produced and convex. The outer claw of the anterior tarsus in the male forms a flattened plate and has a sharp slender tooth near its extremity; that of the middle tarsus is very long and undivided. In the other sex both are simply bifid. The antennal club is perceptibly longer in the male and the pygidium is visible from beneath. In the female the pygidium is only visible from above, the junction with the last ventral segment being at the extremity of the body and not ventral.

Another and closely related example in this genus is *Popillia flavotrabeata*, Thoms., of which only the female appears to have been as yet described. This is an elongate golden- or bronzy-green insect with yellow margins to the thorax and an oblique band of the same colour on each elytron, which however is liable to disappear. The male exactly corresponds to that of *P. rufipes*, except that the thorax retains the coloration of the female, the elytra in fully mature specimens being shining black. The legs in both species are paler and non-metallic in the male. It is remarkable that of this species also a single female specimen in the British Museum has the male coloration, although a trace still remains of the pale elytral streak peculiar to its own sex.

The female of this species is also *P. lacertosa* of Candèze. Herr Kolbe in his monograph of the African species of *Popillia* suggests the identity of this with Thomson's species, and of this I have no doubt.

It will be seen that the sexual differences in the structure of the claws are confined to the African species of the cylindrical testaceous group of *Anomalas*, whereas colour dimorphism occurs in species from all parts of the world representing widely separated sections of the genus. In every case of the latter type the distinction consists not in

any fundamental difference but in the degree of development of the colouring matter, the male, with the exception of the aberrant individuals referred to of the Mexican species, exhibiting a greater exuberance than the female, or the superposition of a darker hue. *Anomala imperialis*, described in this paper, is an apparent exception to this rule, the colours of the two sexes appearing to be unrelated. But experiment shows that the metallic purple colour characteristic of the male of this species is transformed by exposure to sunlight into a green like that of the female, so that here also the male form is obtained by an addition to that characteristic of the female.

From this rule it results that, given a sufficiently wide range of variation, the line of separation will be liable to obliteration, and it may be found that certain individuals of some of the species do not correspond with the sexual characters given; but this will not interfere with the general fact, for in every case mentioned, (except that of *Anomala cinnabarina*, where the original descriptions appear to warrant my conclusion,) the number of specimens examined seems sufficient to establish the general rule; and several species which in all probability belong to this category have been omitted because the number of specimens I have been able to examine is insufficient to be conclusive.

It is important to notice, that the cases of aberration to which I have referred are without exception of the female sex, thus associating them with those cases familiar to us amongst higher animals of the phenomenon of Gynandromorphism, which appears to be of occasional occurrence wherever secondary sexual characters are found.

Table of species exhibiting Sexual Dimorphism.

The Sexes differing in Claw Structure.

Anomala egregia, Gahan. . . .	Somaliland.
A. disparilis, sp. n.	Gold Coast.
A. kersteni, Gerst.	Zanzibar.
A. rufa, Kolbe	Germ. E. Africa.
A. solida, sp. n.	S. Africa.
A. clypeata, sp. n.	S. Africa.
A. transvalensis, sp. n. . . .	Transvaal.
A. distanti, sp. n.	Transvaal.
A. denuda, sp. n.	Old Calabar.
A. calcarata, sp. n.	S. Africa.

The Sexes differing in Coloration.

Anomala 6-oculata, Fairm. . .	Tibet.
A. straminea, Sem.	N. China.
A. rugosa, sp. n.	Nepal.
A. mutans, Blanch.	Sierra Leone.
A. 3-vittata, Perty.	Java.
A. aurata, Fabr.	E. Europe.
A. imperialis, sp. n.	N. China.
A. cinnabarina, sp. n.	S.W. China.
A. vidua, Newm.	Mexico.
A. mutans, Bates	Mexico.
A. oblivia, Horn.	U. States.
A. lucicola, Fabr.	U. States.
Adoretosoma tenuelimbatum, Fairm. .	N. China.
A. metallicum, sp. n.	N. China.
Popillia rufipes, Fabr. . . .	W. Africa.
P. flavotrabeata, Thoms. . . .	W. Africa.

VIII. *Notes on the Rutelid genera* Anomala, Mimela, Popillia, *and* Strigoderma. By GILBERT J. ARROW, F.E.S.

[Read April 5th, 1899.]

ACCORDING to the type specimen now in the British Museum, *Anomala pallida*, F. is the species known as *A. ypsilon*, Wied. Beside this specimen an example of Olivier's *A. varians* appears to have been placed at a time subsequent to the original description of *A. pallida* in the Systema Entomologica, and this seems to have been taken by Fabricius in mistake for his type when writing his Systema Eleutheratorum, in which he quoted his previous description, but referred to the original specimen as *var. minor*. This confusion has hitherto escaped notice, and Burmeister, following the later description, regarded the larger specimen as the true *A. pallida* without observing its identity with Olivier's insect. Both species are Asiatic, the localities given by all the authors mentioned being wholly wrong.

A. humeralis, Walker, which is very closely related to the preceding insect, must be called *A. walkeri*, as the name *humeralis* is preoccupied. It is larger and more convex than *A. pallida*, and has the puncturation more homogeneous and the head entirely dark.

The Rev. T. Blackburn has described an *Anomala* from Australia as *A. australasiæ*, but examination of specimens from Queensland and South Australia shows it to be the common and very widespread species *antiqua*, Gyll., first described from China, and of which there are also specimens in the British Museum from India, Burma, Siam, the Malay Peninsula, Borneo, and Java. Mr. Blackburn remarks in connection with this that another *Anomala*, *A. fuscoviridis*, has been described from Australia. This, however, is a mistake which has arisen through a slip in Blanchard's Catalogue de la Collection Entomologique du Muséum de Paris, in which "Nouv. Hollande" occurs instead of "Nouv. Guinée." I believe this species will probably prove to be the same as *A. assimilis*, Boisd., the figure being imaginary and misleading. *A. antiqua*, Gyll., is therefore in all probability the only beetle of this genus occurring in Australia, and this

has no doubt been carried there at some period more or less recent.

The types of *Anomala* (*Euchlora*) *femoralis* and *perplexa*, Hope, in the British Museum show the two species to be identical. Both names are therefore synonyms of *bicolor*, Fab., with which the catalogue already shows *A. femoralis* as synonymous.

A. tingitana, Blanch. from Algeria is the European species *profuga*, Erichs., which thus ranges, like so many other S. European insects, on both sides of the Mediterranean. Blanchard's specimens, as well as all I have seen from the southern shore of the Mediterranean, belong to the black variety (*A. errans*, var. 5, Illig.). It will be remarkable if this proves to be the only form represented there.

Three species of *Anomala* have been given the same name of *variegata*, of which that described by Hope from Nepal has priority. The second is a Brazilian insect described by Latreille, and wrongly regarded by Burmeister as the same as the North and Central American *A. undulata*. This insect may be called *A. brasiliensis*. *Mimela variegata* of Walker also belongs to this genus, although it is the species which has recently been made the type of a new genus by Dr. Kraatz under the name of *Pœcilosticta princeps*. Dr. Kraatz has regarded it as most nearly allied to *Popillia*, but he is evidently not acquainted with the species of *Anomala* with a produced mesosternum forming the section *Spilota*, to which all the characters mentioned by him refer it. The form of the tip of the front tibia mentioned and figured by Dr. Kraatz as a generic character is distinctive of the females of these insects. Walker's name being inadmissible, this species should be called *Anomala* (*Spilota*) *princeps*, Kraatz.

Dr. Kraatz has formed another new genus (*Hadropopillia*) for *Popillia regina* (not "*reginæ*"), of Newman, which also belongs to the subgenus *Spilota*, and is very closely related to *Anomala strigata*, Lap. Newman's name has been sunk in favour of Guérin's *splendida*, dating from 1840, but as the original description of Newman's *regina*, as of his numerous other species of *Popillia*, was in the "Magazine of Natural History" of 1838 (vol. ii, p. 336) this must be revived as the correct name. This paper was overlooked by the cataloguers, although it preceded by three years that to which they have given the references.

Another close ally of this insect was also described by Newman as a *Popillia* under the name of *P. varia*. It has since been named *Spilota popiliopsis* by Candèze, but must be called *Anomala* (*Spilota*) *varia*, Newm.

A. microcephala, Burm., is synonymous with *A. sulcipennis*, Lap., and two related species described by Bates from Costa Rica in the Biologia Centrali-Americana are old species. His *A. costaricæ* is the same as *A. testaceipennis*, Blanch., described from Bolivia, and *A. vanpatteni* is *A. marginata*, Fab. Bates was in both cases misled by the localities of his insects, which will no doubt ultimately prove to have a wide range. That of *A. marginata*, as at present known, is very peculiar. The British Museum collection contains specimens from Canada. Dr. Horn mentions it as belonging to the Southern States, and in Central America it has apparently only been found in Costa Rica. As it is very abundant where it is found, these apparent gaps in its habitat are remarkable.

Burmeister's *Phyllopertha 8-costata*, a Japanese insect which from the similarity of the names has been confused with Hope's *Anomala costata*, seems, as well as the latter, to be most fitly placed in the genus *Anomala*. It is a very closely related form to *A. sieversi*, Heyden, from Corea. Another Japanese species, *Anomala pubicollis*, Waterh., on the contrary has its nearest allies in *Phyllopertha*, and should be transferred to that genus.

In the genus *Mimela*, the types of *similis* and *bicolor* of Hope belong to the same species; *hopei*, Burm., is the same as *heterochropus*, Blanch.; and *chryseis*, Bates, is *testaceoviridis*, Blanch. *Mimela gaschkevitchi*, Motsch., is *M. lathami*, Hope. Hope mentions Singapore as a locality for this insect, but this is almost certainly due to a mistake, as it appears to be restricted to the northern part of China, Corea, and Japan. A variety occurring in the last is wholly crimson in colour, and there are also specimens entirely black.

Three allied species of *Mimela* have been the subjects of much confusion. *M. leei*, Swed., *M. fulgidivittata*, Bl., and *M. horsfieldi*, Hope, are insects of similar appearance, characterised by rainbow-like bands of red, gold and blue. In the Munich catalogue there is a species, *M. vittata*, Redt., of which *fulgidivittata* stands as a synonym, while *sapphirina*, Parry, occurs as the name of a variety of it. The three names thus brought together really belong to

the three species named above. Parry's insect, which is from Assam (and not Kashmir as stated in the catalogue), is a blue variety of the Assamese *M. lœi*, which is easily distinguishable by the coarse puncturation and deep blue sutural margins of the elytra; and Redtenbacher's species, which was described from Kashmir, is the same as *M. horsfieldi* of Hope, recognisable by its smaller size, less punctured elytra and the golden colour of the hind femora. There is a variety of *M. fulgidivittata*, in which the green ground colour is replaced by a reddish-bronze over the entire surface, and the bands are a purplish black.

Three names have been given to a species of *Popillia* inhabiting the Philippine Islands. The types of *P. scalpta* and *æmula*, Newman, are the same, and *picticollis*, Kraatz, also belongs to this species, Dr. Kraatz having been misled by Newman's very faulty descriptions. *P. æmula* was described from a specimen from which the hairs on the disc of the thorax had been rubbed off, and in *P. scalpta* the author, by a strange omission, made no reference to this most prominent characteristic.

Strigoderma fulgicollis and *insignis*, described and figured by de Brême, are merely two of the colour varieties of *S. sulcipennis*, Burm. The volume in which these were described bears the same date as Burmeister's (1844), but the paper was not published until the following year.

The descriptions of *S. colombica*, Burm., and *S. cupriceps*, Blanch., are virtually the same, and I have no doubt of the identity of the types.

S. nigripennis, Bates, to which a name was given by Bates on account of its darker coloration than *orbicularis*, Burm., is clearly only a variety of the latter, although very distinct. The absence of all structural difference and the fact that the great majority of the specimens occur in one collection from the same place (Cordova) will not permit it to be regarded as another species, and the apparent absence of individuals intermediate in colour is by no means unique.

Synonymical List.

Anomala pallida, F., Syst. Ent., p. 35 = *A. pallida*, var., Syst. El., p. 168 = *A. ypsilon*, Wied.
A. varians, Oliv. = *A. pallida*, Burm.
A. walkeri, n.n. = *A. humeralis*, Walker.

A. antiqua, Gyll. = *A. australasiæ*, Blackb., Proc. Linn. Soc., N. S. Wales, 2nd ser., vii, p. 113.
A. bicolor, F. = *A. perplexa*, Hope.
A. profuga, Erichs. = *A. tingitana*, Blanch.
A. brasiliensis, n.n. = *A. variegata*, Latr.
A. sulcipennis, Lap. = *A. microcephala*, Burm.
A. marginata, F. = *A. vanpatteni*, Bates, Biol. Cent. Amer., II, pt. 2, p. 241.
A. testaceipennis, Blanch. = *A. costaricæ*, Bates, Biol. Cent. Amer., II, pt. 2, p. 235.
A. (*Spilota*) *princeps*, Kr. = *Mimela variegata*, Walk. = *Pœcilosticta princeps*, Kraatz, Deut. Ent. Zeit., 1892, p. 291.
A. (*Spilota*) *varia*, Newm. = *Popillia varia*, Newm. = *Spilota popiliopsis*, Cand.
A. (*Spilota*) *regina*, Newm. = *Popillia regina*, Newm. = *Hadropopillia splendida*, Guér., Kraatz, Deut. Ent. Zeit., 1892, p. 291.
A. cinnabarina, Fairm., Ann. Soc. Ent. Belg., 1887, p. 113 = *Popillia cinnabarina*, Fairm., Ann. Soc. Ent. Belg., 1887, p. 113 = *Ischnopopillia exarata*, Fairm., Kraatz, l.c., p. 293.
A. fairmairei, n.n. = *Anomala cinnabarina*, Fairm., Ann. Soc. Ent. Belg., 1893, p. 308.
A. lateralis, Hope = *Popillia rugicollis*, Newm.
A. 8-costata, Burm. = *Phyllopertha 8-costata*, Burm., nec *Anomala costata*, Hope.
Phyllopertha pubicollis, Waterh. = *Anomala pubicollis*, Waterh., Trans. Ent. Soc. Lond., 1875, p. 111.
Adoretosoma tenuelimbatum, Fairm. = *Phyllopertha tenuelimbata*, Fairm., Ann. Soc. Ent. Fr., 1889, p. 24, nec *P. tenuelimbata*, Fairm., C. R. Soc. Ent. Belg., 1891, p. cciii.
A. virgulatum, Fairm. = *Phyllopertha virgulata*, Fairm., Ann. Soc. Ent. Fr., 1889, p. 24.
A. chromaticum, Fairm. = *Phyllopertha chromatica*, Fairm., Ann. Soc. Ent. Fr., 1886, p. 327.
Mimela lathami, Hope = *M. gaschkevitchi*, Motsch.
M. leei, Swed. = (var.) *sapphirina*, Parry.
M. horsfieldi, Hope = *M. vittata*, Redt., nec *M. fulgidivittata*, Bl.
M. heterochropus, Blanch. = *M. hopei*, Burm.
M. bicolor, Hope = *M. similis*, Hope.
M. testaceoviridis, Blanch. = *M. chryseis*, Bates.

Popillia scalpta, Newm. = *P. æmula*, Newm. = *P. picticollis*, Kraatz, Deut. Ent. Zeit., 1892, p. 284.
P. flavotrabeata, Thoms. = *P. lacertosa*, Cand.
Strigoderma sulcipennis, Burm. = *S. fulgicollis* and *insignis*, de Brême.
S. colombica, Burm. = *S. cupreiceps*, Blanch.

June 22, 1899.

IX. *The development of* Ceroplastes roseatus, Towns. and Ckll. By Chas. H. Dolby-Tyler, F.E.S., British Consul, Panama.

[Read May 3rd, 1899.]

Plate VIII.

Ceroplastes roscatus, Townsend and Cockerell (Journ. New York Entom. Soc., vol. vi, p. 176, September 1898. Ref. Ann. and Mag. Nat. Hist., ser. 7, vol. iii, p. 167, February 1899).

On the suggestion of Professor Cockerell, to whom I am much indebted for kind encouragement and assistance in prosecuting my study of the *Coccidæ*, I undertook in December last to record the development of the exceedingly pretty species that forms the subject of the present paper.

Upon leaving the parent scale the young insects crawl for a short distance along the branch or twig and settle down almost immediately. Having placed some upon the upper surface of a leaf, they wandered over it for upwards of three hours, and eventually reached the twig whereon they fixed at once.

Twenty-four hours after fixation three faint mealy secretions appeared upon the head, thorax, and abdomen respectively, and during the following six hours assumed definite form; the cephalic patch being sub-cylindrical and higher than the rest; the thoracic patch divided transversely into three ridges representing the pro-, meso-, and meta-thoracic terga—the first being somewhat of a shallow inverted horse-shoe shape; and the abdominal patch was divided into seven distinct transverse ridges, narrowing posteriorly, which represented the visible tergites. Ten hours later, or forty after fixation, appeared the first indications of the marginal plates—so conspicuous in the advanced larval condition—in the form of two minute irregular patches of secretion situated upon the margin on either side of the thorax close to the pro- and meso-thoracic, and the meta-thoracic and abdominal sutures (Plate VIII, fig. 1). The colour of the insect's body, which

originally was a claret or light maroon, had changed to a fulvous brown, and incipient development of the dorsal tubercle was apparent in the more convexed and elevated dorsum.

The patches of dorsal secretion continued to grow, the pro- and meso-thoracic ridges uniting in a well-defined quadrangle, and several of the abdominal ridges becoming confluent, until ten hours later they had attained a height equal to that of the dorsum. During the ensuing fourteen hours the quadrangular mass became cubical with a concavity in its upper surface; posterior to, and springing from the base of the cube, another ridge of secretion had arisen and united accurately with the meta-thoracic tuft; and all the abdominal ridges were confluent and serrated at their margin, showing on either side six incisions corresponding to the tergal sutures. Though distinct, the divisions between the regional masses of secretion was inconsiderable. Six hours subsequently a number of scattered nascent secretions appeared laterally cephalad of the thoracic marginal tufts; between the thorax and abdomen a parallel and almost confluent ridge of secretion appeared, inclined forward and united at its apex with that of the meta-thorax; while between the pre-caudal lobes a short median film of secretion was visible. Thirteen hours later several small patches had appeared, marginally luterocaudad. At this stage in one of the insects under observation I noticed a relatively large drop of a transparent fluid ejected dorsally from between the anal plates.

Two days later (to be precise, 130 hours after fixation) the thoracic masses had united, becoming sub-conical and inclined cephalad; the lateral incisions of the abdominal tuft had disappeared; and the marginal tufts could now be traced, although as yet the caudo-laterals had not assumed definite form. The body of the insect, now reverted to its original maroon colour, was visible only as an ovoid fascia separating the dorsal and marginal tufts, and united at its narrower diameter by the naked thoraco-abdominal suture.

The day following the marginal tufts, fifteen in all, were quite distinct, there being six projecting laterally from either side; one cephalad, below the cephalic tuft; and one projecting posteriorly from beneath each pre-caudal lobe. Meanwhile, the growth of the cephalic tuft

appeared to be arrested, or advanced in an imperceptible degree. Three days subsequently the abdominal secretion had attained a height of ·50 mm., and the insect presented the appearance given in Fig. 2, *a*, *b*. At this stage the shallow perpendicular fluting and horizontal striæ of the abdominal tuft were more pronounced than at any other.

Eight days later the pre-caudal setæ, which up till then were constant, had disappeared, and the surface of the lobes was sparsely sprinkled with secretion; the tubercles, three on either side subdorsally, and one cephalad, all co-equal in size, could just be distinguished; while the anal plates had fused into a sub-cylindrical spine.

Four days afterwards the insect presented a somewhat flattened convex, ovate appearance; the marginal tufts appearing as a broad raised band, narrowed caudad, divided by deep indentations into light distinct plates (Fig. 3), there being one cephalad composed of the cephalo-marginal, cephalic, and first pair of lateral tufts; three lateral pairs, the last of which was formed through evalescence of tufts 4, 5; and one caudad made up of No. 6 and the precaudal tufts and surface secretions. The dorsal tufts had united forming a compact ovate, truncate, conical mass, and a faint secretion appeared between this and the marginal plates. The first step towards the elaboration of true wax was now apparent, the substance of all the plates being consolidated, each one showing a disappearing apical tuft of primitive secretion.

From this period for the ensuing eight days no apparent external growth of secretion was visible; meanwhile, however, the elaboration of true wax continued, and at the expiration of this period the base of each plate was composed of a homogeneous mass of pink-hued wax, and the interstices half filled with it, so that the insect's body was now completely hidden from view with the exception of the anal process, a small portion of which projected through the waxy covering.

Five days later the fusion of secretion had much advanced, the whole test was widened and nearly circular. Seen from above the central plate appeared slightly polygonal, somewhat longer than broad, and viewed in profile, laterally, its apex is seen to be inclined cephalad. The marginal plates are conical and the caudal plate, the growth of which appears to be arrested mediad, has commenced to merge on either side into No. 3.

A week subsequently the caudal plate was entirely merged into No. 3, and the insect, which now measures externally 3 mm. in length, presents seven well-defined plates. The apical tufts of snowy white secretion, which contrast so noticeably with the roseate hue of the waxy plates, are very minute and in many instances have disappeared entirely.

During the ensuing fortnight the secretion of wax proceeds rapidly, the sutures between the plates are completely filled, and the end of the stout anal process is visible as only a small black point. The insect has attained a length of 6 mm., on an average, and appears as in Fig. 4. At this stage the rosy colour is most pronounced at the recently filled sutures, and its existence would seem in part due to the translucence of the newly-formed wax allowing partial transmission of the deep maroon colour of the living insect beneath.

A fortnight later, almost exactly ten weeks from the date of fixation, the ♀ had arrived at maturity and the test was fully formed, presenting the appearance described by Messrs. Townsend and Cockerell, with one addition, viz.—that in the smaller and more perfectly formed specimens (Fig. 5) the apex of the test is mucronate and curved cephalad.

The rate of growth of individual insects varies considerably, their relative position upon a branch appearing to have a marked influence upon development; those nearer the main stem or trunk seemingly thrive better than others farther removed. The largest fully-formed test in my series measures long. 10 mm., trans. 8 mm., alt. 6 mm., and the smallest $3\frac{5}{10} \times 3 \times 2$ mm., both being of the same generation. Very few arrive at maturity owing to the attacks of various parasitic Hymenoptera, amongst which, however, I have succeeded in rearing only one, *Leeaniobius cockerellii*, Ashm. They are also preyed upon by the larvæ of a Coccinellid, *Azya luteipes*, Muls.

There are four broods a year, but owing to the causes mentioned above their colonies are kept within very narrow limits, and considered economically they are innocuous.

Explanation of Plate VIII.

[*See explanation facing the* Plate.]

X. *A second Asiatic species of* Corydalis. By Robert McLachlan, F.R.S., etc.

[Read June 7th, 1899.]

Plate IX.

In the Proceedings of the Zoological Society of London for 1884, Prof. Wood-Mason described and figured (p. 110, pl. viii) the first Asiatic species of *Corydalis*, a genus up to then thought to be peculiarly American, from the Naga Hills. Through the kindness of Mr. J. H. Leech, B.A., F.L.S., I am able to describe and figure a second Asiatic species, from Western China, and in the remarks appended to the description are indications that probably a third exists. I saw the specimens described by Prof. Wood-Mason, but did not examine them very critically: they are now in the Calcutta Museum; the description is unfortunately not sufficiently detailed.

I think it just possible that the Asiatic species may eventually be separated generically from the American. In the former not only is the posterior portion of the head produced into a sharp tooth on each side (as in the American), but there is also an additional sharp tooth (wanting in the American species) on each side of the *disk* of the head somewhat posteriorly, and the elongated mandibles of the ♂ show indications (more or less slight) of one or two teeth on their inner edge in addition to the minute one just before the apex. But mandibular development is erratic in *Corydalis*, for it is well known that in some American species the mandibles of the ♂ are not more developed than in the ♀, whereas in others the difference is only slightly marked, but in the majority very great.

Corydalis orientalis, sp. n.

♂ *Head* very large, subquadrate (without the neck), 13 mm. broad (without the posterior teeth), sides straight, the posterior angles produced into a very strong black acute triangular tooth, anterior edge straight with a deep median semicircular excision, disk convex posteriorly, rugose, on each side of the front of the convex portion is a broad acute black triangular tooth; neck strongly defined (4 mm. long by 7 mm. broad in front), convex: the general

colour may be taken as blackish above, with strongly impressed yellowish markings, the alate lateral expansions yellowish, reticulated with blackish, a large irregularly cuneate reticulated yellowish median space not quite extending to the ocelli, two large (scarcely separated) yellowish spots behind the ocelli, a similar transverse spot before the ocelli (between the antennæ), the external frontal angles also yellowish; neck yellowish above, with its anterior edge, a fine longitudinal median impressed line, and two cuneate lines (not reaching the posterior margin), black: beneath the colour is blackish, the sides yellowish longitudinally marked and reticulated with blackish; orbits yellowish; sub-mentum blackish, very strongly excised, each side produced into a very strong triangular acute tooth; labrum yellow above; maxillæ long black sub-cylindrical, yellow at its apex, the palpi small, black, each joint at its apex, and the first two internally, yellow. *Eyes* small, olivaceous. *Antennæ* about half the length of the wings, fine, slender, submoniliform, black, the basal joint with a yellow ring at its apex. *Mandibles* elongate (21 mm. long, without reckoning the curvature), rather broad, and slightly curved, blackish piceous; the external edge is regular; the basal portion has a broad groove above, and is much flattened and dilated to nearly a third of the whole length, the dilated portion ending in a nearly rectangular tooth on the inner margin; much beyond the middle of this margin there is a second tooth, small and acute, and just before the apex a third, almost spiniform.

Prothorax much narrower than the head, subcylindrical, much longer than broad (13 mm. long, 7·5 mm. broad in the middle and 9·5 posteriorly), its sides nearly parallel, scarcely dilated in front, but considerably so on its posterior edge, with a blunt transverse ridge on each side of its median portion; above blackish, with a median yellowish longitudinal stripe narrowed posteriorly, and somewhat irregular longitudinal lines, forming ill-defined bands on either side: beneath black, with a narrow transverse yellow line anteriorly, and a large yellow spot on each side of the 'neck.' *Meso-* and *meta-thorax* black above; on the former the anterior lobe and scutellum marked with yellowish.

Legs blackish, somewhat cinereous; coxæ, trochanters, and base of femora, yellowish beneath.

Abdomen blackish cinereous (colour changed): last dorsal segment deeply grooved above, almost to its base; superior appendages somewhat longer than the segment, parallel, strong, cylindrical, slightly curved downwards; inferior appendages geniculated, the apical portion strongly turned inward (in bad condition).

Wings smoky cinereous, subhyaline; anterior wings with a few

faint paler spaces on the disk; *the neuration very strong, black, and all the transverse nervules margined with black*, those towards the base very broadly margined; there are also some independent black or blackish spots below the radius, and in the basal portion of the cubital region (this black margining of the nervules gives the wings a peculiar tessellated appearance); in the broad costal area several of the nervules anastomose in an asymmetrical manner near the costal edge, forming two irregular rows of costal cellules in that portion (this character is evidently irregular, and may probably not always be present); posterior wings as in the anterior, but the nervules are margined only in the apical portion.

Length of body (without the mandibles) about 61 mm. Expanse of wings about 146 mm. (the tips of the wings damaged).

Hab. CHIA-TING-FU, WESTERN CHINA, 1000 ft., May. (Type Coll. McLachlan.)

This differs very strongly from *C. asiatica*, Wood-Mason, in the structure of the head, thorax, and mandibles, and also in the markings of the body, and the peculiarly tessellated appearance of the wings.

I have a much mutilated male (wings damaged and end of abdomen wanting) from Assam that probably represents a third Asiatic species, more allied to *C. asiatica* * in the form of the mandibles, but with the prothorax longer, even more so than in *C. orientalis*. From the markings on the body it could probably be identified by description, but I prefer to await the acquisition of a more perfect specimen.

It may not be out of place to remark that this Assam insect was no doubt regarded as a vicious animal by its native captor; its wings were torn off to prevent its escape by flight, and a thread noose (still *in situ*) was placed round its prothorax, so that it could be led about without fear of coming in contact with its mandibles, these harmless members being no doubt regarded with feelings of dread; the end of the abdomen has apparently been cut off from fear of the appendages or a concealed sting!

* In the Entomologists' Monthly Magazine, vol. xxv, p. 133, I alluded to this specimen as belonging to *C. asiatica*.

EXPLANATION OF PLATE IX.

[*See explanation facing the* PLATE.]

XI. *An annotated List of the* Ephemeridæ *of New Zealand.* By the Rev. A. E. Eaton, M.A., F.Z.S.

[Read June 7th, 1899.]

Plate X.

Pseudo-Neuroptera.

Family *EPHEMERIDÆ.*

ICHTHYBOTUS, gen. nov.

A genus of the Sectional Type of *Ephemera*, resembling *Pentagenia* in style of wing-neuration, and in having the median caudal seta abortive in the ♂ imago, but either not much shorter than or subequal in length to the outer setæ in ♀. Legs as in *Ephemera*, excepting the claws of the fore tarsus of the ♂, the outer claw being hooked and the inner obtuse, instead of both alike being obtuse. Distinguished from the other genera of this Sectional Type by the ♂ genital forceps, resembling in pattern those of a *Siphlurus* (cf. *S. lacustris*),—the forceps —basis subquadrate with the posterior angles obliquely truncate for the insertion of the limbs, the first joint in which is shorter than the basis. The name in Greek means *fed on by fish.*

Ichthybotus Hudsoni. (Plate X, figs. 1*a*—1*d*, details.)

Ephemera Hudsoni, McLach., Ent. Mag. (2), v, p. 270 (Dec. 1894).

Complete specimens lately received by Mr. McLachlan enable the description to be continued in respect of the ♂ and ♀ imago, and have decided what was doubtful concerning the genus. Genital forceps dull waxy yellowish, slightly dingy at the tips. Penis bifid, with thin or flattened lobes of even width, concave beneath, truncate at the tips, and divergent.

♀ Imago.—Wings transparent, tinted uniformly throughout the disk with light yellowish green, with black neuration, except near the wing-roots, where the stronger nervures become olive-brown and

the tint of the membrane to a small extent deeper: marginal and submarginal areas of the fore-wings throughout very light reddish (burnt umber) brown. Setæ very pale sepia-brown, shifting to whitish, with the uniformly distinct joinings very narrowly picked out with blackish. Length of body ♂ 19—20, ♀ 20—21; wing ♂ 20, ♀ 21—22; setæ ♂ im. (exterior), 33, ♀ im. 19 and 18—20 and 19; anterior leg ♂ 15, ♀ 9 mm.

Wellington District (*Hudson*, No. 32).

The Sectional Type of *Leptophlebia* is represented by two genera in New Zealand, of which one is new. Mr. Lillie discovered nymphs of single species of each genus last season, and most kindly forwarded specimens to the author. Their investigation is postponed until it can be ascertained whether the discoverer purposes publishing full descriptions of them in that country or not. The nymph assigned by him to *Atalophlebia noduiaris* has tracheal branchiæ of the same form as those of *Leptophlebia:* the other genus, *Delcatidium*, has acutely ovate single lamellæ.

ATALOPHLEBIA.

Tarsal claws all narrow and hooked; hind wing more or less obtusely subovate; forceps-basis of ♂ either entire, or at most merely emarginate in the middle of its apical edge. The homogeneity of this genus, alluded to with implied suspicion as long ago as 1884 in Trans. Linn. Soc. London, (2) Zool., vol. iii, p. 84, remains uncertain. The degree of importance to be attached to the differences noted in the character of the caudal setæ of the adult flies depends largely upon whether they correspond with differences in the tracheal branchiæ of the nymphs. In identification of species, the form of the penis, the colour or markings of legs and setæ of the imago, and the colouration of wings of the subimago are items of much importance. Wings of imagines are often very similar in closely related species.

Atalophlebia versicolor, sp. nov. (Plate X, figs. 2*a* and 2*b*, details).

Subimago (dried, and perhaps partly reddened *post mortem* in the killing-bottle, like other specimens captured by Mr. Hudson).—Fore wings, in the marginal and submarginal areas, tinted with dull

reddish purple, but elsewhere marbled with blackish grey; the cross-veinlets in the lighter spaces bordered more or less narrowly with this same colouring.

Imago ♂ (dried).—Notum and legs raw umber or light pitch-brown, opaque at the extreme tips of the fore femur and fore tibia; the fore tarsus matches the tibia in tint. Abdomen and forceps dark pitch or bistre-brown; the markings faded. Setæ medium warm sepia brown, with the distinct joinings blackish; some of the alternate joinings indistinct or not coloured; the mediam seta lacking. Basal joint in the forceps-limbs compressed, narrowed somewhat suddenly after the acute end of the inferior dilatation. Penis-lobes contiguous to each other, concave beneath towards the line of contact, up-curved, narrowed and sloped off towards their truncate tips. Wings vitreous with black neuration; fore-wing, in the marginal and submarginal areas, tinted with transparent raw umber or brown amber; cross-veinlets of the same areas, narrowly set off with black, showing strongly, and a few of them (both near the subcostal node and again midway beyond these towards the apex), suffused by a small dark greyish cloud that extends from the costa to just below the radius. The cross-veinlets of the marginal area, all simple, number about six before and sixteen beyond the bulla. Length of wing 10—12; outer setæ 17 mm.

Hab. WELLINGTON (*Hudson*); 1 sub. (No. 47) and 1 im. Its nearest ally seems to be *A. australis*, Walk., a Tasmanian species, which has forceps of a similar pattern, but dark-banded femora and more numerous cross-veinlets in the pterostigmatic region of the fore-wing.

ATALOPHLEBIA DENTATA (Plate X, fig. 3, detail).

Leptophlebia dentata, Etn., Trans. Ent. Soc. London (1871), p. 80 (♂ and ♀ im.), pl. iv, 18, 18*a*—*c* (details).
Atalophlebia dentata, id., Trans. Linn. Soc. London (2), Zool., vol. iii, p. 88 (subim. and im.) [1884].

Resembles the preceding species in the form of the forceps, figured with the penis, etc., in 1871. The penis-lobes, contiguous with each other throughout, are elongate triangular and thin with their outer edge thickened. The wings of the subimago are without pale markings, and the femora without dark bands. Fig. 3 now given shows in fine stipple the extent of the yellow amber tint, and in coarser stipple that of the bistre-brown of the description of 1884; the specimen appears to have had the darker tint changed in the killing-bottle to reddish purple towards the apex of the wing;

and it may be noticed that the dark edging of the cross-veinlets of the marginal area, before the bulla, has taken the form of very small single spots.

Hab. WELLINGTON (*Hudson*, No. 33).

ATALOPHLEBIA NODULARIS.

Leptophlebia nodularis, Etn., *op. cit.* (1871), p. 81, pl. iv, figs. 20, 20*a*—*c* (details), subim. and im. ♂.
Atalophlebia nodularis, Etn., *op. ante cit.* (1884), p. 89, with reproductions of figs. 20*a*—*c* of 1871.

The forceps of this species need re-figuring, the fig. 20 of 1871 being manifestly ill-drawn. The discovery of the nymph by Mr. Lillie is noted above.

Hab. CHRISTCHURCH (*Fereday*); DUNEDIN (*Lillie*); WELLINGTON (*Hudson*, No. 46).

ATALOPHLEBIA SCITA.

Baëtis scita, Walk., List of Neuropt. Ins. in Brit. Mus., part iii, p. 570 (1853).
Leptophlebia scita, Etn., *op. supra cit.* (1871), p. 81, pl. iv, figs. 21, 21*a* (details).
Atalophlebia scita, id., *op. supra cit.* (1884), p. 90, pl. x, figs. 16*f* (details).

In the explanation of the fig. 16*f*, *loc. cit.*, of the penis, it is wrongly referred to as an underside view. The earlier figure was sketched from beneath, but the later from above.

Hab. CHRISTCHURCH (*Fereday*).

DELEATIDIUM, gen. nov.

Distinguished as a genus from *Leptophlebia* by the ♂ imago having genitalia conformable in pattern to those of an *Atalophlebia*, and by the nymph having tracheal branchiæ in the form of single, ovate, acute, penni-veined, foliaceous lamellæ. The cross-veinlets of the fore-wing, in the typical species, are in two of the specimens widely spaced in places, after the manner of those of the species of *Atalophlebia* here illustrated; but in the other specimens of the same and of the other sex the blanks are less noticeable or are filled up. The name in Greek signifies *a little bait*.

DELEATIDIUM LILLII, sp. nov. (Plate X, figs. 4*a*, 4*b*, details).

Subimago (in fluid).—Wings uniformly light grey with opaque neuration. Setæ grey; their joinings towards their tips evenly defined.

Imago (dried).—♂ body pitch-brown, the thorax polished above. Femora and fore tibiæ raw umber brown; fore tarsus and hinder tibiæ lighter in tint; hinder tarsi somewhat of a sepia-grey throughout. Wings vitreous with pitch-black neuration, except in the fore-wing the finer cross veinlets of the marginal and submarginal areas that precede the pterostigmatic region (which are deficient in colouring), and the roots of the stronger nervures interior to the humeral cross-vein, which are raw umber brown; the membrane at the extreme roots is almost imperceptibly tinted raw umber or greenish. In the marginal area of the fore-wing, before the bulla, are usually about 6 faint cross-veinlets, and beyond that 2—4 faint and 8—11 stronger veinlets, all simple. Setæ light sepia-grey with blackish joinings, of which some in the basal quarter are alternately distinct and faint. In the abdomen, segments 3—6 are sometimes transparent and whitish to a variable extent at the base.

♀ very like the ♂, but the colouring at the fore-wing roots, interior to the humeral cross-vein, is rather darker in tint. The marginal area of the fore-wing contains about 3—5 faint cross-veinlets before the bulla, and two faint and thirteen stronger beyond that, all simple. Ventral lobe of the ninth abdominal segment slightly (not deeply) emarginate, with acute points.

Length of body 8—9, wing 12; setæ ♂ im. 51 mm.

Hab. DUNEDIN (*Lillie*); WELLINGTON (*Hudson*, No. 46). Mr. Lillie's consignment comprised nymph and both sexes in subimago and imago; Mr. Hudson's 3 ♂ & 1 ♀ im.

It is remarkable that up to the present time all New Zealand representatives of the 3rd Group of Sections of the Family belong exclusively to genera of the Sectional Type of *Siphlurus*. Three genera, *Coloburiscus*, *Ameletus*, *Oniscigaster*, furnish between them six species to the fauna.

COLOBURISCUS.

Hind tibia distinctly longer than the tarsus; basal joint in the hind tarsus vaguely marked off from the tibia, except at the sole (where spinules at the apex of the tibia

set out its limits), measured along which it is shorter than the next joint. In all the tarsi, irrespective of sex, the outer or posterior claw is narrow and hooked, the inner broad and obtuse. Costal shoulder of the hind wing remarkably acute-angled. In Trans. Linn. Soc. London, (2) vol. iii,* pl. xvii, 32*b* legs 2 and 3 ♀ of a North American species, the tibio-tarsal joining should have been shown by stipple instead of a firm line.

COLOBURISCUS HUMERALIS.

For synonymy refer to *op. cit.*, p. 202. Compared with the description there given, the ♂ imagines lately forwarded by Mr. Hudson appear to have the pterostigmatic tint darker than the specimens described, the newer colouring approaching pitch-brown. The tint is lighter in the females accompanying them, and in another much smaller specimen of this sex from Wellington is very faint indeed. But this last individual ♀, from the fact of its caudal setæ being collapsed and greyish white with the joinings very narrowly black, may have been killed before its colouring was fully developed. The nymph is still unknown.

Hab. WELLINGTON (*Hudson*, Nos. 31, 65); CHRISTCHURCH (*Fereday*) and OTAGO.

AMELETUS.

Hind tibia subequal in length to (hardly if at all longer than) the tarsus; basal joint in this tarsus, measured along the sole, equal to the next joint, and also dorsally subequal thereto, the breadth of the colouring of the tibio-tarsal

* N.B.—The following corrections needed in the writing of Plates XVIII—XX of the volume cited may advantageously be noted here:—

Plate XVIII, in head-line, *for* COLOBURUS *read* COLOBURISCUS: also *for* SIPHLURUS ? (and Pl. XX) *read* AMELETUS (and Pls. XIX, 33 ?*c*, LXIV, 22—24, and LXV, 13). Also at foot *for* S. ? femoratus *read* A. subnotatus.

Plate XIX, in head-line, *for* COLOBORUS *read* COLOBURISCUS: also *after* CHIROTONETES *add* 33 ? AMELETUS. Also at foot *for* halenticus *read* haleuticus; and after 33*c*, *for* Ch. *read* A.

Plate XX, in head-line, *for* 34 *read* 34*c*: also *commence the line with* ? 34*b* METAMONIUS. Also at foot, after *b*, *for* S *read* M; and *after c* insert S.

Attention to these corrections will greatly facilitate the identification of genera.—A. E. E.

boundary making it difficult to ascertain their exact proportions dorsally. In every tarsus the outer or posterior claw is narrow and hooked, the inner broad and obtuse. Costal shoulder of the hind-wing obtuse.

AMELETUS ORNATUS (Plate X, fig. 5, detail).

Chirotonetes (?) *ornatus*, Etn., Trans. Linn. Soc. London, (2) Zool., vol. iii, p. 208 (nominal reference), pl. xix, figs. 33 ? *c*, details (1885), described p. 321 (1888).

Although the genus *Ameletus* was published in *op. cit.* at pp. 201 and 210 (1885) with illustrations (*cf.* footnote *ante* under *Coloburiscus*), it was only while writing the present article that this species was recognised as one of it. The subimago, of which a wing is now figured, is referred to here on account of the leg-markings; the colour of the wings seems to have been modified to some extent by the killing-bottle.

Hab. CHRISTCHURCH (*Wakefield*); WELLINGTON (*Hudson*, No. 42).

AMELETUS PERSCITUS, sp. nov.

Subimago (dried).—Wings and setæ dull light yellowish, nearly of the same tint as those of *Heptagenia sulphurea*. Abdomen of a very light yellowish ochre, with a dull longitudinal median dorsal purplish stripe, extending from the base nearly to the last segment, strongly contrasted with the ground colour. This stripe is composed of concatenated spots (perhaps truncated triangles) wide behind, and somewhat blackened at the overlapping apical borders of the segments on each side of a small pale median apical spot: hence it might be described as serrated on each side. Venter spotless.

Imago (dried) ♀.—Wings vitreous, tinted with light yellowish green; neuration olive brown, shifting to pitch-brown and olive green with change of stand-point: cross-veinlets numerous in the marginal area; those in the pterostigmatic portion branched towards the costa and anastomosing. Anterior legs of rather a browner light yellowish colour than the hinder; these tending rather towards yellowish amber; the apical edges of the tarsal joints narrowly blackened, and the last two joints in the fore tarsus, or three joints in the hinder, tinged to a large extent with dark grey. Length of wing 18—20 mm.

Hab. WELLINGTON (*Hudson*, ♀ 1 im. & subim., No. 26).

N.B.—This is the species figured and described (without name) by Mr. Hudson in his Manual of New Zealand Entomology, p. 105, pl. xvi, fig. 4.

ONISCIGASTER.

Hind tibia much shorter than the tarsus, of which the basal joint is much longer than the next. In all the tarsi, and in both sexes, the outer or posterior claw is narrow and hooked, the inner claw broad and obtuse, thus differing from *Siphlurus*, which has all the claws narrow and hooked. The differences between their nymphs need not here be dwelt upon.

Oniscigaster wakefieldi.

Oniscigaster Wakefieldi, McLach., Ent. Mo. Mag., vol. x, p. 108—110, woodcut (1873, Oct.); *id.*, Journ. Linn. Soc. Zool., xii, pp. 139—146, pl. v, 1—5 g. (1874); Etn., Trans. Linn. Soc. London, (2) Zool., vol. iii, p. 224, pl. xxi, 36 (details imago) and pl. Li (nymph).

In this species, the ♀ has 3 dorsal segments, viz. the 7th to 9th, sinuate somewhat deeply on each side at the posterior margin, and dilated laterally into thin expansions that are rounded off to the base in front and acute behind, so as to form broad serratures like coxæ of *Oniscus murarius*. Above these the dorsum, in dried specimens, is somewhat fornicate with a median longitudinal depression. The first and second of the lateral serratures are broader and are rather more produced at the point than the third.

Hab. Christchurch (*Wakefield*).

Oniscigaster intermedius, sp. nov. (Plate X, fig. 6*a*, detail).

A single ♀ im. differs from *O. Wakefieldi* in having only 2 dorsal segments, viz. the 8th and 9th, dilated laterally, and this only moderately: dorsum sub-fornicate above the dilatation. Lateral borders of 8th segment almost straight, except where they gently curve inwards near the base, and very nearly parallel, diverging to only a very small extent posteriorly: dorsum transverse at the posterior margin: the postero-lateral angles obtuse. Ninth segment as broad, or perhaps a little broader than the 8th; its lateral margins saliently curved and bordered each by a linear flange terminating posteriorly in a minute point: the posterior margin of the dorsum transverse between these points. Wings marked as in *O. Wakefieldi*.

Hab. M'Arthur, Nelson, 3600 feet (*Hudson*, No. 34*a*).

ONISCIGASTER DISTANS, sp. nov. (Plate X, figs. 6*b* & 6*c*, details).

Resembles *O. Wakefieldi* in size and markings, but differs in the dorsal segments 6—9 not being produced into lateral flanges oniscoidally; their dorsa are roundly arched, with the posterior lateral angles obtuse, not produced, and the posterior margin transverse. In the fore wings the edging of the dark-bordered veinlets in the wider parts of the first two areas is more neatly defined and not blurred; and the wider part of the pterostigmatic region is more distinctly tinted with warm sepia grey than in the other species. I have seen only 1 ♂ subimago (of which the wings are blackish-grey with black neuration narrowly edged with grey, and with a pale spot extending forwards from the præbrachial (6) fork, and a curved narrow band running transversely from the costa at the base of the wing immediately exterior to the humeral cross-vein) and 2 ♀ im. The setæ of the adult ♀ are piceous, or greyish with black joinings.

Hab. WAINUI-O-MATA RIVER, WELLINGTON (*Hudson*, No. 34 and 34*b*).

In the allied genus *Siphlurus*, a specific difference is noticeable in the lateral outline of some of the abdominal segments of *S. armatus* and *S. lacustris*, ♂ im. analogous to that noted between *O. Wakefieldi* and *O. distans*; but the difference is not nearly so great as in these species of *Oniscigaster*.

EXPLANATION OF PLATE X.

[*See explanation facing the* PLATE.]

XII. *On the* Lepidoptera *of the Altai Mountains.* By Henry John Elwes, F.R.S., F.L.S., etc.

[Read June 7th, 1899.]

Plates XI—XIV.

I.

RHOPALOCERA.

There is probably no great range of mountains in Asia which has been so unaccountably neglected by modern naturalists, as those which form the boundary between Siberia and Mongolia, and which comprise the western end of what are known as the Altai and Sayansk Mountains. Their outlying spurs were partially explored in the last century by Pallas, and in the middle of the present one have been visited by several Russian and German geologists and botanists, among whom Helmersen,* Ledebour,† and Tchihatcheff,‡ are, as far as I know, the only ones who have published their travels in German and French. In the Russian language there is no doubt a quantity of literature relating to the natural history of these mountains, which must unfortunately remain unknown to the great majority of foreigners. The only entomologist, however, who has published anything of much value on the Lepidoptera of these mountains is Lederer,§ whose account of the collections made by Kindermann in the years 1852 and 1853 in the extreme western part of the Altai range is very useful. He enumerates 108 species of Rhopalocera of which, however, only 8 or 10 are species not found in Europe. Quite recently Herr Ruckbeil, a well-known collector employed by Herr Rudolph Tancré, spent three seasons in the neighbourhood of the Saisan lake and at Katun-Karagai and Tchingistai, which are a little to the

* Von Helmersen, Reise nach dem Altai, im Jahre 1834. St. Petersburg, 1848.

† Ledebour, Reise durch das Altai-Gebirge. Berlin, 1829.

‡ Tchihatcheff, Voyage Scientifique dans L'Altai Orientale. Paris, 1845.

§ Lepidopterologisches aus Sibirien. Verh. Zool. Bot. Ges. Wien., 1853, pp. 1—36 (*sep*). Weiterer Beitrag zur Schmetterlings-Fauna des Altai gebirges in Sibirien. *op. cit.* 1855, pp. 97—120.

south and west of the district explored by Kindermann. Though nothing has been published as to his collection, I am able, through the kindness of Herr Tancré, to give a list of the Rhopalocera, which includes several species not found by Kindermann, most of which appear to belong rather to the fauna of Turkestan than to that of the Altai.

The butterflies of the ranges to the south and west of the Altai, known as the Alatau, are fairly well-known from the collections made by Haberhauer and others; but of those of the whole central and eastern Altai we were quite ignorant.

When the opening of the Siberian railway made it possible to reach the country in a reasonable time, without a winter sledge journey of several weeks' duration, I determined to visit Siberia; partly with the object of hunting the great wild sheep (*Ovis ammon*, Pall.) which is found on the Mongolian frontier, and partly with the hope of adding something to our knowledge of the butterflies, birds, and plants of Asia, whose geographical distribution and variation has always been my favourite study. I was also very anxious to see whether there was any evidence of a boundary line between the eastern and western Holarctic regions, and to reach if possible the sources of the Yenesei river, which was thought by my late friend, Mr. H. Seebohm, to be the probable line of demarcation between the birds of eastern and western Siberia.*

I was fortunate enough to find a most excellent companion in Mr. W. A. L. Fletcher, who had previously accompanied Mr. and Mrs. Littledale on their celebrated journey through Tibet, and who, though his principal object was to hunt big game, very kindly assisted me in collecting on the journey to and from the hunting ground.

I cannot find that any English traveller except Atkinson has ever written anything about the part of the country we visited, but before giving a sketch of the route and the nature of the country in which my collections were made, I must acknowledge the kind assistance I received from M. Serge Alphéraky, who introduced me to a Russian naturalist, M. Berezowsky, who accompanied us as far as the last Russian outpost, and would, if he had remained with us, have given me much needed assistance in interpreting and collecting. As, however, he left us at Kuch Agatch,

* Cf. H. J. Elwes on Zoology and Botany of Altai Mountains, Linn. Soc. Journ. Zool. vol. xxvii, pp. 23—46, 1898.

I was unable to find time to do as much as I hoped in other branches of zoology; and the difficulties of the country and the languages were such that we were obliged to confine our journey to much narrower limits than we had planned.

M. P. P. Semenoff, President of the Entomological Society of St. Petersburg, also gave me much kind help and advice; and General Bolderoff, the Governor of the Altai, was also most obliging in furthering our objects. We left Moscow on May 19th, in quite summer weather, which, however, only lasted as far as the Ural Mountains. At Kazan we spent a few hours and found several butterflies, including *P. machaon*, *Arg. selenis* and *dia*, already on the wing. In the great Barabinsky steppe, through which we passed in the train for two days, there was not a green leaf to be seen on the birch trees, and the only butterfly I saw was *Pieris chloridice*. At Obb, where we arrived on May 26th, it was still quite cold, and the only butterflies were a few hibernated *G. rhamni* and *Vanessas*, besides *L. sinapis*.

Here we left the railway, and went up the Obb river by steamer to Barnaoul, the capital of the Altai district and the only town of importance in it. From here we drove across more or less cultivated and mostly open country to Biisk, where we arrived on June 2nd, and found the birches and poplars just bursting into leaf. The spring was said to be exceptionally late, from fifteen to twenty days behind the usual time. Up to this point I had seen no sign of real mountains, and the patches of forest were small and stunted; but from the earth cliffs above Biisk, we could see the outlying spurs of the real Altai Mountains. After four days' delay, during which I caught a few butterflies, such as *Lycæna argiades*, *Argynnis dia*, *Papilio machaon*, *Polyommatus amphidamas* and *Anthocharis cardamines*, we at last got off on June 6th, and reached a big village called Altaisk, after ten hours' driving in a wickerwork country cart, the only vehicle which can get over such roads as are found beyond Biisk. The weather continued cold and cloudy, and during the four days we took to reach Ongodai I got very few insects, though the flora, scenery, and country were of a very much more attractive character than anything we had hitherto seen. Larch is the prevailing tree of this part of the Altai Mountains, with spruce in the marshy bottoms, and extremely luxuriant herbaceous vegetation everywhere except on the dry southern

exposures of the hillsides. A day before reaching Ongodai, the valleys opened out very much into wide steppe-like flats, on which thousands of horses were grazing, and the last Russian villages ceased. Beyond Sheballina there are hardly any Russian settlers, except a few merchants; and Tartars, who speak a language closely akin to Turkish, and live a nomadic life, are the only inhabitants. At Ongodai we had another delay of four days, whilst waiting for horses, as beyond this point everything has to be packed on horseback. This village is a very promising place for a collector, lying at an elevation of about 3000 feet, and close to well-wooded valleys running up into mountains at least 6000 feet high.

The weather here began to be quite warm, and though butterflies were still scarce, I got some very good species which I had not expected, among them *Pamphila argyrostigma*, Eversm., and *Œneis sculda*, both of which were new to Western Siberia.

A Russian entomologist, M. Alexis Jacobson, joined us here and stayed at Ongodai for two months. As he was good enough to send me his collection of *Rhopalocera*, I am able to form a good idea of the butterflies of this part of the Altai, and to add several species to the list of those I took myself.

We left Ongodai on June 14th, and marched about 250 versts in seven days, crossing the deep hot valley of the Katuna river on the second day, then over a pass of about 5000 feet to avoid a gorge in the Katuna valley, to a place called Ena, where the scenery was very peculiar, and thence up the valley of the Tchuja river for five days to Kuch Agatch.

My collecting was of course very much confined to the line of march, but I always kept a man with me to hold my horse, and dismounted whenever I saw a likely spot or an insect I wanted. The sun was very intermittent, and on most days we had thunderstorms; but in the valley of the Tchuja I got many good butterflies, especially near Aibulak at about 4000 feet elevation, where *Thecla fridvaldszkyi* and *Erebia edda* and a very large and distinct species of *Œneis* were taken. In the steppe of Kurai, which is surrounded with high snowy mountains, the only abundant insect was *Triphysa phryne;* and when we ascended to the gorge between it and the Upper Tchuja Steppe, we found great banks of snow still unmelted in the valley at Kuyuktana, and vegetation extremely backward; but a new

Lycæna, which I found more common in the higher mountains south of the steppe, showed that we were getting into a good and new region.

In the Tchuja Steppe, which is a large plain surrounded by mountains 8000 to 9000 feet high, interspersed with marshes, salt lakes, and stony plains covered with a scanty grass, I found no insects out as yet, except an occasional straggler of *Pieris chloridice*. At Kuch Agatch, a frontier trading post, we hired fresh horses and men for a month, and started up a valley which runs into the high mountains on the Mongolian frontier, to hunt wild sheep which were very numerous about thirty miles south of Kuch Agatch. For the first ten days bad weather and the attractions of stalking prevented my doing much entomology; but on July 3rd, butterflies began to get so numerous and interesting, that I only hunted when the weather made collecting impossible. Near our camp, which was about 7000 feet elevation, and several miles beyond the last stunted larch trees, which here find their highest limit at about 6800 feet, I got many very interesting species which were quite unexpected and unknown, except from the Upper Amur and Eastern Sayansk Mountains. The hills were immense downs, covered with dry wiry grass, and intersected by rocky gorges with marshy and gravelly flats, and ran up into steep rocky mountains whose slopes were covered with shale and boulders, and whose tops were often flat, and reminded me of the high fjelds of Norway. Peat, and the plants which grow on peat in all similar mountain ranges which I have visited in Northern Europe and America were absolutely wanting; but I found several insects such as *Argynnis freija* and *frigga* which in other countries are associated with peat bogs, in wet grassy flats and by the side of Alpine rivulets.

The weather continued until July 22nd to be very changeable, and though often quite hot in the sun, the latter rarely remained out for more than two or three hours, and hardly a day passed without severe thunder, hail, or snowstorms. By making the most of every glimpse of sunshine, I was now able to add rapidly to my collection, and got good series of many rare species which I did not find elsewhere. On July 13th, in a valley near our camp on the Darkoti or Tachety river, which was full of a greater number of beautiful Alpine plants than I ever saw in one spot before, I first saw the rare *Parnassius eversmanni*, and though a fall

on my head from a pony which was not used to a butterfly-net, hindered my work a good deal for a week, by the time we got back to Kuch Agatch on July 19th, I had nearly 1000 specimens.

The steppe was now covered with a large locust, which flew up in hundreds when disturbed, but the only butterflies I found on it were *Satyrus autonoë* in great abundance, and *Lycæna cyane*, which was nearly over. On the marshy banks of the Tchuja river I got a few *Argynnis* and *Cœnonympha*, but the weather was again very cold for two days, and a snowstorm on July 19th covered the mountains to a depth of nearly a foot on the higher levels. On almost every clear night during our stay in the Tchuja Mountains it froze, and in consequence few or no night-flying moths were taken. Retracing our steps for two days to Kurai, I found a great many species which I had not seen before, and on the 23rd turned north from Kurai, over a high pass which leads to a valley running into the Bashkaus river; at the head of this valley I found one of the best places for collecting I have ever seen, and got into quite a new climate and vegetation, much damper than that of the Tchuja valley. To give an idea of what was to be found here, I copy from my diary as follows :—

"July 24th.—Marched about 20 miles over a pass about 8000 feet high into a wooded valley, and encamped at about 5000 feet on a tributary of the Bashkaus. A dull day, but warm and still, and a few gleams of sunshine after 12. Collected—

24 ♂ 4 ♀	*Erebia kefersteini.*
20 ♂ 20 ♀	*E. maurisius.*
1 ♀	*Erebia* allied to *dabanensis* perhaps new;* 7000 feet.
1 ♂ 1 ♀	*E. euryale*, worn and almost over; 6000 feet.
3 ♂	*E. sedakovi* quite fresh, in larch forest.
7 ♂ 2 ♀	*E. tyndarus*, 7500—7000 feet.
4 ♂ 1 ♀	*E. lappona*, 7000—8000 feet.
1 ♂	*Lycæna astrarche* (the only one seen).
2 ♂	*L. optilete* in willow swamp (the first seen).
1 ♀	*L. eros.*
2 ♂	*L. pheretes.*
1 ♀	*Hesperia comma* (the first seen).

* *E. fletcheri.*

1 ♀	*Œneis norna*, var. *maxima* (nearly over).
2 ♂ 1 ♀	*Hesperia centaureæ.*
1 ♂ 1 ♀	*Pieris chrysidice.*
6 ♂	*Colias palæno* in willow swamp (the first seen).
2 ♂	*C. melinos* (quite over).
1 ♂	*Melitæa dictynna.*
1 ♂	*Parnassius delius.*
1 ♀	*Melitæa*, var. *britomartis* ?
1 ♀	*Œneis sculda.*
1 ♂ 1 ♀	*Arg. pales*, very common at 6000 feet.
5 ♂ 1 ♀	*A. aphirape.*
5 ♂	*Cœnonympha iphis.*
2 ♂	*C. tiphon*, small pale var.

The hope of getting more of what I supposed to be a new *Erebia* induced me to halt a day, and retrace my steps to the pass, which entailed a rough ride of four hours. Until twelve o'clock there was little or no sun and only two hours in the afternoon. I was unable to find more of the *Erebia* but got *Parnassius stubbendorfi*, which I had not seen before, as well as *P. eversmanni* and *delius.*

After leaving this camp, we passed through marshy larch forest with dry meadows until we got into the main valley of the Bashkaus, which is here a large river flowing in an open park-like valley, at about 4000 feet elevation. We crossed it by a wooden bridge, and in the evening reached Ulaghan, where the Saisan or chief of the upper Tchuja and Bashkaus districts resides, and where there is a small Russian church, and one or two wooden houses. The chief, however, though a Christian, prefers to live in his *yourt*, a large round, felt-covered wicker-work tent, which forms the movable habitation of Mongols and Kirghiz throughout a large part of Central Asia.

After some delay in getting fresh horses we left Ulaghan on July 27th, a dull day with rain at intervals until 4 p.m. But notwithstanding this some butterflies which I had not met with before were out; *Argynnis ino* was in abundance, and *Erebia ligea* was seen for the first time, after crossing a high ridge covered with larch forest, which forms the watershed between the Bashkaus and the Tchulischman Valleys, which unite ten miles above Lake Teletskoi.

On the next day Fletcher went up into the mountain after roe, and succeeded during his mid-day rest in taking

three specimens of *Argynnis angarensis*, a North and East Siberian species, which is new to the Altai. I descended about 2000 feet into the dry rocky gorge of the Tchulischman, where I found a very much warmer climate than I had experienced for six weeks, and a number of butterflies new to me among them; the most interesting were *Pararge deidamia*, and a *Thecla* which I supposed to be *T. w. album*, but which turns out to be the Eastern species *T. prunoides*.

This valley is of quite a different character to any I had hitherto seen in the Altai, having steep rocky slopes and precipices on both sides, with waterfalls from the upper slopes, which are wooded with larch.

On July 29th we followed it down for twenty miles, and found the valley open out again as it approached its junction with the Bashkaus into grassy plains, with rich grass, and in some places a little cultivation of spring rye, the first signs of agriculture I had seen for six weeks.

After crossing the Bashkaus by a ferry, the horses being swum over this large and rapid stream, we came to a small settlement where there is a little Russian church; but we saw no Russians, except one or two travelling traders between Kuch Agatch and Lake Teletskoi, which we reached on July 31st.

The valley of the Bashkaus after its junction with the Tchulischman is very beautifully wooded, and the herbaceous vegetation became very rich and luxuriant; but of an East European type, utterly unlike that of the Tchuja Valley, and a number of common European butterflies appeared which I had not seen before. I did not find a single non-European species north of the junction of the Bashkaus, though no doubt the high mountains round Lake Teletskoi, which I had not time to ascend, would produce some of the alpine species of the Altai.

North of the lake, which took us two days' rowing to traverse, we got into a much more densely wooded country, and twenty miles down the Bija Valley, we came to the first Russian village. The valley opens out a good deal, and in some parts is covered with magnificent forests of pine, the largest I have ever seen in Europe or Asia; these, however, are being rapidly wasted by fire and axe, the logs being floated down to supply the villages on the Obb, where there is, as far as I saw, no really fine timber.

The best of the collecting was now over, all the summer

butterflies being much worn, and though I found second broods of *Araschnia levana, Lycæna orion, Leucophasia sinapis* and others, as well as some common European species I had not hitherto observed, it is quite evident that this part of the country is not to be compared in interest or novelty to the Tchuja Valley.

On August 6th we got to the first Russian post-house, where, although the roads were in places frightfully bad, wheel carriage again became possible, and the change from dense forest-clad hills to an open cultivated country was sudden and remarkable.

In the course of a three days' drive to Barnaoul I took only one butterfly, *Polyommatus virgaureæ*, which I had not previously seen, and reached the railway at Krivostchokovo rather used up, as the terrible jolting, combined with a touch of malarial fever (which seems to be prevalent in autumn in the lower Bija Valley), laid me up for four days before starting for Moscow.

The weather during our journey across the steppe was cloudy or wet, and as there seemed to be no entomological inducement to stay a day or two in the Ural as I had intended, we came right on to Moscow without stopping.

I will now give a complete list of the Lepidoptera I procured, together with those taken by M.M. Jacobson and Berezowsky at Ongodai, and in order to complete the list of species found in the Altai, as far as possible I have added those species recorded by Lederer and Tancré, and a few others which I found in Dr. Staudinger's collection and in that of M. Grum-Grshimailo, which I purchased at St. Petersburg.

I may add, that all of these come from the south and western district near Semipalatinsk, and possibly a few of them are hardly found north of the Irtysch river, which I take as the boundary of the Altai in that direction.

It must be understood that my list only refers to the Altai Mountains so far as they are in Russian territory. There is a great southern extension of the Altai range in Mongolia which is unknown to entomologists, and some travellers and geographers include the mountains forming the boundary between Central Siberia and Mongolia, and those at the head-waters of the Yenesei river in the Altai system, but I prefer to call these the Sayansk Mountains. Towards the south-west there is no definite boundary except the Irtysch river between the Altai and the

Alatau Mountains, and I am not sure whether I ought to include all the species collected by Ruckbeil, some of which were taken at Saisan in the upper Irtysch Valley. Most of the species characteristic of the Central Asian fauna, such as *Parnassius actius*, *Anthocharis pyrothoë*, *Colias thisoa*, *Œneis tarpeia*, and *Satyrus heydenreichi*, were only taken by Kindermann and Ruckbeil in the Irtysch Valley and at Saisan; and if they were excluded, my list would show an even more decidedly European and Siberian element than it does now. A large number of the species I collected were only found in the valleys of the Bashkaus, Tchulishman, and Ursul, and not in the high bare mountains south of the Tchuja Steppe, where I spent the most of my time and collected most thoroughly. Here I only took about thirty-six species, and as a list of these will be interesting to show what the really high mountain butterflies are I will give it separately.

The following occurred at 6500 feet, which is about timber-line and upwards:—

Parnassius delius, var. *alpina*.*
A *P. eversmanni*.*
Aporia crataegi.
Pieris chloridice.
P. chrysidice (seen once, not identified).
A *Colias melinos*, var. *alpina*.*
A *C. nastes*, var. *mongola*.*
Lycæna ægon.
L. argus.
L. pheretes.
L. orbitulus.
A *L. argali*.
Vanessa urticæ.
Melitæa iduna.*
M. aurinia, var.
M. cinxia, var.
M. aurelia, var.
A *M. arcesia*, var.*
Argynnis aphirape.
A. selenis.
A. pales.
A. freija.
A. frigga, var.
A. dia, var.
A *Erebia kefersteini*.
A *E. maurisius*.
A *E. parmenio*.
E. lappona.
E. tyndarus.
A *E. ero*.
A *Œneis mulla*?*
A *Œ. sculda*.
Œ. bore, var.*
Cœnonympha tiphon, var.
Triphysa phryne.
Hesperia centaureæ.

This small list is very interesting, as showing the character of the high alpine fauna: eleven of the species are non-European, fifteen are also found in Lapland, and the same number in Amurland; only nine in the Pamir, so that the character of the fauna is essentially boreal rather than Central Asiatic.

* Those marked * were not taken elsewhere. Those marked A do not occur in Europe.

		Altai Mountains, taken by Elwes.	Ongodai, by Jacobson and Berezowsky.	The South-Western Altai, by Kindermann, Ruckbeil, etc.	Thianshan Mountains and Kuldja District, by Alphéraky and Grum.	Tarbagatai, by Haberhauer.	Alatau, by Haberhauer.	Pamir, by Grum.	Amur, recorded by Staudinger.	Kentei, by Dorries.	Kokonor, by Grum.	Lena, by Herz.	In Europe.
		1			2	3	4	5	6	7	8	9	10
1	*Papilio machaon*	×	...	×	×	×	×	×	×	×	×	×	×
2	*P. podalirius*	...	...	×	×	×	...	...	...	...	...	...	×
3	*Parnassius apollo*	×	×	×	×	×	×	...	...	×	...	×	×
4	*P. delius*	×	×	×	...	×	...	...	...	...	...	...	×
5	*P. nomion*	×	×	×	...	...	...	...	×	×	×	...	...
6	*P. actius*	...	...	×?	×	...	×	×	...	...	...	...	...
7	*P. enedius*	...	...	×	...	...	...	...	×	×	×	×	...
8	*P. clarius*	×	...	×	...	×	...	...	...	...	...	...	...
9	*P. stubbendorfi*	×	×	×	...	...	...	...	×	...	×	...	...
10	*P. eversmanni*	×	...	...	...	...	...	...	×	...	...	×	...
11	*Aporia cratægi*	×	...	×	×	×	...	×	×	×	...	×	×
12	*Pieris napi*	×	×	×	×	×	×	...	×	×	×	...	...
13	*P. rapæ*	×	×	×	×	×	×	×	×	×	×	×	×
14	*P. daplidice*	×	×	×	×	×	×	×	×	...	...	...	×
15	*P. chlorodice*	×	...	×	...	×	×	×	...	...	×	...	×
16	*P. callidice*	×	×	...	×	×	×	×	...	...	×	...	×
17	*Anthocharis cardamines*	×	×	×	×	×	×	×	×	×	...	×	×
18	*A. belia*, var.	×	×	×	×	×	...	×	...	...	...	×	×
19	*A. pyrothoë*	...	...	×	×	...	×	...	...	...	...	...	...
20	*Leucophasia sinapis*	×	×	×	×	...	×	×	×	×	...	×	×
21	*Colias palæno*	×	...	×	...	...	...	...	×	×	...	×	×
22	*C. nastes*? var. *mongola*	×	...	...	...	...	...	...	...	...	...	...	...
23	*C. melinos*	×	...	...	...	...	...	...	×	×	...	×	...
24	*C. hyale*	×	×	×	×	×	×	×	×	×	...	...	×
25	*C. chrysotheme*	×	×	...	...	...	...	...	...	×	...	...	×
	C. erate?	...	...	×	×	×	×	×	×	...	...	...	×
26	*C. aurora*	...	×	×	×	...	...	...	×	×	...	×	...
27	*C. thisoa*	...	...	×	×	×	...	×	...	...	×	...	...
28	*Rhodocera rhamni*	×	...	×	×	...	...	×?	×	×	...	...	×
29	*Thecla betulæ*	...	×	×	×	×	...	...	×	...	...	...	×
30	*T. prunoides*	×	...	...	...	...	...	...	...	×	...	...	...
31	*T. pruni*	...	...	×	...	...	...	...	...	...	...	...	×
32	*T. rubi*	×	×	×	×	×	×	×	×	..	...	×	×
33	*T. frivaldszkyi*	×	...	×	...	...	...	...	×	...	...	...	...
34	*Polyommatus virgaureæ*	×	×	×	...	...	×	...	×	×	...	×	×
35	*P. thersamon*	...	...	×	×	×	×	...	...	...	...	...	×
36	*P. hippothoë*	...	...	×	...	...	...	...	×	...	...	×	×
37	*P. alciphron*	...	...	?×	×	...	×	...	...	...	...	...	×
38	*P. dorilis*	...	...	?×	...	...	×	...	...	...	...	...	×
39	*P. dispar*, var. *rutilus*	...	...	×	×	×	×	...	×	×	×	...	×
40	*P. phlæas*	×	...	×	×	×	...	×	×	...	...	×	×
41	*P. amphidamas*	×	×	...	...	×	×	...	×	×	...	×	×
42	*Lycæna argiades*	×	×	...	×	...	×	×	×	×	...	×	×
43	*L. fischeri*	×	×	×	...	×	...	...	×	...	...	...	...

		Altai, Elwes.	Ongodai, Jacobson & Berezowsky.	South-Western Altai, Kindermann & Ruckbeil. 1	Thianshan & Kuldja, Alpheraky & Grum. 2	Tarbagatai, Haberhauer. 3	Alatau, Haberhauer. 4	Pamir, Grum. 5	Amur, Staudinger. 6	Kentei, Dorries. 7	Kokonor, Grum. 8	Lena, Herz. 9	In Europe. 10
44	*Lycæna ægon*	×	×	...	×	×	×	×	×	×	...	×	×
45	*L. argus*	×	×	×	×	×	...	×	×	×	×	×	×
	L. cleobis, var. ?	×	...	...	...	...	...	...	×	×	...	...	...
46	*L. lucifera*	×	×	...	...	...	...	...	...	×	×	...	...
47	*L. optilete*	×	×	...	...	...	...	...	×	×	...	×	×
48	*L. zephyrus*	...	...	×	...	...	...	×	...	...	...	...	×
49	*L. pylaon* ?	...	...	×	...	...	...	...	...	...	...	...	×
50	*L. cyane*	×	×	...	...	...	...	...	...	...	...	...	...
51	*L. orion*	×	×	×	×	×	...	...	×	...	×	×	×
52	*L. baton*	×	...	...	×	×	×	×	...	...	...	...	×
53	*L. pheretes*	×	×	×	...	×	...	×	×	×	×	×	×
54	*L. orbitulus*	×	×	...	.	×	...	...	...	×	×	×	×
55	*L. astrarche*	×	×	×	×	×	×	×	×	×	...	×	×
56	*L. eros*	×	×	×	×	×	×	×	...	×	×	×	×
57	*L. icarus*	×	...	×	×	×	×	×	×	...	×	×	×
58	*L. eumedon*	×	×	×	×	×	×	×	×	×	×	×	×
59	*L. amanda*	×	×	×	×	×	×	×	×	×	?	×	×
60	*L. admetus*, var. *rippertii*	×	...	...	...	...	×	×	...	...	...	...	×
61	*L. damon*	×	×	×	×	×	×	...	...	...	...	...	×
62	*L. damone*, var.	×	×	...	?	×	...	...	...	...	...	...	...
63	*L. donzelii*	×	×	...	...	...	...	...	...	×	...	...	×
64	*L. argiolus*	...	...	×	×	×	×	×	×	×	...	×	×
65	*L. sebrus*	×	...	...	×	...	...	...	...	...	...	...	×
66	*L. minima*	×	...	×	...	×	×	...	×	×	×	...	×
67	*L. lycormas*	×	...	...	...	...	...	...	×	×	...	×	..
68	*L. semiargus*	×	×	×	×	...	×	×	×	×	×	×	×
69	*L. argali*, n. sp.	×	...	...	...	...	...	...	...	...	...	...	...
70	*L. arion*, var.	×	×	...	×	×	×	...	×	...	×	...	×
	L. arcas ?	...	...	×	...	...	...	...	...	...	...	...	...
71	*L. euphemus*	×	...	×	...	...	×	...	×	×	...	×	×
72	*L. rhymnus*	...	...	×	...	×	...	×	...	...	...	...	...
73	*Apatura ilia*, var.	...	...	×	...	...	...	...	×	...	×	...	×
	Limenitis populi ?	×	...	...	...	...	...	...	×	×	...	...	×
74	*L. hellmanni*	...	...	×	...	...	...	...	×	...	...	...	...
75	*L. sydyi*	...	...	×	...	...	...	...	×	...	...	...	...
76	*Neptis lucilla*	×	×	...	×	×	×	×	×	×	×	×	×
77	*N. aceris*	...	...	×	...	...	...	...	×	...	...	...	×
78	*Araschnia levana*	×	×	×	...	...	...	...	×	×	...	×	×
79	*Vanessa antiopa*	×	...	×	×	...	×	...	×	×	×	×	×
80	*V. atalanta*	...	...	×	×	...	...	...	...	...	...	...	×
81	*V. polychloros*	×	...	×	...	...	...	...	...	...	...	...	×
82	*V. xanthomelas*	...	...	×	...	...	...	...	×	...	...	×	×
83	*V. urticæ*	×	×	×	×	...	×	×	×	×	×	×	×
84	*V. cardui*	×	...	...	×	...	...	×	×	...	×	×	×
85	*V. io*	×	...	×	×	...	...	...	×	×	...	...	×
86	*V. L-album*	×	...	...	...	...	...	...	×	×	...	...	×
87	*Grapta c-album*	×	...	×	×	...	...	...	×	×	×	×	×
88	*Melitæa iduna*	×	...	×	...	×	...	...	...	...	...	×	×
89	*M. maturna*	×	×	×	...	...	×	...	×	×	...	...	×

		Altai, Elwes.	Ongodai, Jacobson & Berezowsky.	South-Western Altai, Kindermann & Ruckbeil. 1	Thianshan & Kuldja, Alphéraky & Grum. 2	Tarbagatai, Haberhauer. 3	Alatau, Haberhauer. 4	Paunir, Grum. 5	Amur, Staudinger. 6	Kentei, Dorries. 7	Kokonor, Grum. 8	Lena, Herz. 9	In Europe. 10
90	*Melitæa aurinia*	×	×	×	×	×	×	...	×	×	×	×	×
91	*M. cinxia*	×	×	×	×	×	×	...	...	×	...	×	×
92	*M. arduinna*	...	...	×	×	×	×	×	...	...	...	...	×
	M. trivia ?	...	...	×	...	...	...	×	...	...	...	...	×
93	*M. phœbe*	×	...	×	×	×	×	...	×	×	...	×	×
94	*M. didyma*	×	×	×	×	×	×	×	×	×	×	...	×
95	*M. dictynna*	×	×	×	...	...	...	...	×	×	...	...	×
96	*M. arcesia*, var.	×	×	...	...	...	...	...	×	×	×	×	...
97	*M. aurelia*, var.	×	×	×	...	×	×	...	×	×	...	?	×
	M. aurelia, var. vel. n.sp.	×	...	...	...	...	...	...	...	...	...	...	...
98	*Argynnis aphirape*	×	×	...	...	...	...	...	×	×	...	×	×
99	*A. selene*	×	×	...	...	...	...	...	×	×	...	×	×
100	*A. selenis*	×	×	...	...	...	...	...	×	×	...	×	×
101	*A. oscarus*	...	×	...	...	...	...	...	×	×	...	×	...
102	*A. euphrosyne*	×	×	...	...	...	...	...	×	×	...	×	×
103	*A. freija*, var.	×	...	...	...	...	...	...	×	×	...	×	×
104	*A. pales*	×	×	×	×	×	×	×	×	×	×	×	×
105	*A.* var. ? *arsilache*	×	...	...	...	...	...	...	?	?	...	×	×
106	*A. dia*	×	...	...	...	×	×	...	...	...	...	×	×
107	*A. amathusia*	×	×	×	...	...	...	...	×	×	...	...	×
108	*A. angarensis*	×	...	...	...	...	...	...	×	×	...	×	...
109	*A. frigga*, var.	×	...	...	...	...	...	...	...	...	...	×	×
110	*A. thore*	×	...	...	...	...	...	...	×	×	...	×	×
111	*A. ino*	×	×	×	×	×	×	...	×	×	...	×	×
112	*A. daphne*	...	×	×	...	...	...	...	...	×	...	...	×
113	*A. hecate*	×	×	×	...	...	×	×	...	...	...	...	×
114	*A. lathonia*	...	...	×	×	×	...	×	...	...	...	...	×
115	*A. aglaia*	×	×	×	×	×	×	×	×	×	×	×	×
116	*A. niobe*	×	×	×	×	...	×	...	×	...	×	×	×
117	*A. adippe*	×	×	×	×	×	×	×	×	×	...	×	×
118	*A. paphia*	×	...	×	×	...	×	...	×	×	...	...	×
119	*A. pandora*	...	...	×	×	...	×	×	...	...	...	...	×
120	*Melanargia iapygia*, var.	...	...	×	×	×	×	...	...	..	...	...	×
121	*Erebia maurisius*	×	×	×	...	× var.	...	...	...	...	...	× var.	...
122	*E. theano*	×	×	×	...	...	...	...	...	...	...	...	...
123	*E. kefersteini*	×	×	...	...	...	...	...	...	...	...	...	...
124	*E. tyndarus*	×	×	...	...	×	...	...	...	...	...	...	×
125	*E. æthiops*	×	...	×	...	...	...	...	...	...	...	...	×
126	*E. sedakovii*	×	×	...	...	...	...	...	×	×	...	...	...
127	*E. ligea*	×	×	×	...	...	...	...	×	...	...	×	×
128	*E. euryale*	×	×	...	...	...	...	...	...	...	...	×	×
129	*E. lappona*	×	...	×	...	...	...	...	...	...	...	...	×
130	*E. fletcheri*	×	...	...	...	...	...	...	...	...	...	...	...
131	*E. rossii*, var. *ero*	×	...	...	...	...	...	...	×	...	...	...	...
132	*E. edda*	×	...	...	...	...	...	...	×	...	...	×	...
133	*E. afra*	...	...	×	...	×	×	...	...	...	...	...	×
134	*E. cyclopius*	...	...	×	...	...	...	...	×	×	...	...	...
	E. medusa	...	...	?	...	...	...	...	×	×	...	×	×
135	*E. embla*	×	...	...	...	...	...	...	×	×	...	×	×

		Altai, Elwes.	Ongodai, Jacobson & Berezowsky.	South-Western Altai, Kindermann & Reckbeil.	Thianshan & Kuldja, Alpheraky & Grum.	Tarbagatai, Haberhauer.	Alatau, Haberhauer.	Pamir, Grum.	Amur, Staudinger.	Kentei, Dorries.	Kokonor, Grum.	Lena, Herz.	In Europe.
				1	2	3	4	5	6	7	8	9	10
136	*Erebomorpha parmenio*	×	×	...	...	...	...	...	×	×	...	...	...
137	*Œneis mulla?*	×	...	...	...	×	...	...	...	...	...	...	...
138	*Œ. norna*, var. *altaica*	×	...	×	...	...	...	...	...	...	...	...	...
139	*Œ. dubia*	×	×	...	...	...	...	...	...	...	...	...	...
140	*Œ. nanna*	×	...	...	...	...	...	...	×	...	...	...	...
141	*Œ. sculda*	×	...	...	...	...	...	...	×	...	...	...	...
142	*Œ. bore*, var. *ammon*	×	...	? var.	...	? var.	...	...	...	? var	...	...	...
143	*Œ. tarpeia*	...	...	×	×	×	...	...	...	...	...	...	...
144	*Satyrus semele*	...	...	×	...	...	...	...	...	...	...	...	×
145	*S. heydenreichi*	...	...	×	×	×	...	×	...	...	...	...	...
146	*S. hippolyte*	×	...	×	×	×	×	...	...	×	...	...	×
147	*S. autonoë*	×	×	×	×	×	×	...	...	×	×	...	...
148	*S. anthe*, var. *hanifa*	...	...	×	× var.	×	×	× var.	...	...	...	...	...
149	*S. briseis*	×	...	×	×	...	...	×	...	...	...	...	×
150	*S. dryas*	×	×	×	×	×	×	...	×	×	× var.	...	×
151	*S. arethusa*	...	...	×	×	×	×	...	...	...	...	...	×
152	*S. actæa*, var. *bryce*	...	...	×	...	...	×	× var.	...	...	×	...	×
153	*Pararge mæra*	×	...	×	...	×	×	...	...	...	...	...	×
154	*P. hiera*	×	...	...	...	×	...	...	×	×	...	×	×
155	*P. achine*	×	...	×	...	...	...	...	×	×	...	...	×
156	*P. deidamia*	×	×	...	...	...	...	...	×	×	×	...	...
157	*Epinephele lycaon*	×	×	×	×	×	×	×	×	×	...	...	×
158	*E. hyperanthus*	×	×	...	...	...	...	...	×	×	× var.	...	×
159	*Cœnonympha œdipus*	...	...	×	...	...	...	...	×	×	...	...	×
160	*C. iphis*	×	×	...	× var.	×	...	...	×	×	...	×	×
161	*C. amaryllis*	×	×	×	...	×	...	...	×	×	×	...	...
162	*C. hero*, var. *perseis*	×	×	×	...	...	...	...	×	×	...	×	×
163	*C. tiphon*	×	×	...	...	×	...	...	...	...	...	×	×
164	*C. pamphilus*	...	...	×	×	×	×	×	...	...	...	...	×
165	*Triphysa phryne*	×	...	...	...	...	...	...	× var	...	× var.	...	×
166	*Carcharodus alceæ*	...	...	×	×	...	×	×	...	...	...	..	×
167	*Hesperia orbifer*	...	×	×	×	...	...	×	×	×	...	...	×
168	*H. tessellum*	×	×	×	×	×	×	×	...	×	...	...	×
169	*H. cribrellum*	×	×	...	...	×	×	...	×	×	...	...	...
170	*H. malvæ*	×	×	×	×	×	×	×	×	×	...	×	×
171	*H. serratulæ*	×	×	...	...	×	×	...	...	...	...	×	×
172	*H. alveus*	×	×	...	...	×	×	...	×	×	...	...	×
173	*H. centaureæ*	×	...	...	...	...	...	...	...	...	...	×	×
174	*Thanaos tages*	×	...	×	...	...	...	...	×	...	...	...	×
175	*Pamphila palæmon*	...	×	×	...	...	...	...	×	×	...	×	×
176	*P. silvius*	×	×	×	...	...	...	...	×	×	...	×	×
177	*P. argyrostigma*	×	×	...	...	..	...	...	×	×	×	...	...
178	*Heteropterus morpheus*	×	...	...	...	...	...	..	×	...	...	...	×
179	*Augiades sylvanus*	×	...	×	×	...	×	×	×	×	×	...	×
180	*Adopæa lineola*	×	×	×	...	×	.	...	×	×	...	...	×
181	*Erynnis comma*	×	×	×	× var.	×	...	×	×	×	× var.	×	×

The authorities for the above lists are as follows:—

1. The lists of Kindermann's collections published by Lederer, and MS. list of Ruckbeil's collections sent me by Herr Tancré.

2. The list of Kuldja butterflies published by Alphéraky in 1881, and the list of Grum-Grshimailo's Thianshan collections, published at p. 522 of his Travels in Central Asia (printed in Russian), St. Petersburg, 1896.

3. The list of Haberhauer's collection in the Tarbagatai and Alatau, and

4. given by Staudinger in Stett. Ent. Zeit, 1881, p. 256.

5. The list given by Grum-Grshimailo of his collections in the Pamir and surrounding regions in Romanoff's Memoires, vol. iv, p. 126-37.

6. The list of Amur butterflies, given by Staudinger in Romanoff's Memoires, vol. vi, p. 106-15.

7. The list of Dorries' collections in the Kentei Mountains given by Staudinger in Iris, vol. v, p. 304.

8. The list of collections made by Grum in Amdo and the Kokonor district. Same source as No. 2.

9. Herz' list of his collections on the Vitim and Vilui rivers in Iris, vol. xi, p. 233.

10. Staudinger's Catalogue. (I may say that I consider that species not found west of the Southern Ural should be considered as Asiatic rather than European.)

The above list of 181 species includes all which are recorded by Kindermann, Ruckbeil and myself, and though it may be increased a little by future collections, yet a comparison with the lists from the Amur, Kuldja and Pamir regions, and with that of the collection made by Dorries in the Kentei Mountains of East Mongolia, shows that there are very few other butterflies in the adjoining regions which can be expected to occur in the Altai.

Out of the whole number about thirty-nine are not found in Europe: of these six are *Parnassius*, only one of which, *P. actius*, is a Central Asian species; the rest are characteristic of Siberia, and all but *clarius* occur in the Amur region. *Anthocharis pyrothoë* is a Central Asian species. Of the eight *Colias* only *thisoa* is Central Asian, the rest are European or forms of European species, except *C. aurora* and *melinos*, which is the Siberian representative of *phicomone*. Of the five species of *Thecla* only *frivaldszkyi* is non-European, and as compared with twenty-four

species in the Amur region, the genus is poorly represented. *Polyommatus* are also scarce, I found none in the higher mountains, and only three in the lower ground, though Kindermann and Ruckbeil seem to have found more in the Buchtarma district. *Lycæna* is well represented by thirty-four species, several of which, however, seem scarce, and only seven are not European. This compares well with the twenty-two species recorded from the Amur region, to which seventeen of the thirty-four extend. In the Pamir region no fewer than fifty-five are recorded, but only thirteen of these are common to the Altai.

Nymphalidæ are poorly represented, *Neptis lucilla* and *Grapta c-album* being the only common species except vanessa *Argynnis* and *Melitæa*. In the latter genus we have eleven, *M. arcesia* being the only non-European species. A single species of *Melanargia* occurs but rarely, and was not seen by me. *Argynnis* is very well represented by twenty-two species. Of these *oscarus* and *angarensis* alone are not found in Europe, and both of them seem scarce or local; but *selenis*, which only extends west to Kazan on the Volga, must be also considered Asiatic.

A. aphirape, *pales*, *freija*, and *frigga* are all very abundant typical northern species, none of which except *pales* were found by Alphéraky in the Thianshan, or by Grum in the Pamirs. Only nine *Argynnis* are recorded from the former and seven from the latter regions, whilst the Amur region has twenty-two, fifteen of which are common to the Altai. *Erebia* is much better represented than I expected to find it, no fewer than sixteen species being recorded of which I got thirteen myself. *E. medusa* should certainly occur also, as it is found both east and west of the Altai, but is not yet recorded. No fewer than nine of these *Erebias* are not found in Europe, and a tenth, *afra*, is a purely Asiatic type occurring in only one locality in Europe. Of these sixteen species not one is found either in the Thianshan or Pamir lists, and seven only in the Amur list, which proves what I suggested in my last revision of the genus, that the mountains of Southern Siberia form a centre of distribution for this genus only second to the Alps of Europe, and having no connection at all with the mountain ranges of Turkestan. *E. kefersteini*, *maurisius*, *theano*, *sedakovi*, *cyclopius*, *dabanensis*, *ero*, *edda*, and *parmenio* are characteristic of this

region, though *sedakovi* and *parmenio* extend to the Amur, and *ero* and *edda* to the north-east of Siberia.

Of the genus *Œneis*, no less than six or seven occur, and only one of them, *tarpeia*, is Central Asiatic; but this is a steppe rather than a mountain species. Of the others, *norna* and *bore* are Boreal species, and *sculda*, *mulla* and *nanna* confined to Asia. Of the eight species of *Satyrus* I only found four, the rest being recorded by Kindermann and Ruckbeil, and these seem confined to the south-western parts of the region. All are European except *heydenreichi*, which is Central Asiatic, and none except *dryas* extend to the Amur region. The other genera of *Satyridæ* are scarce, none of the small *Epinepheles* which are so common in Central Asia occurring, but *Triphysa phryne* is in abundance. The *Hesperiidæ* are mostly European except *C. argyrostigma*.

1. *Papilio machaon*, L.

Only found in the lower parts of the mountains. It was just appearing at Biisk on June 2nd, fresh in the Tchuja Valley at about 4000 feet on June 18th, and not seen again till August 7th, when one or two worn-out females were taken on the Bija river. The specimens are quite European in type.

2. *P. podalirius*, L.

Recorded by Kindermann and Ruckbeil, not seen by me.

3. *Parnassius apollo*, L., and var. *sibirica*, Nordm. = *Graslini*, Oberthür.

Common in the Bashkaus, Tchulishman and Bija Valleys at the end of July, from about 4500 down to 1000 feet, where I last saw worn females on August 3rd. It flies on and below rocky slopes, where its food plant *Sedum ewersi*? is abundant.

I am doubtful whether *sibirica* can be looked on as a marked variety, in the Altai at any rate. Though some of the males have more dark scales, and perhaps a slightly whiter ground colour than in Europe, and average much larger than alpine specimens, yet Scandinavian examples which ought to be typical *apollo* are hardly distinguishable. In the female sex the difference is, however, much more striking, the black scales being more abundant, and

the markings more diffused. The most typical *sibirica* I have come from near Orenburg. The Asiatic form has usually been called *hesebolus*, Nordmann, but Staudinger in Iris, v, p. 304-5, states that this name should be applied to the form from the Kentei Mountains in Central Mongolia (the most easterly locality in which *apollo* has been taken), which differs principally in having the black spots and markings of the fore-wing, and also the red ocelli of the hind-wing, smaller than in other forms of *apollo*. I have specimens from the Thianshan from Grum's collection which agree with those from the Altai, except that the males have the lower half of the fore-wing above quite free from dark scales, the outer part of the wing being pure milk-white.

4. *P. delius*, Esp., and var. *intermedius*, Mén.

First seen in the Tchuja Valley near Tchebit at about 4000 feet elevation flying on rocky slopes covered with brushwood, males only being out on June 18th. Common about Darkoti from 6500 up to about 8000 feet on bare stony mountains from July 14th to 18th, when I first took females; also on the pass between Kurai and the Bashkaus at the end of July, when the males were worn out at 6000—7000 feet. *Saxifraga aizoides*, the food plant of the larva in Europe, was common in most places where I took *delius*. The specimens from Tchuja Valley and Kurai Pass were of the form known as *intermedius*, Mén., of which the males differ from the European form only in being of a slightly purer white ground colour; the females, like those of *apollo*, differ in having as a rule much more dark markings and lunules, as in some of the American forms; but after comparing a very large series from various parts of Europe, Asia, and America, I do not see my way to define *intermedius*, because the variation is too great among them. One female from Kurai is darker than any *delius* I have ever seen except from the Irkut Valley, and resembles some of the forms known as *Hermodur* from north America. Another from Ongodai is of a milky-white ground colour with red ocelli as large as those of *nomion*, and some are hardly distinguishable from European specimens.

The form which I took about Darkoti is, however, very unlike these, and might be separated with more

reason than *intermedius*. It resembles those which I took at Laggan in the Rocky Mountains of Alberta Province, British North America, in being much smaller, the males having often no red ocelli on either wing; though some have small ones, and the black lunules are also much reduced, and the whole appearance of the insect is quite different in consequence. This variety might be distinguished as var. *alpestris*, but as it is quite probable that larger numbers from other parts of the Altai might fail to show these differences, I hesitate to add another varietal name in a genus which is already overladen with them. The form found in the East Sayansk Mountains by Leder resembles these rather than *intermedius*.

5. *P. nomion*, F. d. Wald.

First seen at about 5500 feet on July 22nd, afterwards common in the Bashkaus and Tchulishman Valleys at 2000—4000 feet, down to near the south end of Lake Teletskoi flying in the same places as *P. apollo*, from which at first I did not distinguish it on the wing. I found, however, that it is a weaker flying insect, and much easier to kill than *apollo*, which has the strongest body of any butterfly known to me, and is impossible to kill by pinching. Judging from their greater freshness *nomion* comes out later than *apollo*. I took one male, which at first I thought to be a hybrid between *nomion* and *apollo*, as it seemed to combine the markings of both species. However, after reading what Staudinger has written about similar supposed hybrids from the Kentei Mountains, one of which I have in Grum's collection, and noting the fact stated by him that similar aberrations occur in Amurland, where there are no *apollo*, I am uncertain whether mine is a hybrid or not. It certainly has the chequered fringes of the wings almost as distinct as a *nomion*, whilst *apollo* has the fringes unchequered, and this most distinctive character is not mentioned by Staudinger. There is, however, no reason that I can see why the two species should not breed together.

6. *P. actius*, Ev.

Taken at Tchingistai by Ruckbeil, but not seen by Kindermann or myself.

7. *P. tenedius*, Ev.

Also taken at Tchingistai by Ruckbeil, but not by others. According to Herz, it is one of the earliest butterflies to appear in North-East Siberia. A specimen of *delius* in Staudinger's collection from the Altai (ex-coll. Kindermann) has markings which resemble those of *tenedius* to some extent, but I doubt the possibility of hybridism between these species.

8. *P. clarius*, Ev.

Only taken in one place near the west end of the Tchuja Steppe at about 5500 feet, on dry, hot, rocky slopes overgrown with grass, on July 20th. The males were already worn, but the females fresh. I did not distinguish this from *delius* by its flight or appearance till I had the female in my hand, when the pouch at once showed what it was. The inconstant variety known as *dentata* was taken at Justed by Ruckbeil.

9. *P. stubbendorfi*, Mén.

Common on the Kurai Pass on July 25th, at 6000—7000 feet; the males only flying on marshy alpine meadows below steep rocks, with *eversmanni* and *delius*. The only two females I took were much lower down in swampy larch forest. Jacobson also got one or two at Ongodai.

10. *P. eversmanni*, Mén.

I was surprised to find this rare species, hitherto only known from Central and Eastern Siberia, not uncommon in the Altai. I first took it near Darkoti in marshy alpine meadows, below rocks where snow was still lying at 7000 feet on July 13th, but only males were then out; and though I waited four days in this camp for the females I was obliged to leave without getting any. I afterwards got two worn males on the Kurai Pass. It agrees perfectly with Eversmann's type from Kansk, and with those taken by Leder at Podeika, and by Herz on the Vilui and Vitim rivers, and is rather smaller than those from the Amur, where, according to Graeser, its food plant is *Corydalis gigantea*.

11. *Aporia crataegi*, L.

This was one of the most generally distributed butterflies in the districts I visited. I first saw it at 7000

feet on July 9th, and soon became very abundant, not only up to the very tops of the most stony and barest mountains far above any shrubs, where it was associated with *Œneis bore* and *Argynnis freija*, the only species which I took as high, but it seemed equally at home in the dense forest country of the Bija Valley. It must have a variety of food plants, or be of a very wandering disposition. I saw no trace of any approach to *A. hippia*.

12. *Pieris napi*, L.

I found this coming out at Biisk on June 4th, at Ongodai on the 13th, in the Tchuja Valley at about 5000 feet on the 20th, all these belonging to the spring brood, though there is much difference amongst them, one male from Ongodai having the black spot in cell 3 as conspicuous as in the summer brood in Europe, and one male from Biisk having the spot on the costa of the hind-wing also well-marked. I saw none in the high bare mountains. In the Bija Valley the first week of August a large summer brood was out, a female of which is tinged with yellow. *P. napi* is found in the far north of Siberia, on the Vitim river, and in Kamtschatka where it assumes the *bryoniæ* form. One of my females of the spring brood from the Tchuja Valley and one from Minusinsk in the Yenesei Valley might be called *bryoniæ*, but I do not think that, except in the Alps of Europe and in Lapland, this form seems to be constant. I have a pair from Altin Emil in the Thianshan collected by Grum-Grshimailo which are hardly distinguishable from *ochsenheimeri*, which seems to represent *bryoniæ* in the high mountains of the Pamir. There is also a form in Grum-Grshimailo's collection named by him *sifanica*, which occurs as a spring brood in the mountains of Amdo in North-East Tibet, and which by the very dark heavily marked veins of the underside seems to be *bryoniæ*, but I have no females of this. I have also some specimens from Kashmir which, though they stand in my collection as a variety of *melete*, are really just as near to *napi*, and I do not yet know how it is possible to separate these two species with certainty.

13. *P. rapæ*, L.

I found this on June 6th at Biisk, and again at the end of July in the Lower Bashkaus and Bija Valleys.

The difference between the two generations is more striking than in any other locality from whence I have the species, except, perhaps, in Italy, and as the variations of *P. rapæ* appear to have been little studied I will mention the most striking ones as far as I know them. In Britain, in Gloucestershire at least, there is little difference between the first brood and the second, either in size or colour of the underside. In Germany, France and Spain the difference is rather greater, and in Germany, Poland, and occasionally in England, we have an aberration of the female which is distinctly yellow both on the upper and undersides. In Algeria, where I found it common in the province of Constantine, and as far south as Biskra in April and May, and also at Gibraltar in April, some of the males are without a trace of the black spot in cell 4 of the fore-wing on the upper-side, and this is also the case in the one taken at Biisk. I have similar males from Beirut and Candahar taken in February. In the Canary Islands *rapæ* does not appear to have been modified by the climate as in the case of *brassicæ*, which has there developed the remarkable form known as *cheiranthi*. In the Alps and Pyrenees, where I have taken the species at from 5000—7000 feet in July, at which elevation it can, I think, be only single-brooded, the underside is rather of the summer than the spring type. A female from Mont Cenis is absolutely indistinguishable from the female of *ergane*, and may be that species. Though I am not aware that *ergane* has been recorded from the Alps or Germany, I noted in the collection of Dr. Nickerl at Prague similar examples. In September a form occurs at Florence, for which I am indebted to Signor Stefanelli, which passes under the name of *manni;* this form is characterised by the greater extension of the black on the apex of the fore-wing in both sexes, and (if these specimens are typical *manni*) by the veins of the hind-wing below being distinctly bordered with black dusting from which the interspaces are quite free. These specimens are so like some of the summer brood of *napi* known as *napææ*, Esp., from St. Petersburg and Poland, that I really do not know how to separate them with certainty, and one of the males has indications of black at the end of the veins of the hind-wing above which I see in no other specimen of *rapæ*. In Asia the species has a very wide range. I have specimens from Syria

where it appears to be usually quite small. At Bushir in the Persian Gulf, at Quetta and Candahar in Baluchistan the species is common throughout the season; dated specimens collected by Colonel Swinhoe in February, May, August and November are in my collection, and show the seasonal variation on the underside very fairly. From the Southern Caucasus and from Darwaz in Bokhara I have specimens named by M. Alphéraky *canidia*, var. *manni*, but though I presume he considers this a variety of *canidia*, which also occurs in Turkestan under the form named by Staudinger *palæarctica*, I am almost sure that they are forms of *rapæ* and not of *canidia*. On the Lower Amur, in northern China and in Manchuria, and North-East Tibet, the species also occurs, and has been called by Oberthür var. *orientalis*, but I cannot see the slightest reason for distinguishing this form. In North America the species has been introduced and has now spread from Canada to Alabama and North Carolina, where I took it on Roan Mountain at about 5000 feet. A species, or local race of *rapæ*, has been described by Grum-Grshimailo as *tadjika;* he took it in the mountains of Darwaz and Karategin in South-Eastern Bokhara at 9000 feet in June. Whether it is a mountain form peculiar to Central Asia analogous to *P. ochsenheimeri*, which seems to represent *P. napi* in the same region, is doubtful, but it is easily distinguishable from Turkestan specimens of *rapæ* by the markings of the fore-wing in both sexes and by the colour of the female, which has yellowish hind-wings.

14. *P. daplidice*, L.

The first generation of this occurred at Biisk, and I took one in the Tchuja Valley in June. The second generation was found at the end of July in the Bashkaus at 3000 feet, and at Ongodai by Jacobson.

15. *P. chlorodice*, Hb.

First seen on the Barabinsky Steppe on May 24th, and taken at Kurai and on the Tchuja Steppe on June 17th to June 21st. These were small specimens of the first generation. The second brood was out July 21st at 6000 feet, and was also found in the Bashkaus down to about 2000 feet. These only differ in their larger size from those of the first generation.

16. *P. callidice*, var. ? *chrysidice*, H. S.

This was the only *Pieris* I found on the high mountains above timber-line, and there it was not at all common. The specimens are variable in size, and there may be two broods, as I have a somewhat worn specimen taken on June 20th, and fresh ones from the Bashkaus taken a month later. They are more like the form from the Pamir and mountains of North Persia and Armenia than the European *callidice*, but I do not see how the line can be drawn between *chrysidice*, *callidice*, and *kalora*, Moore from the Himalayas when a large number are compared, though those from the European Alps are usually more yellowish on the hind-wing below.

17. *Anthocharis cardamines*, L.

Taken at Biisk and Ongodai in the first half of June.

18. *A. belia*, Cr., var.

I found a few males of this fresh out at Ongodai on June 13th, but got no females. They are more like the alpine form *simplonia* in some respects, but the underside of the hind-wing is variegated in a different way. Without a larger series of both sexes I am not able to assign a varietal name to this form.

19. *A. pyrothoë*, Ev.

Taken at Kenderlik by Ruckbeil but not seen by myself; perhaps it should not be included in the Altai list, as Kenderlik is south of the Irtysch river.

20. *Leucophasia sinapis*, L.

I found the first generation of this at Kazan on May 25th, and at Biisk and Ongodai at the beginning of June. The second generation was common in the Bija Valley in the first week in August. They do not differ from European specimens.

21. *Colias palæno*, L.

The only place where I saw this was in a swampy flat overgrown with willows on the north side of the Kurai Pass at about 5000 feet, where it had been out some time, though fresh specimens were still to be found on July 25th. Ruckbeil also procured it in the Southern Altai. The males are

variable in the breadth of the border, and in colour agree with those from the Swiss Alps, var. *europomone*, Ochs., *fide* Staudinger. The underside is perhaps a trifle less yellow (more darkly freckled with green), which character Staudinger (Iris, v, p. 311) gives as distinctive of his var. *orientalis*, of which I have typical specimens from Kentei, and others from Vitim and the Amur. I can see very little reason for separating any of these from the Swiss form. The few I have from Japan have a broader border, and appear to be more worthy of a varietal name.

22. *Colias nastes*, Bdv.? var. *mongola*, Alph., Rom. Mém. ix, p. 188.

I found this interesting form abundant in the mountains south of Kuch Agatch, at about 7000 feet, especially in the broad, flat, gravelly beds of mountain streams which were overgrown with alpine and arctic plants. Here it appeared on July 3rd, and soon became very numerous. Its flight was very quick and jerky close to the ground, but not nearly so strong as that of *melinos*, which kept more to the mountain sides. The type of *mongola* was taken by Leder near Urga, according to Alphéraky, but probably this is an error, as Staudinger says (Iris, viii, p. 345), that Leder collected the specimens labelled Urga by Christoph, in the Changai Mountains, about half way between Uliassutai and Urga. Alphéraky says that this form is between *cocandica*, Ersch., and *maja*, Gr.-Gr., but it seems to me to be hardly distinguishable except by its smaller size from *tamerlana*, Stgr., a dark form of *nastes* found in the Eastern Thianshan. *Maja* is much lighter in colour, and the females especially differ from those of *mongola*.

23. *Colias melinos*, Ev.

This butterfly was first seen at Ongodai, where I caught a pair *in cop.* on June 10th, and others on the 14th and 18th, in wooded valleys at 3000—4000 feet. All these specimens, together with a female which I took on the Bashkaus on July 25th, when it was quite worn out, though variable in size may be distinguished from the numerous specimens I afterwards found on the high Tchuja Mountains by the paler colour of their underside, which agrees with five pairs from the Amur and with others from the Vitim, taken by Herz, and Irkut, taken

by Leder. A large number from the Tchuja Mountains vary considerably in size and colour above, but are all darker below on the hind-wing. They were common from 6000—8000 feet, flying fast over the alpine meadows, and easily distinguished by their much more rapid flight from *mongola*, which appeared to confine itself more to the flat beds of the mountain streams. On comparing these alpine specimens with those in Dr. Staudinger's collection from the Kentei Mountains, they seem hardly distinct enough from the valley form to be named as a variety.

24. *C. hyale*, L.

This was very common in the Katuna Valley at 3000 feet on June 17th, but not seen again until I came down to the low country at the end of July, where it was common in the Bija Valley and in the open country about Biisk in the first week of August.

25. *C. chrysotheme*, Esp.

The first generation of this species came out at Ongodai on June 10th, and in the Tchuja Valley a week later, flying rapidly over bare ground. The second generation, which only differs by being on the average somewhat larger, and not as in America by its deeper colour, was abundant in the Kurai Steppe and Bashkaus Valley at the end of July. A specimen from Krasnoyarsk in Grum-Grshimailo's collection, the type of his (? MS.) var. *sibirica*, is paler, and has more yellow at the apex of the fore-wing, but one from Minusinsk in the Yenesei Valley is like those I took; on the average they are decidedly larger and, I think, somewhat brighter than Austrian and South Russian specimens, and resemble more the form known in America as *keewaydin*, W. H. Edw.

26. *Colias aurora*, Esp.

I did not take this myself, but received several specimens from Ongodai, which average somewhat smaller than those from the Amur; all the females were of the white form. It also occurs in the Yenesei Valley, and is recorded by Ruckbeil from the South Altai. Those from the Kentei Mountains are paler in tint and have narrower borders than mine.

27. *C. thisoa*, Mén., and *C. erate*, Esp.

Both taken by Ruckbeil but not seen by me. I do not know the exact localities where he got them, so perhaps they should not be included, though some species of the *thisoa* group ought to occur in the Altai Mountains.

28. *Rhodocera rhamni*, L.

Hybernated specimens were common from the time I reached the Obb river up to Ongodai, and fresh ones were first seen in the Bija Valley in the beginning of August.

29. *Thecla betulæ*, L.

Not seen by me, but apparently not uncommon early in August at Ongodai, where Jacobson got several specimens not differing from European ones, except that the females show a little less yellow on the fore-wing. A specimen from Lake Teletskoi was in the St. Petersburg Museum.

30. *T. prunoides*, Stgr.

I found this in the valley of the Tchulishman river at about 3000 feet at the end of July, and Jacobson also took it at Ongodai. At first I supposed this to be *W-album*, but on comparing it with Dr. Staudinger's collection, he considers that my specimens are the same as *prunoides* from Amurland. He had one taken by Kindermann at Ust-Kamenogorsk in the South-West Altai. The species is easily distinguished from *W-album* by the absence of the well-marked sexual patch on fore-wing of the male, which is constant in that species.

31. *T. pruni*, L.

Recorded by Kindermann, and I have one from Grum's collection, taken near Semipalatinsk.

32. *T. rubi*, L.

Taken at Biisk, Ongodai, and in the Tchuja Valley up to about 4000 feet in the first half of June.

33. *T. frivaldszkyi*, Led.

I found this in bushy places in the Katuna and Tchuja Valleys, at 3000—4000 feet, in the second week in June. It is evidently an early spring insect, as many of the

examples were already worn. It appears to be common throughout Central Siberia, as Jacobson found it on the Upper Yenesei, Leder on the Irkut, and Trybom on the Lower Yenesei as far north as 64°.

This species is probably more nearly allied to the North American group, of which *T. irus*, Godart, is the best-known representative, than to any European species. This group has been generically separated by Scudder under the name *Incisalia*.

It is quite distinct in my opinion from *Thecla* (*Satsuma*) *ferrea* from Japan, both by the pattern of the underside and by the absence of the sexual patch on fore-wing of male.

34. *Polyommatus virgaureæ*, L.

I only found this in the prairie country near Biisk on August 7th, when it was nearly over, but Jacobson sent two pairs from Ongodai, which do not differ from European specimens. I cannot see any difference between the form from the Kentei Mountains named *virgaureola* by Staudinger, which would justify its separation, though some specimens from that locality are almost without white spots and darker on the hind-wing below.

35. *P. thersamon*, Esp.

Not taken by me, but in Staudinger's collection taken by Kindermann.

36. *P. hippothoë*, L.

The same remarks apply to this as to the last species.

37. *P. alciphron*, Rott.

This and the next species are both recorded by Lederer as taken by Kindermann, but I can find specimens of neither of them in Staudinger's collection, and neither were taken by myself or Jacobson.

38. *P. dorilis*, Hufn.

39. *P. dispar*, var. *rutilus*, Wernb.

Recorded by Herr Tancré as having been taken by Ruckbeil. Two pairs which he sent me from Kenderlik are like Sarepta specimens in size. A form occurs in the Kentei and Chingan Mountains.

40. *P. phlæas*, L.

A single specimen taken at Biisk early in June.

41. *P. amphidamas*, Esp.

Common near Altaisk, and up to about 3000 feet, in the first week of June.

42. *Lycæna argiades*, Pall.

The first generation was common at Biisk in the first week of June, the second, much larger, was out in the Bija Valley the first week in August.

43. *L. fischeri*, Ev.

Very abundant in the valleys of the Katuna and Tchuja from 2500—3500 feet in the middle of June. The species swarmed on wet sand and damp places by the side of the river, where it could often be taken without a net. The second generation, which does not seem appreciably different, appeared at the end of July in the Bashkaus Valley. Jacobson also found it common at Ongodai after I left.

44. *L. ægon*, S. V.

Common at Ongodai and in the Tchuja and Bashkaus Valleys in July. Some of the specimens from Ongodai are very dark on the upper side, and might be considered as a small variety of *cleobis*, Brem., which is found in the Kentei Mountains and Mongolia, and of which I have specimens from Alphéraky from Irkut, and from Uliassutai under the name of var. *ida* Stdr. agreeing fairly with mine. Staudinger also says that he has from Minusinsk a form of *cleobis* nearly approaching *argus*. I do not, however, know of any certain distinction between the three species, though a majority of them can be recognized, and *cleobis* seems darker below than *argus*.

45. *L. argus*, L.

Not uncommon from about 3000—6000 feet from the middle of June. Staudinger refers his Kentei specimens to var. *planorum*, Alph., but I do not know how that so-called form can be distinguished, and it is evident that the variation of such a wide-ranging species as this is in all parts of Europe and Central Asia will require very

minute study before the numerous named forms can be distinguished or accepted.

46. *L. lucifera*, Stgr., S. E. Z. 1867, p. 100. Iris, v, p. 316. Pl. III, Fig. 1, 1892.

I found this beautiful species at Kuyuktana in the Tchuja Valley, at about 5000 feet, on July 21st, and it seems to be not uncommon at Ongodai in the middle of that month. My specimens agree with those collected by Leder in Mongolia. It seems to stand nearest to *eversmanni*, whilst *themis*, Gr.-Gr., of which the types from Amdo are in my collection, is a synonym.

47. *L. optilete*, Knoch.

I only found this at one spot in a willow swamp on a tributary of the Bashkans at about 5000 feet; Jacobson also took it at Ongodai. Staudinger says that his specimens from Kentei are between the typical form and the small northern one known as *cyparissus*, and he distinguishes them as var. *sibirica*. I cannot, however, see any ground for this name, as I have specimens from Kamtschatka, Irkut, and Amurland, which all appear to be very similar to those from North Russia.

48. *L. zephyrus*, Friv.

I did not take this species, but received it from Ruckbeil's collection through Herr Tancré, taken at Kenderlik, which being south of the Irtysch river is not strictly speaking in the Altai Mountains. These specimens agree with those from the Caucasus (Borjom) and from Astrabad, which are called *zephyrinus* by Christoph (*cf.* Rom. Mém. Sur Lép., vol. i, p. 102, t. vi, fig. 3, *a*, *b*). This was described as a var. of *zephyrus* by Staudinger (*cf.* Stett. Ent. Zeit., 1886, p. 205) from Turkestan specimens. I have seven pairs from Osch. Gultcha and Darwas taken by Grumm, which vary considerably in all the characters used by Staudinger to separate this form, and I fail to see how any of the Asiatic specimens, of which I have a long series, can be separated.

49. *L. pylaon*, Fab.

Recorded by Lederer, but not taken by any one else. The only insect I can find in Staudinger's collection from

the Altai which might have been mistaken for this, is a somewhat worn specimen of *cyane*.

50. *L. cyane*, Eversm. and var. *deserticola*, var. nov.

I found a very small form of this in the Tchuja Steppe on July 19th, when the males were much worn, flying on very bare stony ground where no other butterfly, except *Satyrus autonoë*, occurred. These are of the same size or smaller than *pylaon* from Sarepta, and on the upperside resemble that species, though on the underside they want the brown marginal spots on the fore-wing. I distinguish this as var. *deserticola*. Jacobson took at Ongodai several specimens of a much larger form, like typical *cyane* from Guberli in the Ural, but with the pale marginal border on the fore-wing less conspicuous, and the black border outside it much more so, and of a slightly darker shade of blue. I believe that this must be considered as a species distinct from *pylaon*. The females show no brown spots on the upperside of the fore-wing as in *pylaon*, and are cœrulescent in colour, as described by Staudinger in his Catalogue.

51. *L. orion*, Pall.

Taken at various places up to 3500 feet at the beginning of June, and again at the beginning of August, so that there are probably two generations, which do not seem to differ. I found the insect nowhere common, and indistinguishable from European specimens, as are those from the Alatan and Thianshan. The var. *orithyia*, Grum, from Amdo (*cf.* Hor. Ent. Soc. Ross., xxv, p. 8 *sep.*), is also distinguishable, judging by the three type specimens in his collection, though the ♀ shows a little orange at the anal angle above, which none of my others do.

52. *L. baton*, Berg.

A single specimen only taken at Ongodai on June 10th.

53. *L. pheretes*, Hb.

Common from about 6000 to 8000 feet in July, and not differing, as far as I can see, from European specimens. Staudinger describes a variety from Kentei under the name of *pheretimus*, as much larger, with broad black borders. A pair which I have from thence as well as one from Irkut seems to bear out this character.

54. *L. orbitulus*, Prun.

Also common at high elevations and not different from the European form, though, again, Staudinger describes those from Kentei, under the name of *orbitulinus*, as much larger. As, however, he only had one fresh specimen, I think this name is somewhat premature.

55. *L. astrarche*, Bgstr.

I only took one specimen of this in the Bashkaus at 5000 feet. This is of the normal form, but Jacobson sent five from Ongodai all belonging to the variety *allous*, Hubn., which seems to be the prevalent form in Mongolia and at Irkut.

56. *L. eros*, O.

I found this in the Tchuja and Bashkaus Valleys at about 5000 feet, but got no females. The shade of blue is, perhaps, as in those from Kenderlik collected by Ruckbeil, of a slightly greyer tinge than in Europe, but not as in the variety *erotides*, described by Staudinger, from Kentei. One of my specimens and one from Kenderlik show a slight dark mark on the centre of fore-wing above, as in the var. *stigmatifera*, Stgr. (MSS.), from Kuruk-tagh.

57. *L. icarus*, Rott.

Apparently rare, as I only took two males, one at Biisk and one in the Tchuja Valley. It is not recorded by Kindermann, or from Kentei by Staudinger.

58. *L. eumedon*, Esp.

Common in the Bashkaus and at Ongodai in July, but none of the variety *fylgia*, Spängberg, which is the prevalent form, and not an aberration in Kamtschatka, and is not uncommon in Kentei and elsewhere.

59. *L. amanda*, Schn.

Taken at Kuyuktana, at Ongodai, and in the Bashkaus, in the latter half of July. Does not differ from European specimens except, perhaps, in being smaller.

60. *L. admetus*, var. *rippertii*, Frr.

A single male of this species was taken by Jacobson at Ongodai on July 20th, and I took another in the Bashkaus. I find no previous record of its occurrence in this part of Asia.

61. *L. damon*, Schiff.

Common on the banks of the Bashkaus river on July 26th, also at Ongodai, and does not differ from European specimens.

62. *L. damone*, Eversm., var. *altaica*, var. nov.

Taken at higher elevations than the former; 5000—6000 feet in the Tchuja and Bashkaus Valleys, and common at Ongodai. This is not the true *damone*, Eversm., which I have from Guberli in the Ural and from Armenia. Both sexes have the base of the hind-wings strongly suffused with greenish. Neither of my two pairs from the Ural show this, nor do those from Ordubad, but some from Saisan in coll. Stgr. are the same as *altaica*. The species is quite distinct from *damon*, and also from its var. *juldousa*, Stgr., which has this green shade at the base of the hind-wing, but a much broader dark border on both wings than *damon*. *Actis* shows this basal colour also, but is of a quite different blue above.

63. *L. donzelii*, B.

I got a single female in the Bashkaus at 4000 feet on July 28th, and Jacobson sent me a series from Ongodai. These do not differ from European specimens.

64. *L. argiolus*, L.

I did not take this in the Altai myself, but Kindermann records it.

65. *L. sebrus*, B.

A single specimen in the Tchuja Valley on June 18th. It has not hitherto been recorded, as far as I know, so far east.

66. *L. minima*, Fuessl.

A single specimen in the Tchuja Valley on June 20th.

67. *L. lycormas*, Butl. = *scylla*, Stgr.

Two males from the foot-hills of the Altai near Altaisk, at about 2000 feet on June 7th, were all that I saw. I mistook them for *semiargus* at the time, or would have waited longer at the place. Though slightly paler in tint above they agree with *scylla* from Irkut, the Amur, and with

lycormas from Yesso in Japan. The latter is variable in the breadth of the border, and I agree with Leech in considering it identical with *scylla*.

68. *L. semiargus*, Rott.

A few specimens from the Bashkaus and Bija Valleys at the end of July.

69. *L. argali*, n. sp.

I first saw this species on June 21st, flying below rocky slopes at Kuyuktana, between the Kurai and Tchuja Steppes, where the spring was only just commencing, and some of the males were already worn. I afterwards found it commoner at about 6000 feet in the beginning of July in the mountains south of Kuch Agatch. The only European species with which I can compare it is *melanops*, but the colour of the upperside, which is a pale silvery grey, is quite distinct, and its nearest allies appear to be *lygdamas*, Dbldy., and *couperii*, Grote, which are probably identical, and are found in South Labrador, Anticosti Island, Wisconsin, and as far north as the Great Slave Lake. There is nothing like it in the Grand Duke Nicolas' collection or in that of Grum-Grshimailo, and neither Alphéraky nor Staudinger have seen anything like it. This species has a remarkable tendency to grease, which I have observed in no other *Lycæna* but *sonoriensis*, Feld. = *regia*, Bdv. from South California, and which may arise from some peculiar food plant of the larva.

♂ Upperside pale metallic silvery blue, both wings with a black marginal band, which is about as broad as that of *melanops;* underside grey, both wings with a white anteciliary line, succeeded by a dark one, a white-edged black line at the end of cell in both wings, and a dark marginal band, broken into spots, base of the hind-wing dusky with scattered grey scales. Fore-wing below with a curved series of five subequal roundish white-edged black spots placed one in each of cells 2–6, and gradually receding from the margin as they approach the costa. Hind-wing below with a nearly regular post-median series of small subequal roundish white-edged black spots placed one in each of cells 2–7, and running parallel to the margin and a similar spot near the basal third of cell 7 ; the latter and the spot proper to cell 6 are sometimes obsolete or wanting, and the postmedian series is sometimes extended towards the dorsum by one or more additional spots. Fringes white, the basal half brown.

Antennæ; shaft black ringed with white, club black on the upperside, white at tip.

Expanse 21–26 mm.

Described from 18 males. I did not obtain the female. *L. melanops*, its nearest European ally, has the upperside purplish-blue, the spots in cells 2 and 6 on the hind-wing below placed at the basal third of those cells, and the fringes white with a dark median line.

In the tint of the upper side *L. argali* resembles more nearly the North American *L. couperii*, Grote, and *L. lygdamas*, Dbldy., but both these species have one or more spots in cell 1*a* on the fore-wing below, the spot in cell 6 on the hind-wing below standing at the basal third of that cell, and the basal half of the fringes whitish.

70. *L. arion*, var. *cyanecula*, Ev.

I found this only in the Lower Bashkaus Valley at the south of Lake Teletskoi, where it was fresh at the end of July. Berezowsky also found it at Ongodai. The specimens are very variable in size, but may be distinguished like those I have from Irkut, from Turkestan, and from Amdo by the much greater average extension, and brightness of the blue at base of hind-wings below. This is found to some extent in *arion*, especially from southern localities, such as the Pyrenees and Armenia, but never (in my specimens) extends to the margin. The var. *caucasica* seems too inconstant to bear a varietal name, but in the var. *uralensis*, Gr.-Gr., of which six pairs are now in my collection, both sexes are much darker and more uniform in colour than in Western Europe, and have the underside as in *arion* and not as in *cyanecula*.

(*L. arcas*, Rott.)

Recorded by Kindermann but not seen by me.

71. *L. euphemus*, Hb.

A few specimens in the Bija Valley at the beginning of August. Ruckbeil also got it at Kenderlik. The specimens do not differ from European ones.

72. *L. rhymnus*, Ev.

This is recorded by Lederer as taken by Kindermann.

73. *Apatura ilia*, var. *metis*, Frr.

There is a specimen in Dr. Staudinger's collection from the Altai taken by Novoprachin at or near Semipalatinsk, which is quite the same as the form found at Sarepta.

(? *Limenitis populi*, L.)

I saw, but did not succeed in taking, in the thickly wooded country north of Teletskoi, a specimen which I am almost sure was this species. It has been taken in the Kentei Mountains.

74. *Limenitis hellmanni*, Led.

Discovered by Kindermann in the South-west Altai, and since taken by other Russian collectors from Semipalatinsk, but not seen in that part of the Altai which I visited.

75. *Limenitis sydyi*, Led.

The same remarks apply to this species as to the last.

76. *Neptis lucilla*, Fab.

One of the commonest butterflies in the Bashkaus, Bija, and Tchuja Valleys, from the middle of June to the end of July, ascending to nearly 6000 feet. It flies slowly in bushy places, and is most abundant on river banks and near water. Most of the specimens are of the narrow-banded variety, *ludmilla*, which is prevalent in most parts of Asia, but intermediate forms occur.

77. *N. aceris*, Lep.

This was taken by Ruckbeil in the South Altai, and by Jacobson in the Yenesei Valley, and I have a specimen from Semipalatinsk in Grum-Grshimailo's collection.

78. *Araschnia levana*, L.

The first brood was fresh out at Ongodai on June 13th, the second in the Bija Valley on August 4th. They do not differ from European specimens.

79. *Vanessa antiopa*, L.

I took one or two of this species in the low country in August.

80. *V. atalanta*, L.

I did not see this, but it is recorded by Kindermann and Ruckbeil.

81. *V. polychloros*, L.

A hibernated specimen was seen at Obb on May 27th, and a female fresh out was taken in the Bija Valley on August 6th.

82. *V. xanthomelas*, Esp.

Herr Tancré informs me that this was taken by Ruckbeil, but I have not seen a specimen.

83. *V. urticæ*, L.

Seen here and there in different parts of the country, but commonest in the high mountains, where it was the only *Vanessa* I noticed, and came out about the middle of July.

84. *V. cardui*, L.

Seems to be scarce in the Altai. I only took one on the Bashkaus at the end of July.

85. *V. io*, L.

I took one or two in the low country in August.

86. *V. L-album*, Esp.

This was common at the north end of Lake Teletskoi and down the Bija Valley in the middle of August. When disturbed it settles on the trunks of trees, and is rather wild and difficult to catch.

87. *Grapta c-album*, L.

Hybernated specimens were seen at Barnaoul and Ongodai, and fresh ones came out in the Bija Valley at the end of July. There are two specimens in Dr. Staudinger's collection, one marked West. Sib. and one Altai (coll. Lederer), which seem to be intermediate between what is known as *interposita*, Stgr., from Margilan and Samarkan, which they resemble on the upperside, and *egea*, which they resemble on the underside.

88. *Melitæa iduna*, Dalm.

Though this agrees nearly with typical *iduna* from the mountains of Lapland, the only locality from which I have hitherto seen it, yet, on the whole, Altai specimens may be distinguished by the more silvery, less yellowish tinge of the ground colour of both wings, particularly on the underside. I have only one specimen from Lapland which in this respect might be confused with the Altai ones. I found it common in the high mountains south of the Tchuja Steppe only, from 6000—8000 feet during the first half of July, on dry grassy slopes, associated with *aurinia* and *cinxia*.

89. *M. maturna*, L.
var. *ichnea*, Bdv. Ic., Pl. XXIII, figs. 5, 6.
var. *uralensis*, Stgr., and ab. *mongolica*, Stgr. *Cf.* Stgr., Iris, V, p. 321.

I found only two or three worn-out females of *maturna* at Kuyuktana on the 22nd July, but received several males from Jacobson and Berezowsky taken at Ongodai at the end of June. I have several specimens from Grum-Grshimailo's collection taken in the Altai, and two females taken by him in the Ural. I also have a pair named *ichnea* by Alphéraky from Irkut. I do not think that either *ichnea*, *uralensis* or *mongolica* are sufficiently distinct to be recognised with certainty. Some of them, like those from the Alatau Mountains, are, as Boisduval says, more or less intermediate between *cynthia* and *maturna*. Most of those taken at Ongodai are, however, much more like the form known as *wolfensbergi*, which occurs in Switzerland. It seems that both in Switzerland and in the Altai we have two mountain forms perfectly distinct from each other, that is to say, *cynthia* and *wolfensbergi* in the Alps, and *iduna* and *uralensis* or *mongolica* in the Altai. *Ichnea* being the older name, should probably be used instead of either *uralensis* or *mongolica* for the Siberian form, if it is distinguishable; but I have no doubt that a sufficiently large series from various points would show that it is not so. Boisduval says, that his *ichnea* is found in Lapland and Siberia, and his Plate is most like those from the Sayansk Mountains, the only ones which show black spots in the outer fulvous band on the hind-wing as described in

mongolica by Staudinger. What stood in Grum-Grshimailo's collection as *ichnea* from Sutschan, on the Manchurian coast, is as large as typical *maturna*, and but little different from it.

90. *M. aurinia*, Rott.

I found one variety of this, which is indistinguishable from small European specimens, at Ongodai in the middle of June, and another which most resembles *merope* in the high Tchuja Mountains the first week in July. I am doubtful, however, whether the two forms keep distinct, as one specimen taken in the dry Katuna Valley is of the *merope* type; underneath, however, they have the markings more distinct and not so confluent as in *merope;* but when a large drawer full of the numerous forms of *aurinia* from various parts of Europe and Asia are brought together, it seems to me almost impossible to define many of the numerous local varieties which have received names. The form named *sibirica*, Stgr., which I have from Kentei and Mongolia taken by Leder is, however, very much paler than any of mine, as are those named var. *mandschurica*, Stgr., from Sutschan taken by Dorries.

91. *M. cinxia*, L.

Common in the Tchuja Valley, and as high up as 7000 feet in the mountains, where the specimens are very small and dark.

92. *M. arduinna*, Esp.

This is recorded by Lederer, and I have a specimen from Grum-Grshimailo's collection from the Altai.

(*M. trivia*, Schiff.)

Recorded by Lederer but not seen by me.

93. *M. phœbe*, Kn.

I found this rare in the Altai. The specimens do not differ sufficiently from European ones to require a varietal name, though in East Asia the species becomes much larger. Its local variations, however, are often very inconstant.

94. *M. didyma*, O., var.

This was abundant in the Katuna, Tchuja and Bashkaus Valleys, and also at Ongodai. The general average of my

specimens are very like those from the Amur and Kentei which Staudinger calls var. *didymoides*, Ev., and ab. *latonigena*, Ev., but none of the males are so pale and devoid of marking on the hind-wings as those from Kentei, and many of them can be matched almost exactly in Europe. The females are, however, more variable, some being like those of var. *ala*, Stgr., from the Thianshan, some very pale like those from Kentei, and others with a good deal of green, as are found not unfrequently in Europe. The difficulty of defining the local varieties of this species is, however, even greater than in the case of *aurinia*.

95. *M. dictynna*, Esp., var.

I found this species not common in the Tchuja and Bashkaus Valleys in June and July. This supposed variety has been named *erycina* by Lederer, who says that a variety with a pale yellowish-white spotting on the upperside was sent by Kindermann as *erycina*, and is figured by Herrich-Schäffer (Fig. 601). I cannot see, however, that there is any reason to distinguish either the Altai form, or those from Irkut collected by Leder; I have quite similar specimens from Europe, though the Altai examples have more pale spots at the base on the hind-wings above than is usual in Europe.

96. *M. arcesia*, Brem., var. *minor*, Stgr. MSS. ?

This is a small mountain species which matches nothing exactly in Grum-Grshimailo's collection, though it comes, perhaps, nearest to what he calls *asteroidea*, Stgr., from the Alexander Mountains. It is not *solona*, Alph., as I at first supposed, being more heavily marked above, and seems to come nearest to what is now considered to be the true *arcesia*, Brem., which I have so identified by Alphéraky from Irkut. I found it only in the high mountains from 6500—8000 feet, where it was common on grassy slopes during the whole month of July in company with *cinxia*, *iduna* and *aurinia*.

97. *M. aurelia*, Nick., var. *britomartis*, Assm. (?) and var. *nova* (?).

I found in the Tchuja Valley, on June 20th, at about 4000 feet, the first specimens of this, and received others somewhat similar from Ongodai. I did not get the females until I returned to the Bashkaus Valley at the

end of July, when the species was nearly over. In the high Tchuja Mountains at 7000—8000 feet, I found a small paler form, which is not exactly like anything in my collection, though it perhaps comes nearest to the form which Ménétries called *orientalis*, of which I have several specimens from Kamtschatka taken by Herz. This is certainly distinguishable in the Altai from the valley form, which comes nearest to what is called *britomartis* in Europe, and has been so named by Grum and Tancré, from both of whom I received Altai specimens. The difficulty, however, of referring the Asiatic *Melitæas* of this group to either of the three European supposed species which they most resemble is almost insuperable, and the greater the number of specimens that one receives from different localities the greater the difficulty becomes. I have about two hundred selected specimens of the various named forms of *athalia*, *aurelia*, and *parthenie* from Europe; and from Asia I have about seventy which have been named as follows: *britomartis* from the Altai valleys; a small mountain form which I call *orientalis*, Mén., from the high Altai mountains and Kamtschatka, and one sent by Tancré as *britomartis* which resembles these; a form from N.-E. Siberia in Grum's collection named var. *sibirica*, which appears to be a MS. name; a larger and much redder form from the Alatau Mountains taken by Haberhauer, and from Kenderlik in the South Altai taken by Ruckbeil, which Staudinger calls *parthenie*, var. *alatanica;* a form from the mountains near Samarcand named *parthenie*, var. *sultanensis*, by Staudinger, which is paler in colour above, and has the markings more obsolete below, which give it a very distinct appearance from any of the others; a small dark form, nearest to *britomartis* but differing somewhat from it below, from the Amur, which is the *plotina* of Bremer, and is considered a good species by Graeser* (Berl. Ent. Zeits, 1888, p. 88); a form named *mongolica* by Staudinger from Sutschan, larger than *plotina*, and most like *aurelia* from Germany; a form taken by Jankowsky in Manchuria, given to me as var. *magna* by M. Alphéraky: this is most like specimens from Corea,† which I treated in P. Z. S.

* One from Semipalatinsk in Staudinger's Coll. stands under this name.

† This is in Dr. Staudinger's Coll. as var. *koreana* from near Gensan.

1881, p. 899, as probably a variety of *athalia*, but which is much more like a large dark *britomartis*, and quite unlike the Japanese and Corean form of *athalia* known as *niphona*, Butl.

After writing the above I submitted a number of these specimens to Baron von Hormuzaki, who has lately studied the European forms of this group of *Melitæa* in the Verh. Zool. Bot. Gesch. Wien, and in Iris, xi, pp. 1—13. He identifies them as follows: "The form named var. *sultanensis* is certainly much more nearly allied to *minerva*, Stgr., and ought to be placed as a good species near *phœbe*, on account of the black spots at the base of the hind-wing below which are never found in the *athalia-parthenie* group." I may say that I have from Grum-Grshimailo's collection one of Staudinger's types of *sultanensis;* they resemble more closely what I have from the same collection as *asteroides*, Stgr., from the Alexander Mountains, than those I have received from Staudinger as *minerva* from the mountains near Osch in Fergana.

Of my specimens from the Altai he writes as follows:— "They may be considered as *aurelia*, var. *veronicæ*, Dorfm., from which they only differ by their small size; they have all the characters of *veronicæ*, namely, white spots on the underside of the hind-wings, anal spot bordered with black, black bands very wide, brown marginal bands, etc.," but these characters are not constant in my series. Of the form from the high Tchuja Mountains he says, "also a variety of *aurelia* analogous by the colours to *aurinia*, var. *merope*, it deserves a name if there are many similar specimens." I may say, that I have six males and one female absolutely similar, which I can distinguish from all those taken in the valleys.

Of the specimens from Corea which M. Alphéraky calls var. *magna*, he says, "I think this is the form described as *latifascia* by Fixsen, but whether it belongs to *parthenie* or *aurelia* is not yet sure, but a form very like it but smaller has been described by Staudinger as *mongolica*." I have a pair of this *mongolica*, and certainly would not like to separate it from the Corean form, so that if we adopt Fixsen's name, *mongolica*, Stgr., and *magna*, Alph., will have to be treated as synonyms. The form from Kamtschatka is certainly *parthenie*, var. *orientalis*, Mén., and some of my Altai specimens are hardly distinguishable from these.

98. *Argynnis aphirape*, Hb.

This was common in all parts of the country from about 5000—8000 feet the first week in July, flying in wet grassy places above the forest. The specimens are like *ossianus* in size, but paler than either that or the typical *aphirape* in both sexes, and agree with those sent from Irkut by Leder, but they are not so pale as those sent from Nicolaievsk by Graeser. On the whole, I do not see how any local forms of this species can be distinguished, as there is much variation among specimens from Finland, North Russia, and Scandinavia, which, though usually referred to var. *ossianus*, have no common distinctive character.

99. *A. selene*, Schiff.

Of this I only found a single specimen in the Upper Tchuja Valley on July 23rd. I received another taken at Ongodai by Jacobson. These might be called var. *hela*, Stgr., if there was any constancy in that form, which so far as my specimens show is not the case.

100. *A. selenis*, Evers.

I took this first at Kazan on the Volga on May 21st with the earliest spring butterflies. These specimens were pale in colour, and are typical *selenis*. In the Altai I found it at many places, from 3000 feet on June 17th, up to 7000 feet on July 23rd, when the species was still fresh in the Upper Tchuja Valley. It frequents bushes near marshy meadows, but was never plentiful, and I only got two or three females. The Altai form is more like those from Amurland and Dahuria which have been separated by Erschoff as var. *sibirica*. I have a specimen so named from his collection, but I do not see how they can be distinguished with certainty, as there is considerable variation among them, though they are on the whole darker and larger than those from the Volga.

101. *A. oscarus*, Ev.

Though I looked out carefully for this I did not succeed in finding it myself, but Jacobson took two or three at Ongodai, which seems to be its most westerly known range. The species, though very closely allied to *selenis*, *euphrosyne*, and *selene*, may, I think, be certainly distinguished by the

underside of the hind-wing. Altai specimens are much smaller than those from the Lower Amur, and not so dark as those from Irkut.

102. *A. euphrosyne*, L.

I only took this in the Tchuja Valley at 3000—4000 feet in the middle of June, when it was not common, but Jacobson and Berezowsky sent a few from Ongodai, which do not differ from Central European specimens.

103. *A. freija*, Thnb., var. *pallida*, var. nov.

This was perhaps the commonest butterfly on the dry grassy downs in the mountains south of Kuch Agatch, especially at 7000—8000 feet in places where there was little vegetation but dry wiry grass, quite unlike the boggy places which it frequents in Europe and North America. I first saw it on June 25th, and took a large series in good condition. The whole of these are at once to be distinguished from any of my large series from Europe, East Asia, and America by the pale colour of the fore- and hind-wings, which gives them the appearance of faded butterflies even when they are fresh out. This is especially noticeable on the underside of the fore-wing, and as those taken by Herz on the Vilui river are darker on the average than European specimens, I think this must be regarded as a constant local variety. The only other localities in Siberia from which I have it are Albasin on the Upper Amur river, and the E. Sayansk Mountains. Both these show some approximation to the var. *pallida*, but are distinguishable from it.

104. *A. pales*, Schiff.

This was very abundant after the middle of July from 6000—7000 feet, and varied extremely in size and colour. It was most abundant in marshy meadows above timber-line. In size they average considerably larger than European specimens, and are considered by Staudinger to belong to the form known as *Isis*, Hubn., which is in the Alps of Europe inconstant; the females vary as in Europe from the very darkest *napæa* to the palest form. I saw nothing like the Pamir and Ladak form known as *generator*, Stgr. Those taken by Leder in the Sayansk Mountains and Mongolia are, on the whole, very like my specimens.

105. *A.* var. vel. bon. sp. *arsilache*, Esp.

The only places where I took what I believe to be the Siberian representative of this form were by the side of a river, in a flat marshy meadow surrounded by willows at 6000 feet, and in flat swampy forest in the Bashkaus country at 4000—5000 feet. I paid particular attention to the localities, as it has been remarked, both in Lapland by Staudinger, and by myself and others in the Alps, that *arsilache* is confined to boggy ground, and does not fly like *pales* on grassy mountain sides. The difference in size, pattern, and colour of these specimens from *pales* is just about the same as in Europe, they are smaller with narrower and more pointed wings. I found no real peat-bog in the Altai, but it seemed to me that this form had confined itself as nearly as possible to flat and marshy ground, and was never on the hill-sides. Herz records *arsilache* from the Vitim river, but three female specimens taken by Czekanowsky in North-Eastern Siberia are distinct in appearance and like nothing else I have seen. My numerous specimens from Lapland, Norway, and Finland vary as much as they do in the Alps, and I am unable to say whether many of them are *pales* or *arsilache*. It is highly desirable that these two supposed species should be bred under similar conditions, which would be easy enough to any one resident in Switzerland.

106. *A. dia*, L., and var. *alpina*, var. nov.

This was fresh out at Kazan on May 21st, and at Biisk on June 4th. I did not see it in the mountains until I got to Darkoti, where it was abundant during the second week in July. All those taken here, though for the most part worn when I got them, are much darker and smaller than any other specimens of *dia* I have seen, and can be separated at a glance, both from the first brood of the low country, and from those of the second generation, which I found fresh out when I left the mountains in the first week in August. I have never heard of *dia* as a high Alpine butterfly before, and believe that in Europe it is double brooded wherever it occurs. This can hardly be the case at an elevation where the summer lasts only about six weeks. A few specimens taken by Jacobson at Ongodai were somewhat paler, but evidently belong to the single-brooded form which I propose to call *alpina*. Judging from what

Herz says of those taken by him on the Vitim, which he describes as rather small, above very dark, I presume they are the same as mine; I have none from Eastern Asia, but Herz says that three specimens sent by Leder from Mongolia were very light in colour on the upperside.

107. *A. amathusia*, var. *sibirica*, Stgr.

I only took one in the Tchulishman Valley on July 28th at 5000 feet, but received three or four more from Ongodai. All of these are smaller and paler in colour than usual in Europe, but females from St. Petersburg, which appears to be its most northern range, are also small and pale. They are the same as what Staudinger describes from the Kentei Mountains in Mongolia (*cf.* Iris, v, p. 330) as var. *sibirica*. A series from the Ural Mountains, taken by Grum-Grshimailo, were placed under this name in his collection, but I have some from Modane and Briancon in the Western Alps which I can hardly distinguish from these latter.

108. *A. angarensis*, Ersch.

Two males, both much worn, and a fresh female, were taken by Fletcher on July 28th at about 6000 feet in the Tchulishman Valley, and like those found by Herz on the Vilui and Vitim, average smaller and somewhat darker than those from Kentei and the Amur. The species occurs as far north as the Olenek and Jana rivers in North-East Siberia, where Czekanowsky seems to have found it abundantly. His collections seem to have been principally made in the district of Verchojansk considerably north of Yakutsk, and when worked out, as I hope they will be shortly, will form a valuable addition to our knowledge of that very remote region.

109. *A. frigga*, Thb., var. *alpestris*, var. nov.

This was to me a very unexpected discovery on the high Tchuja Mountains at from 7000—8000 feet elevation, where it was common during the first half of July on wet alpine meadows high in the mountains. A bog-loving species like its congener *A. freija* in Europe and America, it finds here no real peat, and I presume in consequence of this has developed a variety constantly different from all those in my collection both in its paleness and the comparatively slight development of the dark colour at the base of the

hind-wing. The only ones which at all approach it are those from Colorado, and these are much smaller and more rufous in colour. The only other Asiatic locality from which I have *frigga* is the Vilui river, where it is large and dark.

110. *A. thore*, Hb., var. *borealis*, Stgr.

I did not find this myself, but received two very small pale-coloured specimens from Ongodai, and have another from the Yenesei Valley in Grum-Grshimailo's collection. These three are, like the Amur specimens, paler than any from Europe, though they most resemble those from Lapland known as var. *borealis*, Stgr.

111. *A. ino*, Esp.

This was abundant in the Bashkaus country and round Lake Teletskoi below 4000 feet, at the end of July, and the specimens do not differ appreciably from European ones; though those from Irkut and Kentei, which are larger and paler, have been separated as var. *clara* by Staudinger, whilst those from the Ussuri district and Lower Amur, var. *amurensis*, Stgr., are again much larger than either.

112. *A. daphne*, Schiff.

This I did not take, but received two pairs from Ongodai, which agree with European specimens.

113. *A. hecate*, Esp.

This was abundant only in one place, just north of the Kurai Steppe in a luxuriantly wooded valley, and was fairly fresh on July 23rd. Berezowsky and Jacobson took it at Ongodai. The Altai specimens are most like Hungarian ones, both sexes, the females especially, being much darker and more heavily marked than the form from the Pamir known as *alaica*, Stgr.

114. *A. lathonia*, L.

I did not see this, though Lederer records it from the Buchtarma Valley.

115. *A. aglaia*, L.

This was common from about 6000 feet down to Lake Teletskoi in the latter half of July, and did not appreciably differ from average European specimens.

116. *A. niobe*, L.

This was common in the Bashkaus Valley, and also at Ongodai in July, and did not differ from European specimens.

117. *A. adippe*, L.

Found at the same time and place as the last. Most of the specimens have the silvery spots below, but one belongs to the variety *cleodoxa*, O. All of them have the androconia on veins 2 and 3 well marked, which is not the case in some of the specimens from Mongolia, North China, Korea, and Amurland, which may belong to another species, which as yet I am not able to define exactly. Those with the androconia only on vein 2 seem to occur in Amurland, Korea, and in North and Central China and Japan, with *adippe*, *niobe* and *neriippe*, and are usually confused in collections with one or other of these.

118. *A. paphia*, L.

Common above and below Lake Teletskoi in the Bija Valley, and does not differ from European specimens.

119. *A. pandora*, Schiff.

I did not see this species, but it was taken by Ruckbeil in the South-West Altai.

120. *Melanargia iapygia*, var. *suwarovius*, Hbst.

I did not take this myself, but have received specimens from Herr Tancré taken by Ruckbeil. It is also recorded as *M. clotho* by Lederer. I have seen it from the Yenesei Valley, where Jacobson found it rarely.

121. *Erebia maurisius*, Esp., t. 113, 4, 5. Pl. XI, fig. 1, 3 ♂ 2, 4 ♀; and

122. *E. theano*, Tausch. Mem. Mosc. I, p. 207, t. 113, 1. Pl. XI, fig. 5 ♂ 6 ♀.

I got a large number of specimens of these two species, which enable me to appreciate their distinctive characters in a way which I could not do when I last wrote on the genus *Erebia*. Esper's figure of *maurisius* combines the distinctive characters of both species in a way which renders it impossible to say with certainty which he had before him, though I am inclined to think it was a var.

of *maurisius*, with the outer margin of the hind-wing below resembling that of *theano*. Such a specimen, however, does not exist in the large series which I took, but even if it were *theano*, I prefer to retain the name now generally known for the species here described and figured. First as to their habitat: *maurisius* is an alpine butterfly occurring in greatest numbers from about 7000 to 6000 feet on wet grassy and rocky hill-sides, above and within the limits of the larch woods. In the Bashkaus Valley I took it as low down as 5000 feet, and here, as well as at Kuyuktana, between Kurai and the Upper Tchuja Steppe, I found it in company with *theano*, and though some specimens are so like *theano* that when taking them I did not distinguish them, there are none which I cannot now assign with tolerable certainty to one or other species. *Maurisius* was first taken on July 15th near Darkoti in the mountains south of the Tchuja Steppe, and became very abundant about a week later, when I took the first females. At Kuyuktana on July 22nd and 23rd the males were getting somewhat worn, whilst the males of *theano* were quite fresh and the females not yet out. On the pass between Kurai and the Bashkaus it was so abundant at from 6000—7000 feet that I got twenty females in one day, and as I descended this valley it was gradually replaced by *theano*, and disappeared altogether before I descended to the Tchulishman Valley.

The range of *theano* in this district therefore appears to be from about 3000—6000 feet, and that of *maurisius* from 5000 to nearly 8000 feet. The latter varies extremely, as will be seen by the figures I give; but the characters by which it may be invariably distinguished from *theano* are as follows. On the underside the band of fulvous elongated blotches on the fore-wing below are evenly bounded on the inside by the darker chocolate of the cell, whilst in *theano* the fourth and fifth spots, which are normally longer and paler than those of *maurisius*, are longer inwardly than the third spot. In *theano* the group of spots at base of hind-wings below is far better defined and more developed, though they are sometimes nearly wanting, and in the females of *maurisius* are sometimes present, though *never to the same extent* as in *theano*. The outer margin of fore- and hind-wings below is normally *grey* in *theano*,* whereas in *maurisius* it is of the same

* In figure 5 the colour comes out too red.

colour, or nearly so, as the rest of the hind-wing. The fringes of *theano* are distinctly white when fresh, chequered with brown at the ends of the veins, whilst in *maurisius* they are unchequered and usually dark. In my last Revision of *Erebia* (Trans. Ent. Soc. Lond., 1898, Pt. II, pp. 175 and 188) I treated *stubbendorfi* as a form of *maurisius*, whereas by these characters there is little doubt that it is a var. of *theano*, though the marginal and basal markings of both wings below are much less developed and sometimes entirely absent. I did not see this form in that part of the Altai which I visited. *Pawlowskyi*, on the other hand, I have little doubt is an Eastern form of *maurisius;* I have specimens collected by Leder in the East Sayansk mountains which are absolutely intermediate, and some of the females cannot be distinguished from Altai specimens. This variety is more distinct in the Chamardaban Mountains south-east of Lake Baikal, and extends in a small arctic form, in which the spots of both wings above and below are much reduced in size, as far north as the Olenek river within the Arctic Circle, where it was collected by Czekanowsky. As it was described from the Yakutsk district, this small form is probably the typical one.

The species will now stand as follows :—

Maurisius, Esp. Altai, 5, 8000 feet = *kindermanni*, Stgr.

var. *borealis et orientalis, pawlowskyi*, Mén. East Sayansk Mountains, Chamardaban Mountains, N.-E. Siberia.

var. *occidentalis, haberhaueri*, Stgr. Tarbagatai Mountains.

Theano, Tausch. Altai, 3, 6000 feet.

var. *stubbendorfi*, Mén. S.-W. Altai, (? Semipalatinsk district).

123. *E. kefersteini*, Ev. Plate XI, fig. 8, 9 ♂ 10 ♀ (fig. 7 ?).

Next to *maurisius*, this was the most abundant *Erebia* in that part of the Altai which I visited, from about 5500 —7500 feet, and is extremely variable, as will be seen by the four figures in my Plate. I cannot say that either of these four figures can be considered typical, three representing rather the extreme variations in either direction, one (fig. 10) with well-developed ocelli, another

(fig. 8) with much fulvous in the fore-wing, and a third (fig. 9) in which the markings are at a minimum; fig. 7 is possibly either a hybrid between *kefersteini* and *maurisius*, in whose company it occurred, or an aberration of one or other, I cannot tell which. *Kefersteini* appears to be equally common in the East Sayansk and Chamardaban Mountains, whence it was originally described, and probably occurs right through the mountains of Central Siberia. It appears in the latter half of July, but I did not take the females till the end of the month, and they appear to fly but little, as most of those I found were settled on grass stems, or kicked up out of the long grass.

124. *E. tyndarus*, Esp.

This was an abundant species at from 6000—8000 feet in the latter half of July, on similar ground to that which it frequents in the Alps. The form found in the Altai is nearer to var. *dromus* than to *tyndarus* from the Alps, but can be distinguished from the former by the great inward extension of the fulvous on the fore-wing above, which extends half-way down the wing, and by the underside of the fore-wing having no transverse band as in *dromus*, and in the Caucasian form which is referred to *dromus*. In both these characters it resembles the American variety from Colorado more than those from Armenia or North Persia, known as var. *dromulus*, Stgr., and var. *iranica*, Gr.-Gr. They are not, however, like Staudinger's description of var. *sibirica* from Tarbagatai, being no larger on the average than Alpine specimens, and the spots on the hind-wing are sometimes very conspicuous and sometimes almost absent. I can distinguish most of them, as also those taken by Leder in the Sayansk Mountains, from any of the named varieties by the inward projection of the chocolate patch on the upperside of the fore-wing. In all other forms of *tyndarus*, except, perhaps, those from the Caucasus, the chocolate patch on the fore-wing above is rather a band fairly straight on the inner margin; in the Altai form it runs in a blunt point more than half-way towards the base of the wing. On the underside the whole centre of the fore-wing is plain chocolate, as in var. *ottomana*, without any transverse band as in *dromus*.

125. *E. æthiops*, Esp.

This was common in the forests round Lake Teletskoi

below 2000 feet, Bija Valley, and open country towards Biisk, towards the first week in August, and does not differ from European specimens.

126. *E. sedakovii*, Ev.

Common in the forest country of the Bashkaus and its tributaries the last week in July, but the females had not appeared at the time we left this country. Jacobson also found it common at Ongodai, and sent me a female taken on August 8th. The Altai specimens vary little, and seem smaller than those from the Amur country. The range appears to be from about 3000—5000 feet, never mixing with *æthiops*. It flies on grassy places in open forest.

127. *E. ligea*, L.

Abundant in larch forests in the Tchulishman Valley, where I first saw it on July 27th at about 4000 feet, when the males were a little worn and the females quite fresh; from this point down to Lake Teletskoi in the Bija Valley the species was common. The bands above are somewhat paler and broader than average European specimens, as are those from Lake Baikal and the Amur Valley, but not to the same extent as in the typical Eastern form *ajanensis*, Mén.

128. *E. euryale*, Esp.

I found this myself only on the north side of the Kurai Pass in marshy larch forest at 5000—6000 feet, on July 25th and 26th, when specimens were mostly worn. They did not occur where I found *ligea*. Jacobson and Berezowsky took it at Ongodai, and some of these specimens might as well be called *ligea*. In fact I am not able to draw a line between them, for though the same general characters by which they are separated in Europe, namely, smaller size and less distinct markings below, will usually separate them in Asia, yet there are some which cannot be certainly referred to either species. The general character, however, is like those from the Irkut Valley, referred to in my recent paper on the genus *Erebia* in Trans. Ent. Soc. 1898, p. 198.

129. *E. lappona*, Esp.

Found in the Tchuja Mountains at about 8000 feet, but not abundantly, on July 9th and 10th, and on the

Kurai Pass July 25th. The specimens do not differ from those of the Alps.

130. *E. fletcheri*, sp. nov. (Plate XII, fig. 4 ♀).

When we crossed the pass between the Kurai and the Bashkaus on July 24th, Mr. Fletcher took at about 7500 feet a single female *Erebia*, which I at once perceived to be distinct from anything I had seen in the Altai. As, however, I did not see it till the evening, I rode back the next day a distance of four hours to see if I could find more of it, but was unsuccessful. Though it comes extremely close to and is perhaps identical with a worn female taken by Leder somewhere in the Irkut Valley, which was sent to me by M. Alphéraky as a female of *E. dabanensis*, yet it differs so much from two undoubted females of that species taken in the Chamardaban Mountains a little to the eastward, that after submitting it to Dr. Staudinger for his opinion, I venture to describe it as a new species. On plate XII, fig. 4, I have figured this specimen, together with a pair of *dabanensis* (fig. 5 ♂ 6 ♀) and a female (fig. 8) taken by Herz on the Vilui river, and identified by him with *dabanensis* (*cf.* Iris, xi, p. 246, 1899). This latter specimen, as well as a male from the Vilui, for which I am also indebted to the Grand Duke Nicholas Michailovitch, and another female (fig. 7), taken by Czekanowsky on a tributary of the Olenek river in North-Eastern Siberia, for which I have to thank the Museum of the Imperial Academy of Sciences at St. Petersburg, differ from *dabanensis* in the bands and ocelli below on both wings, as shown in the plate. They are probably an Arctic variety of *dabanensis*, but our knowledge of the fauna of these remote districts is not yet sufficient to decide their specific position with certainty. These three probably form a group, as far as we know confined to Eastern Siberia, which has no near ally in Europe.

131. *E. rossii*, Curt.? var. *ero*, Brem. (Plate XII, fig. 1, 3 ♂ 2 ♀).

On June 27th, when approaching a flock of *Ovis ammon*, I saw a large dark butterfly flying on the shaly slope of one of the high mountains south of the Tchuja Steppe, which I at once saw was an *Erebia* new to me, and as soon as the rams were out of sight I got out my net and caught

it, and was much surprised to find, so far from the locality where it had previously been taken, this rare and peculiar species. In two or three days it became quite common, and throughout the month of July, wherever the ground was suitable, it was with *Argynnis freija*, one of the most abundant butterflies. It frequents steep shaly and rocky hillsides from about 7000—9000 feet, and is not difficult to catch on a hot day, though of all the *Erebias* I have ever taken it is the most difficult to get in perfect condition. I have figured two males and a female, of which figure 1 is the most typical. The colour of the rings round the ocelli comes out too yellow in all these figures, it is rather a chocolate colour. There is considerable variation in the ocelli, which above are normally as follows: one with a double pupil near the apex of the fore-wing, and about three on the hind-wing; sometimes, however, specimens such as figure 3 occur, and I have seen one in the St. Petersburg Museum from Kansk, in which the ocelli are even better marked than this. I have never, however, seen a male in which the fulvous shows on the upperside of the fore-wing as in figure 2. The hind-wing below is the characteristic feature of this species, the ocelli being always replaced by white dots, normally four in number, near the outer margin of the paler band. The underside of the fore-wing is, except the margin and costa, constantly fulvous, more so than in specimens from the East Sayansk Mountains, and as far as I can judge the insect, which I have compared with Bremer's type, is absolutely identical with those from Hudson's Bay referred to in my last Revision of *Erebia* (Trans. Ent. Soc. Lond., 1898, p. 202). If, as I believe, these are identical with *rossii*,* which, however, appears to be a smaller and Arctic form of the species, the Asiatic form will have to be treated as a variety of it. The fringes of all my specimens are uniformly dark, but in one or two there is a slight tendency to pale chequering, which is better marked in a female from Chamardaban, ex. coll. Grum-Grshimailo.

132. *E. edda*, Mén.

This is another of the rare species hitherto only known from Eastern Siberia. I found it first in the Tchuja

* The *genitalia* seem to be identical with those of *rossii* as figured by Aurivillius, Ins. Vega Exp., iv, t. 1, iv. *Cf.* Elwes, Trans. Ent. Soc., 1898, p. 202.

Valley on June 19th, a very wet day, when I caught three males fresh out at about 4000 feet. On the next day, at the foot of the pass on the road to Kurai, it was quite abundant along the dry bed of a mountain stream, where with Mr. Fletcher's help I got twenty fresh males in an hour. A single female, however, was the only one I could procure, and I never saw the insect again, though Jacobson and Berezowsky got two or three at Ongodai a little smaller, and with a little more fulvous on the fore-wing than in most of my specimens. It flew weakly in the grass, and settled only on stones in the bed of the river, and appeared to be confined to a very limited area. The species is a very distinct one, probably most nearly allied to *tristis*, from which, however, the chocolate circles surrounding the ocelli on the fore-wing and the much richer brown of both wings will constantly distinguish it. In the male only there is a distinct velvety patch in the centre of the fore-wing above. Occasionally there are one or two smaller ocelli below the large double-pupilled one. On the hind-wing below there are three distinct marginal white points, and one larger one at the edge of the somewhat indistinct central dark band. There is also a greyish patch near the costa on the hind-wing below. The fringes are in very fresh males dark, but in my only female the edge of the fringe on the fore-wing is grey. The only difference between the sexes is the paler colour of the ring on the fore-wing.

133. *E. afra*, Esp.

I did not take this, but it is recorded by Kindermann and Ruckbeil, and I have specimens from near Semipalatinsk in Grum-Grshimailo's collection.

134. *E. cyclopius*, Ev.

This fine species, which appears to be an inhabitant of pine forest in the low country rather than a mountain species, was not seen by me, but Herr Tancré has sent me a specimen taken at Justid (?) in the Altai by Ruckbeil, which agrees perfectly with other Siberian specimens. Grum-Grshimailo seems to have found it common near Miask in the Southern Ural, and I have five beautiful fresh pairs from that locality in his collection. Some of these show a tendency to fawn-coloured markings at the end of the veins of the fore-wing. Jacobson also found it in

the Yenesei Valley, and it occurs in the Kentei Mountains and Amur Valley.

(*E. medusa*, Fab.)

This is the only species of *Erebia* which I expected to find, but did not, in the Altai. Though it has not hitherto been taken there, so far as I know, yet as Jacobson found it in the Yenesei Valley, and Leder took it in Mongolia, it will probably be found. A fine series of the variety *uralensis* taken at Miask by Grum-Grshimailo at the end of May are fairly constant in the distinguishing characters of the underside. Most of the males and all the females show a well-marked grey dusting on the hind-wing and apex of the fore-wing, which is characteristic of this variety, and an equally fine series of *medusa* from Podolia, which is the nearest point in Europe from which I have it, show a slight trace of this in one or two females only. An additional character of *uralensis*, which is also common to var. *polaris*, is the absence of the large chocolate-ringed ocelli on the hind-wing below.

135. *E. embla*, Thunb.

This I took only on June 20th, close to the place where *edda* was common, but within the forest. I found four males in all, and never saw the species again, neither was it found at Ongodai. These four males are precisely similar to those taken in Kamtschatka by Herz, and described by Alphéraky as var. *succulenta*, which, like those from Mongolia named *lama* by Staudinger, are in my opinion an oriental variety. I have, however, one or two males from Scandinavia hardly distinguishable from them. They are fairly distinct from those which Ménétries called *embla-disa*, of which I have several pairs from the Vitim and Vilui rivers taken by Herz, who says (Iris, xi, p. 246) that many of them approach *disa*. When I wrote last year on *Erebia* I said that I had seen no true *disa* from Siberia; there are, however, several in the Museum at St. Petersburg taken by Czekanowsky on the Upper Tunguska river, which cannot be separated from *disa*, and as I have also one from Northern Siberia, we must conclude that the two species remain distinguishable in Asia as in Northern Europe. I may add, that among Czekanowsky's Siberian collection are two or three specimens which appeared to me indistinguishable from *E. fasciata*, Butl.,

hitherto only known from arctic America, though I have not yet had an opportunity of comparing them.

136. *Erebomorpha* (gen. nov.) *parmenio*, Boeb.

I first saw this butterfly on July 2nd, flying before a strong wind. It had a very peculiar flight like nothing I had ever seen before, and after pursuing it for about a mile on horseback I finally succeeded in catching it by getting down wind of it and waiting for it. A week later it became very common in a broad gravelly flat intersected by arms of the river, and covered with a rich flora of beautiful flowering plants and grasses growing amongst the stones; and by July 15th it became one of the most abundant butterflies all over the dry parts of the country, extending up to quite 7000 feet, and was last seen in the Bashkaus Valley at about 4000 feet on July 25th, when it was worn out and nearly over. The flight of this butterfly is quite unlike that of any other *Erebia* I know, and this in conjunction with its very short antennæ, great difference of size and shape in the sexes, and other peculiarities inclines me to put it in a new genus for which I propose the name of *Erebomorpha*. In my last revision of *Erebia* I grouped it with *myops*, *maracandica*, *radians*, *kalmuka*, *hades*, and *herse*, to all of which its venation is somewhat similar. Dr. Chapman, however (*cf.* Trans. Ent. Soc. Lond., 1898, p. 233) states that *myops* is not an *Erebia* and comes nearest to *Cœnonympha;* in this I am willing to agree with him. *Maracandica*, *kalmuka*, and *radians* may be grouped with it, but *hades* and *herse* seem to go better with *Paralasa*, Moore. The clasp-form of *parmenio* according to Chapman is nearest to that of *afra*, and it may be that these two species are more nearly allied than their superficial appearance would lead one to suppose, but I have never seen the last alive. *Parmenio* differs in its manner of flight from any butterfly known to me, flapping slowly along near the ground with its hind-wings in a different plane from the fore-wings; it settles on grasses, and where it is abundant rises in swarms before one's horse's feet and flaps slowly out of the way, unless the wind is strong, when it is liable to be carried off to a considerable distance. The females come out about a week after the males, and were common on July 11th; they can be recognised by their weak jerking flight and are very easy to catch.

The form of *parmenio* which I took in the high Tchuja Mountains is constantly smaller than those which I found in the Tchuja and Bashkaus Valleys, and from those taken at Ongodai by Berezowsky, only one male out of ten pairs from the high mountains could be confused with all the other specimens I have. The males of this high level variety which might be distinguished as var. *alpina*, average about 45 mm.; the largest (one male) is 51 mm. The females measure about 40 mm. The smallest of the males from Ongodai is 51 mm., and the average about 53 or 54 mm. This alpine form is also much darker with less rufous in the fore-wing and the ocelli smaller; on the underside I see no difference. The Altai Mountains appear to be the most westerly locality in which *parmenio* has been taken. It is common in the Irkut Valley; Dorries found it in high-lying forests in the Kentei Mountains in Mongolia, and Graeser took it abundantly at Pokrofka on the Upper Amur.

Among all the insects I collected in the Altai none have given me anything like so much difficulty to identify as the species of *Œneis*, and though I have compared them very carefully with what I believe to be now an unequalled series of all the known species, I am still doubtful what to call some of them. Though I revised the genus so recently as 1893,* and endeavoured to use the form of the clasp as a guide to the separation of the allied species the acquisition of much new material obliges me, as I find it usually does, to modify several of the opinions then formed, and as I am practically obliged to revise the Asiatic species again in order to identify the Altai ones, I may as well give the results here.

137. *Œneis mulla*, Stgr., Stett. Ent. Zeit., 1881, p. 270, vel. sp. nov. (Pl. XIII, fig. 1 ♂, 7 ♀).

I found this rare and little-known species at one spot only, about thirty miles south of Kuch Agatch, on stony ground among rocks, and confined to a very narrow area.

As we rode up the valley on June 25th, and had just come in sight of the first flock of *Ovis ammon*, I saw a specimen settled on a rock and caught four males in about five minutes.

On June 28th I returned to the place, and after

* Trans. Ent. Soc., 1893, pp. 457—481.

waiting some time took one ♀ only, the sun being very fitful, and the insects wild and difficult to approach; two more visits to the place only resulted in the capture of four more females, three of which, however, were quite fresh. In its habits this is a true *Œneis*, but in appearance the female is very like *Satyrus hippolyte*. It is not so nearly allied to *jutta*, as I thought when I revised the genus. The male has a distinct sex-mark which, notwithstanding what Dr. Staudinger says (Iris, vii, p. 248, *note*), is, though not absolutely constant in some species, a very useful character in separating these nearly allied insects. P.S.—Since seeing Dr. Staudinger's types I am not at all certain whether this is the same species as *Mulla*, which as Staudinger says is a near ally of *jutta*, and resembles that species more on the underside than mine does. As, however, there are only two males in his collection, and I am unable to examine the *genitalia* of the type, I will not give another name until more material comes to hand.

138. *Œ. norna*, var. *altaica*, var. nov. (Pl. XIII, fig. 2 ♂, 5 ♀).

This fine species was first taken in the Tchuja Valley at about 4000 feet on June 19th, and the female a few days later near Kurai. I did not see more than one or two specimens on any occasion, and as it flies fast in open larch woods and settles on tree-trunks it was hard to catch. When we returned to the valley again a month later I got three or four more, mostly worn specimens. I have also a female from Grum's collection from the south-western part of the Altai (near Semipalatinsk), and have seen others taken at Kysas in the Abakan district of the Yenesei Valley in 1897 by Jacobson, which I believe to be the same species. I also have four males taken by Ruckbeil in 1881 or 1882 in the South-Western Altai sent to me by Herr Tancré as *norna* var.; but the females from Tchingistai sent me this year by him as *norna* var. appear to be *verdanda*, Stgr. (Plate XIV, fig. 6 ♀). The males when quite fresh are very dark, a much more chocolate colour than the females, or than any *norna* from Scandinavia. The underside of the hind-wing is also much more brightly marked and spotted than in *norna*. But the character of the sex-mark, the form of the band of the hind-wing, and that of the clasp which appears identical with that of *norna*, incline me to think

it is only a variety of that extremely variable species, and the difference between it and typical *norna* are not so great as between large Swedish specimens and the very small, pale, and sometimes almost unspotted specimens which are found on the Porsanger Fiord in Arctic Norway, and are known as *ab. fulla*, though I think they are distinct from the true *fulla* of Eversmann, of which I have seen the types at St. Petersburg, and which occur in the Alatan and Tarbagatai Mountains.

139. *Œ. dubia*, n. sp.? (Pl. XIII, fig. 6 ♂; Pl. XIV, fig. 3 ♀).

Though I have considerable doubt as to whether this is a good species, or only a form of the last, yet I have no difficulty in separating it from any specimens of *Œneis norna* in my collection by the following characters, which are found in 9 ♂ and 2 ♀ in my collection.

First, there is a total absence of the androconia which forms a conspicuous sex-mark on the fore-wing in all specimens of *norna* from Europe or Asia.

Secondly, a difference in the form of the clasp, which does not agree either with that of the *jutta*, *norna*, *nanna* or *bore*, with all of which I have tried hard to identify it.

Thirdly, the much darker colour of the female.

Fourthly, the fact that it seems to appear much later in the season than *norna*, var. *altaica*.

The only one I took myself was a fresh ♀ on July 24th (Pl. XIV, fig. 3) in swampy larch forest north of the Kurai Pass; this was quite fresh five weeks after *norna* first appeared. I received, however, from Messrs. Berezowsky and Jacobson ten males and one female taken at Ongodai in July, which are evidently the same species, *and no norna was amongst them*. I cannot see any well-marked difference from *norna* in the colour or pattern of the males, though the transverse band of the fore-wing below is very faint or obsolete in *dubia*, and well-marked in *norna*, var. *altaica;* and the difference in colour of the fulvous outer band on both wings above is striking. I have also compared specimens with Dr. Staudinger's collection, and can find nothing like *dubia*, but I believe that in the collection made by Jacobson in the Yenesei Valley in 1897, now in St. Petersburg, there is one of this species, as there is also one of my *norna*, var. *altaica*.

140. *Œ. nanna*, Mén. (Pl. XIII, fig. 3 ♂ 8 ♀; fig. 4 ♂ ab. ?). *Œ. hulda*, Stgr., Rom. Mém., vol. iii, p. 149, t. xvi, 8 ♀; *Œ. nanna*, Mén. *op. cit.* vol. vi, p. 200.

I found this very rare at about 6000 feet in a rocky larch wood above Kuyuktana in the Tchuja Valley on July 22nd, when I took a fresh male and a somewhat worn female. At the time I took them to be a var. of *norna*. On comparing them carefully with typical specimens of *nanna* from Pochrofka on the Upper Amur, with Ménétries' figure of ♂ *nanna*, and with Staudinger's figure of ♀ *hulda*, afterwards identified by him with *nanna*, I think mine are the same. The sex-mark in this species is sometimes very well marked, in others as Staudinger truly says,* " Nur sehr schwach bei einigen Stucken fast gar nicht erkennen," but the number of the ocelli (in all my specimens five on the hind-wing), the form of the band on the underside which does not form such a sharp point inwards as in *norna*, and the much more mottled and less distinct band below than in *urda* (though fig. 3 in this respect is aberrant), seem to me to make the species distinguishable from any other. I have a single specimen, however (fig. 4), which I took at about 6000 feet near Darkoti, in the same locality where *sculda* was common, and which I doubtfully assign to *nanna* by its sex-mark and the form of its clasp, in both of which it differs from *sculda;* but for the clasp, I should rather have supposed this specimen to be an alpine form of *norna*. Though I saw no *norna* in this district above the limit of forest there was a clump of stunted larch in the neighbourhood where *norna* might occur. Since writing the above I have seen Dr. Staudinger's types of *hulda* = *nanna*, and am convinced that it is a good species, and that mine are the same.

141. *Œ. sculda*, Ev. (Pl. XIV, fig. 5 ♂ 9 ♀; Plate XIII, fig. 9? ab. ♂).

This species and var. *pumila*, Stgr., which has not previously been recorded from the Altai, but only from the neighbourhood of Kiachta in East Mongolia, and from Pochrofka on the Upper Amur, was first taken near Ongodai on June 10th and was not uncommon on grassy hill-sides in the Ongodai Valley; though strange to say it was not included in Mr. Jacobson's collection. In the first half of

* Iris, vii, p. 248.

July I found it extremely abundant from 7000 to 8000 feet on the high grassy hill-sides in the wild sheep country, where it was by far the commonest *Œneis*, and perhaps, except *Argynnis freija*, the commonest butterfly. It was extremely variable in the number of ocelli, some specimens having as many as four on the hind-wing, and some none at all. The colour of these alpine specimens was also normally much paler and more fulvous than those from the wooded Ongodai Valley, which are a darker brown or dull chocolate tinge as in fig. 5, like those from Amurland. This species always rests on grass and avoids rocks, and is very easy to take as its flight is short and weak as compared with other *Œneis*. The wings seem to be of an extremely tender character, becoming worn very soon after it emerges from the chrysalis.

142. *Œ. bore*, var. *ammon*, var. nov. (Pl. XIV, fig. 2 ♂ 7 ♀).

Found fairly common in the higher parts of the country I visited from 7000 to nearly 9000 feet after July 2nd. The females, however, were comparatively scarce, and the insect hard to catch, as it frequents swampy ground and flies fast.

It is distinguished from the nearly allied *hora*, of which *verdanda*, Stgr., seems to me a slight variety; and also differs from *fulla*, Ev., by its much darker colour. It agrees with *fulla* in having a more or less conspicuous sex-mark, which *hora* has not, and differs from both in the clasp and in the band of the hind-wing below, which is as broad or broader at the costa as it is lower down, and resembles that of var. *taygete*. The veins of the hind-wings below are not so whitish as in that variety, but it comes nearer to it than to any Asiatic species I know, and has a similar clasp; only one ♀ among the thirty or forty specimens I took had ocelli or spots on either surface, whereas in *hora* and *fulla* there are usually (not always) one or two on the fore-wing, and one on the hind-wing.

The above six species were all I took myself, but as several others have been taken, or may be expected to occur in the Altai range, I will here allude to them.

143. *Œ. tarpeia*, Pall.

Not taken by me, but recorded by Lederer and Tancré. I have specimens from the neighbourhood of Semipalatinsk in Grum's collection.

Œneis hora, Gr.-Gr., Hor. Ent. Ross., xxii, p. 307; Rom. Mém., iv, t. xx, 1, and var.? *verdanda*, Stgr., Iris, x, p. 349. (Pl. XIV, fig. 1 ♂ 6 ♀.)

This is a very little known insect, which was originally described from two males taken by Grum-Grshimailo in the Altai Pamir; these types are now in my possession. It is a near ally of *bore*, which it represents in the high mountain ranges of Central Asia. A form of it described by Staudinger in Iris (vol. x, p. 349) as *verdanda*, is common in the Thianshan, the Borochoro Mountains (part of the same range), and in the Kuruk-tagh Mountains near Korla in Eastern Turkestan. I also received from Herr Tancré three males and two females (the latter marked '*norna* var.' Pl. XIV, fig. ♀) from Tchingistai in the South-Western Altai, which I cannot distinguish from *hora*.

The principal, if not the only difference, which I am able to see between the types of *hora* from the Pamir, and the twenty-one other specimens in my collection (three of which are from Korla) is that in the latter the band of the hind-wing below ends at the costa in a more or less narrowed and pointed apex, instead of coming right up to the costa in a broad band. Otherwise the two forms are practically identical, and differ from the Asiatic form of *bore* which I have above described in having no male mark. The clasps of *hora* and *verdanda* seem identical and want the large tooth near the middle of the upper edge found in clasps of the *bore* type. The ocelli, which are not very conspicuous, vary as in other species, two being the normal number on the fore-wing and one on the hind-wing. In colour they are brown, often more fulvous than the Altai *bore* which is blackish, whilst *fulla* is grey. And the females, especially those from Tchingistai, are paler fulvous than the males, whereas in *bore* and *fulla* the two sexes are nearly or quite the same colour. The ♂ figured is from Tchingistai (ex. Tancré), and differs from the types of *hora* from the Altai now in my collection in having no *ocellus* on hind-wing above, and being rather less fulvous in colour. I figure it to show that the character principally relied on by Staudinger when describing *verdanda*—namely the shape of the band on the hind-wing below—is inconstant, and am quite ready to admit that neither *hora* nor *verdanda* are specifically distinct from *bore*.

Œ. jutta is not yet recorded from the Altai, but as it was taken in the Upper Yenesei Valley by M. Jacobson, I quite expect it to be found.

Œ. urda (Ev.) may also occur in the Altai district, as I have a pair in Grum's collection from the Oka river, which is west of Irkutsk.

Œ. bore, var. *panza*, Christoph. = *semidea* var. *panza*, Christ., Iris, vi, p. 87; *crambis*, var. *panza*, Herz, Iris, xi, p. 247 (1893). (Pl. XIV, fig. 4 ♂.)

This species was sent to me by Alphéraky as *crambis*, var. *panza*, but after studying what Dr. Staudinger has said about it in Iris, viii, p. 250, I agree with him that it should be treated rather as a variety of *bore*, and Mr. Edwards' examination of the clasp-form confirms this opinion, though Herz in his account of his Lena expedition (Iris, xi, p. 247) apparently overlooking what Staudinger has said, treats it as a variety of *crambis*. I have five males and two females taken by Herz which show an indistinct sex-mark in the male, and I have two females from the Tomba river in the district of Verchojansk taken by Czekanowsky. The bands of these vary somewhat below, and the two latter specimens do not show the pale marginal bands above as in the Lena specimens, but I think that they can belong to no other species, though not unlike a ♀ of what I believe to be *jutta* from the same locality.

Œ. tunga, Stgr., Iris, vii, p. 248, t. 9, fig. 1 ♀; *Œneis semidea*, var. *also* (Bdv.) Ic, p. 197, t. 40, figs. 1, 2; apud. Herz, Iris, xi, p. 247. (Pl. XIV, fig. 8 ♀.)

I have seen specimens of this species in the collection of the Grand Duke Nicholas Michailovitch, and have to thank him for a male from the Vitim river, the clasp of which agrees with that of *semidea;* and a female from Irkut which I have figured, and which I think without doubt is the same species as *tunga*, Stgr. A third specimen, also a female, from Chamardaban in Grum-Grshimailo's collection agrees very well with these, which M. Alphéraky and Herz identify with *also;* and though Boisduval says he received *also* from Siberia through Eschscholtz, his figure does not represent *tunga*, but is more probably taken from an American specimen of *semidea* which he supposed to be the same as *also*. *Semidea* or some-

thing like it may probably be found in North-East Siberia, but as *tunga* is in the type specimens, and in all the others I have seen unmistakably different, I think the name of *also* must remain as heretofore a synonym of *semidea*. The types of *tunga* were taken by Leder in the East Sayansk Mountains, and the species may probably occur also in the high mountains of the Altai.

144. *Satyrus semele*, L.

This was taken at Saisan in the Irtysch Valley by Ruckbeil, but not seen by me.

145. *Satyrus heydenreichei*, Led.

Taken by Kindermann and Ruckbeil, but not seen by me.

146. *S. hippolyte*, Esp.

A small pale-coloured variety of this, showing much less of the yellowish colour on the band of the fore-wing and hind-wings than in any of those I have from the Thianshan, Orenburg, and other parts of Western Siberia, was very abundant on the bare Tchuja Steppe (6000 feet) when I crossed it on July 19th, and was evidently fresh out. It made short flights close to the ground and rested on the bare earth on its side, and was quite easy to catch. On this day fresh snow was falling and lying on the mountains round, almost to the level of the steppe, and the cold perhaps accounted for the comparative sluggishness of the insect.

147. *S. autonoë*, Esp.

This insect came out abundantly about the same time as the last, and was common from the Upper Tchuja Steppe down to about 2000 feet on the Tchulishman river, and also at Ongodai. There is considerable variation both in size and colour, and some of them might be called var. *sibirica*, Stgr., which is described from Kentei as having the transverse band more or less whitish or brownish. This would apply to specimens from Boro-choro in the Thianshan, whilst four pairs from Amdo in North-East Tibet, which I have in Grum-Grshimailo's collection under the name of var. *extrema*, Alph., show this character very strongly developed.

148. *S. anthe*, var. *hanifa*, Nordm.

I found a female from Semipalatinsk, of this form, sent by M. Novoprachin in Staudinger's collection, but of a deeper brown than those from the Caucasus.

149. *S. briseis*, L.

This was very common on the Bashkaus at the end of July at 2000—3000 feet, but not seen anywhere in the Upper Tchuja Valley.

150. *S. dryas*, Scop.

This was very common in the Tchulishman and Bashkaus Valleys, and on comparing it with a large series from Europe, a pair from Kentei, and several pairs from the Amur, I can see no sufficiently constant difference in Siberian specimens to justify the varietal name *sibirica*, which has been applied by Staudinger to those from Kentei, and which he says occur also at Saisan and in Amurland as a more or less common aberration.

151. *S. arethusa*, Esp.

This was taken commonly by Ruckbeil at Saisan, but not observed by myself.

152. *S. cordula*? var. *bryce*, Hubn.

I received three males and a female under the name of *actæa*, var. *bryce*, taken by Ruckbeil near Saisan, and find a pair in Grum-Grshimailo's collection from the Altai, probably taken near Semipalatinsk, under the name var. *altaica*, Gr.-Gr. (Hor. Ent. Ross. xxvii, p. 384, 1893). They agree very fairly both on the upper and undersides with specimens from Sarepta usually known as *bryce*, and differ from *cordula* in the females having no yellowish tinge on the fore-wing below, and the males more mottled with grey below. In both these characters they also agree with those from the Thianshan Mountains, taken by Grum-Grshimailo, whilst all those from the province of Bokhara have the fore-wing below in the female yellowish, like *cordula*.

153. *Pararge mæra*, L.

A worn-out specimen or two were still flying in the Bija Valley at the beginning of August. I did not receive it from Ongodai, but Lederer records it.

154. *P. hiera*, Fabr.

This is an early spring species in Asia. I took one at Biisk on June 4th, and saw two or three more in the foot-hills of the mountains on the 6th. Neither Kindermann nor Ruckbeil seem to have found it, but it occurs in the Kentei Mountains and on the Lena.

155. *P. achine*, Scop.

This was uncommon or nearly over on the Lower Bashkaus and Bija Valleys at the beginning of August, and, as Staudinger says of those from Kentei, seem to be smaller in size than European specimens. It occurs as far north as St. Petersburg.

156. *P. deidamia*, Ev.

A few worn-out specimens were found in a hot rocky gorge in the Tchulishman Valley on July 28th, and I received two or three from Ongodai. This species occurs as far west as the Ural, where Grum-Grshimailo took it in the beginning of June. There is no appreciable difference between these West Siberian specimens. Those from Amdo, however, in Grum-Grshimailo's collection are larger, paler below, and have the white fringes, which are only apparent in quite fresh specimens, much more conspicuous.

157. *Epinephele lycaon*, Rott.

This was the only species of the genus common in the Altai. Specimens from Uliassutai in Mongolia were separated by Staudinger as var. *catamelas* on account of the uniform dark colour of the underside of the hind-wing. This character is, in my specimens, variable, and though on the average it holds good, yet I can pick out some European examples, which are nearly the same on the underside. I have three males and a female collected by Ruckbeil at Kenderlik, a much more southern and probably hotter place than that part of the Altai where I was, which are as pale below as any European specimens.

158. *Epinephele hyperanthus.*

I found this species only in the Lower Bashkaus and Bija Valleys, from about 2000 feet down to the open country at the beginning of August.

159. *Cœnonympha œdipus*, Fab.

Recorded by Ruckbeil and Lederer, but not seen by me.

160. *Cœnonympha iphis*, var. *iphicles*, Stgr., Iris, v, p. 338, var. *heroides*, Christoph. *op. cit.* vi, p. 87. Herz, *op. cit.* xi, p. 248.

I found this species common in the Tchuja and Bashkaus Valleys after July 20th at about 3000—6000 feet. On comparing them with those taken by Herz on the Vilui, by Leder at Irkut, both under the name of *heroides*, Christoph, and with one from Kentei, described by Staudinger as var. *iphicles*, I can find no appreciable differences between them; and though I would have preferred to use the name *heroides* on account of the marked resemblance of this variety to some specimens of *hero*, var. *perseis*, the females especially being very similar, yet as Staudinger's name has a year's priority over Christoph's, I adopt it. The differences between this form and *iphis* from Europe are trifling, and two females from the Ural seem to form a transition; but on the whole they are somewhat paler in colour with the ocelli much better marked above, and on the underside of the hind-wing surrounded by confluent rings of fawn colour, which I do not see in any of my European specimens.

C. iphis? var. *mahometana*, Alph., Lep. Kuldja, p. 95 (in separata).

This is a well-marked form from the Thianshan, and was also taken at Kenderlik, a Russian frontier post south-east of Lake Saisan by Ruckbeil; but insects from this locality, though they have been sent out by Tancré as from the Altai, can hardly be included in the fauna of the district as I restrict it.

161. *C. amaryllis*, Cram.

A very abundant species in the lower parts of the country up to about 4000 feet. I took it fresh on June 17th, and it was still flying, though a good deal worn, on July 30th. These specimens are a trifle smaller than those from Pokrofka on the Amur, and the ocelli better marked than in the supposed var. *rinda*, Mén., which I have from Blagoveschenk on the Amur, taken by Hedemann. Another form taken by Roborowsky and sent to me by Alphéraky as his var. *evanescens* seems to be like

those from Amdo in Grum-Grshimailo's collection, distinguishable by the greater development of the white bands on the hind-wing below.

162. *C. hero*, var. *perseis*, Lederer (*cf.* Staudinger, Iris, v, p. 338. Herz, *op. cit.* xi, 248).

I found this in the Tchuja Valley from 3000—4000 feet, fresh in the middle of June, and in the Upper Bashkaus Valley on July 24th. On the average they differ from the ordinary European form which extends to the Ural in having rather more developed white bands below, and the ocelli more distinct above. The same characters are even more pronounced in specimens from the Amur and Askold, so that perhaps the name of *perseis* may be applied generally to Asiatic races of this species.

163. *C. tiphon*, Rott. var.

I found this species in some of the more marshy parts of the valleys at about 5000—7000 feet. They belong to a form which differs a little from Alpine and North European specimens, of which I have a large series. They come nearest on the upperside to some of those taken in Colorado which are known as *ochracea* and *inornata*, W. H. Edw., but are more spotted on the underside. They are slightly larger and darker in colour than those known as *cæca*, Stgr., from Turkestan; they are paler and about the same size as the average North European forms known as *isis*, and quite unlike the pale grey form known as *viluensis*, Mén., = *grisescens*, Christoph (Iris, vi, p. 87), which Herz took on the Vilui river (*cf.* Iris, xi, p. 249), and which I also have from the Verchojansk district taken by Czekanowsky, and in a larger and somewhat darker form from Kamtschatka as var. *mixturata*, Alph. Having recently written on the variations of this species in the *Entomologist's Record*, 1896, p. 228, I can only add, that when a large series (my own includes something like one hundred selected pairs from the Holarctic region) are brought together it is practically impossible to define exactly any of these varieties.

164. ? *C. pamphilus*, L.

This is recorded by Lederer as having been taken by Kindermann, but I can find no Altai specimens in Staudinger's collection.

165. *Triphysa phryne*, Pall.

Neither Herz on the Lena nor Dorries in Kentei seem to have found any form of *Triphysa*, but I have specimens from Grum-Grshimailo's collection taken at Krasnoyarsk, and at some place in Northern Siberia, the name of which I cannot decipher. Jacobson also found it common in the Upper Yenesei Valley. The name *Dohrnii* was given by Zeller to a single specimen, locality unknown, which had a whitish border to the wings, and there were a considerable number of specimens in Grum-Grshimailo's collection, taken in the Nan Shan Mountains and the province of Amdo, in which this character is well marked. The females of this form all show two conspicuous black spots on the upperside of the fore-wing, and in some cases have two small black spots above them, but not in line; on the underside the position of these spots is much better seen and is in all the specimens markedly different from those of typical *phryne* from Sarepta, which are in a regular curved series following the line of the outer margin. Four pairs, which were collected by Leder in some part of Northern Mongolia, or perhaps in the Irkut Valley, show these differences in a less marked degree, but I am disposed to separate them at least as a variety from *phryne*. There is also a form described by Erschoff as *albovenosa*, and figured in Rom. Mém. Sur. Lép. II, Pl. XVI, fig. 20, which he says was taken in the Amur Valley far east of Blagoveschenk, which appears to me only a variety of *phryne*, with the spots undeveloped. Staudinger in Rom. Mém. Sur. Lép., vi, p. 208, treats this name as synonym of *nervosa*, Mots., which he puts as probably a variety of *phryne*. *Nervosa* was described from Japan, but as no specimen of any *Triphysa* has reached Europe from Japan, so far as I know, this is probably a mistake. The only female specimen I have from the Amur has no ocelli above on either surface, and only faintly marked ones on the hind-wing below. It appears to me on the whole that there are two or three well-marked forms of this genus; *phryne* extending from Sarepta through the steppes and mountains of Western and Central Siberia to some unknown point, possibly in the longitude of Lake Baikal with a more or less marked variety *albovenosa*, Erschoff, vel. *nervosa*, Mots., from the Amur Valley; secondly, a form extending from Northern Mongolia southerly to the

province of Amdo, which may be called *Dohrnii*, Zell., but which can usually, if not always, be distinguished from *phryne* by the different position as well as the greater development of the four ocelli on the fore-wing. Lastly, there is a form found in the Kuruktagh near Korla, var. *striatula*, Stgr. (? MSS.), which is distinguished by pale longitudinal striations on the fore-wing of the male. This form seems by the position of the spots to belong to *phryne* rather than to *Dohrnii*.

166. *Carcharodus alceæ*, Esp.

I did not secure this species, but it is recorded by Lederer, and I have four specimens from Kenderlik taken by Ruckbeil. Haberhauer also found it at Saisan.

167. *Hesperia orbifer*, Hb.

I received two males of this species from Ongodai, taken by Messrs. Jacobson and Berezowsky. A dark var. known as *lugens*, Stgr., is recorded from the Kentei Mountains.

168. *H. tessellum*, O.

I found this common in the Tchuja Valley at 4000—5000 feet on July 22nd and 23rd in dry rocky places, and received others taken at the beginning of July by Jacobson. I found it also in the Bashkaus Valley.

169. *H. cribrellum*, Ev.

Found in the Tchuja Valley in the middle of June, and in the Bashkaus Valley at the end of July. I also received it from Ongodai. I have specimens from Eastern Mongolia taken by Leder, and Grum-Grshimailo took it at Amdo, and at Turgai in South-Western Siberia. Altai specimens are the typical form and not the darker one var. *obscurior*, Stgr., which is found in the Kentei Mountains and on the Amur.

170. *H. malvæ*, L.

Common at Biisk on June 4th, and at Ongodai and in the Tchuja Valley until the 18th up to 4000 feet, but I did not see it after the latter date.

171. *H. serratulæ*, Rbr.

I found this in the Tchuja Valley at from 3000—6000 feet in June, and have a single specimen taken at 7000 feet in the Tchuja Mountains on July 11th. I also found it in the Bashkaus Valley at the end of July. I do not

know how to distinguish between this species and the next except by the genitalia of the male (*cf.* Elwes and Edwards' Revision of Oriental *Hesperiidæ*, Trans. Zool. Soc. Lond., vol. xiv, part 4, 1897, p. 156; Pl. XXIII, figs. 24, 25, 25*a*).

172. *H. alveus*, Hubn.

This was very common at Ongodai from June 10th, but I have no specimens certainly belonging to this species from other localities in the Altai. According to Dr. Staudinger's identification of *serratulæ* and *alveus* I have transposed the names, what he calls *serratulæ* being my *alveus* and *vice-versâ*. It seems to me a very difficult question to decide which is right.

173. *H. centaureæ*, Rbr.

This was the only species of *Hesperia* which was at all common in the high Tchuja Mountains, where it occurred from the beginning of June at from 7000—8000 feet. I also took in the Bashkaus Valley at about 5000 feet, flying in marshy places near water, what appears to be this species, and received from Ongodai two or three specimens of what may be a variety of it with the white spots on both wings above much better developed. It was also taken by Leder in the East Sayansk Mountains, but is not recorded from Kentei.

174. *Thanaos tages*, L.

I only found this at one place in the Tchuja Valley at about 4000 feet on June 17th. The specimens do not differ from European ones.

175. *Pamphila palæmon*, Pall.

I did not take this myself, but received a few taken at Ongodai by Jacobson. These belong to the variety described by Christoph as *albiguttata*, which I have from Guberli in the South Ural, from Irkut, and from Kamtschatka. Though this variety appears to be fairly constant in the Altai, it is not so in the Ural, judging by Grum-Grshimailo's specimens. Some from Sutschan in Staudinger's collection also seem to be intermediate.

176. *P. silvius*, Knoch.

This was fairly common at Ongodai on June 13th, and I took it in the Tchuja Valley on June 18th, but did not see it afterwards.

177. *P. argyrostigma*, Ev.

I was very much pleased to find this interesting species, which has not previously been recorded from Western Siberia, common at Ongodai on June 13th, when the males were abundant, but I only got a single female. I found it in the Tchuja and Katuna Valleys from 3000 up to about 5000 feet. It flies very rapidly close to the ground in marshy spots and settles on damp sand or mud. It is apparently very common in North-East Tibet, as there were many specimens from Amdo in Grum-Grshimailo's collection. It also occurs in the East Sayansk and Apfelgebirge (Jablonnoi Mountains), where Dorries took it in 1896.

178. *Heteropterus morpheus*, Pall.

I found this only at one boggy spot by a river in the Bija Valley near Lake Teletskoi on August 2nd, when the species was much worn and nearly over. These examples have less markings on the upperside of the fore-wing than in Europe, and the yellow of the underside appears to be much less developed, but the specimens are not fresh enough to say whether this distinction is constant.

179. *Augiades sylvanus*, Esp.

Small specimens of this species, much worn, were taken near the Teletskoi Lake on July 31st.

180. *Adopæa lineola*, Ochs.

I only found this myself in the Bija Valley at about 1500 feet on August 3rd and 4th, but Berezowsky sent fresh specimens from Ongodai.

181. *Erynnis comma*, L.

I found this only in the Bashkaus Valley at 3000—5000 feet on July 24th and 30th, but judging from the specimens sent to me by Berezowsky and Jacobson, it is common at Ongodai. I see nothing in these specimens to distinguish them from European ones, though Alphéraky separates as var. *mixta* three specimens taken by him at 8000—9000 feet in Kuldja in July.

Explanation of Plates XI—XIV.

[*See explanation facing the* Plates.]

September 30, 1899.

XIII. *The Colour-relation between the pupæ of* Papilio machaon, Pieris napi *and many other species, and the surroundings of the larvæ preparing to pupate,* etc. By F. Merrifield, F.E.S., and Edward B. Poulton, M.A., F.R.S., etc., Hope Professor of Zoology in the University of Oxford.

[Read October 5th, 1898.]

A.—INTRODUCTORY. (F. Merrifield and E. B. Poulton.)

B.—EXPERIMENTS UPON THE PUPÆ OF *Papilio machaon.*

1. *Experiments upon the Summer Pupæ of* Papilio machaon. (F. M.)
2. *Results of the above Experiments.* (E. B. P.)
3. *Experiments upon the Winter Pupæ of* Papilio machaon. (F. M.)
4. *Results of the above Experiments.* (E. B. P.)
5. Mr. C. V. A. Peel's *Winter Pupæ of* Papilio machaon *described.* (E. B. P.)

C.—EXPERIMENTS UPON THE PUPÆ OF *Papilio podalirius.* (Cora B. Sanders and E. B. P.)

D.—EXPERIMENTS UPON THE PUPÆ OF *Pieris napi.*

1. *Experiments upon the Winter Pupæ of* Pieris napi. (F. M.)
2. *Results of the above Experiments.* (E. B. P.)

E.—EXPERIMENTS UPON THE PUPÆ OF *Pieris brassicæ.*

1. *Experiments upon the Winter Pupæ of* Pieris brassicæ. (F. M.)
2. *Results of the above Experiments.* (E. B. P.)
3. *Experiments upon the Winter Pupæ of* Pieris brassicæ. (E. B. P.)
4. *Experiments with conflicting colours upon the Winter Pupæ of* Pieris brassicæ. (E. B. P.)

F.—NOTES ON THE STRUGGLE FOR EXISTENCE IN THE LARVÆ OF *Pieris brassicæ.* (E. B. P.)

G.—EXPERIMENTS UPON THE PUPÆ OF *Pieris rapæ.*

1. *Experiments upon the Winter Pupæ of* Pieris rapæ. (F. M.)
2. *Results of the above Experiments.* (E. B. P.)

H.—EXPERIMENTS UPON THE PUPÆ OF *Vanessidæ*.

1. *Experiments upon the Pupæ of* Vanessa urticæ *and* Pyrameis cardui. (C. B. S. and E. B. P.)
2. *Experiments upon the Pupæ of* Vanessa io. (Mabel E. Notley, Florence A. Wright and E. B. P.)

I.—EXPERIMENTS AND OBSERVATIONS UPON THE SUSCEPTIBILITY OF CERTAIN LEPIDOPTEROUS LARVÆ AND PUPÆ TO THE COLOURS OF THEIR SURROUNDINGS. (A. H. Hamm and E. B. P.)

K.—OBSERVATIONS ON THE COLOUR-RELATION BETWEEN A COLEOPTEROUS SPECIES (*Cleonus sulcirostris*) AND ITS SURROUNDINGS. (W. Holland and E. B. P.)

L.—APPENDIX. THE QUALITY OF LIGHT REFLECTED FROM THE COLOURED AND OTHER BACK-GROUNDS EMPLOYED IN THE EXPERIMENTS RECORDED IN THE PRESENT MEMOIR. (Sir John Conroy, F.R.S., and E. B. P.)

A.—INTRODUCTORY.

In Prof. Poulton's paper in the Philosophical Transactions of 1887, vol. 178 B. pp. 311–441, "An Enquiry into the Cause and Extent of a Special Colour-relation between certain exposed Lepidopterous Pupæ and the Surfaces which immediately surround them," he recorded some experiments on the full-fed larvæ of *Papilio machaon* from which he inferred that this species was not susceptible to the colours of its surroundings, a conclusion which surprised him, having regard to the marked dimorphism of the pupæ [the larva not showing any corresponding dimorphism to which the different colours of the pupæ could be ascribed, as in the case of the geometrid genus *Ephyra* (Phil. Trans. *l. c.* p. 437)], and Prof. Poulton suggested that further experiments should be tried, more especially as he had had only eleven larvæ, of which two died. At the meeting at Cambridge in August last of the International Congress of Zoology M. Bordage of Réunion communicated a paper in which he expressed the opinion that the pupæ of the genus *Papilio* appeared to have lost any susceptibility to colour which they might at one time have possessed, but Mr. Trimen, your President, gave an instance to the contrary, and expressed the opinion that too few experiments had been made to warrant at present any conclusion on the subject.

Early in July last I happened to mention to Prof. Poulton that I had then a considerable number of larvæ of *P. machaon* which I had received from Germany, and at his suggestion I experimented on some of those I had left at this time, receiving much useful information from him personally as well as from the very full record of his experiments on other species, in the paper above referred to, and in his subsequent paper in the Transactions of this Society for 1892, pp. 293–487.

The experiment thus begun gave rise to many other experiments in which different species were employed. The results were in large part displayed and an account given of them at the meeting of this Society on October 5th, 1898 (Proc. Ent. Soc. Lond. 1898, pp. xxx—xxxi). Professor Poulton was at the meeting and also showed the results of some further experiments he had been making in 1898 (Proc. Ent. Soc. *l. c.* pp. xxxii—xxxiii). The same day I suggested to him that it would be useful to arrange the results of my experiments according to the standards of colour which he had already published, and construct fresh standards for the species with which he had experimented but little or not at all. He approved the suggestion and agreed to arrange the results accordingly, and also offered to include the results of the experiments he had recently made.

This memoir accordingly appears in our joint names. The name or initials of the worker who conducted the investigation will appear in the heading of each description. Professor Poulton is responsible for the new standards of comparison and the tabulation of all the pupæ. In arranging the pupæ, he allowed due weight to the description of my results so far as I had made one.

F. MERRIFIELD.

A few brief words are all that are necessary to form my introduction to our joint paper; inasmuch as Mr. Merrifield has fully explained the circumstances under which it came to be written. I was only too pleased to act upon his suggestion, and thus to combine the record of our investigations. It is more convenient in every way that there should be a single complete account instead of two less complete ones. The method adopted of placing the initials of the writer after the title of each Section he has communicated makes our individual responsibility perfectly clear.

A portion of my investigations were carried on jointly with Miss Cora B. Sanders, of Lady Margaret Hall, Oxford. These Sections are preceded by her name or initials as well as my own.

The experiments upon the colours of the pupæ of *Vanessa io* were carried on, under my direction, by Miss Mabel E. Notley and Miss Florence A. Wright, of Lady Margaret Hall. Their names are added to the title of the Section in which the experiments are described.

Some interesting observations of Mr. A. H. Hamm and Mr. W. Holland of the Hope Department of Zoology, Oxford, form in large part or entirely the subjects of two Sections to which their names have been added.

Sir John Conroy, F.R.S., very kindly helped me in determining the quality of the light reflected from the various backgrounds, and his name has been similarly added to the Appendix in which our results are described.

I wish also warmly to thank Mr. W. Holland and Mr. A. H. Hamm of the Hope Department for their most efficient help in many parts of the work; Mr. C. V. A. Peel for kindly lending specimens which have been described, and Mr. Arthur Sidgwick and Mr. Nicholson for drawing my attention to interesting observations made by them which are recorded in Section I.

E. B. Poulton.

B.—EXPERIMENTS UPON THE PUPÆ OF *Papilio machaon.*

1. Experiments upon the Summer Pupæ of *Papilio machaon.* (F. M.)

I am generally away from home from nine or ten o'clock until five or later, and therefore my opportunities for taking a larva just at the right moment, when it has done feeding and before its sensitiveness to colour has begun, are imperfect. But I was able to select fourteen larvæ, which seemed to have arrived at the full-fed stage, and I prepared a few glass cylinders of about 6 inches in height and mostly $3\frac{1}{4}$ inches in diameter, though some were an inch or two wider, which I placed in flower-pots nearly filled with earth. They were in two divisions, viz. (1) furnished with dark sticks, and (2) furnished with light sticks. Division (1) had about six dark brown sticks of from $\frac{1}{4}$ to $\frac{3}{8}$ of an inch in diameter taken from an old

faggot-stack, and had a roof of black net. Division (2) had the same number of peeled and therefore nearly white willow slips of the same size, and had a roof of white muslin. The sticks were secured by driving them into the earth, and the cylinders were in both cases exposed to the same amount of light, *i. e.* close to a rather large window, but on most days moved from the W.N.W. to the E.S.E. side of the house, and back, to avoid hot sunshine. As larvæ, where crowded, have been found to affect each other's pupal colouring (Phil. Trans. 1887, *l. c.* Ent. Trans. 1892, *l. c.*), only two or three were placed in each cylinder.

I exhibit the eleven pupæ or pupa-cases, which were obtained under these conditions. As the dark pigment resides in the pupa-case, it is easy to see on examining this whether the pupa was a green one or not, as, if the pupa was a green one, the pupa-case is practically free from pigment, though sometimes stained in places by the meconium, whereas if the pupa was bone-coloured the case is much darkened by brown or black markings.

It was obviously desirable to ascertain what was the proportion of *grey* * and *yellow-green* pupæ in my stock, and on going through the whole remainder of them, 145 in number, I found that 76 might be described as of the former and 69 of the latter or yellow-green form. Many of these however were of intermediate colouring, and it was not easy to classify them. Seven of the 145 had pupated on the green carrot-tops on which the larvæ had been fed; of these six were *yellow-green*, one was *grey*.

This made a very strong case for susceptibility, but it was not conclusive, and I determined to try the experiment on a larger scale with the second brood.

Before describing in detail the results of this and other experiments it is necessary to tabulate the colours which the pupa of *P. machaon* is known to assume, so as to have a standard of comparison. The following table and description were made by Prof. Poulton on May 2nd, 1899, after carefully comparing the whole of my pupæ together with a number belonging to Mr. C. V. A. Peel.

2. Results of the above Experiments. (E. B. P.)

There is a distinct dimorphism in the pupæ of *Papilio machaon*, and the intermediate forms are very rare as

* See note on page 374.

compared with the extreme. The two forms may be classified as (1) *yellow-green*, and (2) *grey*.* The former have a yellow ground-colour with deep green markings, the latter a bone-coloured ground with dark purplish brown, and in places black markings. With few exceptions the dark markings of the *grey* forms correspond in position with the green markings of the *yellow-green* forms, the chief exceptions being on the surface of the pupal wings, where the green forms a more continuous area, less interrupted by the yellow ground-colour than the dark marking is by bone-colour.

This correspondence in position becomes all the more interesting and remarkable when it is remembered that the two markings are entirely different in constitution, origin, and even in the pupal layers in which they are respectively situated, the green pigment being relatively unstable, probably a modified form of chlorophyll derived from the food-plant, and situated in the deeper laminated layers of the pupal cuticle, the dark pigment being very stable (remaining permanently in the empty pupal case), solely due to the metabolic activity of the animal organism, and confined to the thick layer of cuticle which lies above the laminated layer and forms the outermost part of the pupal shell. (See Poulton, Proc. Roy. Soc. 1885, Vol. xxxviii, p. 279, in which however the laminated layer is erroneously distinguished from the "true cuticle.")

We can again classify the (1) *yellow-green* and (2) *grey forms* as (*a*) *dark* and (*b*) *light*, thus :—

1. *Yellow-green* { *a. Light forms.* / *b. Dark* „
2. *Grey* { *a. Light* „ / *b. Dark* „

* I formerly spoke of the darker pupæ as *brown* (Phil. Trans. 1887, *l. c.* p. 407), a description which is clearly incorrect. Mr. Merrifield has introduced the appropriate term "bone-coloured," which accurately expresses the appearance of the ground-colour of these pupæ as well as those of the corresponding forms of *Pieris napi* and *P. rapæ*. The whole appearance of these pupæ is however due to the combined impression made by the pale ground-colour and the dark markings, and I think that "*grey*" expresses this effect as a whole more truly than any other word ; although there are pupæ in which the markings are so inconspicuous that the effect seen is that of the ground-colour alone.

E. B. P.

A *light yellow-green* form (1 *a*) is bright yellow over the dorsal surface slightly mottled with green on the sides, this colour becoming distinct round the spiracles and forming a spiracular streak interrupted between the abdominal segments. At the posterior extremity of the pupa this green streak is continued on to the sides of the anal spine, and in the more strongly marked pupæ of this degree the whole of the spine is green. The green mottlings are rather more distinct upon the abdominal segments below the spiracular band than they are above it, and have a more pronounced longitudinal arrangement. The dorsal region of the thorax is also more or less mottled with green which becomes concentrated to form a distinct apical patch on the mesothoracic median spine. The wings, limbs, antennæ, and head are deep green, the latter being, in the palest pupæ, the most strongly coloured part of the whole surface.

In the more deeply coloured of the light forms (1 *a*) the mottled green tends to spread backwards from the mesothoracic spine forming a broad indistinct greenish band.

In the *dark yellow-green* pupæ (1 *b*), further development and coalescence of the mottlings transform this dorsal band into deep green. It occupies the whole dorsal area between the subdorsal rows of small tubercles. Below, the green of the spiracular stripe,—continuous in pupæ of this degree —spreads upwards and invades the yellow ground-colour leaving only a yellow lateral band, sharply defined above where it terminates at the level of the subdorsal tubercles, while below it gradually passes into the invading green. Anteriorly this yellow band terminates below the mesothoracic spine. The dorsal green band is palest (yellowest) in its median part and in the posterior half of its length, in front of the caudal spine, the dorsal surface of which is green. The band is also interrupted in the region of the metathorax by a yellow patch, traversed by a green median line.

The *light grey* forms (2 *a*) resemble the *light yellow-green* (1 *a*), substituting bone-colour for yellow, and dark purplish-brown for green, allowing of course for the greater contrast between ground-colour and marking which is thus brought about, and for the difference over the wings which has been already alluded to.

The *dark grey* forms (2 *b*), by making a similar substitu-

tion, resemble the *dark yellow-green* (1 *b*). The purplish-brown is increased in extent as is the green of the corresponding form (1 *b*), the dark dorsal band becoming a specially prominent feature which contrasts strongly with the appearance presented by the *light grey* pupæ (2 *a*).

I will now apply the arrangement suggested above to the results of Mr. Merrifield's experiment. The pupæ were compared on May 2nd, 1899. Three of the 14 larvæ died without pupating. Of the remaining 11, 6 had been placed in the cylinders furnished with dark sticks; 5 of these pupated on the dark sticks. In comparing these summer pupæ and putting each in its place in the scale of colour, great assistance was derived from Mr. Merrifield's descriptions made in 1898, when more of the pupæ were alive and those which were dead had changed less extensively.

All the pupæ attached to dark sticks were clearly *grey* forms (1), except one (probably dead), which was intermediate between *yellow-green* and *grey*, having a bone-coloured ground with many of the markings, especially upon the wings, greenish instead of brown. Of the remaining 4 pupæ, 1 had emerged in 1898, and was intermediate between *dark* and *light grey* (2 *a*, *b*) or a lightish *dark grey* (2 *b*); 1, still alive, was also a (2 *a*, *b*); 2, dead, were certainly *grey*, and probably *dark grey* (2 *b*).

The sixth pupa was dead and much discoloured, but from Mr. Merrifield's description in 1898, it had evidently been a *yellow-green* form (1 *a*) or (1 *b*): "The larva had imperfectly attached itself to a dark stick and had then, before pupating, fallen on the earth which, being moist, was of a dark colour. It had there formed a yellow-green pupa, somewhat misshapen."

Of the 5 placed in light surroundings, 4 were attached to shaved white sticks.

Two were dead, but both were evidently *yellow-green*, one probably a *light* and the other a *dark* form of this degree, (1 *a*) and (1 *b*).

Two had emerged, but both had been *yellow-green* and one certainly a *light* form (1 *a*), the other probably *dark* (1 *b*).

The fifth pupa, attached to the white muslin top, had also emerged. This pupa was an exception, being a distinct *light grey* form (2 *a*).

3. Experiments upon the Winter Pupæ of *Papilio machaon*. (F. M.)

In order to continue the experiments, begun upon the summer pupæ, I obtained from Germany, from the 31st of August to the 2nd of September, 1898, about 150 more larvæ, most of them young.

Apparatus.

In order to cope to some extent with the difficulty I had in taking the larvæ just at the right moment, owing to my long daily absences from home, I provided two special breeding-cages. These were made of $\frac{5}{16}$ inch deal, each in two compartments. Thus there were four compartments the external dimensions of which were 16 inches in height, 12 inches in depth from front to back, and 8 inches in width. The front of each cage was a sheet of glass, about 14 inches in width and 12 inches in height, as it started at 3 inches from the bottom; it was vertically divided down the middle by the thin deal partition between the two compartments. The backs were of perforated zinc, corresponding in size with the glass fronts, and the outer sides were of deal containing the doors. The tops were open, but covered with woven material as stated below. The framework of the top, and generally, was about an inch wide, and there were many angles more or less shady, vertical, and horizontal, where the parts of the framework met at right angles.

The compartments were covered internally as follows:—The whole of the interior, except the glass front and the perforated zinc backs, was covered with tissue-paper; black in the black compartment, white in the white compartment, green in the green compartment, and about one-half orange and one-half yellow (the division being vertical) in the orange-yellow compartment. The perforated zinc backs and the open tops were covered with woven material, viz. the black compartment with double black muslin (covered with a slate), the white compartment with double white calico, the green compartment with threefold yellow-green art muslin (fourfold on the top except for the *brassicæ* experiment hereafter described when it was twofold), the orange-yellow compartment with orange-yellow leno; this leno, instead of paper, being also used in some of the angles of the framework.

The fronts of the cages were placed within a few inches

of a second-floor window about 3 feet wide and 6 feet high, they were facing the W.N.W. and looking into an open country, and were often screened by a muslin window-blind during hot sunshine. No direct light from the sky reached any part of the interior except a small part of the bottom and of the sides.

Much orange light came through the roof of the first compartment, very little greenish light through the top of the green compartment, and much white light through the top of the white compartment; in addition to white direct light, much was reflected from the coloured interior of these three compartments, but the black compartment was very dark inside except the part close to the glass front.

The effect was that the black compartment was for the most part very dark; the white, green and orange-yellow compartments much lighter, as the tops transmitted much light, and the colours were such as to reflect a great deal of light. In the green compartment, however, while covered with the fourfold art muslin, very little light came through the top. In all cases a little light came in through the chinks of the doors, and a very little through the draped perforated zinc at the back. In all four compartments there were shady regions in the angles of the framework, and I found so many of the larvæ had a disposition to select these shadier regions for pupating, where of course the coloured light would operate less strongly, that I found it expedient to transfer them, when I could do so in time, to receptacles where they were exposed to stronger light. For these purposes I prepared glass cylinders of the dimensions before mentioned, covered at the bottom and for about two-thirds of the outside circumference with paper of the appropriate colour, leaving clear the one-third next the window, and the tops being usually covered with paper of the same colour, but sometimes with clear glass. In this way I fitted up cylinders for the following colours: black, white, green, yellow, orange, Dutch "gold," all provided with sticks covered with paper of the corresponding colour. These cylinders were placed on thin pieces of wood or cork carpet with tintacks driven through the bottom, forming spikes on which the coloured sticks were fixed. The bottoms, as well as about two-thirds of the circumference opposite the light, and the tops, were covered with single or double paper of the proper colour

secured by three ties of thread and on the tops by a sheet of clear glass. In the case however of the dark sticks the bottom was of dark cork carpet, and these cylinders were clear all round, with a sheet of clear glass on the top.

In order not to crowd the larvæ, it was my practice to transfer them, when spun up on the sticks, to wide-mouthed Bordeaux plum-bottles of clear glass having a greenish hue, of about the same size as the cylinders, but fitted for two-thirds of their circumference with coloured paper inside instead of outside, and I sometimes transferred larvæ direct from the compartments of the breeding-cage to these bottles, as pupating against glass in front of coloured paper did not appear to me to be the same thing in effect as pupating against the coloured paper. In these bottles the coloured paper was inside, and therefore nearer the larvæ than in the cylinders. The sticks in the bottles could not be prevented from shifting as heavy larvæ crawled over them, and the larvæ appeared to dislike this, and to be more restless and slower in pupating than when the sticks were fixed.

The cylinders and bottles were placed within a few inches of the window above referred to, or of another window having the same aspect, but only about 4 feet high by 3 feet wide. As the objects in both were necessarily near the light, and, except in those given over to black, light, coloured or uncoloured, was admitted all round and by the tops, the larvæ in these were as a rule exposed to much more light, both direct and reflected, than those in the breeding-cages.

I also lined a clear glass saucer with green carrot-tops and placed it in a second saucer with green carrot-tops, among which some larvæ pupated, the surface being covered with a sheet of clear glass.

Most of the *machaon* larvæ in the cylinders or bottles spun up against the coloured sticks provided for them, but in a few cases they spun either against the glass where it was covered outside by coloured paper or against the clear glass front of the cylinder or bottle. In these cases I always classified the pupæ as "orange through glass" or as "orange on glass," the pupæ in the latter case being often not near the special colour, although the larvæ in moving about had probably been at times exposed to the colour influence. If, however, these larvæ follow the same laws as those of *Vanessa urticæ*, they are only sensitive when

at rest on the surface upon which they will afterwards pupate. (Phil. Trans. 1887, *l. c.*) Allowance must be made, on the other hand, for the possible disturbance of larvæ after they have entered the susceptible phase.

Colours of the different surroundings.

Besides these black or coloured cylinders or bottles I had clear glass cylinders or bottles supplied with the other objects enumerated below for the pupæ to attach themselves to, some also being shut up in absolute darkness. The result was that I obtained several classes of pupæ, viz. from—

1. Black paper (*a*) in strong light, (*b*) in more or less shade.
2. Dark sticks from old faggots or freshly-cut dark alder.
3. Dirty white paint, being that of a breeding-cage ten years old.
4. Darkness.
5. Light-coloured dry stems (dead stems of *Epilobium hirsutum*).
6. Dead reeds, light brown in colour.
7. Dull green reeds.
8. Bright golden yellow oatstraw.
9. Dutch "gold," with embossed pattern.
10. Green paper (*a*) in strong light, (*b*) in more or less shade.
11. Green carrot-tops.
12. White paper (*a*) in strong light, (*b*) in more or less shade.
13. Yellow paper (*a*) in strong light, (*b*) in more or less shade.
14. Yellow orange leno (*a*) in strong light, (*b*) in shady corner.
15. Orange paper (*a*) in strong light, (*b*) in shady corner.

Some of these had the further differences which are indicated in the exhibit and described in the classification of the pupæ.

I exhibit the results of all these exposures, 72 individuals. All of these may repay study; the details will be described by Prof. Poulton. I could perhaps have made the Exhibition Case more attractive as well as more effective for purposes of comparison had I detached the pupæ from the

coloured backgrounds that in most cases adhered to them; but I thought it eminently desirable that the exhibition should supply its own evidence, so as to enable all who see it to draw, independently, their own conclusions. I supplement it, however, with all the other pupæ obtained in the course of my experiments. As general results it will be enough perhaps here to say that the 16 pupæ of *P. machaon* on the black paper-covered sticks and on dark natural sticks are all *grey*, with the exception of one, which is *yellow-green;* those that were in a strong light are very dark; that of the 4 on carrot-tops all are *yellow-green;* that of the 9 on white paper 1 is *grey* and the other 8 all *yellow-green* or *light grey* with a greenish tinge; that of the 6 on yellow paper 2 are *greenish-grey* and the other 4 *yellow-green;* and that of the 4 on orange paper all are *yellow-green.*

These results seem to me clearly to prove the susceptibility of *P. machaon.*

The pupæ of *P. machaon* on the other coloured surroundings employed did not give such definite results; particulars are given in the next section.

4. Results of the above Experiments. (E. B. P.)

The pupæ were compared May 2nd, 1899.

The various conditions to which the larvæ of *P. machaon* were subjected will be considered in the same order as that adopted by Mr. Merrifield on p. 380.

(1) black paper. (*a*) *In strong light.*

2 pupæ, fixed to black tissue-paper, were very *dark grey* (2 *b*).

1 pupa, fixed to black tissue-paper, was intermediate between *dark* and *light grey* (2 *a*, *b*).

1 pupa, fixed to black tissue-paper, had emerged, and was *grey*, probably similar to the last.

1 pupa, fixed to black net, was dead, and was *grey*, probably similar to the last.

5

(*b*) *In fair light.*

The single pupa (dead and discoloured) was fixed to black net. It was impossible to place it with any certainty, but the appearance suggested that it had been *yellow-green.*

(*c*) *In a dark corner.*

All the pupæ were fixed to the black paper.
1 pupa was very *dark grey* (2 *b*).
3 pupæ (one dead) were *grey*, probably *light* (2 *a*).
1 pupa was *grey*, probably intermediate between *dark* and *light* (2 *a*, *b*).

5

(2) DARK STICKS (ONE MUCH LIGHTER THAN THE REST).

All the pupæ were attached to the sticks.
2 pupæ were *dark grey*, (2 *b*) one very dark.
1 pupa, on the lightest bark, was *light grey* (2 *a*).
2 pupæ (dead) were *grey*, probably *light* (2 *a*).
1 pupa (dead) and much altered, was probably the *yellow-green* form (1) described by Mr. Merrifield on p. 381.

6

(3) DIRTY WHITE PAINT.

1 pupa, fixed to the painted surface, was intermediate between *dark* and *light grey* (2 *a*, *b*), but with some tendency, in the possession of a greenish tinge, towards the *yellow-green* form (1).
1 pupa, fixed to the painted surface, was dead and changed in colour, but it had probably been *yellow-green* (1).

2

(4) DARKNESS.

2 pupæ were intermediate between *dark* and *light yellow-green* (1 *a*, *b*).
1 pupa (dead) had altered in colour, but had been a *light* form of either (1) or (2).
1 pupa was probably *light yellow-green* (1 *a*), but had darkened, apparently preparatory to emergence.
1 pupa was intermediate between (1) and (2) and also intermediate between dark and light (*a*, *b*).

5

The absence of strong pigmentation, and the tendency towards *yellow-green* rather than *grey*, were the marked results of darkness, so far as these 5 pupæ are concerned.

(5) LIGHT-COLOURED DRY STEMS (*Epilobium hirsutum*).

1 pupa (dead and discoloured) was probably *light grey* (2 *a*).
1 pupa (dead, or perhaps discoloured, preparatory to emergence) was probably a *yellow-green* form (1).

2

(6) DEAD, LIGHT BROWN REEDS.

Both pupæ had become greatly discoloured, and one at least was dead. The position of one was uncertain; the other had apparently been a *yellow-green* form (1).

(7) DULL GREEN REEDS.

1 pupa, fixed to reed, was intermediate between *dark* and *light grey* (2 *a*, *b*).
1 pupa, fixed to reed, was intermediate between *grey* and *yellow-green* (1, 2).

2

(8) OATSTRAW (BRIGHT GOLDEN YELLOW).

1 pupa, fixed to straw, was a *light grey* form (2 *a*), with some tendency towards *yellow-green*.
1 pupa, fixed to straw (dead and discoloured) was of uncertain position, but clearly it had not been highly pigmented.

2

(9) DUTCH "GOLD" (EMBOSSED).

1 pupa, fixed to "gold," was intermediate between *dark* and *light grey* (2 *a*, *b*), with a slight tendency towards the *yellow-green* form (1).
1 pupa, fixed to "gold" (dead), was intermediate between *dark* and *light yellow-green* (1 *a*, *b*).

2

(10) GREEN PAPER. (*a*) *In strong light.*

1 pupa was *dark yellow-green* (1 *b*).
1 pupa was *light grey* (2 *a*).
1 pupa was dead and of uncertain position, but probably it had never been strongly pigmented.

3

(*b*) *In good light.*

The single pupa was dead and discoloured, and its position uncertain. It was obvious however that it had not been strongly pigmented.

(*c*) *In fair light.*

1 pupa was intermediate between *light yellow-green* and *light grey* (1 *a*, 2 *a*).
1 pupa (dead or emerging) was probably a *yellow-green* form (1).

2

(*d*) *In shady corner.*

1 pupa was *light grey* (2 *a*).
1 pupa was intermediate between *light* and *dark grey* (2 *a*, *b*).

2

(*e*) *Fixed to glass near the green paper.*

The single pupa was dead, and so discoloured that it could not be placed.

Hence green paper is far less powerful than yellow or orange paper (Nos. 13, 14, 15), or the natural green of chlorophyll (No. 11) in the production of green pupæ of this species, thus agreeing with the results already obtained in the case of other species (Phil. Trans. 1887, and Trans. Ent. Soc. 1892, *l. c.*). It is noteworthy that the most shaded part of the green surface produced the strongest tendency towards *grey* forms.

(11) GREEN CARROT-TOPS.

1 pupa was intermediate between *dark* and *light yellow-green* (1 *a*, *b*).
3 pupæ (dead or emerging) were *yellow-green*, probably of the same shade as the above (1 *a*, *b*).

4

(12) WHITE PAPER. (*a*) *In strong light.*

4 pupæ were *light yellow-green* (1 *a*), one of them with a tendency towards *grey* (2), and one very remarkable in possessing an almost *white* ground.
1 pupa was intermediate between *light* and *dark yellow-green* (1 *a*, *b*).

1 pupa was discoloured, but had probably been intermediate between a *light* and *dark grey* (2 *a*, *b*).

6

The form with white ground perhaps indicates some special influence of the surroundings in the direction of producing a peculiarly close resemblance; but more experiments are needed in order to render it certain that the case was not that of a rare individual peculiarity.

(*b*) *In fair light.*

1 pupa was intermediate between *light* and *dark yellow-green* (1 *a*, *b*).
1 pupa was *light yellow-green* (1 *a*), with a tendency towards bone-colour in the ground (2).

2

(*c*) *In dark corner.*

The single pupa was discoloured, but was probably *light yellow-green* (1 *a*), with some tendency towards *grey* (2).

(13) YELLOW PAPER. (*a*) *In strong light.*

1 pupa was *dark yellow-green* (1 *b*).
3 pupæ were *yellow-green* (1), discoloured, but probably *light* (1 *a*), or intermediate between *light* and *dark* (1 *a*, *b*).
2 pupæ were *light yellow-green* (1 *a*), with some tendency towards *grey*.

6

(*b*) *Through glass.*

The single pupa was dead, and had entirely blackened.

(*c*) *On glass.*

The single pupa was discoloured, but was probably *yellow-green*, and certainly had not been highly pigmented.

(14) YELLOW-ORANGE LENO.

This label could not be found as distinct from the *yellow* (13) and *orange* (14); or I may have overlooked it. The results are certainly included in one or more of the sub-divisions of (13) or (14), inasmuch as the total number of the pupæ examined is 72,—the number given by Mr. Merrifield.

(15) ORANGE PAPER. (*a*) *In strong light.*

3 pupæ were *light yellow-green* (1 *a*).
1 pupa was *dark yellow-green* (1 *b*).
4

(*b*) *Through glass.*

The single pupa was dead or emerging, but appeared to have been intermediate between *dark* and *light grey* (2 *a*, *b*).

(*c*) *In shady corner.*

2 pupæ were *light yellow-green* (1 *a*).
1 pupa was *light grey* (2 *a*).
3

As Mr. Merrifield has stated on p. 381, the examination of these pupæ seems "clearly to prove the susceptibility of *P. machaon*." At the same time there was one unsatisfactory point in the evidence, viz. the extremely unhealthy condition of the pupæ. A large solitary ichneumon began to emerge from the pupæ in the autumn of 1898, soon after the date at which Mr. Merrifield showed them before this Society (October 5th, 1898). At intervals they continued to emerge until the early summer; and soon after my examination was made on May 2nd, 1899, they came out suddenly in large numbers. The ichneumons almost invariably gnawed a hole in the pupal wing, in order to escape. The whole batch produced very few butterflies.

It was unfortunate that press of work prevented me from comparing the pupæ until so late, when the discoloration of many of them had proceeded so far; but under any circumstances it was much to be desired that the susceptibility of undoubtedly healthy pupæ should be tested. Such a test I have fortunately been able to apply, and the result confirms Mr. Merrifield's conclusion in the most complete and convincing manner, as may be seen from the succeeding section.

5. MR. C. V. A. PEEL'S WINTER PUPÆ OF *Papilio machaon* DESCRIBED. (E. B. P.)

Through the kindness of Mr. Peel I have been able to compare a fine set of very healthy pupæ from Wicken Fen. The pupæ were in part attached to green reeds; in

part to the wood (somewhat darkened by age), and in part to the perforated zinc of two ordinary rectangular breeding-cages. It is clear that the two latter sets of pupæ had been formed from captured larvæ, while the set attached to reeds may have been, in part at least, found so attached in the open. Mr. Peel is not sure upon the point; but the fact that reeds, and reeds only, have been selected is in favour of this interpretation. The majority of the pupæ have now emerged successfully, and nearly all of those that remain are still healthy. Very few have died. The entire absence of parasites in this set of larvæ, as compared with their excessive abundance in Mr. Merrifield's continental individuals is of high interest, and suggests the same conclusion as that at which I arrived last year in breeding large numbers of Continental and English larvæ of *Vanessa urticæ*, viz. that the greater abundance of birds in this country may, by destroying parasites, compensate for their direct attacks on the species of Lepidoptera (see Report of British Association, 1898, Section D). I will now give the results of the examination which was made on May 3rd, 1899.

14 *pupæ attached to reeds.*

Thirteen pupæ were distinct *light yellow-green* (1 *a*). Of these 2 were fixed at some distance from each other on the same reed, while 10 were on separate reeds. Just below the thirteenth pupa was fixed the single exception a *dark grey* pupa (2 *b*).

19 *pupæ upon wood or zinc.*

In the breeding-cage which contained the reeds, one *dark grey* (2 *b*) pupa was lying loose upon the floor, and another of the same kind (2 *b*) was attached to the zinc.

In another breeding-cage 5 pupæ were attached to the zinc, in a curved line, near together. From above downwards their arrangement was—

2 pupæ intermediate between *dark* and *light grey* (2 *a*, *b*).
1 pupa *dark grey* (2 *b*).
1 „ again intermediate (2 *a*, *b*).
1 „ *light grey* (2 *a*).

Thus the central pupa was darkest, as though some influence had been exerted by the neighbouring larvæ or pupæ (as is so markedly the case in *Vanessa*).

Above these 5 pupæ, on the wooden roof, were 3 pupæ, two close together and one near them in the corner. All were *light grey* (2 *a*).

At the opposite end of the cage 3 pupæ were scattered over the zinc, one being intermediate between *dark* and *light grey* (2 *a*, *b*), two, *dark grey* (2 *b*).

On the wooden roof over them was a compact group of 5 pupæ, all intermediate between *dark* and *light grey* (2 *a*, *b*); while a single pupa loose on the floor was also intermediate (2 *a*, *b*).

Thus there was not a single exception among the pupæ on the zinc and wood. Furthermore those fixed to the latter were on the whole lighter than those fixed to the darker zinc. The singular completeness of the result is best shown in a tabular form as follows:—

	Yellow-green (1)		Grey (2)			
	Light (*a*)	Dark (*b*)	Light (*a*)		Dark (*b*)	
Attached to green reeds	13	—	—		1	=14
			Intermediate.			
Attached to wood of cage	—	—	3	5	—	= 8
Lying loose on wooden floor (more in shade than roof and sides, and with dark débris scattered over it)	—	—	—	1	1	= 2
Attached to zinc	—	—	1	4	4	= 9
						33

It is unnecessary to examine these data further. It is obvious on an inspection of the above table that there is only a single exception to the complete susceptibility of the pupæ.

The much greater susceptibility of this set of pupæ as compared with Mr. Merrifield's considered as a whole, and with the few upon which I experimented in 1886 (Phil. Trans. 1887, *l. c.* p. 406), is probably due to their more healthy and vigorous condition, and perhaps in part to some of the results having been obtained under normal conditions (if it is admitted that most of the green pupæ were formed in the open). The larvæ are not gregarious, so there is no justification for assuming a family tendency towards susceptibility on the part of the set as a whole.

Local differences in susceptibility are of course possible, and an enquiry directed along this line might lead to results of high interest.

It is a great pleasure to me to see this species, upon which so much doubt has been thrown—in the first place in the discussion which followed Mr. T. W. Wood's communication to this Society in 1867 (Proc. pp. xcix—ci), and nineteen years later as the results of my experiments—now finally proved beyond doubt to be susceptible to the colours of its environment. This result, which we owe to Mr. Merrifield, is a further warning against the errors into which we are liable to be led by relying, as Mr. Bond did (in the 1867 discussion), upon a general impression gathered from a wide experience not specially directed towards the solution of the problem, as I did, upon an insufficient number of individuals subjected to experiment.

C.—EXPERIMENTS UPON THE PUPÆ OF *Papilio podalirius.* (Cora B. Sanders and E. B. P.)

Five full-fed larvæ of this species were found by us in Switzerland, between Visp and Stalden, on July 22nd, 1898. They were all, except one, of the usual yellow-striped green form. The single exception was brownish-green with many red spots somewhat similar to those which occur upon certain forms of the larvæ of *Smerinthus ocellatus* and *S. populi.* It is possible that the darkened ground colour was due to changes preparatory to pupation, or perhaps to ill-health, as the larva died without pupating. Two of the larvæ were placed in a white muslin bag and offered green reeds together with the green twigs and leaves of the food-plant: three were placed in a black net bag, and provided with dark brown branches, as well as the food-plant. In a few days four of them pupated, one being fixed to the white muslin and three to the black net.

It was immediately seen that the latter were far darker than the former. A careful comparison was made on May 3rd, 1899.

The pupa which had been fixed to white muslin was a pale dull orange tint, especially dull over the wings. Of the other three which had been fixed to black net, one was also dull orange but of a distinctly darker shade,

while the remaining two were much darker still, being of a purplish-brown deepest in tint over the wings.

These small numbers are not sufficient to prove the susceptibility of this species; but they render such susceptibility probable. It is to be hoped that larger and more varied experiments will be made by those who have the opportunity of obtaining considerable numbers of the larvæ of *P. podalirius*.

D.—EXPERIMENTS UPON THE PUPÆ OF *Pieris napi*.

1. Experiments upon the Winter Pupæ of *Pieris napi*. (F. M.)

I exhibited to this Society on November 2nd, 1892 (Proceedings 1892, p. xxx), some pupæ of *P. napi* showing that the species was susceptible. In this present year I was experimenting on the species for other purposes, and determined to avail myself of the apparatus I had to provide for experiments on the coloration of pupæ of *P. machaon*. Mr. Harwood supplied me in the early part of August with a number of females captured in the vicinity of Colchester, and from them I obtained several hundred eggs on watercress, on which I fed the larvæ till about their last stage when that food was largely supplemented and finally replaced by cabbage. These when approaching pupation were exposed to the same colour influences as the *machaon* larvæ had been (substituting green cabbage-leaves for carrot-tops), and to the following in addition (16) planed deal in shade, (17) planed deal in light.

They seemed very unwilling to pupate on orange (except on the glass in front of the orange paper), so I shut up some in (18) a threefold yellow-orange leno cylindrical bag with single leno on the top, and orange paper outside two-thirds of the circumference, and here they were obliged to pupate.

In this species and in *P. brassicæ* my results are too numerous for me to show the whole in the Exhibition Case; but I have brought with me in glass-bottomed boxes, so that they can be seen, all the pupæ of both species which are not thus displayed (in the Exhibition Case), duly classified. There are in all about 340 pupæ of *P. napi*.

About 80 of the *napi* not in the general Exhibition Case are in a second Exhibition Case under the following circumstances. I had an old breeding-cage (somewhat resembling those previously described, but a little smaller) in two compartments with a glass roof over both; one of these was lined with black and had its glass top covered with double black tissue-paper, nearly opaque; the other was lined partly with orange paper, and partly with yellow paper or yellow-orange leno, and the glass top was covered with three-fold orange leno, transmitting much orange light. Finding that a number pupated on the glass roof, I succeeded in detaching the plate of glass from the roof and mounting it for exhibition in a second case. It will be seen that on the black side there are 34 pupæ all bone-coloured and nearly all much spotted with dark; on the orange yellow side 46 pupæ, all green except 4 which are bone-coloured, though with a yellowish tinge, and nearly all the 46 practically unspotted.

I think this second Exhibition Case, in which the pupæ have arranged themselves, affords a very effective demonstration of the sensitiveness of this species.

The following section will contain a detailed statement of results by Prof. Poulton. Here it will be sufficient in reference to the first Exhibition Case to point to the contrast between the 10 on black paper or the 8 on black or dark sticks, all of which are dusky, with much black spotting, and the 19 on yellow or orange paper all of which, with one exception, are green, to the 12 on or near cabbage-leaves, many being attached to the glass bottle, most of which are green, and to the varying colour of those in darkness; the 8 on Dutch gold, the 7 on planed deal, the 8 on green and the 6 on white paper being nearly all bone-coloured, and most of them spotless or nearly so. These results clearly prove the high susceptibility of the pupa.

All the four species experimented on by me, in preparing to pupate vary in colour according to their surroundings, and I do not see any room to doubt, when the 16 pupæ of *machaon* on black paper or dark sticks are compared with the 4 on green carrot-tops, or when the 18 pupæ of *napi* on black paper or dark sticks are compared with the 12 which pupated on or near cabbage-leaves, that the adaptation must be in many cases protective.

2. Results of the above Experiments. (E. B. P.)

The pupæ of *Pieris napi* were compared on January 2nd, 1899, with a view to the construction of a standard table.

As compared with the allied *P. rapæ*, the dimorphism of the ground-colour is far more marked. Furthermore, the ground is almost invariably restricted to bone-colour or green in *P. napi*, whereas many different shades are common in *P. rapæ*. Even in pupæ with the darkest markings the bone-coloured ground is far less obscured by generally distributed pigment in *napi* than it is in *rapæ*. There is also in the former a marked dimorphism in the arrangement of the black markings, which show characteristic differences even when present in similar amounts in the two forms—bone-coloured and green. Thus the bone-coloured forms, however pale, almost always possess a distinct black patch (made up of two or three spots or short lines) in the centre of the fore wing. This character, which I call the "wing-mark," is either wanting or far less developed in the green forms, even when more richly pigmented in other parts of the surface.

Another difference is the far greater irritability of the pupæ of *P. napi*. A slight stimulus, such as light breath, would almost always cause active movements, when the more stolid pupæ of *P. rapæ* remained quiescent. This observation, which certainly held at the time the examination was made, may perhaps have been due to differences in the degree of development then reached by the two species.

The forms of the two pupæ are almost alike, and as each varies considerably, it is very difficult to distinguish them with certainty by this means; but the above-mentioned tests enabled me easily to pick out two pupæ of *P. rapæ*, which had found their place among Mr. Merrifield's numerous *napi*, having been accidentally introduced as larvæ in the food-plant.

The pupæ of *P. napi* are either *green* or have a *bone-coloured* ground with black markings and minute dots. The latter may be classified, according to the amount of pigment, as:—

(1) *Dark*, (2) *Intermediate*, (3) *Light*. In the *light* forms the pigment is so small in amount that the pupæ

are practically *bone-coloured* (3 *a*). The *green* pupæ are equally deficient in pigment and may be regarded as a dimorphic form of this degree (3 *b*). These relationships may be conveniently expressed as follows:—

1. Dark.
2. Intermediate.
3. Light. (*a*) *Bone-coloured.*
   (*b*) *Green.*

(1) The *Dark* pupæ. The ground is bone-coloured. Black pigment is strongly developed on each side of the dorsal surface, forming a large sub-rectangular patch on each side of each abdominal segment, fusing into an irregular mass anteriorly, on each side of the thoracic region. The dorsal line is marked posteriorly by a distinct dot on each segment. Seven dots can be recognized, including one on the caudal spine. There is also a large pigment patch on each side of the mesothoracic keel and on each side of the anterior rostrum. Minute black points are scattered between the sub-dorsal pigment and that of the dorsal line.

On the sides, the principal development of pigment is on the wings, in which part of the venation is thus rendered conspicuous, while the outline of the hind margin of the future wing is marked by a distinct row of black dots. Near the centre of the wing is the "wing-mark" made up of two or more, generally three, intensely black patches —the largest inferior — apparently occupying spaces between the veins. Even in the darkest forms these patches are nearly always conspicuous from their superior blackness: they often tend to fuse, forming in many cases a single large patch.

The eye is strongly pigmented superiorly, but below and including the crescentic mark upon which alone of the entire pupal surface the facetted structure is developed (the pupal eye), it is devoid of pigment.

(2) The *Intermediate* pupæ. The ground is bone-coloured. These pupæ differ from the last, with which they are connected by transitional forms, in the lesser development of black pigment both dorsally and on the wings. As a rule the diminution is proportional throughout, but in certain cases the dorsal pigment may retain its full development.

The lesser amount of black pigment renders the intense

black patches in the centre of the wing especially distinct and sharp.

(3) The *Light* pupæ. (*a*) *Bone-coloured.* These also are perfectly transitional into the *Intermediate* pupæ. In pupæ of this degree the pigment is everywhere reduced, remaining strongest in the black patches in the centre of the wing, which become excessively conspicuous against the pale bone-coloured ground. In some of the most extreme cases these patches become much fainter, but a trace of them is probably always to be found. In other parts the pigment spots and patches are much smaller, and are often represented by minute dots: on the eye it is often absent altogether.

(3) The *Light* pupæ. (*b*) *Green.* Pigment is never highly developed upon the ground-colour of these pupæ. With very rare exceptions it does not exceed the amount present on the *light bone-coloured* pupæ (3 *a*). The *green* pupæ are far more transparent than the *bone-coloured*, and the palest are even more deficient in pigment than the palest of the *bone-coloured* forms. The most important difference in marking has already been mentioned, viz. the absence of the black patches in the centre of the wing (the "wing-mark") even when pigment is developed elsewhere as greatly as in a decidedly dark *bone-coloured* pupæ of the corresponding degree (3 *a*)—a pupa which would always possess distinct and prominent patches. Occasionally, however, faint traces of the marking may be detected, as minute dots, even in the palest *green* forms, and very rarely it is fully developed. All marked exceptions will be described below. In the centre of the wing the transparency is such that a considerable depth into the pupa can be seen, and the large tracheæ distinctly made out.

Before classifying Mr. Merrifield's numerous pupæ, I am tempted to suggest what I believe to be the meaning of this strange dimorphism in marking. The possible failure of my hypothesis would not, however, alter the validity of the observations which I have here recorded. Without attaching too great weight to it, I do not hesitate to suggest the hypothesis, thinking it possible that observation and thought may be stimulated by its means.

I have just alluded to the great transparency of the *green* pupæ (3 *b*), and have stated that this is especially marked in the centre of the wing, viz. in the exact position of the dark mark on the *bone-coloured* pupæ (3 *a*).

These latter are also, though less transparent than the green, chiefly so in the same area.

The *green* pupæ resemble green leaves and stems, and Mr. Merrifield's experiments show that they are produced by such surroundings: the *bone-coloured* pupæ resemble, and are produced by, such surfaces as bark, wood, or stone.

Now the transparency is no hindrance to the concealment of the former: it is rather an advantage. But to the latter it is a distinct hindrance and, when once seen, immediately betrays the fact that the pupa is not the opaque object to which it presents so strong a superficial resemblance. I believe that this is the reason why this particular area is so invariably covered up by dark patches of pigment in the pale bone-coloured pupæ of this species. I believe that the persistence of this particular mark when the other pigment spots and masses are disappearing in the palest pupæ, is due to the operation of natural selection.

The experiments and observations Miss Cora B. Sanders and I were able to conduct, in the summer of last year, prove that pupæ (in this case of *Vanessa urticæ*) are subject to a tremendous struggle for life: they also strongly indicate that the enemies are guided by their sight in hunting for them. Hence it appears to me that there is nothing improbable about the suggestion that this dark patch covering the transparent area may have been retained by natural selection in certain forms, because transparency would be a danger, may have been dismissed in certain others, because transparency would be an advantage.

The pupæ were compared and tabulated on Dec. 22nd, 1898, and on the following dates in 1899—Jan. 6th, 7th, 9th, and 28th. Nearly all of them were extremely healthy, and showed the effects of the conditions in a remarkable manner. As these are the first complete and detailed experiments which have been conducted upon this sensitive species, and the material was in such excellent condition, the comparison was carried out with the utmost care, and numerous details were recorded which are included in the tabular statement below. The order is that in which the pupæ of *P. machaon* were considered so far as the conditions were the same. The conditions which were different are placed at the end.

It is to be observed that the *light-green* forms (**3** *b*)

Experiments.	Degrees of Pupal Colour.					Remarks.
	Dark (1)	Intermediate (2)	Light (3)		Totals	
			Bone-coloured (*a*)	Green (*b*)		
1. Black.	6	4			10	Three of the (2)s very dark.
2. Black compartment (pupæ fixed to black).	15	1	1		17	(2) Very dark: (3 *a*) very light. Also two dead pupæ which were probably (1) or (1) and (2).
3. Miscellaneous black compartment.		1			1	
4. Black through glass (in shade).			1		1	Very pale pupa.
5. Black compartment, through glass.		2	1		3	The (3 *a*) darkish.
6. Black half of a sheet of glass forming roof. The other half was orange-yellow and will be described below. All pupæ were on black "through glass." The whole sheet was exhibited to this Society. (See page 391.) Anterior group mostly close to clear glass front.	5	6	6		17	Pupæ mostly fixed parallel to glass front: the heads of only five pointed towards light, and only two of these pointed directly (the body line at right angles to glass front).
Group half-way between back and front, and towards inner side (viz. nearest orange).	1	1			2	One pupa pointing towards light; one had become loose.
Group in posterior inner corner of roof.	1	1			2	Another pupa had died and is not classified: another was accidentally mixed with next group and is there classified. All four towards light (direct).
Group in posterior outer corner and extending along outer side of roof.	10	2			12	Including one pupa from last-named group. All pupæ towards light and all direct except one.
7. Black compartment on or near front glass	3	7	4		14	One (3 *a*) rather dark with an indistinct wing-patch; another much lighter with a faint one. In addition, an extraordinary intermediate form not tabulated—a pale green ground with the pigment of a (2).

Experiments.	Degrees of Pupal Colour.					Remarks.
	Dark (1)	Intermediate (2)	Light (3)		Totals	
			Bone-coloured (*a*)	Green (*b*)		
8. Dark sticks.	2	4	1		7	Another pupa had died. The (3 *a*) was dark.
9. Dark sticks: pupæ fixed to bottle.		1		1	2	The (3 *b*) very pale and pigmentless.
10. Dirty white paint.	9	15	5	2	31	Two had died and are unclassified. It is certain that neither was green. One pupa was withdrawn as a *P. rapæ*. One (3 *b*) dark but no wing-mark to be detected.
11. Glass of old cage.		3	4		7	All light for their degrees except one (3 *a*).
12. Darkness.		1		6	7	Of the (3 *b*)s two are deep green with much pigment for this degree, two similar with little pigment, two pale and almost pigmentless.
13. Dead reeds.		4	4		8	Wing-mark faint in three (3 *a*); two of them dark for this degree.
14. Dead reeds; pupæ on glass.			1	1	2	(3 *b*) deep green with little pigment.
15. Dull green reeds.		3	7	1	11	(3 *b*) pigment very dark, equal to darkest (3) or even light (2): wing-mark small but dark. One (3 *a*) with very slight wing-mark. The (2)s light.
16. Dull green reeds; pupæ on glass.			3		3	Another pupa dead. Wing-mark indistinct in one.
17. Oat-straw.			3	2	5	(3 *a*) wing-mark indistinct in two. (3 *b*) one pale, one deep green, both with very little pigment.
18. Oat-straw; pupæ on bottle.			2		2	Pupæ with little pigment and wing-marks indistinct.

Experiments.	Degrees of Pupal Colour. Dark (1)	Intermediate (2)	Light (3) Bone-coloured (*a*)	Green (*b*)	Totals	Remarks.
19. Dutch "gold" on sticks.			8		8	Six pupæ with very little pigment. Wing-mark very faint in two, invisible in one.
20. Dutch "gold" through glass.				1	1	Deep green; little pigment.
21. Dutch "gold" on glass.			1		1	Almost pigmentless except for very distinct, dark wing-mark.
22. Green paper spills.			7		7	Another pupa dead. Five pupæ with very little pigment, and wing-mark indistinct, or even invisible.
23. Green paper, through glass.			1		1	Very little pigment.
24. Green paper, on glass.				1	1	Very little pigment; deep green.
25. Green cabbage-leaves; pupæ chiefly on bottle.			4	6	10	Another pupa dead: (3 *a*)s very light, but with wing-mark conspicuous. (3 *b*)s pale green except one, all with little pigment.
26. Green cabbage-leaves; pupa on white muslin.			1		1	Very pale pupa with faintly transparent yellowish appearance.
27. White paper.			6		6	Very little pigment; wing-mark distinct and dark on three, indistinct on one, hardly visible on two.
28. White paper, through glass.			1		1	Almost pigmentless.
29. Yellow paper.			1	7	8	Nearly all pupæ almost pigmentless. The (3 *a*) transparent yellowish and really transitional to (3 *b*). Of the latter, two pale, two intermediate, and three deep green.

Experiments.	Degrees of Pupal Colour.					Remarks.
	Dark (1)	Intermediate (2)	Light (3)		Totals	
			Bone-coloured (*a*)	Green (*b*)		
30. Yellow paper, through glass.			1	1	2	The (3 *a*) is transparent greenish-white, and transitional to (3 *b*). The latter deep green with much pigment for this degree.
31. Yellow paper, on glass.			1		1	Like the (3 *a*) described above and, like it, very pale and pigmentless.
32. Orange leno bag.				11	11	Two pale, nine deep green. One of former fixed to a leaf. Seven with very little pigment and the others not very dark.
33. Orange-yellow compartment; miscellaneous pupæ.				8	8	Another pupa dead. One pale, two intermediate, five deep green. All very pigmentless except three of latter (not very dark), and one remarkable deep green form with the pigment of a (2) and a small distinct wing-mark; also present on two of the last-mentioned set of three.
34. Orange compartment, near leno and dirty white paint.			1	3	4	(3 *a*) very pale and pigmentless with *no* wing-mark. (3 *b*) one pale, two deep green, all dark pigmented; faint trace of wing-mark on one.
35. Orange yellow half of glass roof. The pupæ on the	Anterior scattered group, many close to clear glass front.		1	13	14	Five pupæ parallel to glass front (four close to it), one with tail, seven with head pointing directly to light: one with head to light, but body line not direct (viz. forming angle of about 45° with front). (3 *a*) very pale, transparent, and pigmentless, much more so than any on the black side of same sheet. One (3 *b*) pale

Experiments.	Degrees of Pupal Colour.					Remarks.
	Dark (1)	Intermediate (2)	Light (3)			
			Bone-coloured (*a*)	Green (*b*)	Totals	
						yellowish-green, and really transitional to (3 *a*). It and five others almost pigmentless, six with very little pigment, and one with much, like a dark (3 *a*) and yet hardly a trace of wing-mark. Twelve of the (3 *b*) distinct green ground.
Compact group in the outer side of the middle part of roof (viz. away from the black).			1	7	8	Heads of all pupæ directly point to light. The (3 *a*) very pale, but more pigmented than any green (3 *b*) in this group and with traces of wing-mark. (3 *b*) all distinct green and very little pigment.
Group in the inner side of the middle part of roof (towards the black).			1	8	9	Another pupa dead. All heads pointed directly to light. (3 *a*) with very little pigment. Seven (3 *b*) similar, and one darker, but no trace of wing-mark. All (3 *b*) distinct green.
Elongated group along outer side of posterior part of roof.				13	13	All directly faced light except one parallel with front and two reversed (tails directly pointing to light). All distinct green, and, except three, with very little pigment.
Inner side of posterior part of roof.				1	1	Distinct green, very little pigment. Directly faced light.
36. Orange, through glass.				3	3	Another pupa dead. One pale, two deep green; all very pigmentless.

other (black) half have already been tabulated (6) on page 396. All pupæ were on orange-yellow "through glass."

Experiments.	Degrees of Pupal Colour.					Remarks.
	Dark (1)	Intermediate (2)	Light (3)		Totals	
			Bone-coloured (*a*)	Green (*b*)		
37. Orange compartment; leno through glass.			2	3	5	(3 *a*) very pale and pigmentless. (3 *b*) one pale, two deep green, one of latter with medium pigment, other two very pigmentless.
38. Orange-yellow compartment, on or near front glass.		1	19	6	26	Another pupa dead. (2) very pale. (3 *a*) ten pupæ very pale and pigmentless with wing-mark minute, faint, or absent; of these two are greenish and transitional to (3 *b*). Six are light with wing-mark prominent. Three rather darker, but only average for this degree. (3 *b*) one pupa pale, five deep green. Two almost pigmentless (including pale one): four rather dark for this degree and minute wing-mark on two.
39. Planed deal, in light.		1	3		4	(2) very pale. Very little pigment on (3 *a*)s and very faint wing-mark on one: prominent on others.
40. Planed deal, in shade.			5		5	Four with very little pigment, but wing-mark distinct: one typical.
41. Planed deal, on glass lid.			1		1	Very pale and pigmentless, but wing-mark distinct.

which presented any trace of a "wing-mark" are specially so described: when no reference is made to this character it may be assumed that it was absent in (3 *b*)s, normal in (3 *a*)s.

I will now briefly summarise the results obtained with this highly interesting and sensitive pupa. For the sake of brevity (3 *a*)s are called *light* pupæ; (3 *b*)s *green* pupæ.

Black (1 to 7). The very powerful effect of black in

producing the darkest pupæ is very clearly seen. The black paper did not act quite as strongly through the thickness of glass (4, 5, 6) as when the pupæ were in direct contact with it. When the pupæ were upon the glass window at a varying distance from the black paper, the effects were much less marked (7). Black in shade (4) produced an *intermediate* pupa, but the parts of the roof of case (6) which were farthest removed from the light produced pupæ which were rather *darker* than those nearer to it.

Dark sticks (8) produced as great an effect as black, but little or no influence was exerted at a distance (9).

Dirty white paint (10) gave rise to a great variety of pupæ, all forms being represented among the thirty-one forms tabulated, the *dark* and *intermediate* degrees (1) and (2) strongly predominating.

Clear glass (11) produced *intermediate* and *light* pupæ, while in *Darkness* (12) they were strongly *green*—six out of seven being (3 *b*). This result is so remarkable and extreme an effect of darkness that further experiments are to be desired. It is probably to be explained by the strong normal tendency of this species to produce *green* forms in the absence of any effective stimulus (see 9, 14, 24, in support of this: the pupæ on the glass removed from the stimulus are greener than those subjected to it).

Dead reeds (13) produced *intermediate* and *light* pupæ; at a distance (14) *light* and *green* ones were formed.

Dull green reeds (15) produced chiefly *light* pupæ (3 *a*) with some *intermediate* (2) and a single *green* one (3 *b*); on the glass they were all *light* (16).

Oat-straw (17) caused the pupæ to become *light* (3 *a*) and *green* (3 *b*), while at a distance they were *light* (18).

Dutch "gold" (19, 20, 21) tended strongly towards *light* pupæ (3 *a*), the only exception being in the case of a *green* pupa (3 *b*) formed when the gilt surface was the other side of glass (20). At a distance (21) the single pupa was similar to those fixed on the gilt.

Green paper (22, 23, 24) produced almost exclusively *light* pupæ (3 *a*), the action through glass (23) being similar to that of the coloured surface itself. At a distance a single *green* pupa (3 *b*) was formed.

Green cabbage-leaves (25, 26) on the other hand produced far more *green* than *light* pupæ, affording a most interesting comparison with the artificial colour. On this point see the Appendix in which the constitution of the light

reflected from the latter is described. The pupa on white muslin (26) was *light* (3 *a*), and probably affected by this surface rather than the leaves.

White paper (27, 28) is of great interest, invariably producing *light* pupæ (1 *a*); the influence through glass (28) being the same as that exerted directly (27). We see in this and in the pupæ produced by Dutch "gold" (19—21) a great advance in the susceptibility of these pupæ over those of the *Vanessidæ*. Thus the highly sensitive pupa of *V. io* is influenced in the same direction by bright green (such as those of nature), yellow and orange as it is by golden metallic surfaces and by white. These all alike tend to produce brilliant green pupæ with a golden sheen over much of the surface. And yet such pupæ would only be concealed on the bright green backgrounds. The pupa of *P. napi* is similarly influenced by bright green, yellow, and orange, but is quite differently affected by white and gilt. The pupæ in the latter case are *light bone-coloured* (3 *a*), and certainly much more effectually concealed on a white surface than if they were green. Traces of the same kind of sensitiveness at a much lower level of development are rendered probable in *Papilio machaon* from the results already recorded, and will be seen to exist in *Pieris brassicæ* and *P. rapæ*, in the formation upon a white background of intermediate, grey, and pale forms rather than green ones. The similar effects of bright green, yellow, and orange are certainly to be explained as they have been in many other species, both larvæ and pupæ, by the fact that all these colours reflect a high proportion of the effective rays, viz. the yellow and orange. This will be proved in the case of *P. napi* by the results of the spectroscopic examination of the backgrounds which were made use of (see Appendix).

Yellow paper (29—31). Produced only the *light* (3 *a*) and *green* pupæ (3 *b*), the latter strongly predominating. The influence through glass (30) and at a distance (31) was less strong in the direction of green, although the number of pupæ was too small to carry much weight.

Orange leno and paper, in some cases combined with yellow (32—38), were even more powerful than the yellow in producing *green* pupæ (3 *b*); in fact if we consider those experiments only in which the pupæ were directly placed on the backgrounds or were only separated by the thickness of the glass (32, 33, 35, 36, 37), no less than sixty-

seven *green* pupæ (3 *b*) were formed as against five *light* ones (3 *a*). The influence through glass (35, 36, 37) was undiminished; but that at a distance (34, 38) was immensely reduced, a single *intermediate* pupa (2), a large number of *light* (3 *a*), and only a few *green* (3 *b*) being produced.

Planed deal (39—41) seemed to produce effects comparable to those of white, viz. that form of pupa out of the various possible degrees, which harmonized best with the background, viz. *light* (3 *a*), a single *intermediate* one (2) also appearing. No appreciable difference is to be noted between the effects in strong light (39), shade (40) and at a distance (41).

Looking at these experiments as a whole, the much smaller effect produced by the coloured backgrounds upon the pupæ "on the glass," viz. at a more or less distance from the effective stimulus, harmonizes well with the results of previous investigation.

The strong tendency of the pupæ, or rather the larvæ, to face the light directly is well shown in the results of Experiments (6) and (35) where the positions are recorded. The *great* majority of the exceptions were due to the larva placing itself parallel and in close proximity to the clear glass front. A similar tendency to seek the angles between a horizontal and vertical surface probably in part explains the fact that so high a proportion *directly* faced the light, the body line having been drawn into parallelism and often into contact with the sides. In these experiments only one pupa was parallel with and close to the back, but I have noticed very many pupæ of *Pieris brassicæ* in shallower breeding-cases, in this position. The few complete exceptions in (6) and (35) in which the head pointed directly away from the light are enough to show that susceptibility is unaffected by orientation.

Mr. Merrifield is to be congratulated in having proved the high degree of sensitiveness possessed by this pupa. While the susceptibility is as great as that of any other species, even of the highly sensitive *Vanessa io*, the range of controllable modification is probably wider than in any other as yet investigated in sufficient numbers. This is shown by the production not only of *green* and *dark* forms, but of *pale* and *grey* pupæ upon such backgrounds as white paper and planed deal. At the same time the range is not nearly so great as that of the larva of *Amphidasis betularia*, which can produce on appropriate dark

surfaces many distinct shades ranging through *black*, *brown*, and *grey*; and also on the provision of the appropriate stimuli can become *white* or *green* (Trans. Ent. Soc. 1892, *l. c.*).

The reactions of the pupæ of *Pieris napi* to the colours employed agree well with the observations recorded in the case of other susceptible pupæ if allowance be made for the wider range of controllable modification.

E.—EXPERIMENTS UPON THE PUPÆ OF *Pieris brassicæ*.

1. Experiments upon the Winter Pupæ of *Pieris brassicæ*. (F. M.)

I took advantage of the pestilential abundance of the larvæ of this species to experiment on them and I exhibit samples of the results, which will be described so far as necessary in the following section. It is the less necessary to refer to them at any length, because the species has been so fully experimented on by Prof. Poulton as described in the papers before referred to, and as will appear later in this memoir, also during the present year (1898). But I would call attention to one feature, that has been carried perhaps a little further than had been done before, in my experiments on this species and the next referred to, *P. rapæ*. It seemed a fair inference both from Prof. Poulton's paper and from my personal observation of the experiments with darkness on the other two species, that the positive application by reflection or otherwise of some decided colour (including black and white among colours) was necessary to affect the colour of the pupæ in a marked degree. Accordingly I tried the experiment of surrounding some pupæ with clear glass away from all near reflecting objects. For this purpose I placed the full-fed larvæ in clear glass cylinders covered by clear glass and resting on a clear glass sheet several inches above the table, so that light reached them all round. They were placed on a table near the window. It will be observed that in the case both of this species and the next, the pupæ of the larvæ thus exposed to uncoloured light on all sides, rather closely resemble those in darkness, the former being somewhat darker than the later. In the case of *P. napi* darkness produced much variety of colour: of seven all but one are green but of somewhat varying tint, and the one bone-coloured and two of the green ones are much spotted with dark.

I found this species very troublesome as to the place of its pupation. In no one case did I succeed in getting it to pupate on a stick whatever its colour, and it had a way of pupating on the clear glass in front of the cylinder or bottle. To circumvent it I procured some white photographic trays, some of which I covered with orange glass, and others with deep green glass, while one was lined with black paper and covered with clear glass, and another, left white, was covered with clear glass. The space left between the bottom of the tray and the glass covering varied from about $\frac{1}{4}$ inch to $\frac{3}{8}$ inch or a trifle more, and in some cases it will be seen the pupa bears marks of squeezing. These instances are indicated by the word "screen," in the case of trays thus provided with screens of coloured glass, "tray" where the covering was clear glass.

The whole of the pupæ obtained (about 80) are displayed, part in the Exhibition Case, and part in the glass-topped boxes.

2. Results of the above Experiments. (E. B. P.)

The pupæ of *P. brassicæ* were compared May 3rd and May 6th, 1899, the results being shown in the following table (see pp. 407, 408). The degrees of pupal colour are the same as those suggested and fully described in Phil. Trans. 1887 (*l. c.* pp. 409, 410). The letters *g. o. w. y.* indicate the faint greyish *green, orange, yellow,* or *white* tint of the pupæ in the darker degrees. The tint is however usually very faint, being greatly obscured by the dark pigment (see also Trans. Ent. Soc. London, 1892, p. 439).

These results afford a very useful confirmation of those which have been previously obtained. Thus the *black* (1, 2, 3) produced uniformly *dark* pupæ, the effect being as strong when the dark surface was behind glass (3) as when it formed the surface to which the pupa was attached (1, 2). The black surroundings also produced a considerable effect upon pupæ which were attached to the clear glass at some distance (4).

Darkness (5) produced far more *intermediate* pupæ, although still upon the *dark* side of *intermediate*. As Mr. Merrifield has suggested, this result is to be compared in an interesting manner with that of *clear glass* (28). It is probable that in these two cases we witness the results of pupal tendencies undirected by any effective stimulus.

Experiments.	Degrees of Pupal Colours. (1) Darkest. (α)	(1) Intermediate. (β)	(1) Light. (γ)	Whitish Yellow. (2)	Green. (3)	Remarks.
1. Black.	1 *o*	3 *g*				The darker pupa dead.
2. Black tray.	1 *w*	2 *g,y*				Also one dead and one emerged: both probably (1 β).
3. Black, through glass.	1 *g*	2 *g*				
4. Black, on glass.		4 *w,y g,g*				Also one dead, probably a (1 β).
5. Darkness.		2 *g,o*	3 *g,w,y*			Probably one more pupa accidentally transferred to those on clear glass.
6. Green paper.		1 *y*	1 *y*	2	1	
7. Green gauze.				1	1	
8. Green, through glass.			2 *w,g*	3	1	
9. Green screen.				1	1	Also one dead, probably (2); and one emerged; not darker than (1 γ). The (3) was a peculiar greyish-green.
10. Green, on glass.			3 *g,g,w*	3	1	Also one dead; a (1 γ), or darker.
11. Cabbage leaves.			2 *g*	1	1	Also one dead, evidently a (2) or (3).
12. White.		1 *w*		1		
13. White paper (cylinder).		1 *y*				
14. White paper.		2 *w,g*	1 *y*			Also one dead, but certainly a (1 β).
15. White calico.		2 *y,w*	1 *w*			
16. White tray.		1 *w*			1	
17. White, on glass.			2 *y*	1		

Experiments.	Degrees of Pupal Colours. (1) Darkest. (α)	Intermediate. (β)	Light. (γ)	Whitish Yellow. (2)	Green. (3)	Remarks.
18. Yellow paper.					2	Also one dead.
19. Yellow, in shade.		3 *w.g*				Also one dead, but probably a (1 β).
20. Yellow, through glass.			2 *w.g*			
21. Yellow, on glass.				1		
22. Yellow compartment, on glass with patch of white paper behind.					1	
23. Orange leno.		1 *w*	1 *g*			Also one dead or emerging, about a (1 β).
24. Orange.			1 *w*	1	1	
25. Orange, through glass.					1	
26. Orange screen.				4		
27. Orange on glass.				1	3	One (3), a curious greyish form.
28. Clear glass.		6				Also one dead, probably a (2) or (3). The (1 β)s are, one greyish-orange, four green, one white. Probably one pupa belongs to the group in darkness.

Green paper, *gauze* and *cabbage-leaves* (6, 7, 8, 10, 11) caused the appearance of far lighter pupæ, the majority being the *whitish-yellow* degree (2). Here too the influence through glass (8) was as strong as in the other experiments (6, 7). The few pupæ subjected to light through *green glass* (9) were of the two lightest and greenest degrees, thus confirming the effects described in Trans. Ent. Soc. Lond. 1892 (pp. 429—432, 446, 466—

468), and ascribed to the greater concentration of the effective rays. The stimulus produced a strong effect at a distance (10). The powerful effect of a natural green environment (11) is of great interest.

The experiment with *white* (12—17) was especially useful, as this environment had been almost omitted from the previous investigation of this species. It is at once seen that the effect is to produce *intermediate* pupæ, inclining towards the *dark* side. In this, the results differ widely from those obtained with *Vanessa urticæ* and *V. io* in which white surroundings produced strong effects in the direction of the golden and green pupæ respectively. There is great uniformity in the results obtained by the different white backgrounds, and the action at some distance (17) was clear. It will be found that my own experiments (43 to 48) in 1898 (see pages 415, 416) lead to the same conclusions as those which result from Mr. Merrifield's.

Yellow surroundings (18 to 22) produced the usual strong effects in the direction of the palest, greenest pupæ, the influence being much reduced in shade (19), and also reduced when acting through glass (20). An influence at some distance was probably exerted in (22).

Orange surroundings (23 to 27), for the most part, produced the same effect as the yellow, the orange leno (23) being an exception. Influence was strong through glass (25), and at some distance (27). The orange screen (26) produced considerable effects, in accordance with the principles already explained (Trans. Ent. Soc. Lond. 1892, *l. c.*); although an even stronger result might have been expected.

This account of the results should be read in relation to the Appendix, in which the colours reflected from the various backgrounds are analyzed.

3. Experiments upon the Winter Pupæ of *Pieris brassicæ*. (E. B. P.)

I also took advantage of the immense abundance of this species to repeat some of the experiments made in previous years upon insufficient numbers. The larvæ in part came from St. Helens, Isle of Wight (experiments 5, 6, 37, 38, 39, 40), partly from St. Helens and near Reading (13, 41, 42), and partly from St. Helens and near Oxford (remaining experiments, including those with conflicting colours,

and excepting Nos. 4 and 12). They were collected by Miss Cora B. Sanders (St. Helens and Reading), by Mr. W. Holland (Oxford), Mr. A. H. Hamm (Oxford), and by myself (St. Helens). Experiments 13, 41, and 42 were conducted by Miss Sanders; 5, 6, 37, 38, 39, and 40 by me, and the remainder by Mr. Holland and Mr. Hamm. I wish to express my warm thanks for all the large amount of kind help I have received.

The conditions of experiment are sufficiently shown in the following tabular statement (see pp. 411—416), the constitution of the reflected light being given in the Appendix.

The pupæ were examined on May 6, 7, 8, 9, 10 and 11, 1899, when several of them had emerged or were emerging. All these, however, are indicated below, and nearly all could be tabulated with considerable accuracy.

The positions of the pupæ in relation to the receptacles employed and to the light were noted in a large number of examples, with the following results. Thirty-six pupæ were fixed to the roof (or in the angle between it and the back), with a direction parallel with the front (generally clear glass) and back; 25 were fixed to the front, back, or sides in a vertical position with the head uppermost (including a few with the head downwards—cases in which pupation certainly occurred during a temporary reversal of the position of the receptacle); 41 were fixed, almost invariably to the roof, with the head pointing directly towards the light, viz. with the line of the body at right angles to the front (generally clear glass); 11, otherwise similarly placed to the last, had their heads pointing directly away from the light; 15, otherwise similar, had their heads obliquely directed towards the light; 10 their heads obliquely directed away from it. It is therefore clear that there is, upon the whole, a tendency to direct the head towards the light, although the tendency is not nearly so strongly marked as in *P. napi*. There was no appreciable difference in the colour according as the head pointed towards or away from the light.

Reviewing the results of the tabulated experiments, the effect of black (1 to 9) is, with certain exceptions, similar to that which has been obtained before, and also to Mr. Merrifield's investigations carried on simultaneously. These exceptions are the very dark pupæ obtained in almost complete darkness (8), and the very unusual lightness of some of those in dim light (6, 7).

Experiments.		(1) Dark. (α)	(1) Intermediate. (β)	(1) Light. (γ)	Whitish-Yellow. (2)	Green. (3)	Remarks.
1. Black lined cylinder (wide and low, placed on side with clear glass front).		1					On roof near and parallel with glass front. Emerging.
2. Black lined cylinder (very similar to last).		3	1 *y*				Similar position to above; together with three other dead pupæ (unclassified). Two of the (1 *α*) greenish, the other emerged.
3. Smallish black cylinder (intermediate in size between 7 and 24, same arrangement) with two compartments, moderate illumination.				1 *y*			Pupa on black paper roof of upper compartment.
4. Tarred fence near Oxford.							Two pupæ found April 2, 1899, by A. H. Hamm. They were very dark, probably (1 *β*) or even (1 *α*).
5. Black-lined box 25·5 c.m. by 21 c.m. in section; 9·5 c.m. deep. Window 11 c.m. by 13·5 c.m. covered with black net. Box placed on one short side. Illumination moderate.	Attached to roof.		4 *g*, *g*, *w*?	4 *g*, *o*, *o*, *y*			One (1 *β*) emerging. Also seven dead, four probably (1 *γ*), two (1 *β*) or (1 *γ*), and one uncertain. Also one emerged, and was a (1 *γ*). Pupæ chiefly in two crowds of seven to R., and five to L. of roof. The heads were nearly as often away from light as towards it; often oblique, and often parallel with back or front.
	Loose on floor.			1 *g*			Also one dead; it had been a (1 *γ*).
6. Box very similar to last, but window a little smaller.	Attached to roof.		4 *w*, *w*, *o*, *o*	1 *y*	2	1	Also six dead; 1 = (1 *β*), 4 = (1 *β*) or (1 *γ*), and 1 = (1 *γ*). Also two emerging, a (1 *γ*) and a (1 *γ*) or (2). A group of four at back and of ten on left side, heads of those (six) not parallel with back nearly always turned to light.
	Attached to black net window.		1 *y*				Also three dead on the sides of box; all (1 *γ*) or rather lighter or darker than this. Also one dead, loose on floor—a (1 *β*) or (1 *γ*).

Experiments.	(1) Dark. (α)	(1) Intermediate. (β)	(1) Light. (γ)	Whitish-Yellow. (2)	Green. (3)	Remarks.
7. Small black compartmented cylinder, in deep shade. The cylinder about 10 c.m. high by 6 c.m. in diameter. A black paper partition divided the cylinder into two chambers illuminated by a narrow window 2· to 3·5 c.m. wide.					1	Pupa from a single larva put in lower compartment. Rather more pigment than usual, but deep green ground. Pupa fixed vertically, head upwards, at top of side opposite window, but latter closed above and the roof very convex below, so that larva had been in deep shade.
8. Black cylinder in almost complete darkness: 16 c.m. diameter by 10 c.m. deep.	1 *o*	3 *g*				All pupæ isolated. All (1 β) very dark and two of them nearly (1 α).
9. Black-lined (3 sides) rectangular glass case (18 c.m. square by 28 c.m. high) with perforated zinc roof.	1 *o*, *g*	3 *o*, *g* ?				Four pupæ isolated on roof; the (1 α) *g*, on clear glass window, just below black binding and zinc at top, and near black paper of side.
10. Perforated zinc roof of yellow-lined (three sides) rectangular glass case (28 c.m. square by 38·5 c.m. high).		4 *o*, *o*, *g*, *g*	1 *o*			Also one emerged; was a (1 β) or (1 γ). All tabulated pupæ on roof in groups of two and three.
11. Similar zinc roof of similar white-lined (3 sides) case (23 c.m. square, by 33 c.m. high).	1 *w*	2 *o*				Also one dead, probably a (1 γ) or (2). All pupæ isolated on roof.
12. Brown paper.		1				Found in O. U. Museum by A. Robinson. Probably an escape from my cases. Imago had emerged, but pupa so dark it may have been even a (1 α).
13. Salmon-pink box in strong light (24 c.m. by 13·5 c.m. in section in front).					1	All sides and roof sloped inwards to a back only 10 c.m. by 18 c.m. This caused a very strong illumination.
14. Orange paper-lined cylinder (22 c.m. diameter, 10.2 c.m. deep). Placed on side with clear glass front.			1		2	Also one emerged, a (2) or (3). The (1 γ) bright yellowish green. All pupæ on roof.

Experiments.	(1) Dark. (α)	(1) Intermediate. (β)	(1) Light. (γ)	Whitish-Yellow. (2)	Green. (3)	Remarks.
15. Orange-lined cylinder (27 c.m. diam. 8 c.m. deep) arranged as the last.			1 *g*		2	One (3) on glass front, three-quarters up. Others on roof.
16. Orange-lined cylinder (30·5 c.m. diam. 9·8 c.m. deep). Arranged as the last.					4	Also one emerged, evidently a (3). One of the (3)s had the pigment of a (1 γ) but bright green ground of a (3). All pupæ on roof.
Four-compartmented orange-lined box. Each compartment 10 c.m. square, 6·4 c.m. deep. Box placed on side with clear glass front. — 17. Compartment I.					3	Two on roof, one on floor. The box had clearly been turned over for a time, so that floor became roof.
18. Compartment II.				1	2	All on roof.
19. Compartment III.			1 *g*		2	Also one emerging—a (2) or (3). Two on roof, one on angle of roof and side, one head *downwards* on side; clearly due to box having been turned over.
20. Compartment IV.						One pupa emerging, but probably a (1 γ); one dead, but was a (2) or (3). Both on roof.
Compartments 4·5 c.m. by 3·75 c.m. in section, 5·3 c.m. deep. — 21. Compartment H, orange-lined.				1		On back, close under roof.
22. Compartment L, orange-lined.					1	In angle between roof and back.
23. Lower compartment of small orange-lined cylinder, similar to 7.					1	In angle between roof and side.
24. Lower compartment of large orange-lined cylinder (8 c.m. diam. by 18 c.m. high, with window 3·4 c.m. wide) arranged similarly to 7.					1	Position of pupa clear although emergence had occurred. On roof, close to side.

Experiments.	(1) Dark. (α)	(1) Intermediate. (β)	(1) Light. (γ)	Whitish Yellow. (2)	Green. (3)	Remarks.
25. Orange-lined rectangular glass case (30·5 c.m. square, 41 c.m. deep) on side with clear glass window.		1 *g*	1 *y*	3	3	Also two dead, a (2) and a (2) or (3). One of the (2)s tabulated was loose on floor: all the rest of the pupæ on roof. The darkest pupæ in dim illumination.
Eight-compartmented box. Compartments 12—13 c.m. by 14 c.m. in section, 8·4 c.m. deep. Placed on side with clear glass front. — 26. Compartment E, orange-lined.					2	On roof.
27. Compartment F, orange-lined.					3	Two on roof, one on side. Also one dead on side and one on roof; both probably (3) or one perhaps (2).
28. Compartment G, orange-lined.				2	1	All on roof; one emerged and one emerging, but position seemed certain.
29. Compartment H, orange-lined.			1 *o*	1		Also one emerged, almost certainly a (2). All on roof.
In same boxes as 21 and 22. A wider and E narrower box than H and L. — 30. Compartment A, yellow-lined.					1	Pupa loose on floor.
31. Compartment E, yellow-lined.						One pupa dead on roof, a (2) or (3).
32. Upper compartment of large yellow-lined cylinder Similar to 24.				1		Pupa on side just below roof.
Eight-compartmented box. These compartments similar to other four, viz. 26 to 29. — 33. Compartment A, yellow-lined.					1	In back corner of roof.
34. Compartment B, yellow-lined.				2		One on roof, one on back: latter with the green ground of a (3).
35. Compartment C, yellow-lined.				1	1	Pupæ isolated on roof.
36. Compartment D, yellow-lined.			4 *o*, *g*, *g*, *y*		1	Four crowded, one isolated (1 γ) *y* on roof.

Experiments.	(1) Dark. (α)	(1) Intermediate. (β)	(1) Light. (γ)	Whitish-Yellow. (2)	Green. (3)	Remarks.
37. Yellow-lined box placed on side, 20 c.m. square, 6 c.m. deep. Window 14·5 c.m. square, yellow leno covered.		1 *o*	1		9	Also one dead, but clearly a (3). Four (3) and the (1 β) on yellow leno window. Six (3)s on roof.
38. Yellow-lined box placed on long side: 14 c.m. by 18·5 c.m. in section, 8·5 c.m. deep. Window 10·5 c.m. by 15 c.m. as above.				9	3	Also two dead, probably a (2) and a (1 β) or (1 γ). All pupæ on roof; mostly in small groups.
39. Yellow-lined box placed on short side: 21 c.m. by 12 c.m. in section, 9 c.m. deep. Window 8 c.m. by 15·5 c.m. as above.			1 *g*	4	3	Also five dead, two emerged and one emerging, but all certainly (2)s or (3)s. Ten on roof, six on left side (three (2)s and three dead).
40. White box (31·5 cm. by 16 c.m. by 6 c.m. deep) with yellow leno window (11 c.m. by 23.5 c.m.), probably placed upwards.			2 *g*, *y*	2		Also three emerging; they were either (2) or (3), or in one case possibly a (1 γ). All attached to edge of leno, where pasted to box.
41. Green cabbage-leaves.				1	6	All seven on separate leaves, except that there was another dead one, certainly a (3), on the same leaf as one of them. Also one pupa dead, but certainly a (3), and two emerged, both (2) or (3). Also a pair on one leaf, one dead and one emerged, both certainly (3s).
42. Dark purple-lined box with white roof, in very dim light: (12 c.m. by 19·5 c.m. by 7 c.m. deep).			6 *g*	9	1	Also six dead probably three (2)s, one (2) or (1 γ), one (2) or (3), one (1 β) or (1 γ). Also one emerged; probably a (2). All tabulated pupæ on white roof, except two (2)s, loose on floor. All pupæ very much undersized.
43. White opal gas globe (usual size).				1	1	Pupæ isolated in upper part of globe.

Experiments.		(1) Dark. (α)	(1) Intermediate. (β)	(1) Light. (γ)	Whitish-Yellow. (2)	Green. (3)	Remarks.
Four-compartmented white-lined box, placed on side, with clear glass front. Dimensions same as 17 to 20.	44. Compartment A.			2 *g*			Pupæ on roof, isolated.
	45. Compartment B.		1 *g*			1	Also two dead or emerging, probably (1 β), or perhaps (1 γ) in one case. All pupæ on roof, three crowded.
	46. Compartment C.		1 *g*	1 *g*			One on roof, one on floor (case having doubtless been turned over).
	47. Compartment D.		2 *g*		1		Two on roof isolated, one on back.
48. Rectangular glass case with three sides lined with white paper, and white opal glass roof (20·4 c.m. square, 30·6 c.m. high).			2 *g*	1 *g*			Two pupæ isolated on roof. One (1 β) on black binding of angle between window and side, but close to white paper.

The effects of a dull surface of perforated *zinc* (9—11) and of *brown paper* (12) were, as might be expected, practically the same as those of black.

Salmon paper (13) acted like *orange* (14—29), and produced the lightest and greenest form of pupa. The results of so many experiments with *orange* are very striking, especially as a very deep reddish-orange surface paper was employed.

Yellow (30—40) also produced striking results in the same direction, but not equal in the proportion of the greenest pupæ, to those of *orange*.

Green cabbage-leaves (41) acted like *orange*.

Experiment 42 was very mixed, the pupæ being, almost all of them, fixed to a *white* surface in a *dark purple* box in a very dim light. They were strongly on the light side of intermediate.

White (43—48) has been already described as producing pupæ on the dark side of intermediate (see p. 409). There are, however, some few marked exceptions in both Mr. Merrifield's and my experiments, in which the lightest and greenest pupæ were obtained.

Thus Mr. Merrifield's and my experiments in 1898

afford most useful confirmation in the case of a species which has not been hitherto sufficiently tested, besides bringing evidence of its behaviour under conditions as yet hardly tried at all. In the next section is recorded an experiment upon the same species, which, more than all others, needed repetition because of the important conclusions which follow from it.

4. Experiments with Conflicting Colours upon the Winter Pupæ of *Pieris brassicæ*. (E. B. P.)

I had long been anxious to repeat some of these experiments upon the species of *Pierinæ* because of their extreme suitability for such an investigation and because of the important conclusions which follow from the results.

It had been originally supposed by Mrs. M. E. Barber (Trans. Ent. Soc. 1874, p. 519) that particoloured pupæ are produced by a particoloured surface—a conclusion which naturally followed from the views held by many at that time as to a direct "sun-picture or photograph" on the fresh, moist skin of the pupa. A single pupa of *Papilio nireus* had seemed to support this conclusion.

In 1886 I made a large number of conflicting colour experiments on *Vanessa urticæ* (Phil. Trans. 1887, *l. c.* pp. 368—392). The contrasted colours were, however, only applied during Stage III when the larvæ are suspended preparatory to pupation and are less sensitive than at an earlier period. Nevertheless the results were sufficient to make it highly improbable that any parti-coloration of the pupal surface could occur as the result of such a mixed stimulus, and led to the conclusion that the effects were due to the intermediation of the nervous system in the central parts of which the opposing influences from different regions of the body met and produced more or less of an equilibrium, resulting in the dispatch to all parts of the body surface of stimuli producing intermediate effects. These conclusions were so far-reaching and important that it was necessary if possible to repeat the experiments with other species in which the conditions were more favourable. Although such experiments were not made in 1886 upon the *Pierinæ*, it was clearly seen, when the paper came to be written, that they would be peculiarly suitable for the purpose, because of the great length of the whole sensitive period and the fact that its two stages are both passed under conditions which are eminently favourable for such

an investigation. A few such experiments upon *P. rapæ* were attempted by G. C. Griffiths in 1887 (Trans. Ent. Soc. 1888, pp. 265, 266), and the results upon the whole supported those obtained in the case of *V. urticæ*. But the experiments were not very convincing because the colours employed were not those which produce the most marked and opposite effects.

In 1888 I made some experiments of the kind upon *P. rapæ* and *P. brassicæ* (Trans. Ent. Soc. 1892, pp. 445, 446 and 484), using a box lined with black and orange squares, but owing to the excessive mortality from the attacks of ichneumons only 6 of the latter and 2 of the former could be tabulated. The results however entirely confirmed the experiments made in 1886 upon *V. urticæ*, intermediate and not parti-coloured pupæ being always obtained. In 1892 I made a large number of experiments upon *Vanessa io* (*l. c.* pp. 420—426), and again upon *V. urticæ* (*l. c.* pp. 391—397). Furthermore a method had by then been arrived at which enabled the larvæ of the *Vanessidæ* to be subjected to conflicting colours during the whole of the sensitive period; and another method whereby the dorsal and ventral surfaces could be subjected to opposing stimuli (in the case of *V. io*, *l. c.*). In all previous experiments the anterior and posterior parts of the body had been thus treated. All such modifications and additions yielded confirmatory results.

I was nevertheless very anxious to repeat the experiments upon the *Pierinæ* and therefore took advantage of the abundance of *P. brassicæ* last year (1898). Here, again, however, owing to the *Ichneumonidæ*, my results were not at all what I had anticipated; but taking them in combination with those which have been already published they leave little or no room for doubt.

Two conflicting colour-boxes were made for me by Mr. W. Holland and Mr. A. H. Hamm. The first box had an internal section of 54·5 c.m. by 14·2 c.m., and a depth of 7·4 c.m. (from back to front in the position made use of). It was used resting on one long side with a clear glass front. The roof (the side uppermost in the position in which a receptacle is used is here always called the "roof") was divided into 9 bays of about equal size by means of 8 hanging partitions (each 7·4 c.m. deep and thus extending from the back to the clear glass front, and hanging down for a distance of 3·5 c.m.); while the back

was similarly divided into 10 bays by 9 partitions which alternated with those of the roof. These were 9·0 c.m. high and their lower borders 2·0 c.m. from the floor, while they projected 3·5 c.m. from the back towards the glass front. The object of this division of the internal surface was to separate the larvæ as much as possible, and thus minimise their influence upon each other during the sensitive period. The whole internal surface, except the floor, of the box, and both surfaces of all the partitions were lined with a chess-board pattern of orange and black, each 1·4 c.m. square, and thus as nearly as possible half the length of an average mature larvæ of *P. brassicæ* when resting in Stage II preparatory to pupation. The pattern was made by ruling the outlines of the squares in pencil upon a sheet of deep orange surface paper and then carefully pasting black tissue-paper squares over alternate orange squares.

It is much to be regretted that an experiment conducted with so much care should have produced such limited results as regards the numbers of pupæ.

The first box only contained 3 pupæ which could be tabulated with certainty on May 6th when the examination was made. All were fixed in the left-hand bay of the roof, near to the glass window.

One pupa was fixed diagonally across a black square with the end of its tail lying on another one, and the head, directed towards the light, overhanging an orange square. It was dead but had clearly been a (2) or a (3).

The second was fixed parallel with the glass, the posterior $\frac{3}{5}$ of its body on the anterior part of a black square, but a little overhanging an orange square in front, and the anterior $\frac{2}{5}$ similarly on orange and overhanging black as well as orange in front (viz. towards light). It was a greenish (1 β).

The third pupa was also parallel with the glass, although the tail curved towards it. The posterior $\frac{2}{3}$ of its body was on the posterior (viz. away from glass) border of (so that the right side overhung) a black square, the anterior $\frac{1}{3}$ similarly on and similarly overhung orange. The left side (away from glass) overhung the opposite colours in each case except the posterior $\frac{1}{6}$ which curved towards light, viz. towards the middle of the black square, so as to overhang black. The pupa was a greenish (1 γ).

There were also two other dead pupæ which could be

placed with tolerable accuracy, by an examination of the persistent cuticular pigment.

One of these pupæ was at the back of the roof in the same bay as those described above. It was chiefly upon the black, extending obliquely across parts of two black squares which were in contact at the junction of its anterior and middle thirds; at this point therefore and on each side it, the sides of the body overhung orange. There was very little pigment and it had been certainly not darker than a (1 γ), and probably either a (2) or (3).

The second pupa was on the roof of the bay at the opposite end of the box, close to the hanging partition. Its anterior half was on black, its posterior on orange, crossing almost at the middle of the adjacent sides of the squares; its head towards the light. It had probably been a (1 β).

Although these five pupæ had been subjected to the most strongly contrasted influences in various regions of their bodies, there was not, in a single instance, the faintest trace of parti-coloration. The opposing influences gave rise to a general effect which was almost exactly intermediate between the effects which they would have respectively produced if they had acted alone. It is to be noted that if there is any deviation from the intermediate position it is in the direction of the effects produced by orange. The larvæ seem upon the whole to have rested in contact with black in preference to orange, and thus overhung the latter colour rather more than the former. But many more experiments would be required in order to estimate exactly the relative strengths of these two opposing influences; and it is noteworthy that the results of my experiments upon this species in 1888 led to different conclusions upon this point.

The second box was 43·6 c.m. × 15·4 c.m. in internal section and had a depth of 10· c.m. It was similarly arranged with 6 hanging partitions, and 7 projecting from the back each 8·5 c.m. long but in other respects similar.

The second box was examined on May 7th. In this case six had pupated on the glass. Of two isolated pupæ, fixed in a vertical position with head uppermost, one had emerged and one was dead or emerging; both were probably (1 γ). Two more, similarly placed, were dead and could not be classified. Of two near together, but

otherwise similarly fixed, one was a greenish (1 γ) and one, emerging, was probably a (1 γ) or (2).

Two pupæ were fixed to the parti-coloured surface of the roof. Of these one diagonally crossed two black squares in a manner very similar to that of the first described of the two dead pupæ in the first box, which could not be classified with certainty. The direction of the body was oblique with the head away from the light. It had emerged, but had clearly been a (2) or (3). The second was fixed in another bay, near to and parallel with the glass. The posterior $\frac{2}{3}$ of the body crossed a black square, the anterior $\frac{1}{3}$ was on the next orange one. It had emerged but had evidently been a (1 β) with quite dark pigmentation. There was *no trace* of less pigmentation in the anterior third of its body.

These results entirely confirm those obtained in the first box.

Although further experiments of this kind are to be desired, especially upon so sensitive a species as *P. napi*, it may be regarded as certain that the conclusions derived from the earlier experiments with conflicting colours are sound, and that not parti-coloured pupæ but uniform intermediate ones are obtained in this way.

F.—NOTES ON THE STRUGGLE FOR EXISTENCE IN THE LARVÆ OF *Pieris brassicæ*. (E. B. P.)

I have previously noted the numbers of this species which perish from the attacks of parasites in a year in which the larvæ are specially abundant. It seemed of interest to obtain further records, and I accordingly asked Mr. Holland and Mr. Hamm to keep notes of the number of larvæ attacked by ichneumons and the numbers dying apparently from other causes, which they removed from the cases containing the mixed larvæ from St. Helens and Oxford (see p. 409). The results are recorded in the table on the following page.

In the breeding-cases from which these larvæ were removed only 121 pupæ were taken, including the dead ones; so that the extinction is on a vast scale. Even if it be conceded that the larvæ dying without the appearance of parasites, and the dead pupæ, were entirely due to the conditions of experiment (such as the possible introduction and spread of some form of bacterial disease), the

extinction due to the attacks of a single species of parasite is still immense, only about $\frac{2}{7}$ of the whole surviving it.

		Number of Larvæ attacked by *Ichneumonidæ*.	Number of deaths apparently due to other causes.
1898.	Sept. 22	23	—
	,, 23	25	—
	,, 24	70	—
	,, 26	227	20
	,, 27	64	18
	,, 28	96	29
	,, 29	47	3
	,, 30	54	71
	Oct. 1	37	2
	,, 2	107	—
	,, 3	2	49
	,, 5	145	32
	,, 6	42	7
	,, 8	35	17
	,, 11	11	5
1899		at least 31	at least 20
		Total 1016	Total 273

G.—EXPERIMENTS UPON THE PUPÆ OF *Pieris rapæ*.

1. Experiments upon the Winter Pupæ of *Pieris rapæ*. (F. M.)

The next experiments tried were on this species and are detailed in the following section. I was late for this species and did not experiment with more than 50 or 60 larvæ, from which I obtained the single row of about 40 pupæ which are now shown in the Exhibition Case. Here I call attention to the contrast between those in the black surroundings on the one hand and those in the green paper, yellow, or orange surroundings on the other, the green in this species seeming more effective than it proved with the other species and the yellow less so.

2. Results of the above Experiments. (E. B. P.)

The colour variations of the pupæ of *P. rapæ* have been already described and figured (Phil. Trans. 1887, *l. c.* pp. 410, 411, Plate 26, figs. 31—41), and it is here only necessary to state that the standard classification begins with the darkest pupæ (1), ranging through the less dark (2) and still lighter (3) to the pale (4) and the green (5).

Mr. Merrifield's pupæ were compared on March 20, 1899: the results are given below without much detail,

inasmuch as the species is already known to be susceptible. In addition to those tabulated below, Mr. A. H. Hamm found two very dark pupæ, evidently (1), on a tarred fence near Oxford, on April 2, 1899.

All the (5)s were bright green and very pronounced

Experiments.	Degrees of Pupal Colour.					Remarks.
	Darkest. (1)	Less dark. (2)	Still lighter. (3)	Pale. (4)	Green. (5)	
1. Black.	2					Also 2 dead.
2. Black, on glass.			2			Pinkish ground-colour.
3. Dirty white paint.			1			Very dull, dark pupa. Removed from *P. napi*.
4. Darkness.			4	1		(3) Pinkish : (4) greenish.
5. Green.				1	1	Also 1 dead : (4) greenish.
6. Green, through glass.				1		Also 1 dead or emerging. (4) light pinkish.
7. Green screen.				1		Also 1 dead. Pupa greenish.
8. White, on glass.				2		1 greenish, 1 pinkish.
9. Yellow.				1	1	(4) greenish.
10. Yellow in shade.				1	1	(4) greenish.
11. Yellow on glass.					2	
12. Orange.		1		1	2	Also 1 dead : (4) pinkish.
13. Orange screen.					1	Also 1 dead (removed from *P. napi*).
14. Clear glass.	1	3	1			Also 1 dead.

representations of this degree. A few other conditions were tried, but the single pupæ subjected to them had died and the colour had changed so greatly that they could not be tabulated.

The numbers of the pupæ are not large and the results quite confirmatory of previous experiments. (Phil. Trans.

1887, *l. c.*, and Trans. Ent. Soc. Lond. 1892, *l. c.*: see also G. C. Griffith's experiments on this species in Trans. Ent. Soc. Lond. 1888, p. 247.)

It is interesting to observe the relation between the effects of darkness (4) and those of clear glass (14). The latter produced even darker pupæ relatively to the former than in the case of *P. brassicæ*.

The table does not support Mr. Merrifield's conclusion that the yellow (9, 10, 11) was less effective than in the case of *P. brassicæ*. The six pupæ were of the two lightest degrees, four of them green and the other two greenish.

The effect of the green and orange screens (7, 13) is confirmatory of previous results with other species (*P. brassicæ* and *V. io*).

It is not necessary to comment further upon the other results, all of which will be clear upon an inspection of the table on p. 423.

II.—EXPERIMENTS UPON THE PUPÆ OF *Vanessidæ*.

1. Experiments upon the Pupæ of *Vanessa urticæ* and *Pyrameis cardui*. (C. B. S. and E. B. P.)

In the course of our investigations in 1898 into the struggle for existence during the pupal period of *Vanessa urticæ* it was necessary to produce a very large number of pupæ with colours as widely contrasted as possible. In order to achieve this we made use of black surroundings on the one hand and gilt (Dutch "gold"), yellow, orange, and white on the other. There was abundant evidence in the 700 pupæ which we obtained of the previously recorded influence of these surroundings, and also, to our frequent annoyance, of the effect of the dark surfaces of the larvæ upon one another. In fact so powerful was this influence and so gregarious were the larvæ under the conditions of our experiments that intermediate pupæ were generally produced when the lightest forms were desired. The conditions of the investigation rendered it impossible to isolate so many larvæ in separate cases.

Many of the larvæ pupated on the leaves and stems of the food-plant (nettle), and when isolated brilliant golden pupæ were almost invariably produced.

A few larvæ of *P. cardui* were also found and subjected to black and white surroundings: the pupæ being dark in the one case, and light, and often brilliantly metallic, in the other.

2. Experiments upon the Pupæ of *Vanessa io*. (Mabel E. Notley, Florence A. Wright, and E. B. P.)

The experiments of last year upon the struggle for existence during the pupal period are now being repeated in the case of *Vanessa io*. In this case all the pupæ were obtained at the outset of the investigation, and the results as regards their colour susceptibility can now be given.

We are greatly indebted to Mr. W. Farren of Cambridge, and to Mr. H. W. Head of Scarborough, who sent us numerous companies of larvæ in excellent condition. Kind help was also received from Mr. W. H. Harwood of Colchester, and from Mr. A. E. Holdway of Newton Abbot.

The larvæ thus obtained were placed in a large number of "light" and "dark" receptacles, the former being lined with orange, yellow, or white paper (white opal glass was used in the case of a few larvæ), the latter with black paper (a few were attached to the dull surface of perforated zinc). All were placed in a strong light and only shielded from the direct rays of the sun. A few were subjected to conflicting colours in one of the boxes described on pp. 418, 419.

The results obtained are tabulated below (see p. 426), the degrees of pupal colour being those described in Trans. Ent. Soc. Lond. 1892, p. 398; the (1)s and (2)s being the darkest forms with the underlying green completely or very nearly concealed by pigment which is blacker in (1), lighter in (2); the (4)s and (5)s being distinct green forms very bright and glittering in (5), duller and with more dark pigment in (4); the (3)s intermediate.

The pupæ which were attached to the nettle-leaves, leaf-stalks or stems are indicated by the letter *n*, and those found loose on the floor by the letter *f*. These facts were not however recorded at the beginning of the experiments so that more pupæ were in reality found in these positions in the companies received at first. The facts are important inasmuch as the pupæ on the floor were adversely influenced in the experiments with light surroundings, the pupæ on the nettles in the experiments with dark.

The companies are tabulated separately below, but it was not thought necessary to describe each separate receptacle, as this work is confirmatory. The numerous receptacles in which the larvæ of each company were placed are grouped together as "light surroundings," and "dark surroundings."

Companies of Larvæ.	Conditions of Experiments.	Degrees of Pupal Colour. (1)	(2)	(3)	(4)	(5)	Totals.
Company of 64 larvæ (3 died), received July 11, from W. Farren of Cambridge.	Light surroundings.			2	11	22 (3 *n.*)	35 (3 *n.*)
	Dark surroundings.	4	9 (1 *n.*)	11 (3 *n.*)	1	1 1 *f.*)	26 (4 *n.*) (1 *f.*)
Company of 172 larvæ (26 died), received July 11, from W. Farren of Cambridge.	Light surroundings.	1	2 (1 *f.*)	7 (3 *f.*)	26 (8 *n.*) (3 *f.*)	90 (21 *n.*) (3 *f.*)	126 (29 *n.*) (10 *f.*)
	Dark surroundings.	9 (1 *n.*) (2 *f.*)	4 (1 *n.*)	3 (1 *n.*)	1 (1 *n.*)	3 (1 *n.*)	20 (5 *n.*) (2 *f.*)
Company of 163 larvæ (16 died), received July 13, from W. Farren of Cambridge.	Light surroundings.		4 (1 *f.*)	2	2	72 (33 *n.*)	80 (33 *n.*) (1 *f.*)
	Dark surroundings.	10	44	9	1	3	67
Company of 87 larvæ (16 died), received July 14, from W. H. Harwood of Colchester.	Light surroundings.	2	4	3 (1 *n.*)	3	31 (13 *n.*)	43 (14 *n.*)
	Dark surroundings.	8 (2 *n.*)	10 (5 *n.*)	4 (4 *n.*)	2 (2 *n.*)	4 (4 *n.*)	28 (17 *n.*)
Company of 57 larvæ (16 died), received July 14, from W. H. Harwood of Colchester.	Light surroundings.		1	2	4 (1 *f.*)	29 (9 *n.*) (1 *f.*)	36 (9 *n.*) (2 *f.*)
	Dark surroundings.	3	1	1			5
Company of 148 larvæ (8 died), received July 14, from H. W. Head of Scarborough.	Light surroundings.	4	1	13 (2 *n.*)	9 (1 *n.*)	83 (16 *n.*) (2 *f.*)	110 (19 *n.*) (2 *f.*)
	Dark surroundings.	2	20	4 (1 *f.*)	1	3 (2 *n.*) (1 *f.*)	30 (2 *n.*) (2 *f.*)
Company of 18 larvæ (11 died), received July 15, from Torquay from A. E. Holdway.	Light surroundings.					7 (3 *n.*)	7 (3 *n.*)
Company of 112 larvæ (21 died), received July 15, from W. Farren of Cambridge.	Light surroundings.			4	3 (1 *n.*)	29 (11 *n.*)	36 (12 *n.*)
	Dark surroundings.	15 (1 *f.*)	28	5 (1 *f.*)	5	2 (2 *n.*)	55 (2 *n.*) (2 *f.*)

Companies of Larvæ.	Conditions of Experiments.	Degrees of Pupal Colour. (1)	(2)	(3)	(4)	(5)	Totals.
Company of 185 larvæ, received July 15, from H. W. Head of Scarborough.	Light surroundings.		13	11	15 (1 *n.*)	84 (10 *n.*) (2 *f.*)	123 (11 *n.*) (2 *f.*)
	Dark surroundings.	10	50 (2 *n.*) (1 *f.*)		1 (1 *n.*)	1	62 (3 *n.*) (1 *f.*)
Company of 46 larvæ (2 died), received July 19, from H. W. Head of Scarborough.	Dark surroundings.	11 (1 *n.*)	19 (3 *n.*)	9 (2 *n.*)	3 (2 *n.*)	2	44 (8 *n.*)
Company of 139 larvæ (37 died) received July 19, from H. W. Head of Scarborough.	Light surroundings.	1	7 (7 *f.*)	8 (2 *n.*) (3 *f.*)	5 (2 *n.*)	17 (1 *n.*) (1 *f.*)	38 (5 *n.*) (11 *f.*)
	Dark surroundings.	8 (1 *n.*) (1 *f.*)	32 (5 *n.*) (14 *f.*)	19 (1 *n.*) (13 *f.*)	4 (4 *f.*)	1 (1 *n.*)	64 (8 *n.*) (32 *f.*)
Company of 25 larvæ, received July 21, from H. W. Head of Scarborough.	Light surroundings.			1	1	15 (4 *n.*) (1 *f.*)	17 (4 *n.*) (1 *f.*)
	Conflicting surroundings.		1	2	5		8
Company of 70 larvæ (8 died), received July 21, from H. W. Head of Scarborough.	Dark surroundings.	20	31 (4 *n.*)	6 (4 *n.*)	3 (1 *n.*)	2 (2 *n.*)	62 (11 *n.*)

	Totals.	Degrees of Pupal Colour. (1)	(2)	(3)	(4)	(5)	Totals.
Companies experimented on in 1899, 13. Total number of larvæ, 1302 (180 died).	Light surroundings.	8	32 (9 *f.*)	53 (5 *n.*) (6 *f.*)	79 (13 *n.*) (4 *f.*)	479 (124 *n.*) (10 *f.*)	651 (142 *n.*) (29 *f.*)
	Dark surroundings.	100 (5 *n.*) (4 *f.*)	248 (21 *n.*) (15 *f.*)	71 (15 *n.*) (15 *f.*)	22 (7 *n.*) (4 *f.*)	22 (12 *n.*) (2 *f.*)	463 (60 *n.*) (40 *f.*)
	Conflicting surroundings.		1	2	5		8

These results prove the extreme sensitiveness of *V. io*, and they afford valuable and very extensive confirmation of some of the results described in Trans. Ent. Soc. Lond. 1892, pp. 397—432.

I.—EXPERIMENTS AND OBSERVATIONS UPON THE SUSCEPTIBILITY OF CERTAIN LEPIDOPTEROUS LARVÆ AND PUPÆ TO THE COLOURS OF THEIR SURROUNDINGS. (A. H. Hamm and E. B. P.)

1. *Stauropus fagi.* Mr. W. Holland and Mr. A. H. Hamm of the Hope Department, who are extremely skilled and accurate observers, drew my attention last year (1898) to the fact that the larvæ of this species differ in tint according as they are reared upon beech or birch, and that the colours are in each case such as to conceal them.

During the present year Mr. Hamm reared two batches (from different parents) upon the same food-plant, beech, but in other respects under very different conditions as regards environment. One of the batches was reared in a white tissue-paper lined rectangular glass case with a perforated zinc lid, the other in a similar case lined with black tissue-paper. We compared the two, placing both batches on white paper, on July 13, 1899.

There were 24 larvæ in the batch reared in the white case, and of these all but 2 were in the last stage and mostly advanced in it. All but 1 were *much* lighter than larvæ of this species usually met with in nature, and some most markedly lighter. The other batch consisted of 14 larvæ, of which 10 were in the last stage (mostly advanced), 1 in the last but one, and 3 in the last but two. All were very dark, and most of them far darker than those generally met with in nature. It is clear that this species is highly sensitive, and it would be of great interest to repeat the experiments under conditions which have been found in other larvæ to produce the strongest effects. It is remarkable that such considerable results followed from surroundings which were not apparently in contact with the larvæ (for these at any rate when they were examined rested upon the twigs and not upon the walls of the case). I do not think, in any of the previous experiments with larvæ, that equal effects have been produced in this manner; and one is tempted to enquire whether it is possible that the larvæ in earlier and specially sensitive stages, did actually rest upon the black and white walls of the cases.

2. *Notodonta ziczac.* My friend Mr. Arthur Sidgwick showed me, in the summer of last year (1898), a larva of

this species which he had obtained from *Populus alba*, and I was greatly struck by the remarkable lightness of its tint. It was quite unlike any larva of the species I had ever seen. Mr. A. H. Hamm informs me that he has also observed great differences in the depth of colour of this larva according to the food-plant upon which it has been found. It is highly probable therefore that this species is also sensitive, and searching experiments upon it are greatly needed.

This case and the last are of high interest, inasmuch as no larva at all closely allied to these two species has yet been shown to be sensitive to the colours of its environment.

3. *Amphidasis betularia.* Mr. A. H. Hamm tells me that he has again and again observed in nature the wide differences between the colours of this highly sensitive larva upon various food-plants, and that the differences are invariably in the direction of concealment. Mr. Hamm's experience in the field is so wide and his powers of observation so keen that the strongest confirmation is afforded to the observations recorded in my previous paper (Trans. Ent. Soc. Lond. 1892, pp. 359, 360).

4. *Eupithecia pimpinellata.* Mr. Merrifield informs me that Mr. Nicholson (of Lewes) has noticed that this larva appears in two forms—reddish-brown and green—which correspond to the two forms of the seed-heads of *Pimpinella saxifraga* on which it feeds. Mr. Nicholson states that the green larvæ are nearly always found on the green heads and the others on the brown.

The power of colour adjustment is probably present in a very high degree in the larvæ of the genus, and numerous carefully conducted experiments are much to be desired.

5. *Vanessa polychloros.* I may also mention that a pupa of this species which I found (July 1899) upon the dark painted iron railing at the North Entrance Gate of the Oxford University Museum, harmonised very perfectly with the surface from which it was suspended.

6. *Vanessa antiopa.* In August 1897 I found several living pupæ of this species attached to fences, buildings, etc., at the Hunt Club, Scarborough Heights, Toronto. I specially noticed that there was a marked resemblance to the environment. This was all the more noticeable inasmuch as the colours differed very widely, some surfaces being very dark and others very light.

K.—OBSERVATIONS ON THE COLOUR-RELATION BETWEEN A COLEOPTEROUS SPECIES (*Cleonus sulcirostris*) AND ITS SURROUNDINGS. (W. Holland and E. B. P.)

The Rhynchophorous species *Cleonus sulcirostris* is described as possessing very variable markings (Fowler, *British Coleoptera*, London, 1891). Mr. W. Holland has recently found it upon the red sands of Boar's Hill near Oxford, and it is most interesting to observe that all the specimens are reddish-brown in colour, entirely different from the grey forms found by him on the sand-hills at Deal, and from the darker grey ones which he finds on Shotover Hill also near to Oxford and only a few miles from Boar's Hill. There are yellow and red sands on the top of Shotover, but Mr. Holland has as yet only searched for this species in localities where they are not exposed on the surface. There have been no exceptions to the colours of the very large numbers found on both hills. It is reasonable to suppose that these colours, which certainly harmonise with the ground of each locality, are protective; inasmuch as the species possesses in a very high degree the instincts which lead to concealment.

So far as I am aware this is the first time that such local adaptation of colour has been shown to occur in a Coleopterous insect, and the interesting question arises as to whether the species possesses the power of varying its colour during growth according to the stimulus provided by the colours of its surroundings, or whether the results are due to the varying operation of natural selection in different localities leading in each case to the survival of the individuals which are best concealed.

It will be of the highest interest to look for further examples in Coleoptera, as well as to attempt to ascertain the manner in which the colour adaptation is brought about.

L.—APPENDIX.

THE QUALITY OF LIGHT FROM THE COLOURED AND OTHER BACKGROUNDS EMPLOYED IN THE EXPERIMENTS RECORDED IN THE PRESENT MEMOIR. (Sir John Conroy and E. B. P.)

My kind friend Sir John Conroy, F.R.S., again helped me to make a correct analysis of the light reflected from the backgrounds employed in our experiments. The papers, etc., were examined in the Laboratory of Balliol College, Oxford, on July 24th, 1899. The beam from an electric arc was passed through a bisulphide of carbon prism, and the spectrum thrown on a white paper screen in a darkened room. The coloured papers, etc., were held so as partly to cover the spectrum, and sometimes two were held in the spectrum side by side for purposes of comparison. The method was thus the same as that made use of on the previous occasion (Trans. Ent. Soc. 1892, *l. c.* pp. 459 *et seqq.*), except that the lime-light illumination was then employed, and our spectrum was therefore weaker at the blue end than with the electric arc. The results obtained are recorded below.

I. *Coloured backgrounds, etc., employed by F. Merrifield:*—

Black net and *black tissue-paper* (used as a plane surface and also rolled round sticks). The reflected light from both gave a feeble continuous spectrum. The transmitted light was the same but still feebler.

Dark sticks also gave a faint continuous spectrum: *cork carpet* was similar except that the reflected red was prominent.

Orange tissue-paper (used as a plane surface and also rolled round sticks). Some absorption of green and more of blue and violet; absorption more marked in the sticks where there was more than one thickness of the paper. No appreciable difference between the reflected and transmitted spectrum of the paper. The spectrum was far more like that of a yellow paper than of the deep orange used in my experiments, which removed everything except the red, orange, and yellow.

Orange leno gave a very similar spectrum, the blue and violet being almost cut off, and the green a little darkened.

The absorption was more marked in the transmitted light.

Yellow tissue-paper (also rolled round sticks). Violet cut off and blue much diminished; hardly any blue in the transmitted light, and in the thicknesses of paper rolled round sticks.

Golden yellow oat-straw gave a very similar spectrum, the blue and violet being absorbed and the rest unaffected.

Unfaded bright yellowish-green tissue-paper (also rolled round sticks). The red shortened and dimmed; the blue and violet much absorbed. Transmitted light similar, as also the reflected light from the paper round sticks.

Bright yellowish-green art muslin. A similar spectrum. Not much difference between transmitted and reflected light, except that two thicknesses produced far greater effects in the former.

Dull green reeds. Whole spectrum somewhat weakened, the blue most and then the red.

Yellow metallic surface of brass (*Dutch gold*), also rolled round sticks. Appears to give a strong continuous spectrum, but the yellow colour is due to absorption of the blue end.

Dead reeds. The lightest of them gave a typical yellow spectrum with absorption of the blue end only; in the others there was diminution of all other regions, although the blue end was still most reduced.

Turned cylindrical wooden sticks (probably deal). A very similar spectrum; the blue end was still more absorbed than any other part, although less so than in the dead reeds.

Dirty white paint gave a very similar spectrum with some absorption throughout, most in the blue, least in the green.

White paper rolled round sticks, white calico, shaved white sticks all gave a strong continuous spectrum with no selective absorption.

Yellow glass (used as screen). Blue and violet cut off, the rest unabsorbed.

Deep green glass (used as screen). The green almost unabsorbed. The whole of the blue end, and nearly all the red and orange absorbed.

II. *Coloured backgrounds employed by E. B. Poulton* and those who worked with him.

The *Black papers*, both "surface papers" and tissue-papers, gave the same results as Mr. Merrifield's, and those previously recorded (E. B. Poulton in Trans. Ent. Soc. Lond. 1892, pp. 461—464), and the same was true of the *yellow* papers (surface and tissue) and *yellow leno*, all of which were typical; the *white paper*, and the *white opal glass*. The *deep orange* paper was similar to that I have previously used, and very different to Mr. Merrifield's. The following backgrounds had not been examined before:—

A dull surface of metallic zinc (perforated) gave a dim continuous spectrum (general, but no selective absorption).

Salmon pink surface paper. A very faint absorption of the blue was all that could be seen. The blue also looked redder, an effect which may have been due to the stray white light reddened by selective absorption in the paper.

Violet paper. Much of the blue end, and considerable red were reflected. There was an absorption band between the green and the blue, and the yellow, orange, and green were much absorbed.

XIV. *Notes and Descriptions of some Species of Western Australian* Coccidæ. By CLAUDE FULLER, F.E.S., Government Entomologist, Pietermaritzburg, Natal.

[Read October 4th, 1899.]

PLATE XV.

THE following Notes and Descriptions are the outcome of some months' residence at Perth, on the Swan River, Western Australia, where in the immediate vicinity of the city I collected the majority of the specimens. For many, particularly those from other localities, I am, however, indebted to my friends and their colleagues Messrs. Richard Helms, A. M. Lea, and A. E. Lankaster. A catalogue of the greater number of the species was published in 1897, in the Journal of the W. A. Bureau of Agriculture. The diagnoses given therein were very brief, and intended only as preliminary to the publication of the full descriptions; which were then almost in the same form as that in which they are now presented. It has been impossible, owing to many vicissitudes, to take full advantage of the time that has since elapsed, and little more has been done than to modify the arrangement to some extent, correct a few obvious errors, and add remarks to those species which have since been discussed by other authors.

Family COCCIDÆ.

MONOPHLEBINÆ.

Genus CALLIPAPPUS,* Guérin-Ménéville.

Since 1849, when Guérin-Ménéville† formed this genus for the reception of a single species *C. westwoodii* from the Swan River, Western Australia, no further additions have been made to it. I have, however, been very fortunate in securing many specimens of his species, and two others as

* Mr. T. D. A. Cockerell has, I understand, recently placed this genus in the sub-family *Margarodinæ*, tribe *Xylococcini*.

† Revue Zoologique, p. 129, 1849.

well, the study of which enables me to establish, somewhat at the expense of Mr. Maskell's genus *Cœlostoma*, a genus of six numbers.

1. *Callipappus westwoodii*, Guérin-Méneville.
2. *Callipappus australis*, Maskell.
   (*Cœlostoma australe*, Maskell, 1890.)
3. *Callipappus immanis*, Maskell.
   (*Cœlostoma immane*, Maskell, 1891.)
4. *Callipappus rubiginosus*, Maskell.
   (*Cœlostoma rubiginosum*, Maskell, 1893.)
5. *Callipappus, farinosus* Full.
6. *Callipappus, bufo* Full.

Having a large amount of material at my disposal I have been able to examine the three West Australian species fairly thoroughly, and have found in their structure a most interesting and distinctive feature—the complete intussusception of several of the abdominal segments of the mature ♀s, in the form of a marsupium, in which the eggs are laid and incubated. This feature could have only been overlooked by the former students of the genus for want of material, and Signoret, though he figures five abdominal segments, says that only two are visible. Maskell in placing the three species mentioned above in his genus *Cœlostoma*, must have been guided by that part of Signoret's definition where he says: "Rostrum and mouth-parts between the bases of the anterior legs, and a little below their insertion." Maskell found that the insects sent him from Australia were without mouths, and that enlarging the characters of *Cœlostoma* placed them therein. The members of the genus *Callipappus* are however mouthless, and one must conclude that Signoret has referred to the small buccal nipple or obsolete mouth sometimes seen, as the rostrum; for it is evident that he could not have made out the rostrum, as he says that he was unable to see or study the genital orifice and anus for, "notwithstanding a maceration of several days, the tegument was not rendered transparent."

Characters :—♂, Antennæ 10- or 11-jointed, tapering from base to apex: first 2 joints short, the rest longer. Eyes facetted. Abdomen slightly lobed at the sides, the last segments bearing a caudal brush of long, glassy filaments. Penis very long. Legs long; tibia longer than tarsus, the latter bearing a single claw. Balancers large and wide, with a hook to one side of the extremity.

♀, adult. Viewed from above, the body is usually more or less triangular in outline; from the side it is seen to be thin and pointed in front, and truncate and much inflated behind, with a decided keel extending around the head and along each side, but not behind. Abdomen intussuscepted, only the first two or three segments being visible. The intussuscepted portion forming an ample pouch with a comparatively small entrance, and extending inwards almost to the cephalic region. Sexual orifice and anus situated at the back of the pouch. Eggs deposited in the pouch, the young escaping when hatched through the opening unaided by any maternal exertion. Antennæ 10-jointed; the basal joint wider than long; the apical the longest and slightest. Rostrum and mentum entirely absent. Legs thick, the anterior pair not differing from the posterior.

Larva red, oval; abdomen rounded, the extremity truncate and projecting slightly, and exhibiting a short anal tube; there are several strong spines and four floriform pores in the anal region. Legs ample; tarsus longer than tibia; coxa large; claw simple. Antennæ of 6 joints, of which the apical and the basal are the thickest, giving a constricted appearance; apical joint oval and wider than 3, 4, or 5; joints 1 and 2 stout and wide. Rostrum ample. Mentum monomerous, spined.

1. *Callipappus westwoodii*, Guérin-Méneville. (Pl. XV, figs. 3, 3 *a*.)

Adult ♀ of the usual form of the genus, though not much inflated; bluntly rounded behind; sides of the thoracic region parallel, those of the head tapering acutely; a distinct keel runs round the apex and terminates on either side of the extremity. Legs ample and stout, with strong, spine-like hairs; tarsus curved, with a comb of spines on the inner margin. Rostrum and mentum obsolete. Antennæ 10-jointed. Epidermis mammillate. Colour dark purple, with an obscure patch of chestnut on the last thoracic segment. Opening of pouch ventral; from the folds around it long glassy filaments are secreted. Length one inch; width one-half inch.

♂ purple. Antennæ 10-jointed. Length of body 0·25 inch, length of caudal brush 0·5 inch. (For full descriptions of ♀ and ♂ Signoret's notes should be consulted.)

The adult ♀s were found beneath the dead bark scales of various *Eucalypti*. The ♂s are often captured on the wing.

2. *Callipappus farinosus*, sp. n. (Pl. XV, figs. 1, 1 *a*, 1 *b*, 1 *c*.)

Adult ♀ of the usual form and much inflated, being at times

almost cylindrical. When viewed from above, the body is elongate-ovate with a marginal keel. Colour of dorsum claret-brown, sometimes mottled ; ventrum chestnut. Thoracic segmentation indicated by tranverse bands of red. Antennæ 10-jointed, tapering, joints of a dark brown colour, except the 3 basal, which are red. Legs stout, and when the insect is *in situ* always extended; those of *Westwoodii* are drawn under the body. Opening of pouch in the form of a transverse slit, terminal. Intussusception extending in to the region of the mesothorax. The species is more easily distinguished from the foregoing by the nature of its secretion. This appears mealy, and besides covering the whole body, is strewn widely around it. When highly magnified the meal is seen to consist of particles of glassy cylinders bent almost into the form of a circle. Length of majority of specimens one inch, width one-half inch.

On *Casuarina sp.* Perth.

3. *Callipappus bufo*, sp. n. (Pl. XV, figs. 2, 2 *a*, 2 *b*, 2 *c*.)

Adult ♀ stationary, found in exposed positions on twigs or leaves, to which it is affixed by a silky pad lying between the bases of the posterior legs. The legs appear to grasp the twig or leaf, but do not in reality. Length of several specimens 0·5 inch. Viewed from above, the body tapers to a point at the head and is abruptly truncate behind ; contour almost triangular. Cephalic region thin and flat ; thoracic inflated above and below ; dorsum with two median humps. Where attached to twig or leaf there is a depression in the ventral surface. A decided keel runs round the head and terminates on either side of the base. The colour of the dorsum is not uniform ; it is purple-brown, with reddish patches on either side of the median line above the intermediate and posterior legs. The colour of the ventral surface is a purple-brown. The whole of the body thinly covered with a fine meal, which is more plentiful in the region of the abdominal segments. Opening of the pouch in the centre of the posterior end, almost circular.

Taken on *Casuarina humilis*, *Banksia menziesii* and *B. ilicifolia*. The species approaches *Callipappus* (*Calostoma*) *rubiginosus* reported by Maskell from South Australia; it differs chiefly in having 10-jointed antennæ.

Genus Icerya, Signoret.

4. *Icerya purchasi*, Maskell.

This species occurs in small colonies on *Acacias* and *Citrus*, etc., but is kept completely in check by *Novius cardinalis* and other natural enemies.

COCCINÆ.

Genus Coccus, Linné.

5. *Coccus acaciæ*, Maskell.

This insect occurs on *Acacia pulchella* and another small "wattle" much resembling it. I think I may safely say that it is the prettiest and most highly coloured Coccid that I have ever seen, vying in brilliancy with the gaudy *Chrysomelidæ*. Maskell's description having been made from dried material, the following colour notes from living insects are added :—

Adult ♀ very convex, almost globose, slightly elongate behind. Dorsum shining and distinctly segmented, ornamented with four longitudinal rows of vermilion, and five rows of lemon-yellow spots. The spots are upon each segment and are separated by transverse bars of shining black, which occur in the constrictions. The median line consists of small yellow spots ; on either side are large red spots, and beyond these a wider row of yellow ones ; the spots in the remaining rows are much smaller. The transverse bars of black, lying in the constrictions, are not of even breadth, but are narrowed at several intervals, the red spots being sometimes confluent. Length 0·13 inch.

Genus Eriococcus, Targioni-Tozzetti.

6. *Eriococcus agonis*, sp. n.

♀ sac of apparently a loose texture, the accumulation of fumagine being always so thick that the colour and true nature are quite obscured.

Adult ♀ elongate, convex, segmented ; colour purple ; length 0·06 inch. Antennæ tapering, 7-jointed ; 7 the longest, 2 and 3 sub-equal and next in size ; 7 is constricted and occasionally appears as two joints ; sequence 7 (2, 3) (1, 4) (5, 6). Mentum elongate-cordate, trimerous. Tarsus twice the length of tibia, digitules normal. Anal tubercles normal with 5 spines on each, one on either side of the apex and 3 at the base ; the spine upon the inner margin is very conspicuous and thorn-like ; apex of tubercle with a long spine. Anal ring probably 8-haired. There are a very few inconspicuous spines on the dorsum and two upon the margins of each segment.

On *Agonis flexuosa* ("Native Peppermint").

7. *Eriococcus apiomorphæ*, sp. n. (Plate XV, fig. 8.)

♀ sac white, thick, complete, very convex ; contour elliptical ; length 0·2, width 0·1, height 0·1 inch.

Adult ♀ globose ; length 0·12 inch. Antennæ 7-jointed, joints 2, 3 and 4 subequal, 7 smaller but larger than 5 and 6 which are subequal. Mentum long, conical, trimerous. Legs slender ; tarsus longer than tibia ; upper digitules knobbed, lower fine hairs ; claws sharp. Anal tubercles small, cylindrical, each with 2 spines at the base and one on the lateral margin ; apex almost truncate bearing a long seta. Anal ring 8-haired. Dorsum bearing very small acuminate spines, the margin with a fringe of much larger spines arranged at regular intervals.

Larva cinnamon-colour, segmented, ovate.

♂ puparium white, elliptical, convex ; length 0·06, width 0·03 inch.

This species has only been found in the empty chambers of the female gall of *Apiomorpha maliformis* and in the galleries formed in its walls by boring beetles, and was invariably associated with ants.

8. *Eriococcus cypræaformis*, sp. n. (Plate XV, fig. 5.)

♀ sac elongate-oval, very convex, smooth, shining ; sides prehensile ; colour light brown ; length 0·15, width 0·11 inch.

Adult ♀ filling sac. Antennæ 7-jointed, joint 1 globose, 2 shorter and stout, 3 and 4 subequal and stout, 6 and 7 narrow and subequal. Mentum short, cordate. Legs long. Anal tubercles large, very chitinous, rough and tapering ; each is furnished with 2 spines, one upon the outer margin at half the length, the other on the outer side of the apex. Dorsum pitted with irregular oval and circular pores and clothed with many spines.

Second stage ♀ naked, green, distinctly segmented, almost flat. Tubercles conspicuous and similar to adult. Antennæ cylindrical, 6-jointed ; the second and third joints fused together ; sequence (2, 3) (1, 6) (4, 5). On the margins of each of the last three segments of the abdomen there are 3 small spines.

Larva with tapering antennæ of 6 joints, apical joint conical. Abdomen ending in two long tubercles.

On *Casuarina sp.* The sac of the adult ♀ very much resembles a small "snake-head" shell, particularly when at all old and bleached.

9. *Eriococcus elegans*, n. sp. (Plate XV, fig. 4.)

Adult ♀ segmented, convex, elongate and narrow ; stationary, and covered above by a secretion of a number of white filaments which are arranged in 3 distinct rows of well-defined, curling, pyramidal tufts. Colour red-brown. Length 0·1 inch. Antennæ rather long, 6-jointed, apex haired, sequence 3, 2, 4, 7 (5, 6) 1. Legs ample, tarsus

longer than tibia and bearing long upper digitules, and a long sharp claw. Anal ring 8-haired. Tubercles almost conical, spined and bearing setæ. Dorsum densely clothed with short, conical spines and many protruding spinnerets.

On *Casuarina humilis* (?). The species is clearly an *Eriococcus*, but the dorsal covering could never be regarded as a sac, although, as the insects affect the axils of the branch and branchlets, they are completely enveloped.

10. *Eriococcus Gurneyi*, sp. n. (Plate XV, fig. 9.)

♀ sac complete above but not extending completely beneath the insect, tough, felted, rather flat, elliptical.

Adult ♀ filling sac, white, elongate, segmented : dorsum clothed with innumerable, closely set, short, stout, conical spines. Antennæ 8-jointed, joints 7 and 8 fused. Legs slender, tarsus longer than tibia, upper and lower digitules knobbed. Mentum dimerous. Anal tubercles cylindrical, black, spined and with setæ. Anal ring large, 8-haired.

Second stage ♀ active, pink or lemon-yellow. Antennæ, legs and tubercles as in adult. Dorsum clothed with long, cylindrical, glassy tubes, surmounted with conical caps ; those on the abdomen being the longest. The insect in this stage is a very elegant little creature, and highly suggestive of a hedgehog.

On a Rhamnaceous plant, in company with *Inglisia fossilis*, Mask. The name of my friend Mr. E. H. Gurney, of the N. S. W. Department of Agriculture, is attached to this species.

11. *Eriococcus hakeæ*, sp. n. (Plate XV, fig. 7.)

♀ sac of a tough, felted nature, white or buff colour and very convex ; length 0·2, width 0·13, height 0·1 inch.

Adult ♀ pink ; length 0·15—0·2 inch. Antennæ 7-jointed, 3 the longest, 6 the shortest ; sequence 3, 4, 1, 2, 7, 5, 6. Mentum dimerous, conical, hairy. Legs ample, furnished with several spines, tibia and tarsus subequal, digitules present. Anal tubercles large, stout, tapering and spined ; the median margins with 4 to 6 conspicuous spines, laterals with 3 ; with setæ. Anal ring conspicuous, with 8 long hairs. Dorsum with many conspicuous, conical spines, a few being larger than the majority ; the margins of each segment bear a pair of much longer acuminate spines, those on the posterior segments being the longest.

On *Hakea ilicifolia*. The sac of this species much

resembles that of *E. apiomorphæ*. The insects frequent the deepest crevices of the bark, but are easily dislodged.

12. *Eriococcus imperfectus*, sp. n.

♀ sac thick white, elliptical, slightly convex, incomplete beneath; length 0·1, width 0·6 inch.

Adult ♀ fawn-coloured, filling sac, segmented, margin fringed with short conical spines set at regular intervals. Antennæ 7-jointed, 3 the longest, 2 and 4 subequal, 5 and 6 short, small and equal, 7 twice the length of 6 and bearing a few hairs. Rostrum large; mentum conical, dimerous. Legs well developed, tarsus longer than tibia, claws slender, upper digitules conspicuous. Anal tubercles large, cylindrical, bearing several longish spines and setæ; apex conical.

Second stage ♀ active and without sac.

On *Melaleuca sp.* This species has been noticed to leave its food-plant occasionally before secreting the sac, and was first discovered on a paling fence, against which the host-plant was growing.

13. *Eriococcus simplex*, var. *dealbatus*, Maskell.

Eriococcus tricarinatus, sp. n. (Plate XV, figs. 6, 6 *a*.)

♀ sac elongate-oval, narrow behind, convex, with 3 longitudinal, dorsal ridges; one median, the others placed half way between it and the margins and so dividing the dorsum into 4 subequal regions; perforated behind, orifice small and circular. Length 0·08 inch.

Adult ♀ filling sac, purple or brown, convex above, flat beneath, tapering behind. Antennæ 7-jointed, tapering, apical joint large, globose and hairy; sequence (12) 3 (74) (56). Mentum dimerous, conical, haired at apex. Legs slender, tarsus twice as long as tibia; upper digitules knobbed, lower dilated. Anal tubercles cylindrical with 5 spines, 3 near the base and 2 at the apex; apex tapering and bearing a long seta. Anal ring large with 8 rather long flat hairs.

On *Eucalyptus gomphocephala*, on the galls of *Maskellia globosa*, Fuller.

Genus Olliffia, gen. nov.

Characters:—Adult ♀s stationary, with somewhat conspicuous anal tubercles which approach those of an *Eriococcus*, but differ in having a chitinised prolongation of the dorsal arc of the anal opening, between them. Antennæ 7-jointed, atrophied. Legs atrophied or absent. The name of the late Mr. A. S. Olliff has been respectfully attached to this genus.

14. *Olliffia eucalypti*, sp. n. (Plate XV, fig. 10.)

Adult ♀ stationary, hidden beneath bark scales and covered completely with fumagine; slightly elongate. Abdomen a little prolonged and ending in two stout, blunt, spined tubercles, without setæ. Anal ring situated between the bases of the tubercles, and bearing 6 stout hairs, the dorsal arc is prolonged in the form of a chitinous, conical point. Antennæ small atrophied, tapering, apex haired, apparently 7-jointed. Rostrum large; mentum 3-jointed. Spiracles conspicuous. Legs absent, the last pair represented by inconspicuous thickenings of the epidermis. Epidermis with scattered, compound spinnerets. Length 0·04 inch.

On *Eucalyptus sp.* From ten prepared specimens.

Genus Rhizococcus, Signoret.

15. *Rhizococcus tripartitus*, sp. n. (Plate XV, figs. 11, 11 *a*, 11 *b*.)

Adult ♀ naked, at first of an obscure green (olive), becoming light brown or buff-coloured with maturity; there are 3 median, parallel, longitudinal markings of dark brown. Dorsum punctate, spined and divided into 3 well-defined regions by two transverse ridges, the median region is rectangular, the terminals triangular. Body elongate, wedge-shaped, tapering and prehensile at both ends. Antennæ 7-jointed, often joints 6 and 7 are fused and appear as one. 3 is the longest joint and equal in length to all the more apical ones, 1 and 2 are subequal in length, but 1 is the wider. Abdomen with a slight cleft, tubercles small triangular and Lecanid-like. Anal ring with 8 hairs. Viviparous. Length 0·2—0·25 inch.

Larva elongate, segmented; with very distinct anal tubercles which are spined and bear long setæ. Margin of body fringed with spines of which there are also 4 longitudinal and more conspicuous rows on the dorsum. Antennæ 6-jointed. Tarsus longer than tibia.

On *Casuarina*. Like *R. casuarinæ*, Maskell, this species affects the axils of the branch and branchlets. It is generally found in company with *Fiorinia casuarinæ*, Mask.

Schraderiæ, Fuller.

The term *Schraderiæ* was proposed for a section of the *Coccinæ* to include the genus *Apiomorpha*. This genus has until recently been known by Schräder's name *Brachyscelis*, which, though well known to have been previously occupied, has been left undisturbed by the more recent

students, until changed to *Apiomorpha* by Rübsaamen in 1894. The sectional name has therefore been chosen as some small tribute to the first worker,—the father of Australian gall-study.

In placing the genus here, as a sub-family between the *Coccinæ* and *Dactylopiinæ*, I have been guided by the analogy of the anal tubercles of the adult ♀s to those of the ♀s of *Eriococcus*, and the 6-haired anal ring (only noticeable in the pre-adult stages, owing to the subsequent chitinising of the surrounding region) to the *Dactylopiinæ*. The larvæ also are not far removed in their characters; the fringe of spines around the margin of the body are analogous to those of some larvæ of the genera *Sphærococcus* and *Cylindrococcus*, whilst the suppressed anal tubercles connect with Dactylopius.*

Unfortunately the genus is the type of the sub-family *Brachyscelinæ*, and, therefore, in removing it I propose to let that sub-family remain with *Ascelis* as the type genus.

Genus Apiomorpha, Rübsaamen.

Characters:—Adult ♀s pear-shaped, the abdomen tapering, and ending in 2 strongly chitinous tubercles. Mouth parts small, more or less atrophied. Feet and antennæ present in all stages, but more or less atrophied in the adult. Anal ring with 6 hairs. Inhabiting woody galls of characteristic shapes, whose growth, at the expense of their host, they cause and direct.

Larvæ ovate, segmented; abdomen ending in 2 suppressed tubercles, each bearing a long seta. Margin of the body surrounded with a fringe of uniform acuminate spines, each of which bears for a little while after birth, on either side, thin, hyaline, wing-like appendages; each species apparently bearing the same number.

♂s undergoing their transformations in separate cylindrical galls.

16. *Apiomorpha karschi*, Rübsaamen (1894); *Brachyscelis fletcheri*, Fuller (1896).

This species occurs over the greater part of Australia; I have collected it in several parts of New South Wales, in Victoria and Western Australia (Blackwood and Swan Rivers), and have seen specimens collected in South Australia. The species is referred to as var. *Fletcheri*, by Mr. Froggatt (*Ayr Gazette*, N.S.W.); but I have found the

* Since writing the above, I notice that Mr. Pergandé, who examined specimens of the genus in connection with his study of *Xylococcus betulæ*, considers it closely related to the *Coccinæ*.

galls varying to so great an extent, singly and confluent, that I am convinced that *Fletcheri* is synonymous with *Karschi*. On several species of *Eucalyptus*.

17. *Apiomorpha munita*, Schräder. I have this species from Geraldton, W. A., the galls being 4-sided, with the typical ridges at each corner.

18. *Apiomorpha munita*, Schräder, var. *munitior*, var. nov. This is a very common variation of the gall of *munita*, found near the Swan River; it also occurs in N. S. W., and differs from the type in having a smooth, round wall without the four corner-ridges.

19. *Apiomorpha munita*, Schräder, var. *tricornis*, Froggatt. In company with the foregoing variation of the type, in fact often upon the same twig, I have several times obtained perfect 3-horned specimens. These were perfect galls, and presented no indication of an arrest in the development of a fourth horn; and as the inmates were alike, there was no doubt but that the variation was in the galls alone.

20. *Apiomorpha pomiformis*, Froggatt. (Plate XV, fig. 15.) I have a specimen of this species, which is also reported from North Western Australia by Mr. Froggatt.

21. *Apiomorpha ovicola*, Schräder. Taken in company with *A. Helmsii*.

22. *Apiomorpha glabra*. I have many galls answering to the description of this species as given by Mr. Tepper, but out of more than fifty, none contained Coccids. The warts referred to in Tepper's description were quite common upon the galls, and are not those of the ♂, but of a Hymenopteron.

23. *Apiomorpha strombylosa*, Tepper (1893) = *Brachyscelis crispa*, Fuller (1896). Taken near the mouth of the Swan River (A. M. Lea). As with *A. karschi*, this is another species described by me in which the name chosen by the late A. S. Olliff and myself was retained. Owing to the persistence with which Mr. W. W. Froggatt refers to my notes as Olliff's published manuscript, I feel bound to repudiate the statement, and to reluctantly point out that no MS. notes whatever, bearing upon Coccids, were left by Mr. Olliff.

24. *Apiomorpha cucurbita*, sp. n. (Plate XV, figs. 13, 13 *a*.)

In the catalogue of *Coccidæ* given in the Journal of the Bureau of Agriculture, W. A., I referred to this gall as a variety of *regularis*, Tepper. I have since come to regard it as distinct. The ♀ gall is smooth, pendulous, ellipsoidal, and narrow at the base; the apex is truncate, and slightly dilated, the orifice being in the centre of a counter-sunk depression. When fresh the galls are green in colour, and usually striped with white, resembling a small gourd. Length 1¼ inch, greatest diameter 0·9 inch.

Adult ♀ not observed.

I am indebted for this species to Mr. R. Helms, Kimberley, N. W. A.

25. *Apiomorpha maliformis*, sp. n. (Plate XV, fig. 14.)

Adult ♀ pyriform, white or yellow, except the last 3 abdominal segments, which are reddish-brown; coated with a mealy, white secretion; length $\frac{2}{5}$ to $\frac{3}{5}$ inch; greatest width $\frac{3}{10}$ inch. Epidermis with many minute floriform pores, and clothed with short, hairy spines. Facial furrow semi-circular. Median depression of meso-thorax transverse and deep. Anal appendages stout, horny, rough, and clothed with stout, yellow spines; parallel, bending outwards at the apex, which is surmounted by two short, truncate tubes. Antennæ atrophied, small, tapering, truncate, apparently 5-jointed. Legs, anterior small and inconspicuous, posterior 4, prominent, but small. Posterior margins of abdominal segments bearing a row of thorn-like spines; those on the last 4 being stronger than those preceding. Mouth small.

♂ unobserved.

♀ gall sessible, sub-spherical, smooth; length 1 to 1·3 inch, diameter 1·3 to 1·5 inch. Apex flat, orifice small, usually with 4 short cracks radiating out from it. Colour blue or greenish-grey. ♀ chamber balloon-shaped; length $\frac{3}{5}$ inch; width $\frac{2}{5}$ inch. Walls thick, hard, and woody.

♂ gall small, green, cylindrical; apex dilated; length $\frac{1}{3}$ inch. Growing upon the leaves.

The ♀ gall of this species is usually though not always found growing upon the fruit of *Eucalyptus patens* (?), which in point of fact, it somewhat resembles. This is not the only instance in which I have seen the galls of this genus upon the fruit, and their existence there quite upsets the theory that the galls are modified fruits, etc. It may be of interest to add that, out of some hundred odd

galls collected, many had been eaten into by *Sigastus fascicularis*, Pasc., and in several cases the beetle was found hiding in the chamber of the gall. In every instance an entrance had been made at the apex of the gall, where the wall is thinnest; from the circumstances under which the beetles were found, there is no doubt that they sought the Coccid. Swan River, W. A.

26. *Apiomorpha helmsii*, sp. n. (Plate XV, figs. 12, 12 *a*, 12 *b*.)

Adult ♀ orange-yellow; last 3 abdominal segments red-brown; appendages dark brown; median portion of the dorsum appearing to the naked eye as if stippled with fine red-brown dots. Body elongate, cephalic region rounded off, but slightly tapering, and narrower than the thorax; metathorax narrower than mesothorax. Abdomen long, tapering. Anal appendages long, rough, tapering to a point, adjacent, with the tips deflexed outwards and upwards, and bearing a short, stout pine on the inner margin. Antennæ atrophied, basal joint much swollen, apex truncate and surmounted with 5 hairs. Legs atrophied; first pair small, without claws; second pair stout and clawless; third pair large and clawed. Rostral setæ short, mentum simple. The hinder margins of the segments are fringed upon the dorsum with a row of sharp, thorn-like spines, and the median region of the whole of the dorsum is densely clothed with short, stout, thorn-like spines. Epidermis with many small, multiocular pores, and clothed with numerous short hairs.

♂ unobserved.

♀ gall, bright green, narrow at the base and widest near the apex, sessile or shortly stalked; summit truncate, with a central cone rising from it, the point of which is perforated by the small entrance to the chamber. Usually 4—5-sided, with prominent longitudinal ridges at each corner extending from the base up, and ending abruptly with the summit. Length 1 to $1\frac{1}{2}$ inch. The twig to which the gall is attached is always much swollen around its base, so that the gall grows from a small pit. ♀ chamber elongate, almost fusiform, the widest portion being toward the apex.

Immature ♀ galls sessile, somewhat pyramidal, swollen at the base; apex conical; sides strongly ribbed; orifice closed.

♂ gall growing upon the leaves, cylindrical, longitudinally ribbed; summit dilated, and deeply serrate; colour light yellow. Length $\frac{3}{10}$ inch.

Midland Junction, Swan River, W. A.

I have much pleasure in attaching the name of Mr. Richard Helms to this species. The "direction of the

axis" is remarkably constant in the growth of the ♀ galls, there being nearly always some indication of an effort towards upward growth. The majority of the galls are found growing out from the twig at an angle of about 45°, when they arise from the upper side of the twig, and its growth is natural; when upon the lower side they often bend right round and grow up. When they are upon a twig that is growing downwards they grow back, so that the apex is towards the sky. There are, of course, exceptions, it being possible to find galls at all angles with the twig; they are, however, but the exceptions proving the rule. The species is a very common one in the neighbourhood in which it was found, and there are acres of Eucalypts laden with the galls, and in some places the ground is strewn with dead galls. The Coccids seem to be much sought after by birds, the galls being found torn open and the inmates gone; curiously enough, however, they are not, to my knowledge, subject to parasites, and the gall-walls harbour no inquilines; facts which without doubt account for the numbers in which the galls were found. Another interesting habit noticed is, that although the ♂ galls never grow upon the ♀ galls, as is the case with two or three other species, it is quite a common thing to find ♀ galls growing upon each other, and in these cases it is curious to notice that the gall which supports others is never swollen at the point of attachment, as is the case with the twigs.

DACTYLOPIINÆ.

Genus Sphærococcus, Maskell.

Adult ♀s naked, or covered with cottony or waxy secretion, or inhabiting woody galls. Anal tubercles small or absent. Antennæ usually atrophied. Legs absent or atrophied. Larvæ exhibiting anal tubercles.

27. *Sphærococcus pulchellus*, Maskell.

This handsome species is particularly common on *Hypolymma angustifolium* and also on *Melaleuca* sp. Its general colour is white; Maskell's figure is not quite correct.

28. *Sphærococcus leaii*, sp. n. (Plate XV, fig. 21.)

Adult ♀ occupying a small, elegant, somewhat spherical gall, with fluted sides; growing at the apex of the branchlets of *Casuarina*, sp. Viewed externally the gall appears to be formed of many separate

panels, which when viewed from the inside are seen to be united to one-half their height. ♀ chamber balloon-shaped.

Adult ♀ segmented, sub-globose; abdomen not prolonged into a tail; almost filling chamber. Colour pink. Antennæ atrophied, close, short, and tapering, surmounted with a few hairs; 6 or 7 joints. Legs short, stout; tibia longer than tarsus; tarsus clawed. Rostrum large; mentum conical, trimerous (?), apex haired. Anal tubercles absent. Anal ring not conspicuous. Dorsum clothed with numerous, acuminate, yellow spines. Viviparous.

Larva elongate, fringed with spines. Anal tubercles bearing setæ and spines. Antennæ of 6 joints. Legs thick, tarsus slightly longer than tibia, upper and lower digitules knobbed. Colour crimson.

The galls of this species are formed by the insects attacking and diverting the apical growth of the branchlets. In appearance they much resemble the galls of *Cylindrococcus*. The young galls, which are almost as large as those containing the adults, are soft, and three or four young are usually found in them; what becomes of the additional inmates I am unable to say, but it is probably a case of the "survival of the fittest." Named after Mr. A. M. Lea, Government Entomologist of Tasmania.

29. *Sphærococcus tepperi*, sp. n. (Pl. XV, fig. 16.)

Galls formed like those of *S. socialis*, Maskell, being composed of aborted leaves and occupied by many Coccids. Spherical, flattened at the base and apex; the points of the aborted leaves protruding. Colour green.

Adult ♀ flat, elongate, pyriform; head pointed; abdomen widely rounded behind; abdominal segments chitinous; colour yellow. Eyes black. Antennæ projecting on each side of the head, short, thick, probably 5-jointed; apex truncate, haired. Mentum dimerous. Legs, anterior 4 absent; posterior pair atrophied, apparently 2-jointed, with circular pores, and resembling in shape those of *S. styphelieæ*, Mask. Anal orifice simple, with 4 spines above and a row behind. Spiracles large. Length 0·04 inch.

Taken on a small *Melaleuca* or *Kunzia*. I have much pleasure in naming this species after Mr. J. G. O. Tepper of Adelaide Museum, S. Australia.

30. *Sphærococcus ethelæ*, sp. n. (Pl. XV, fig. 20.)

Adult ♀s stationary, globular, green, covered by several convex superimposed scales of white wax, congregating together and forming

woody excrescences and wounds which together with the white secretion much resemble the attack of the "woolly aphis" on the apple. Length 0·05 inch. Epidermis with many conspicuous and slightly-protruding pores, and clothed with inconspicuous spines. Spiracles conspicuous, surrounded by groups of multiocular pores. Legs absent. Rostrum large. Mentum conical, apex haired, probably dimerous. Antennæ represented by small chitinous thickenings. Near the regions of the posterior spiracles are semi-circular chitinous lobes, possibly atrophied legs. Anal ring unobserved. Cast skin of earlier stage covering adult.

On *Casuarina*. Swan River.

31. *Sphærococcus tormentosus*, sp. n. (Pl. XV, fig. 18.)

Adult ♀s usually congregating together and secreting quantities of white, woolly matter. When taken singly the tests are sub-globular with a central, longitudinal parting of the filaments. Length of test 0·13 inch. Adult ♀ convex above, flat beneath; brown. Antennæ very small, atrophied, sub-conical not jointed. Mentum dimerous, short. Legs absent. Spiracles large. Epidermis with many minute, multiocular pores and bearing many short, tubular spinnerets. Anal tubercles absent. Setæ absent. Length 0·08 inch.

Larva yellow, very elongate, with 2 conspicuous anal tubercles, bearing spines and setæ. Anal ring with 6 hairs. Antennæ 6-jointed; joints 4 and 5 sub-equal and shortest, 3 and 6 sub-equal and longest. Tarsus longer than tibia; claws slender; upper and lower digitules knobbed. Mentum long, conical, dimerous. Dorsum bearing transverse rows of short conical spines.

Adult ♂, only one observed, brownish-yellow, elongate; abdomen short, not tapering: spike short, with a dorsal curved appendage. Antennæ moniliform, sub-clavate; 10-jointed; joints 1 and 2 large and wide, 2 the longer; 3 clavate and slender; 4, 5, 6, and 7 sub-equal and globose; 8 and 9 larger and sub-equal; 10 sub-conical. Length, including spike, 0·09 inch.

On *Melaleuca* sp. Swan River. This species is close to *S. acaciæ*, Mask. It differs inasmuch as the larva of that species is without tubercles and the adult ♀ without antennæ.

32. *Sphærococcus morrisoni*, sp. n. (Pl. XV, fig. 22, 22 *a*.)

♀s inhabiting galls. Mature gall ob-ovate, apex truncate, and perforated. Colour light red; outer walls roughened where leaves have fallen off. ♀ chamber divided into two parts, the lower

division being spherical and small, and having a wide circular opening into the upper chamber, which is balloon-shaped.

The ♀ rests upon the ledge at the bottom of the upper chamber, and its abdomen protrudes into the lower chamber, where the larvæ are deposited. Here also the larvæ grow to twice their size before seeking a suitable place to form a gall on their own account, drawing nourishment, without doubt, from the inner walls of their "nest."

Adult ♀ secreting dorsally a tuft of white cottony matter. Dorsum flat and circular, very chitinous and segmented, and densely perforated with small pores, of which very small transverse rows mark the segmentation. Ventrally very convex; epidermis of ventrum thin, bearing a few conical spines and perforated by multiocular pores; some of the spines are apparently arranged in transverse rows. Rostrum ample. Mentum short, cordate. Spiracles conspicuous. Antennæ atrophied, sub-conical, not jointed. Legs absent. Viviparous.

Larva crimson, with a double fringe of spines and two longitudinal rows on dorsum. Antennæ 6-jointed. Rostrum ample. Legs stout; tibia and tarsus sub-equal. Tubercles inconspicuous.

On *Melaleuca sp.* from Pinjarrah, W. A. I have attached to this species the name of Dr. Alex. Morrison, M.D., to whom I am much indebted for the identification of many of the host-plants mentioned in these notes.

33. *Sphærococcus morrisoni*, var. *elongata*, var. nov. (Pl. XV, fig. 23.)

The adult ♀s differ from the type in being but a little smaller. The galls however are more slender and often longer than those of the type, and are grey-green in colour. In this variety the outer bark of the gall continues to grow for some inches, and fresh twigs form above its apex. Swan River.

Genus Cylindrococcus, Maskell.

Insects inhabiting galls which appear to be aborted and misshapen forms of the twigs of the plants. Anterior feet present the remainder represented by patches on the epidermis. Anal segment circular, slight convex, not prolonged into a tail. (Maskell.)

34. *Cylindrococcus gracilis*, sp. n. (Pl. XV, fig. 24.)

The gall of this species very much resembles that of *S. spiniferus*, Maskell, but is much more slender and the imbricated bracts do not project like those of *S. spiniferus*. Length from 1 to 1¼ inch; width ⅛ inch. Colour green.

Adult ♀ like *S. spiniferus*, with the remarkable palmate appendages at the extremity of the abdomen. Antennæ atrophied; wide at the base and tapering; apex sharp and slightly curved; apparently 3-jointed. Anterior feet atrophied.

Larva red, active, elongate. Antennæ 6-jointed. Eyes distinct. Legs long and slender; tibia longer than tarsus, only one long upper digitule. Tubercles moderate, apex truncate bearing on the inner margin a strong spine, and on the outer side of the apex a long seta. Six longitudinal rows of spines on the dorsum, the median pair of rows and those on the margins long, the latter conspicuously so; the other two rows small; the spines are borne upon the last 9 segments, 6 to each. The long lateral spines are serrate at the apex, and slightly dilated.

On *Casuarina humilis* (?). Swan River, W. A.

Genus Ourococcus, gen. nov.

Adult ♀s stationary, inhabiting crevices in the bark of their food-plant, and secreting a single long glassy "tail" from between the two more or less distinct tubercles in which the abdomen ends. Abdomen tapering. Antennæ more or less atrophied. Feet absent or atrophied. ♀ and larva unobserved.

35. *Ourococcus eucalypti*, sp. n. (Pl. XV, figs. 28, 29, 30.)

Adult ♀ surrounded by a black waxy secretion and occupying a deep-seated cavity in the bark. Abdomen tapering slightly and ending in two incurved sharp points, which almost meet, enclosing a circular space, through which the long glassy tail is secreted. Body sub-globular, not distinctly segmented; abdominal region strongly chitinous and ventrally much striated with irregular corrugations converging towards the extremity. Rostrum long, mentum conspicuous, dimerous. Antennæ atrophied, short, tapering; apex truncate, with a few short hairs; apparently 3-jointed. Legs absent. Spiracles large. Epidermis with many multiocular pores. Within the abdomen when cleared with *liquor potassæ* there is discernible a peculiar sub-cordate chitinous organ, which is densely covered with tubular processes; the apex of the organ is directed towards the cephalic region, is truncate, and a small circular opening into the organ can be seen; on each side of this opening there is a prominent tube-like process. On either side of this organ are somewhat similar but smaller and circular organs. Behind the central organ a groove extends to the base of the points. A distinct group of pores extends from the base of each antennæ to the posterior spiracle.

On *Eucalyptus sp.* This insect is doubly interesting on account of its peculiar structure and the fact that it was found buried to some depth in the living bark. When I first found it I was much struck by this circumstance, and succeeded in obtaining a clue as to how it had "burrowed" into the bark. A search of the higher branches of the tree revealed many longitudinal slits in the fresh bark which, upon examination, were found to extend into the bark in an upward direction almost to the wood, and to contain the eggs of some large Homopteron. These slits corresponded exactly in direction with those in the older bark occupied by the Coccids, which they must have taken possession of as larvæ. How the young Coccid is able to enlarge the cavity to suit its increasing proportions is rather inexplicable.

36. *Ourococcus casuarinæ*, sp. n. (Pl. XV, figs. 25, 25 *a*, 26.)

Adult ♀ stationary, chestnut-brown, unsegmented, slightly globose, extremely chitinous and hard, hiding beneath the bract-like leaves of *Casuarina;* accompanied by much fumagine and secreting a single, long, glassy tail. Abdomen tapering slightly and ending in two conspicuous tubercles, which bear 3 stout spines. The margin of the abdomen bears similar spines to those on the tubercles, and on each side of the terminal tubercles there are usually from 2—4 less prominent tubercles. There is a central groove in the abdomen similar to that seen in *O. eucalypti* and *O. cobbii*, and with difficulty a similar form of organ is to be detected. Mentum conical. Antennæ very small, atrophied; 2- or 3-jointed, a few hairs at the apex. Legs absent. Behind the posterior spiracles there are two convex, semicircular, lobe-like appendages, thickly perforated with circular pores, and having a honeycombed appearance.

Swan River, W. A.

37. *Ourococcus cobbii*, sp. n. (Plate XV, figs. 27, 27 *a*.)

Adult ♀s found beneath bark scales of *Eucalyptus sp.* and also in wounds in the bark, secreting long, glassy filaments, stationary. Abdomen chitinous, rounded, ending in two inconspicuous chitinous tubercles, each bearing a small spine. Inside the abdomen is to be seen, after preparation, a reniform organ similar in nature to that seen in *O. eucalypti.* Antennæ of 7 joints, atrophied, tapering, apex haired. Mentum long, conical, dimerous. Dorsum with spines and compound and short, tubular spinnerets. Upon the margin of some

of the abdominal segments are short, stout spines, the points of which are directed towards the head.

The name of Dr. N. A. Cobb, of the N. S. W. Department of Agriculture, is respectfully attached to this species.

Genus Dactylopius (Costa).

38. *Dactylopius macrozamiæ*, sp. n.

Adult ♀ active; light yellowish-brown; elongate, flattish, segmented; with dorsal meal and short lateral tassels. Antennæ of 8 joints, basal wide and stout, remainder cylindrical, apical longest and almost fusiform; sequence 812(35)5(67). Legs ample, spined. Tubercles small. Anal ring conspicuous with 6 strong hairs. Dorsum clothed with many hair-like spines and with numerous multiocular pores and raised spinnerets. Mentum conical, apex haired, monomerous (?). Eyes sub-conical. Length 0·16 inch. Eggs yellow, deposited in thin cottony webs.

Larva yellowish-brown. Antennæ 6-jointed, anal tubercles small.

On *Macrozamia frazeri*, Swan River. Generally found at the bases of the fronds.

39. *Dactylopius adonidum*.

On Oleander and *Coleus*.

40. *Dactylopius grevilleæ*, sp. n.

Adult ♀s stationary, sub-globose, distinctly segmented, slightly mealy, inhabiting complete and almost spherical sacs. Colour purple-black. Antennæ 7-jointed; 7 longest, remainder sub-equal, there is seemingly an atrophied joint between joints 5 and 6. Legs short, stout; tibia longer than tarsus, tarsus clawed; upper digitules slight, lower dilated. Epidermis with many spinnerets and small spines. Anal ring with 6 stout hairs. Tubercles small, each with a long seta and four distinct guttate spines. Similar spines occur laterad of each abdominal segment, and extend in a row across the dorsum.

On *Grevillea bipinnatifida*, Swan River.

41. *Dactylopius lanigerus*, sp. n.

Adult ♀s active, sluggish, congregating in colonies upon the branchlets and secreting immense quantities of woolly matter, which becomes matted together and hangs down in shreds. When removed, the adult ♀ is of a yellowish or dirty brown colour with short tassels of cotton laterad of each segment. Antennæ 8-jointed; sequence 81(23)(4,5,6,7). Mentum conical, dimerous. Legs ample; tibia twice

the length of tarsus. Anal tubercles absent, represented by two small chitinous discs. Anal ring granular, with 8 hairs. Epidermis with scattered fine hairs and compound spinnerets. Length 0·9 inch.

Adult ♂ brownish-yellow; antennæ hairy, 9-jointed. Abdomen short not tapering, and bearing several short setæ on either side of the short style.

Larva reddish. Antennæ 6-jointed, sequence 6 (12) (3,4,5). Abdomen truncate, tubercles short and rounded, with two conical spines median of base, each with a long seta.

Eggs red.

On *Acacia pulchella*. Trivial name "Snow scale." The larvæ and eggs are found amongst the secreted matter which adheres loosely to any object brushing against it; in this way the species is no doubt spread about.

ASTEROLECANIIÆ.

Genus Lecaniodiaspis, Targ. (Prosopophora, Douglas.)

42. *Lecaniodiaspis acaciæ,* Maskell.

This species occurs quite commonly in Western Australia upon *Acacia cyanophylla* and *A. microbotrya*. The ♀s of the second stage are very Lecanid in general appearance, the abdomen being cleft and the tubercles like small triangular lobes.

43. *Lecaniodiaspis melaleucæ,* sp. n. (Plate XV, fig. 31.)

Adult ♀ enclosed in a thin, complete test of paperlike secretion. Viewed from above, the test is ovate with a faint, median carina and several fainter transverse ridges. The posterior end is the wider, and the extremity is pinched up and projects slightly. Viewed from the side the dorsum is seen to be very convex whilst the ventral surface is concave, so that there is a decided keel all round the margin of the test at the junction of the upper and lower halves. The colour of the test is externally grey, but the inner surface is yellow. Length 0·17 inch; width 0·12 inch.

Adult ♀ filling the test; dorsum convex; segmented. Colour dark grey, brown or tinged with yellow. Antennæ cylindrical, 8- or 10-jointed. Legs small and atrophied. Abdomen ending in a slight depression, on either side of which are somewhat elongate lobes without spines or setæ; each lobe is striated and near the apex there are several small pores. Anal ring with 10 short hairs. The margin of the body bears a few small, stout spines, and the

epidermis many raised "figure of eight" spinnerets, and is marked dorsally with many irregular short lines.

Second stage ♀ naked, resting on a thin pad of papery secretion; almost flat; the dorsum rising in the centre in the form of a low cone, and marked with radiating lines. Colour slate-black. Antennæ of 8 joints; basal short and wide, 2 the longest, 3, 4 and 5 sub-equal, 6 and 7 sub-equal, 8 short, rounded, and bearing a few hairs. Lobes spined. Anal ring with 10 long flat hairs. Spiracles not prominent, with small adjacent groups of simple pores. ♂ puparium yellowish-white; segmented; elliptical. Length 0·05 inch.

On *Melaleuca leucodendron* (?). Swan River, W. A.

Genus Asterolecanium, Signoret.

(*Planchonia*. p.n. occ.)

44. *Asterolecanium hakeæ*, sp. n.

Test of adult ♀ light transparent green, flat, circular; fringe generally absent, lighter than scale; diameter 0·06 inch.

Adult ♀ almost circular, light green; flat above, slightly convex beneath. Mentum dimerous. Tubercles fairly distinct, bearing longish setæ, and on the inner margin a single spine. Margin with a row of "figure of eight" spinnerets, which is occasionally double, but not regularly so as in *A. ventrousa*, Maskell. There is also a single row of multiocular pores round the margin.

♂ puparium smaller than test of ♀, oval, segmented, light green.

This species is common on the bark of *Hakea ilicifolia*, and is occasionally found on an *Acacia*, Swan River, W. A. Like *A. ventrousa*, the female rests in a small pit, but it does not cause such an abortive growth of the bark as that species, and in general appearance very much resembles *A. quercicola*, a common species in Sydney and Melbourne on oaks.

45. *Asterolecanium petrophilæ*, sp. n.

Test of adult ♀ flat, yellowish-green, circular, sometimes slightly elongate, fringe white. Length 0·045 inch. Owing to the transparency of the test it usually appears dark brown or black, due to the colour of the ♀ showing through.

Adult ♀ never entirely filling the test. Antennæ represented by a pair of chitinous buttons. Mentum monomerous. Margin with a single row of "figure of eight" spinnerets and a row of simple pores. Dorsum without markings. Ventrum flat.

On *Petrophila linearis*, Swan River, W. A. At first sight this species looks *in situ* much like an *Aleurodes*, and is often found in company with *Parlatoria petrophilæ*. Like the foregoing species it rests in a slight depression.

46. *Asterolecanium stypheliæ*, Maskell.

This species is common on *Styphelia sp.* on the banks of the Swan River, and has also been obtained at King George's Sound.

TARCHARDIINÆ.

Genus Tarchardia, Blanchard.

47. *Tarchardia convexa*, sp. n.

Test of ♀ dark brown, very convex, smooth, with two lateral filaments protruding from circular orifices. Length 0·15 inch.

Adult ♀ elongate, thoracic tubes conspicuous. Abdomen prolonged, with a chitinous ring at the apex; ring with 10 hairs. Antennæ small atrophied, not jointed. Mentrum monomerous. Anterior spiracles larger than the posterior, and surrounded by groups of small pores. Dorsal spine conspicuous, with several adjacent hairs.

On *Hypocalymma sp.* Swan River.

48. *Tarchardia melaleucæ*, Maskell. (Plate XV, fig. 32.)

♂ red, elongate, sides of abdomen parallel, ends lobed. Spike curved downwards. Antennæ cylindrical, not tapering; joints 1 and 2 short and stout, the rest long and narrow; 3 the longest, 4, 5, and 6 diminishing, 6, 7, 8, 9, and 10 sub-equal; apex of 10 rounded and bearing 5 conspicuous knobbed hairs.

On *Kunzia* or *Melaleuca*. Perth, W. A.

LECANIINÆ.

Genus Signoretia, Targioni-Tozzetti.

49. *Signoretia luzulæ*, Dufour, var. *australis*, Maskell.

On various grasses and sedges.

Genus Lichstensia, Signoret.

50. *Lichstensia hakearum*, sp. n. (Plate XV, fig. 37.)

Adult ♀ brown, convex above, flat beneath, stationary, constructing a more or less spherical sac of a pure white, felted secretion, open at the anterior end and exposing the median region of the dorsum. Length 0·15 inch. Of a normal Lecanid form with usual cleft and

small lobes. Anal ring inconspicuous, with 6 hairs. Antennæ rather long, cylindrical, tapering slightly; joint 3 times the length of 2; sequence 3, 2, 1, 4, 5, 6, 7. Tibia longer than tarsus. Epidermis with protruding, multiocular spinnerets.

On *Hakea media* and other species, Pinjarrah (A. M. Lea). The position of the ♀ after egg-laying is *a tergo*, but still within the sac. In my preliminary list this species is mentioned as a *Lecaniodiaspis* (?); I am indebted for its present reference to *Lichstensia* to Mr. T. D. A. Cockerell.

Genus Pulvinaria, Targioni-Tozzetti.

51. *Pulvinaria maskelli*, Olliff, var. *viminariæ*, var. nov.

Adult ♀ almost black, very convex, length 0·35 inch. Egg-sac long and narrow, length including the ♀ *in situ* 0·5 to 0·6 inch. In its anatomical details the ♀ resembles *P. nutysiæ*, Maskell.

On *Viminaria denudata*, Pinjarrah (A. M. Lea), and *Hakea ilicifolia*, Bunbury (C. F.).

52. *Pulvinaria nutysiæ*, Maskell.

On *Nutysia floribunda*. I cannot help regarding this species as a variety of *P. maskelli*. The ♂s were found by me in one case in great numbers upon a tree without the ♀s, and were at first mistaken for a *Ctenochiton*, and mentioned in the list referred to, as *C.* (?) *nutysiæ*.

Genus Lecanium, Illiger.

53. *Lecanium baccatum*, Maskell.

This species occurs in various parts of Western Australia, and in fact most of the Australian Colonies. It has recently been separated from *Lecanium* by Parrott and Cockerell, and referred to as *Cryptes baccatus*.

54. *Lecanium baccatum*, Maskell, var. *marmoreum*, var. nov.

♀ naked, quite white and polished, globular, slightly prolonged in front, with a faint, longitudinal, median elevation, which has a row of shallow depressions on either side. Antennæ cylindrical, 8-jointed: joints 1 and 2 the longest; spical joint haired: sequence (13) (24) (5, 6, 7, 8). Mentum short, condate, monomerous; with several spines. Legs ample; femur swollen; tibia and tarsus slender, tibia the longer; tarsus clawed and with 4 long knobbed digitules. Lobes adjacent, taken altogether elliptical; surrounding region chitinous. Anal ring haired, inconspicuous. Epidermis

with very small spinnerets and multiocular pores, which are more numerous near the anal region.

On *Acacia*, Geraldton, W. A.

55. *Lecanium hemisphericum*, Targ.-Tozz.

On ferns, Perth, W. A.

56. *Lecanium hesperidum*, Linn.

On several plants, including the fig.

57. *Lecanium frenchii*, var. *macrozamiæ*, var. nov. (Plate XV, figs. 40, 40 *a*, *b*.)

Adult ♀ elliptical, slightly convex, margin of dorsum almost black, medium region red-brown. Fringe white. Length 0·13 inch. After egg-laying the dorsum becomes quite black and extremely chitinous. The marginal region exhibits the many radiating channels and tessellations of the type. The fringe consists of transparent, stalked appendages, which are widest at their middle and have the apex rounded; they originate from circular orifices. Antennæ cylindrical with 6 joints, of these 1, 2, 4, 5, are sub-equal, 3 about three times the length of 2, 6 tapering about twice the length of 5; sequence 3, 6 (1, 2, 4, 5). Spiracular spines slender and swollen at the apex; the central the longest, and reaching a little beyond the margin. Cleft represented by a deep narrow incision, the sides of which are parallel, and the posterior contour of the body unbroken. Anal tube conspicuous, striated.

Immature ♀ yellow, elliptical and flat; larger than when mature, measuring 0·16—0·19 inch in length. Dorsum with regular reticulate pattern.

Larva oval, with cleft, lobes and anal tube similar to adult. Length 0·25 inch. There are several single spines opposite each spiracle and a conspicuous one on either side of the cleft.

Antennæ of 6 joints, long and slender and similar to the adult. Legs slender. Fringe wanting.

♂ puparium waxy, white, transparent, with two longitudinal and many radiating carinæ. Pupa red.

On *Macrozamia frazeri*, Swan River. This insect seemed to differ very much from the type as regards the joints of the antennæ, but as it agrees so closely in all other features I have thought it preferable to regard it as a variety.

58. *Lecanium oleæ*, Bern.

On many cultivated and garden plants, very common on

orange, lemon, olive and oleander, also on *Solanum sodomæum* and the weeping willow. I have also taken it on several native plants including *Macrozamia frazeri*.

59. *Lecanium ribis*, Fitch.

A Lecanium taken to be this species was found on an English gooseberry at Albany.

60. *Lecanium tessellatum*, Signoret. On a hot-house plant. Perth, W. A.

Genus Inglisia, Maskell.

61. *Inglisia fossilis*, Maskell. (Plate XV, fig. 50.)

On *Templetonia sp.* Swan River. I have given a further figure of this species, as Maskell's is a little misleading.

62. *Inglisia foraminifer*, Maskell, var. *loranthi*, var. nov. (Plate XV, figs. 50, and 50 *a*, *b*, *c*.)

I received from Mr. A. E. Lankaster specimens of an *Inglisia* found by him at Geraldton which agrees very well with Maskell's description of *I. foraminifer*, except that the adult ♀s are legless. Curiously enough Maskell gives the host of his type as *Santalum*, whilst despite the fact that the West Australian variety is fairly common, it was only found on *Loranthus quandang* (the "quandang" or "native peach"), a "mistletoe" growing on *Santalum acuminatum*.

Genus Ceronema, Maskell.

63. *Ceronema banksiæ*, Maskell. (Plate XV, fig. 38.)

A species which I take to be *C. banksiæ* is particularly common on *Banksia ilicifolia*, and is also found on *B. attenuata* and *B. menziesii*. The adult ♀ agrees in all particulars with Maskell's description; the tests are, however, compact and without cottony threads, and I have moreover never seen any secreted matter beneath a ♀ as described by him, though a large number were examined with this object.

64. *Ceronema dryandræ*, sp. n. (Plate XV, fig. 39, 39 *a*, *b*.)

Test of adult ♀ white, covering the whole of the insect except a small elliptical region of the dorsum towards the posterior extremity, and embracing the anal lobes. The test is narrow behind, broadly rounded in front, and exhibits well-defined convolutions. Length 0·14 inch.

Adult ♀ elliptical, dark brown, tapering behind, closely resembling *C. banksiæ;* the antennæ and dorsum exhibiting the same characters. Abdominal cleft represented by a deep narrow slit; lobes adjacent and tapering. Anal ring apparently hairless, and tube distinct. Region surrounding cleft and lobes conspicuously chitinous. Margin with a regular row of yellow, cylindrical and coronetted spinnerets from which the test is secreted.

Immature ♀ naked, elliptical, with a longitudinal carina. Resembling adult in all anatomical features except the anal lobes, which resemble the tubercles of an *Eriococcus*, tapering and bearing at the apex a long, acuminate spine, also 3 other spines, one upon the upper surface and two upon the inner margin.

♂ puparium, glassy, white, the medium region very much raised.

On *Dryandra nivea*, Darling ranges, and on *Dryandra floribunda*, Perth. The arrangement of the test is not easily described, but is fairly reproduced by the figure; it is particularly neat and pretty, and may be likened to the well-known crest of the Prince of Wales. The genus *Dryandra* is peculiar to West Australia, and its members are closely allied to the *Banksias*.

BRACHYSCELINÆ, Maskell.

As pointed out in my reference to the Genus *Apimorpha* I propose to replace that as the type genus of this sub-family by *Ascelis*, and include with it the genera *Opisthoscelis* and *Cystococcus*.

Genus ASCELIS, Schräder.

Insects gall-inhabiting. ♂s undergoing their transformations within the ♀ chamber, or gall. Adult ♀s without legs, abdomen somewhat prolonged and ending in a chitinous button.

65. *Ascelis melaleucæ*, sp. n. (Plate XV, fig. 35, 35 *a*.)

Adult ♀ yellow, sub-globose, abdomen tapering and ending in a hard, chitinous button. Length about $\frac{5}{70}$ inch. Body unsegmented. Mouth somewhat rudimentary. Legs and antennæ absent. When cleared in potash 6 chitinous ribs are seen to extend into the body from the terminal button. Spiracles distinct.

Gall wider than high. Externally of the same nature and colour as the bark of the host plant. Apex of gall conical; perforated by a small orifice, through which a glassy filament occasionally protrudes. Galls divided into two chambers, the lower is occupied by the ♀ and

communicates with the upper by a very small opening through which, and the outer opening immediately above it, the ♀ secretes the glassy filament. The upper chamber usually contains several ♂ pupæ, encased in white, mealy cocoons.

On *Melaleuca* sp. Swan River. This species is placed provisionally in this genus, as all the species hitherto described are from the *Eucalypti* and have single chambered galls.

Genus Cystococcus, gen. nov.

Characters:—Gall inhabiting. Adult ♀ cyst-like, body unsegmented, striated longitudinally. Legs and antennæ absent. Mouth almost obsolete. Spiracles large. Epidermis without hairs, spines, or pores. Abdomen at the end conical and capped with a hard chitinous button, which is used to close the entrance to the chamber of the gall. Galls like those of the genus *Apiomorpha*, but of a brittle nature, and with walls of an even thickness throughout. The ♂s probably undergo their transformations within the ♀ gall, judging from the number of wings and remains found at times in the galls collected.

The genus is erected for the reception of a very remarkable Coccid brought from East Kimberley, North West Australia, by Mr. Richard Helms. It is no doubt closely allied to *Ascelis*, but both the Coccid and its gall are sufficiently characteristic to warrant the erection of a new genus.

66. *Cystococcus echiniformis*, sp. n. (Plate XV, fig. 36, *a*, *b*, *c*.)

Adult ♀ almost spherical, and nearly filling the chamber of the gall. Cephalic extremity flat; abdominal conical, the apex terminating in a hard, chitinised button. Body unsegmented, striated longitudinally. Spiracles conspicuous, black, usually with white filaments protruding from them. Mouth parts almost obsolete, form doubtful. Legs and antennæ absent. Length 0·5 to 0·7 inch.

Larva unobserved.

Gall spherical, orifice at apex. Diameter from $\frac{3}{4}$ to $1\frac{1}{4}$ inch. The walls are of an even thickness throughout, comparatively thin, brittle and granulate. Colour dirty white outside, the outer surface much resembling a naked sea-urchin. The inner wall with a smooth papery lining which is veined and bears a slight resemblance to the inner wall of a sea-urchin. The chamber follows the contour of the outer surface. Within, the entrance is surrounded by a wooden rim,

which widens out in the form of a funnel or hollow cone, attached at its apex, and in which the conical end of the ♀s abdomen rests. At the cephalic end of the gall there is often a small elevation or table to which the cephalic region of the ♀ is slightly attached. Diameter 0·7 to 1 inch.

Perfect specimens of the ♂ have not been observed. The wings are purple and the abdomen is extremely long.

On *Eucalyptus tesselaris*. These insects are edible and much sought after by the natives to whom they are well known as delicacies. Mr. Helms tells me that they are not at all unpalatable, being cool and refreshing on a hot day. The galls are plucked and broken between the teeth and the inmate sucked out. The specific name *echiniformis* was adopted at Mr. Helms' suggestion, and I am also indebted to him for the following interesting information given in his own words:—

"The insect is readily eaten by all natives and whites who know it. It is merely a bladder filling the cavity of the gall; the taste of its juice cannot be referred to any well-known flavour; it is watery and in fact almost tasteless, and in sucking it one naturally perceives the flavour of the gum-tree. I found it on *E. tesselaris* all over East Kimberley, and it is no doubt widely distributed in the Northern Territory of South Australia, as all the natives from those parts were acquainted with it as a choice tit-bit. The Yundi tribe of natives inhabiting the country about Mount Dockrell, West Australia, and the Mulunya tribe, who live near the upper portion of the Victoria River in the Northern Territory, South Australia, know the insect as 'Ballabi.' Another Northern Territory tribe living in the Forest River district call it 'Ballabbi,' and the Daulananya tribe, on the borders of the Catherine River, Northern Territory, have the two names 'Durdunga' and 'Lador' for it. The Mungui tribe living between Pine Creek and the Catherine River call it 'Lordoch,' and the Osborn River (a tributary of the Ord River) tribe term it 'Kardaddain.'" This is not the first edible Coccid reported from these parts, as Froggatt says that *Apiomorpha pomiformis* is also eaten by the aborigines. It is, however, extremely probable that in this case the two insects have been confused, as the latter gall is extremely hard and woody and requires considerable force to open it.

Genus Opisthoscelis, Schräder.

Adult ♀s inhabiting galls formed on leaves or twigs. Abdomen prolonged into a conspicuous tail. Posterior legs very much prolonged, anterior atrophied or absent.

67. *Opisthoscelis conica*, sp. n. (Plate XV, figs. 33 and 34.)

Adult ♀ very convex, distinctly segmented, colour light brown; covered with meal; abdomen prolonged; length 0·15 inch. Antennæ atrophied, short conical not jointed. Anterior legs absent, posterior legs very long, measuring 0·09 inch, the coxa trochanter and femur short and stout; the tibia very long; tarsus atrophied, represented by a minute nipple at the extremity of the tibia. Rostrum short, mentum cordate. Epidermis clothed with many long, fine curved spines, which are more numerous about the cephalis region and on the margins of the tail, forming a tuft at its apex.

♀ gall on leaves, orifice upon the upper surface. The gall protrudes on both surfaces of the leaf; upon the upper in the form of a cone, and upon the lower in the form of a hemisphere. Diameter at base 0·3 to 0·4 inch. Chamber pyriform, length 0·2, width 0·2 inch.

♂ galls unobserved.

The gall of this species approaches those of *O. subrotunda* and *serrata*. The Coccid is quite distinct from the latter species, and differs from the former in the atrophied tarsus, which in *O. subrotunda* is described as "as long or longer than tibia." On *Eucalyptus sp.* Swan River.

DIASPINÆ.

Genus Aspidiotus, Bouché.

68. *Aspidiotus aurantii*, Maskell.

Taken upon many plants including Eucalypt, the Moreton Bay Fig (*Ficus macrophylla*, Desf.), the Grape, Rose, etc.

69. *Aspidiotus caldesii*, Targ.-Tozz.

On *Acacia sp.* Geraldton.

70. *Aspidiotus ceratus*, Maskell.

On *Acacia sp.* and *Templetonia sp.*

71. *Aspidiotus cladii*, Maskell.

On Sedge. Maskell records the species from Eastern Australia and also from Natal, South Africa.

72. *Aspidiotus dryandræ*, sp. n. (Plate XV, fig. 41.)

Scale of ♀ sub-circular, rather flat, diameter about 0·12 inch. Exuviæ more or less central and inconspicuous. The scale is externally of a dirty fawn-colour, the inner surface being pure white.

Adult ♀ claret-brown: last segment yellow, with 6 lobes well developed and as wide as long; the median pair adjacent, the largest, notched on either side of the apex, the lateral notch being the deeper; second pair deeply incised once on lateral margin; third pair conical with sinuous sides and more removed from the second than the second from the median pair; with the exception of several small notches the rest of the margin is finely serrate. Plates absent. Median spines inconspicuous; second, third, and fourth pairs distinct. Circumgenital pores absent.

On *Dryandra floribunda*. Swan River.

73. *Aspidiotus niveus*, sp. n.

Scale of ♀ circular, very convex, pure white; diameter 0·04 inch. Exuviæ light yellow, central, often hidden by the secretion of first stage.

Adult ♀ bright yellow, somewhat globose, of normal form, abdomen ending in a pair of adjacent, sharply truncate lobes, on either side of which is a small fringe of simple, hairy plates; the spines, with the exception of the median pair, are long and hairlike.

♂ puparium small, white; larval skin yellow.

On *Acacia pulchella*. This species is closely allied to *A. ceratus*, but differs in the form of the lobes and in the absence of the widely forked spine.

74. *Aspidiotus perniciosus*, Comstock.

On peach and apple, in two isolated instances only.

75. *A. perniciosus*, var. *eucalypti*.

Scale of ♀ pyriform, very slightly convex, purple-black when *in situ*, length 0·045, width 0·035 inch. Exuviæ bright red, often surrounded by a ring of white secretion. At the posterior end of the scale there is a crescent-shaped piece of grey secretion which gives the pyriform shape.

Adult ♀ with median lobes converging, well-developed and faintly crenulate on their lateral margins; second lobes small, more or less triangular, and notched twice; third lobes almost obsolete; half-way towards the penultimate segment there is a fairly strong, wide,

pointed prolongation of the margin. Plates more or less branched. Spines situated above the lobes. Length 0·03 inch.

♂ puparium grey or grey-black, margin lighter. Larval skin red. Form normal. Length 0·04 inch.

Adult ♂ with 10-jointed antennæ and dark purple eyes. Length 0·0325 inch.

Larva with antennæ of 4 joints, fourth joint as long as first, second and third together. Abdomen ending in two converging and distinct lobes, incised on their lateral margins with a pair of longish setæ between them. Length 0·0075 inch.

On *Eucalyptus globulus*, an introduced species from Tasmania, in the streets of Perth. From the discussion which has arisen concerning the supposed variety of *A. perniciosus* upon *Eucalypti* in several of the colonies, it would appear that I have been in too much haste in attaching this species to *perniciosus*, and was perhaps ill-advised in selecting *eucalypti* as the name for it. The Victorian species is now, according to Froggatt, *A. eucalypti*, var. *comatus*, Maskell, but the Western Australian form is undoubtedly distinct, both in the arrangement of the lobes and in the absence of the transverse groove upon which, in both type and variety, Maskell lays so much stress. It is in fact a very close relation to *A. perniciosus* and differs chiefly in the presence of the chitinised prolongation of the margins, and also in the more serrated plates, which I find are more pronounced in the second stage female than in the adult.

76. *Aspidiotus rapax*, Comstock.

This is a very common species, and occurs upon a large variety of indigenous plants.

Genus Parlatoria, Targioni-Tozzetti.

Characters:— ♀ scale elongate or subcircular; exuviæ terminal or sub-central, large and of a rounded form.

♂ puparium elongate, not carinate; larval skin terminal.

Adult ♀ broad, last segment with 4 groups of circumgenital pores and usually bearing 6 lobes and many plates which extend to the margin of the more anterior segments.

77. *Parlatoria proteus*, Curtis.

On *Pinus insignis* in Perth.

78. *Parlatoria viridis*, sp. n.

Scale of ♀ elongate, rounded behind, form constant; exuviæ terminal, naked; the first brown and about $\frac{1}{6}$ the size of the second, which is a viridian green, oval and equal to half the length of the whole scale; secreted portion white, occasionally light brown against the second cast skin. Length 0·06 inch.

Adult ♀ rounded-ovate, brown, shrivelling after egg-laying to half the size of the second of the exuviæ. Last segment presenting the following characters:—6 conspicuous tri-lobate lobes, the incisions on either side of the apex being deep and the bases of the lobes much narrowed. Spines inconspicuous. There are two oblong narrow plates, serrate at the apex, between the median lobes; 2 between the first and second lobes, and 3 between the second and third lobes; the plates immediately beyond the third lobes are narrowed at the base, widest near the middle and taper to the apex; they are deeply incised and may be described as palmate. The plates extend only to the penultimate segment. The anterior groups of circumgenital pores are contiguous with the posterior, so that there are apparently only two elongated groups which are constricted at about the middle, 23—26 pores. The merging of the groups into one is a constant feature. Length 0·05 inch.

♂ puparium elongate, slightly convex; larval skin terminal, viridian green; the rest white. Length 0·04 inch.

On *Pittosporum sp.*, Perth. This species causes a yellow stain upon the leaves and affects the growth of the infested plants considerably. It approaches *P. pittospori*, Maskell, the scales differ, however, in colour and also in the position of the exuviæ. The fringe of plates in *P. pittospori* is also said to extend to the rostral region. In external appearance *viridis* appears to more nearly approach *P. myrtus*, but the second of the exuviæ is conspicuously large, whereas in the latter it is not.

79. *Parlatoria zizyphi*, Lucas.

This species has not apparently become acclimatised in West Australia, though it is nearly always present upon lemons brought from the Mediterranean and upon "Pomelos" (*Citrus decumana*) from Singapore.

80. *Parlatoria dryandræ*, sp. n. (Plate XV, fig. 42.)

Scale of ♀ elliptical, exuviæ terminal. Length 0·05, width 0·03 inch. Larval skin blackish-brown, cast of second stage dark brown

and $\frac{1}{3}$ the entire length of scale. Secreted portion of scale pinkish-grey, finely punctate.

Adult ♀ brown with usual lobes, spines and plates, the last fairly wide and extending to all but the cephalic segment, those beyond the third lobes are palmate. Four groups of circumgenital pores, upper laterals 10—11, lower laterals 10—11; pores large and multiocular. Antennæ atrophied, each represented by a wide, truncate process with a horny seta arising from one side of its apex.

♂ puparium pinkish-grey, larval skin brown. Length 0·03 inch.

Adult ♂ dark purple; wings large; eyes black. Legs ample, tarsus and tibia sub-equal, tarsus spined and without knobbed digitules. Abdomen short, rounded, without setæ. Spike about $\frac{1}{2}$ the length of the body.

On *Dryandra floribunda*, Swan River (Helms). This is a rather smaller species than either *P. viridis* or *P. myrtus*, and the number of pores in the groups is remarkably constant.

81. *Parlatoria perpusilla*, Maskell. (Plate XV, fig. 43.)

The specimens of this insect which I have examined show a convex cap, the rim of which overhangs the perpendicular walls of the scale, like the eaves of a roof. The scales do not resemble those of *Parlatoria*, and I notice that Messrs. Cockerell and Parrot have recently referred the insect to *Gymnaspis*.

82. *Parlatoria petrophilæ*, sp. n.

♀ scale elongate, slightly convex, very wide, slate-grey; exuviæ dark brown, terminal, and comparatively very small. Length 0·08, width 0·05 inch. The second of the exuviæ is circular and less than $\frac{1}{4}$ the entire length of the scale.

Adult ♀ with antennæ represented by 2 small chitinous thickenings of the epidermis, each bearing a seta. The lobes are of the usual number and but faintly notched; the third pair have the apex rounded, the sides almost parallel, and taper but slightly to the base. Plates serrate on the lateral margins. Four groups of pores.

On *Petrophila linearis* and *Hakea ilicifolia*. The faintly notched lobes, the small exuviæ and the wideness of the scale seem to characterise it.

Genus Mytilaspis, Targ.-Tozz.

83. *Mytilaspis fulva*, Targ.-Tozz.

Like *Parlatoria zizyphi* this species has never as yet

been found in the orchards of West Australia, though it is particularly common on imported *Citrus* fruits.

84. *Mytilaspis grisea*, Maskell.

Common on various Eucalypts.

85. *Mytilaspis gloveri*, Pack.

The same remark that applies to *M. fulva* applies to this species also.

86. *Mytilaspis pomorum*, Bouché.

The freedom of the orchards of the colony from this species is remarkable, it having been found in only one instance on an apple tree at Mount Barker, an isolated, inland district.

87. *Mytilaspis spinosa*, sp. n. (Plate XV, figs. 4, 5.)

Scale of ♀ white, of a woolly texture, broadly pyriform, generally curved. Exuviæ yellow. Length 0·075, width 0·03 inch.

Adult ♀ brown, sub-elliptical; abdomen ending in a slight, median depression upon either side of which is an inconspicuous, conical lobe. Between the lobes there is a pair of small spines and beyond them 3 others. Five groups of circumgenital, multiocular pores; median 2—3, upper laterals 7—9, lower laterals 10—15. Antennæ represented by a pair of small, horny processes. There is a large group of circumrostral pores, and upon the margins between each antennæ and the last segment are 4 groups each of 5 large, conical spines.

On *Melaleuca sp.* Swan River.

88. *Mytilaspis elongata*, sp. n. (Plate XV, fig. 44.)

♀ scale grey, very long and narrow. Length 0·18, width 0·025 inch.

Adult ♀ elongate; last segment broadly rounded and presenting the following characters: 6 conspicuous lobes, median pair wide, sides parallel, somewhat truncate with 2 small notches on the lateral margin near the apex; second pair wide deeply incised on the lateral margin, apex of lobes truncate, lobule conical; third pair short, wide with 2 small notches at the apex; beyond the third lobes two thickenings of the margin; spines small; 2 hairlike plates between the median lobes, one between them and the second lobes, a broader one between the second and third lobes and 2 tapering and conspicuous plates before the thickenings of the margin. On the margin of

each body segment are groups of conical spines. Circumgenital pores arranged in an almost unbroken, horseshoe-shaped arch. Median group of 7, upper laterals 10—12, lower laterals 10—12.

On *Banksia ilicifolia*. Perth.

Genus Poliaspis, Maskell.

Characters :—♀ scale elongate, exuviæ terminal. Adult ♀ with more than 5 groups of circumgenital pores. ♂ puparium narrow, larval skin terminal.

89. *Poliaspis nitens*, sp. n. (Plate XV, fig. 47.)

Scale of ♀ pyriform, broad, convex, generally straight. Exuviæ light, reddish-yellow, the second being lighter than the first ; remainder of scale pure, silvery white. Length 0·09, width 0·035 inch.

Adult ♀ elongate, yellow. Last segment broadly rounded ; median lobes very short and wide, forming the sides of a slight depression ; beyond this there is on each side a simple, tapering plate and a somewhat deep incision from the much thickened base of which rises a conical lobule (?) ; beyond this again the margin is crenulate and bears another simple plate. There are 7 distinct groups of circumgenital pores, 6 arranged in opposite pairs, the seventh median and anterior to the more anterior laterals, median of 3—4, anterior laterals 7—8, intermediate laterals 15—17, posterior laterals 16—20. No rudiments of antennæ.

♂ puparium white, with a faint median carina.

On *Davisia sp.*, Swan River. The species differs from *P. exocarpi* in the number and arrangement of the group and in the number of pores in each.

90. *Poliaspis intermedia*, sp. n. (Plate XV. fig. 46.)

♀ scale pyriform, generally curved, very convex, white. Length 0·06, width 0·03 inch. Exuviæ terminal, light yellow.

Adult ♀ yellow ; last segment bearing two fairly conspicuous, tapering median lobes, and beyond each 3 equal-sized, conical lobules, beyond these are 2 simple plates between which 2 small rounded lobules may be seen. Eight groups of circumgenital pores, 6 arranged in opposite pairs, and 2 median, the more anterior being before the anterior laterals and the second before the intermediate laterals : the first median of 2—4, second median 3—5, anterior laterals 7—8, intermediate laterals 9—14, posterior laterals 20—25.

On a Leguminous plant. The scales are much duller than those of *P. nitens*, and the insects cluster together in

colonies containing great numbers of ♀s. Described from 15 prepared specimens.

Genus Chionaspis, Signoret.

91. *Chionaspis agonis*, sp. n.

♀ scale straight, long and narrow, slightly convex. Exuviæ pale straw-coloured, remainder of scale dull white. Length 0·13, width 0·03 inch.

Adult ♀ elongate, of a light, yellow colour; pygidium rounded and presenting the following characters: median lobes conspicuous, short, wide, diverging, apex truncate; second lobes much smaller and divided into two lobules, median lobule inconspicuous, narrow at the base and spatulate, outer lobule smaller still and tapering; beyond the second lobes the margin is incised several times; plates simple and tapering, first situated beyond the median lobes, second beyond the second lobes, and a third a short distance beyond that; the spines at the bases of the median lobes are very small, the remainder more conspicuous and adjacent to the plates. Five groups of circumgenital pores, anterior 4 to 8, anterior laterals 13 to 15, posterior laterals 19 to 21.

♂ puparium white with a slight median carina. Larva skin straw-coloured.

On *Agonis flexuosa*.

92. *Chionaspis ethelæ*, sp. n.

♀ scale elongate, broad behind, exuviæ red-brown, rest of scale dull white. Length 0·1 inch.

Adult ♀ elongate, distinctly segmented, with lateral groups of spines, particularly prominent on the four abdominal segments. Antennæ spots distinct. Last segment broadly rounded with a pair of conspicuous, apparently diverging, wide and short median lobes, the inner margins of these lobes are joined by a horseshoe-shaped thickening, they are at first parallel, then rounded and widely divergent; the lateral margins appear concave; immediately beyond the median lobes there is a short simple plate; then 3 equal-sized lobules, the first arising from a depression with thickened sides; there is a second much longer simple plate beyond the third lobule, and beyond this again 2 emarginate and almost obsolete lobules, both originating from depressions with club-shaped, thickened sides; beyond this another simple plate, followed by two similar depressions and several serrations, followed again by similar plate, depressions and serrations. The spines are small and situated before the plates.

Five groups of circumgenital pores, anterior of five orifices, anterior laterals 11 to 15, posterior laterals 15 to 21.

♂ puparium white, opalescent, sides parallel, distinctly tricarinate, with 2 additional and faint carinæ between each lateral and the median.

On *Eucalyptus*, spp.

93. *Chionaspis eugeniæ*, Maskell.

On *Ricinus communis*, East Kimberley, North-West Australia. The ♂ puparia clustered together in a woolly mass.

94. *Chionaspis xanthorrhœæ*, sp. n.

Scale of ♀ shining white, pyriform; exuviæ light yellow.

Adult ♀ yellow. Last segment with a slight, wedge-shaped depression, on either side of which is a short, conical lobule; beyond the lobules at a short interval occur the second lobes, represented by two lobules, the inner being the longer and the larger, the outer short, wide and rounded at the apex. Beyond the second lobes the margin is slightly prolonged and thickened three times. Two very small spines between the median lobules, the others adjacent to the plates which are simple, tapering and very long, and situated subsequent to the lobes and prolongations of the margins. Five groups of circumgenital pores, median usually of 4 orifices, anterior laterals 19 to 20, posterior laterals 25 to 30.

♂ puparium white, not carinated; larva skin yellow.

On *Xanthorrhœa*, sp.

Genus Fiorinia, Targ.-Tozz.

95. *Fiorinia fioriniæ*, Targ.-Tozz.

On hot-house plants, Perth.

96. *Fiorinia acaciæ*, Maskell.

On several species of *Acacia*.

97. *Fiorinia rubra*, Maskell.

On *Acacia*, sp.

98. *Fiorinia casuarinæ*, Maskell.

A very common species in the neighbourhood of Perth.

99. *Fiorinia acaciæ*, var. *bilobis*, var. nov.

An insect agreeing sufficiently with *F. acaciæ*, reported from West Australia by Mr. Maskell, with the exception that there are 2 lobes, closely adjacent and at first sight appearing as one semi-circular lobe.

On *Acacia pulchella*.

Genus MASKELLIA, Fuller.

100. *Maskellia globosa*, Fuller.

On *Eucalyptus gomphocephala*. Perth. (Agricultural Gazette of New South Wales, Vol. viii, p. 579, 1897.)

Genus AONIDIA, Targ.-Tozz.

101. *Aonidia banksiæ*, sp. n.

Scale of ♀ circular, convex, grey ; the second of the exuviæ shows through the secreted portion and gives the whole a deep, orange-red colour. Diameter 0·02 inch.

Adult ♀ almost circular, smaller than second stage. The abdomen ending in a short, wide, chitinous segment with a medium depression on either side of which faint, very short, wide lobes are occasionally to be made out ; plates and pores absent ; there are 6 pairs of spines, and a distinct fold in the margin of the segment beyond the third pair on each side.

The posterior end of the cast of the second stage seems to bear 6 conspicuous lobes, the sides of which are parallel and the apices obliquely truncate and faintly crenulate. There are 2 plates between the medium lobes, 2 between them and the second lobes, and 3 between the second and third lobes ; the sides of the plates are parallel, the apex of each serrate, and they are the length of the lobes.

♂ puparium elongate, white or grey ; larval skin terminal, circular and of a bright orange-colour, exhibiting on each side of the centre 2 groups of pores.

Adult ♂ short and wide, dark purple ; head small ; antennæ 9-jointed ; thorax large and wide, with a medium line of white colour ; abdomen short ; style stout ; wings large and wide. Length 0·04 inch.

This is a very common species around Perth. It is particularly abundant on *Banksia attenuata* and *B. menziesii*, less so on *B. prionotes*, and only found in rare instances on *B. ilicifolia*. Where groups of the scales occur they are never crowded upon one another, and the surface of the leaf all around is covered with a thin "bloom" of white secretion.

CLAUDE FULLER,
JUNE 6, 1899.

EXPLANATION OF PLATE XV.

[*See explanation facing the* PLATE.]

XV. *Descriptions of four new species of* Cicadidæ.

By W. L. Distant.

[Read October 4th, 1899.]

Plate XVI.

The species here described all belong to the genus *Platypleura*, and are from the Ethiopian region. One is from Angola, two from Madagascar, and another from the little-known Pemba Island. The genus *Platypleura* is found in the Ethiopian, Oriental, and extreme eastern portions of the Palæarctic regions, but it is in Madagascar that the genus reaches its maximum in the size, and perhaps in the beauty of its species, one from that island, which is here described and figured, being a particularly large and handsome insect.

Platypleura heathi, sp. n. (Plate XVI, fig. 1.)

Body pale olivaceous with the following black markings:—Head with the area of the ocelli connected with eyes by a transverse fascia, a curved lateral fascia on each side behind front, a streak from inner margin of eyes to base, and two small discal spots on each side; pronotum with two small central spots at centre of inner basal margin, the incisures, and lateral margins (sublaterally anteriorly); mesonotum with a posterior discal transverse series of four spots; abdomen with basal segmental fasciæ—broken discally anteriorly, and apical segment and anal appendage; head beneath, with inner margins of eyes and a curved fascia to face, face with anterior transverse striations and posterior central sulcation, and basal segmental fasciæ to abdomen beneath. Abdomen above and body beneath greyishly pilose. Rostrum and legs dull ochraceous.

Tegmina from base to near the apical areas pale æruginous, thence to apical margin pale bay; venation brown, and two small brown spots in radial area; base of lower ulnar area piceous. Wings blackish, on apical area with paler ray-like streaks; the posterior margin from anal area to apex cretaceous, with a large dark fuscous central spot.

Head somewhat broad, and with eyes about equal in width to base of mesonotum; lateral margins of the pronotum convexly rounded;

face broad and tumid; rostrum reaching the posterior coxæ; opercula overlapping at inner margins; tegmina arched at base of costal membrane.

Long. excl. tegm. ♂ 38 millim. Exp. tegm. 115 millim.

Hab. Madagascar.

I have connected this species with the name of Dr. E. A. Heath, to whom I am indebted for this and many other specimens.

Platypleura andriana, sp. n. (Plate XVI, fig. 2.)

♂ Body ochraceous, with the following black markings:—Head with the margins of the ocelli; pronotum with two small central spots on inner basal margin; mesonotum with a posterior transverse series of four spots, and apical area of abdomen above. Body more or less greyishly pilose; opercula piceous, and some central sternal shadings of the same colour.

Tegmina bay in hue, but from base to about apical areas strongly tinged with ochraceous, with bay-coloured spots of which the principal ones are two in radial area, beyond which are a double irregular series, the innermost strongly oblique towards base, the outermost almost straight. Wings dark castaneous, with pale castaneous rays from base, venation paler. (In some specimens there is a pale spot on outer margin near the anal area.)

The head is somewhat narrow, and with eyes being a little less in width than base of mesonotum; lateral margins of the pronotum convexly rounded; opercula not meeting, well separated.

Long. excl. tegm. ♂ and ♀ 32 to 35 millim. Exp. tegm. 110 to 115 millim.

Hab. Madagascar.

Platypleura quanza, sp. n. (Plate XVI, fig. 3.)

Head, pronotum, and tympana ochraceous; mesonotum and abdomen above castaneous, apical abdominal segments cretaceous, anal appendage ochraceous. Body beneath and legs ochraceous. Head with the anterior margin of front castaneous; a transverse fascia between eyes including area of ocelli, black; a small black spot near inner margin of each eye. Pronotum with a central narrow broken fascia and the incisures piceous. Mesonotum with the basal cruciform elevation ochraceous. Head beneath with a fasciate line between eyes and face, and the central sulcation to face, piceous.

Tegmina hyaline, and about basal half opaque and pale stramineous, with a hyaline spot in radial area; costal membrane and venation

ochraceous. Wings hyaline, rather more than basal half opaque, pale ochraceous.

Head including eyes a little narrower than base of mesonotum. Lateral margins of the pronotum obtusely angulated. Rostrum reaching the basal abdominal segment. Opercula slightly overlapping at their inner margins.

Long. excl. tegm. ♂ 23 millim. Exp. tegm. 78 millim.

Hab. Angola (*Monteiro*).

Platypleura pembana, sp. n.

Head and thorax above olivaceous, abdomen piceous, the apical segment cretaceous; body beneath with the head, sternum, legs, rostrum, and opercula olivaceous, the abdomen piceous. Head, with the lateral margin of front, area of ocelli connected by a transverse fascia with eyes, inner margin of eyes, and a spot on each anterior angle of vertex, black. Pronotum, with the incisures, a longitudinal spot on each side of disc, and two small spots at centre of inner basal margin, black. Mesonotum, with two obconical spots on anterior margin, on each side of which is a short and a long oblique spot, and a spot at the anterior angles of the basal cruciform elevation, black. The body is sparingly greyishly pilose, and the central base of the abdomen above somewhat olivaceous. Tarsi and apex of rostrum, piceous.

Tegmina opaque, bay-coloured or pale brownish-ochraceous, with darker macular shadings, of which the most distinct are three in the radial area, irregular in the four upper ulnar areas, apical margins of the ulnar areas, and a more or less distinct double outer marginal series separated by the veins; venation greenish. Wings very dark castaneous, the venation pale reddish, apical and posterior margin pale fuscous, somewhat greyish near anal area.

Head broad, and with eyes about equal in width to anterior margin of mesonotum; lateral margins of pronotum obtusely angulated; rostrum reaching basal segment of abdomen; opercula very slightly overlapping at inner margins; face strongly transversely striate and with a very broad central longitudinal sulcation.

Long. excl. tegm. ♂ and ♀ 25 to 26 millim. Exp. tegm. 80 millim.

Hab. Pemba Island (*East Africa*).

Explanation of Plate XVI.

[*See explanation facing the* Plate.]

XVI. *On Sexual Dimorphism in the Rutelid genus* Parastasia, *with descriptions of new species.* By GILBERT J. ARROW, F.E.S.

[Read October 4th, 1899.]

PLATE XVII.

IN a paper dealing with the *Anomala* group of Rutelidæ recently published in the Transactions of the Entomological Society, I pointed out the importance in systematic work of ascertaining what characters were sexual. A study of the Asiatic Rutelidæ constituting the *Parastasia* group has strongly emphasised this necessity and shown the worthlessness, in the present family at least, of much of the work in which this point has been neglected.

Having made a preliminary separation of the specimens of *Parastasia* in the British Museum collection upon the basis of Westwood's Monograph of the genus, I was surprised to find an almost entire absence of external sexual differences, and dissection proved that this was due to the fact that the greater number of the apparent species consisted of one sex only. I afterwards found that the existence of sexual dimorphism in this genus had already been noticed by Dr. Ohaus in a recent paper in the Stett. Ent. Zeit. As however this author has not fully recognised the extent of the dimorphism, and as I have been able to examine a number of types unknown to him and a large number of specimens of new and old species, several collections having been kindly lent me for the investigation of this interesting phenomenon, I have thought it desirable to collect together all the instances I have been able to discover, including those already pointed out by him. I shall adhere as far as possible to Dr. Ohaus' subdivisions of the genus.

This group of Rutelidæ includes several remarkable genera, such as *Peperonota*, *Fruhstorferia* and *Didrepanephorus*, characterised by extraordinary differences between the sexes, and it is interesting to find the well-known predominant genus exhibiting the same phenomenon, so long unexpected, in many different ways.

The genus *Parastasia* was originally characterised by Westwood, as he says, "from a female of *P. canaliculata* and a male of *P. Westwoodii*," those sexes of the two species alone being known to him. These two insects represent in a wide sense the opposite extremes of this comprehensive, but sufficiently well-defined, genus, and between them may be ranged forms which have hitherto been regarded as constituting different generic types. As might be expected therefore, the generic characters so far as they are sexual, are wholly incorrect. The male of *P. canaliculata* has remained unknown, Dr. Ohaus stating that he knows only females, whilst two specimens, besides the type (which I have been able to examine), are also females. Another insect however, *P. bipunctata*, described by Westwood from the same collection of Philippine beetles, consists only of males, all the specimens in the British Museum, including the type, being of that sex, and Dr. Ohaus also indicating that the female is unknown to him. The two insects are similar in form and size, the chief differences being that the body, especially the prothorax, is more parallel-sided in the first (*P. canaliculata*, of Westwood), the propygidium not shining, and especially that a part of the yellow fascia is elevated above the general surface of the elytra and has a deep groove on each side of the scutellum. All these peculiar features, in view of those which will be referred to in other species, seem to point to the fact that the two are the sexes of the same species, and looking at all the evidence I have no hesitation in stating this to be the case. In the structure of the claws, as in other features by which the sexes of Rutelidæ are usually distinguished, these two forms are practically identical, nor are the remarkable differences which I have mentioned, like others which I shall refer to later on, known to occur in any form in any other group. The genus *Parastasia* is therefore highly peculiar, and indeed other structural features show it to occupy a very isolated position.

Parastasia canaliculata, the type of the genus (vide the original description, Ann. Nat. Hist., 1841, viii, p. 204) belongs to the 3rd group of Dr. Ohaus, forming the preponderating section of the genus, in which there is no constant external character distinguishing the sexes, but a variety of differences in different species. In *P. rufopicta*, an insect closely related to the previous one, a remarkable

difference already pointed out by Dr. Ohaus, occurs in the propygidium, which in the female has a peculiar microscopic structure producing a dull sooty or velvety surface, while in the male it is rather shining and does not differ in structure from the rest of the surface of the abdomen. Another slight difference, interesting as throwing light upon *P. canaliculata*, is that the elytra of the female have a distinct depression limited by the hinder border of the pale fascia, giving this the appearance of being partly elevated above the general level.

In a new species very near these the female is distinguished by a very slight opaque area bordering the scutellum, recalling both the opaque propygidium of the same sex in the last species and the scutellar grooves of *P. canaliculata*. It also differs from the male both in the sculpture of the propygidium and of the elytra and in the form of the markings.

Parastasia birmana, sp. n. (Plate XVII, figs. 3 and 4.)

Nigra, nitida, elytris fulvo-maculatis, corpore subtus fulvo-hirto; capite grosse punctato, quadridentato; prothorace haud dense, antice grossius, punctato, utrinque bifoveolato; scutello fere impunctato; pygidio et propygidio dense striolato, illo bifoveolato; tarsorum mediorum et posticorum unguibus externis profunde bifidis; ♂ elytris subtiliter sublineato-punctatis utroque macula humerali ~-formi punctaque parva apicali flavis ornato; ♀ elytris politissimis, impunctatis, macula superiori expansa, ad margines basalem scutellarem et suturalem attingente; prope scutellum margine tenui opaco; propygidio subtilissime striolato. Long. 22 m.m.

Hab. BURMA (*Bowring*); YUNNAN (*Oberthür*).

This species is intermediate in general appearance and the character of its markings between the two previous ones and is interesting as combining the sexual distinctions of a number of allied forms. In the expansion of the yellow fascia in the female it resembles the next species.

P. basalis, Cand., of which the sexes, regarded as specifically different by that author, have been associated by Dr. Ohaus, exhibits many differences. The female, as is very generally the case in the genus, has a somewhat different form owing to its greater parallel-sidedness, the elytra, unlike those of the male, are almost entirely unpunctured and the red humeral band extends to the middle, whereas in the male it is shorter and more inter-

rupted. The pygidium, which in the latter sex is quite bare, is thickly clothed with yellow hairs and, as is also frequently the case in *P. canaliculata*, the prothorax is normally quite black in the female and in the male a more or less deep shade of red. But the most interesting difference, although not an invariable one, is that each elytron of the female usually exhibits one or more deep furrows or scratches bordering the scutellum, less conspicuous but of precisely the same nature as those of *P. canaliculata*. There are sometimes as many as four or five of these on each side and occasionally they are quite absent.

P. sumbawana, Ohaus, is another related insect of which the sexes are very distinct. By the kindness of the describer I have been able to examine the type, which, like several similar specimens I have seen, is of the male sex; but in M. René Oberthür's collection, in addition to two specimens of this form, there are four females found with them at Sumbawa which, instead of having the reddish tawny coloration of the male, are black or very dark brown with orange markings on the elytra, consisting of an irregular fascia below the scutellum and an apical spot, very similar to the markings of *P. canaliculata*. The present insect however is smaller than that species, more convex, and less shining, with distinct striation of the elytra and the thorax punctured all over. In these respects it corresponds with the male, in some specimens of which similar paler markings can be faintly traced.

The following new species of this group are also dimorphic. The first, *P. cingala*, is closely related to *P. basalis*, the sexes differing in the pygidium being similarly clothed with hair in the female.

Parastasia cingala, sp. n.

Valde convexa, nigra, nitida, prothorace fasciaque serrata subhumerali coralinis; capite rugoso-punctato; prothorace punctato, utrinque foveolato; scutello fere lævi; elytris leviter sulcatis atque punctatis; pygidio subtiliter striolato nudo; ♀ prothorace crasso, grosse punctato, fascia elytrali latiora sed neque ad margines attingente, elytris sat evidenter sulcatis et punctatis, pygidio hirto. Long. 13—15 m.m.

Hab. Ceylon: Colombo.

This insect, at least in the male sex, closely resembles

P. basalis, but is smaller, with the elytral band in both sexes narrower and the prothorax a bright coral red.

Parastasia timoriensis, sp. n. (Plate XVII, figs. 7 and 8.)

Cylindrica, lævis, nitida (♂ rufo-brunnea, ♀ nigra), macula circumscutellari flava; capite rugoso, prothorace sat grosse punctato, postice dilatato (♂ præcipue), scutello subtiliter, elytris haud, punctatis, pygidio subtilissime striolato. Long. 18 m.m.

Hab. TIMOR (*Doherty, Wallace* (*Hope Museum*), *etc.*).

The sexes in this species are closely alike except in colour. The yellow elytral mark shows no variation in the specimens which I have examined. It reaches the anterior, scutellar and sutural margins but not the lateral border and has a right-angled notch on each elytron. It is relieved in the male by a black posterior edge which merges into the reddish-brown ground colour. All the specimens I have examined are from Timor with the exception of one in the Oberthür collection from the small neighbouring island of Lomblem.

In this section should also be placed *P. andamanica* of Dr. Ohaus, who, knowing only the male, placed it in his "confluens group." Misled by this I at first regarded the insect, of which the female differs entirely in appearance from the form described by Dr. Ohaus, as a new species, but a subsequent perusal of the description led me to suspect the truth, and I have since been enabled to see the type. I shall allow my description to stand however, as the species is as yet quite inadequately described.

Parastasia andamanica, Ohaus, Stett. Ent. Zeit., 1898, p. 13. (Plate XVII, figs. 5 and 6.)

Cylindrica, parum nitida (♂ rufo-brunnea, ♀ nigra), macula humerali fulvo-rufa malleiformi; capite fortiter rugoso, acute quadridentato; prothorace ubique fortiter punctato, utrinque foveolato; scutello subtiliter punctato; elytris regulariter ac fortiter punctato-striatis interstitiis subtilissime (2° grosse) irregulariter punctatis, singulo elytro macula obliqua ad scutellum transverse expansa; pygidio subtiliter transverse rugoso-striolato; ♂ capite fusco, dentibus superioribus minus acutis; prothorace minus gibbo, læte rufo-brunneo, linea media subelevata; scutello, elytris corporeque subtus paulo obscurioribus, macula indistincta. Long. 12—17 m.m.

Hab. ANDAMAN IS.

This insect varies very considerably in size but otherwise very little. It is the most strongly punctured species known to me in this section of the genus. It is easily recognised by the orange-coloured mark shaped like a hammer upon each elytron.

P. bicolor, Westw., the type of which is in the British Museum, and which Dr. Ohaus has wrongly stated to be identical with *P. femorata*, Burm., is a very distinct species also belonging to this group. It is unfortunate that Dr. Ohaus has called the section to which the latter insect belongs (the gen. *Cælidia* of Dejean) "the bicolor group." The original of this sub-genus, from Dejean's collection, will be described later. *P. bicolor* resembles *P. femorata* in coloration but is very different in structure and easily distinguished by its much larger size, more rectangular form and naked legs and pygidium. The two sexes are alike. This is one of several cases in this genus of superficial resemblance between species not nearly related.

P. binotata and *P. Horsfieldi* are two more insects simultaneously described by Westwood from the same part of the world (Java) of which the first appear to be all females and the second all males. The type of the former is unknown, and I have only seen two specimens, which are both females, but the type of the latter and a number of other specimens which I have examined are all males. This confirms Dr. Ohaus' suggestion that these are the sexes of one species; and as they are almost alike except that the female is quite black with a round spot on each elytron near the scutellum, and the male uniformly dark brown, and as no other similar form is known from the same island, this is in all probability correct. In this case the name will become *P. binotata*, Westw., that form having been first described in Westwood's paper. The insect described by Burmeister from Dupont's collection as *P. binotata*, Westw., is entirely different, as shown by his reference to a serial puncturation on the elytra and *sinuated* pale marks. To avoid confusion this species may be re-named *P. Duponti*. M. Oberthür possesses an insect from Southern India formerly in Van Lansberge's collection (which included that of Dupont) and labelled by the latter "binotata, Burm., type." I have seen six specimens of the insect, which is of a deep mahogany colour, and all are males.

Very near the male form of *P. binotata* is the male

P. niasiana, Ohaus, which is in my opinion the missing counterpart of *P. ephippium*, v. Voll., to which it stands in exactly the same relation as does *P. Horsfieldi* to the first, except that the elytral mark is not absent but is of a darker colour. In the type of *P. niasiana* this is of the same shape as in *P. ephippium* except that its anterior process does not quite reach the margin of the elytron; but, from the general terms in which Dr. Ohaus has referred to it, it may not be alike in all specimens. The pygidium, as in the preceding species, is less sharply striolated in the male than in the female form and does not show a smooth median ridge. In all other respects, except the greater parallel-sidedness almost invariably characteristic of the female and the slight interval between scutellum and elytra to which Dr. Ohaus has called attention in *P. ephippium*, and which is evidently a female character, the two are identical. The type of *P. ephippium* was brought from Sumatra, Dr. Ohaus's specimens are from Nias, and two females in the British Museum are from Penang.

An interesting new species may be described here, although only one sex is known, as it seems to form a link between the present section of the genus and those distinguished, together with other characters, by a long mesosternal process. It also exhibits in a more marked degree the strange opaque area described in *P. birmana*, and distinctive of the female.

Parastasia circumferens, sp. n.

♀ Crassa, nigra, nitidissima; capite rugoso, acute quadridentato; prothorace lateribus disperse, antice fortius, punctato, utrinque fortiter foveolato; scutello elytrisque politissimis, his prope scutellum sat late opacis; pygidio cum propygidio subtilissime striolatis, illius linea media apiceque nitidis; processu mesosternali valido acuto; tarsorum mediorum et posticorum unguibus divisis. Long. 21 m.m.

Mas incognitus.

H ab. PENANG (*Lamb*).

This insect presents a deceptive resemblance to *P. ephippium*, which occurs in the same locality, and until I had ascertained it by dissection to belong to the same sex I believed them to be the two forms of the same species. In size, form and surface the new species exactly resembles the old and it shows no structural distinction except in the

prolongation of the mesosternum, although the absence of the yellow markings and the peculiar sooty band surrounding the scutellum make it easily distinguishable. It would not have been described but for the interest attaching to it as demonstrating the little systematic importance in the degree of development of the sternal process, which has been made the occasion of generic separation. The very close relationship of this species to others in which the process is almost absent is strikingly evident.

In *P. heterocera*, Ohaus, which represents Dr. Ohaus' 8th section, the sexes differ typically by the males having the elytra scarlet, sometimes with more or less black at their base, whereas the female is wholly black. The insects of this section are very variable, however, in coloration, and Dr. Ohaus mentions an exceptional female specimen with red elytra. Another in the British Museum shows a trace of red, while several males are entirely black. These exceptions however only indicate that the rule is not invariable. There is another, and probably invariable, difference in the form of the anterior horns which in the male are separate and parallel and in the female converge in a right angle at the base.

P. dimidiata and *nitidula* of Erichson are closely related to this. Dr. Ohaus mentions that all his specimens of the former are females. A search for the male has revealed it in *Urleta ometoides* of Westwood. The type of this was collected by Wallace, together with two specimens of *dimidiata*, at Singapore, and a slight comparison shows them to differ only in coloration and in the cephalic armature, the points by which the sexes of the previous insect are distinguished. In order to confirm my opinion I dissected the specimens mentioned above, which are contained in the Oxford Museum, and demonstrated Westwood's insect to be a male and those collected with it females. It may be mentioned that Westwood did not recognise the latter as *P. dimidiata* (although he had himself published the description of this in an Appendix to his own Monograph), but evidently selected the more conspicuous insect for description without any examination of the others, and of course without any knowledge of the sexual peculiarities of the genus.

Erichson's type, as well as the females in the Oxford Museum, are black with the pygidium and the posterior half of the elytra red. The male is red with the exception

of the head and the anterior half of the elytra which are black, the red posterior part being paler at the extremity. Dr. Ohaus mentions a female coloured practically like this, which is probably exceptional but affords further proof of their specific identity. The structure of the horns in the two sexes is however probably constant, the male showing the same difference as in *P. heterocera* but with a somewhat greater development. Under these circumstances Westwood's name will of course have to give place to that given by Erichson.

Erichson's description of the related *P. nitidula* is from a male specimen, as shown by the form of the cephalic processes. The only corresponding specimen I have seen is in M. Oberthür's collection, which also contains two individuals of the other sex, a third being in the British Museum. These three females agree in having an apical orange band upon the elytra, the male being without marking. The coloration of the sexes thus reverses the condition prevailing in *P. heterocera*, which is very remarkable considering the intimate structural relationship of the two. In the three closely related species, *dimidiata, heterocera* and *nitidula*, we accordingly find the elytral band occurring normally in the male only in one, in both sexes in another, and in the female only in the third. *P. nitidula* may prove to be variable, like the other two, in coloration, but the normal condition seems to be sufficiently indicated by the five known specimens. Both sexes of this species are distinguished by the bronzy lustre upon the elytra, no other known member of the genus being in any degree metallic.

These three species form a section of the genus differing from the previous one in no important particular but the greater development of the cephalic and mesosternal processes. Another section consists of species in which these are not prolonged but the structure of the claws differs entirely in the two sexes, those of the male being as in the last two sections, while in the female they are all undivided. To this group belongs the commonest species of the genus, *P. confluens*, Westw., the sexes of which previously separated as *pilea* and *rugosicollis* have already been brought together by Dr. Ohaus. In this insect, besides the difference in the claw-structure, there is a striking difference both in colour and sculpture, the females being deeply striated and almost black in colour, with the

exception of two clearly defined yellow patches on the elytra, and the males nearly smooth and of a more or less light mahogany colour into which the pale markings partly melt. Of several apparently allied species the males only have been described.

Another insect in which the sexes exhibit similar differences is *P. discolor*, Westw., an insect described from the Philippine Is. of which the type is a male. A series of specimens of the same sex in M. Oberthür's collection exhibit all gradations from this form, in which, of the upper surface, only the head, scutellum and a very narrow line bordering the elytra are black, to one in which only the thorax remains red. From the light forms of this I cannot distinguish *P. scutellaris*, Erichs., described from Sumatra. A specimen in the British Museum is from Penang and brought with this insect is a female which I believe to be the same. A similar one was taken with M. Oberthür's Philippine specimens. This female form is strikingly different in appearance, being entirely black, rather larger and more parallel-sided than the male and coarsely striately punctured. The claws differ in the two sexes as described above. This appears to be a somewhat common type of female in the genus, those of several species being extremely similar.

Of the two following new species related to *P. discolor*, *P. unicolor* exhibits a similar sexual disparity in coloration, and the sexes of *P. alternata*, a very conspicuously coloured insect, differ only in claw-structure.

Parastasia unicolor, sp. n. (Plate XVII, figs. 11 and 12.)

Convexa, nitida, capite prothoraceque grosse, hoc postice rarius, punctatis; scutello vix punctato; elytris lineato-punctatis; ♂ fulvo-brunnea, capite, pedibus, corpore subtus marginibusque omnibus prothoracis, scutelli et elytrorum tenuissime fuscis, undique subtiliter punctata, pygidii medio lævi; tarsorum mediorum et posticorum unguibus divisis. Long. 16 m.m.

♀ tota nigra, plus elongata, fortius punctata, pygidio subtiliter striolato; unguibus omnibus simplicibus. Long. 18 m.m.

Hab. N. Borneo: Sandakan; Elopura.

This insect is exceedingly closely allied to *P. discolor*, Westw., and indeed the black females are hardly distinguishable, but the males are at once separable by their

colour which does not vary in a considerable number which I have examined.

Parastasia alternata, sp. n.

Crassa, fulvo-rufa, capite, scutello, fasciaque transversa humerali partem anteriorem tertium vix obtegente, pedibus corporeque subtus plerumque nigris, margine tenuissimo prothoracis elytrorum pygidiique fuscescente; capite grosse, prothorace subtiliter, punctatis, scutello fere impunctato, elytris leviter sulcatis et punctatis, pectore fulvo-hirto, processu mesosternali brevissimo, abdomine striolato; ♂ tarsorum mediorum et posticorum unguibus divisis, pygidio nitido vix punctato; ♀ unguibus omnibus simplicibus, pygidio grosse punctato. Long. 20 m.m.

Hab. N. India: Allahabad (*Bowring*).

The black *P. vitiensis*, Nonf., as already discovered by Dr. Ohaus, is the female of *P. dolens*, Fairm., which, with *P. melanocephala*, Burm., he has regarded as constituting a separate section on account of the elongate club of the antenna. The male of *P. dolens*, however, is very variable and has a tendency to assume the female coloration. It is normally red, somewhat darker on the elytra, and with three longitudinal black stripes on the prothorax. Two specimens in M. Oberthür's collection, however, have the elytra black and a third has entirely assumed the black colour of the other sex. *P. melanocephala*, Burm., hardly differs sexually in colour, but it and *P. dolens* both show the same difference in the claws as the insects just described.

Another group consists of insects in which the sexes show the same difference in claw-structure, as well as a colour difference, but in these there is a long acute mesosternal process. These constitute the *vittata* group of Dr. Ohaus, who has announced the black *P. atra* to be the female of *P. vittata*, in which the prothorax has a red border and median line, which I have no doubt is correct. The length and form of the sternal process vary very considerably in this species.

P. helleri, Ohaus, of which the female is as yet unknown, is a very nearly related insect.

To this group also belongs *Echmatophorus Pascoei*, Waterh. (Plate XVII, figs. 1 and 2), the original specimens of which being of one sex only were placed in a new genus by Mr. Waterhouse, owing to the distinctive form of the male, produced by the short and broad prothorax, and the presence of the long sternal process, the

existence of which in other species of *Parastasia* he was not then aware of. I have identified the female of this insect in a specimen * which clearly connects this section of the genus with the succeeding one. This female presents a remarkable resemblance, not only in its short ovate form and its simple claws, but also in sculpture and coloration, to the typical form of that group, *P. bimaculata*, Guér. Its right determination is sufficiently evident, however, from the sharp downward curved thoracic spine, the black scutellum and the rounded black spot upon the pygidium, in all of which it exactly agrees with the male *Parastasia Pascoei*. The female has two squared spots on the posterior part of the prothorax, as in *bimaculata*, which in the male unite together and with the black scutellum to form a large heart-shaped mark.

These differences both in bodily form and marking occasion a dissimilarity between male and female which is very remarkable; but still more extraordinary is an undescribed species allied to this in which the two sexes differ not only in form, marking and the structure of the claws, but also in a striking degree in the form of the mesosternum and the sculpture of the elytra. Indeed so complete is the distinction that I long hesitated to associate the two. Considering, however, that all the differences here occurring in combination have already been found in other representatives of the genus, except one, viz. the presence of a long sternal process in the female only, and as the degree of development of this structure has been found to have no systematic importance, distinguishing species closely related, and varying within the limits of a single species, there seems no valid reason for resisting the evidence which points to the identity of the two forms. Four specimens acquired by M. Oberthür from Van Lansberge's collection were taken in the same locality and of these two of different sexes were, judging from the labels, taken simultaneously. Three specimens without a sternal process show no variation and are all males, while the fourth, with a process, is a female and shows an evident relationship, in colour and marking, to the male. I propose to call this insect *Parastasia mirabilis*.

* Note. This specimen, collected by Wallace at Singapore, was found in the Hope Collection at Oxford, but has been transferred to the British Museum, and a co-type of the male form is now in the former collection.

Parastasia mirabilis, sp. n.

Rufo-flava, capite, maculis prothoracis et scutelli corporeque subtus nigris ; capite bituberculato, rugoso ; prothorace leviter, scutello vix, punctatis ; elytris striato-punctatis. ♂ cylindricus ; corpore subtus et scutello toto nigris ; prothoracis basi macula nigra tridentata ornato ; elytris rufis, regulariter striato-punctatis ; pygidio lateribus leviter striolato ; mesosterno parum producto ; tarsorum 4 posticorum unguibus externis divisis. ♀ lata, depressa, pallidiora ; corpore subtus plus minusve, prothoracis et scutelli maculisque minoribus nigris ; singulo elytro disco profunde trisulcato, prope scutellum rugoso et ad lateris medium subtiliter transverse striato ; mesosterno valde producto ; unguibus omnibus simplicibus. Long. 18 m.m.

Hab. MALACCA.

The male exactly resembles that of *P. Pascoei* in its rather peculiar coloration, but is more elongate, the sternal process is almost absent and the thoracic mark is produced forwards in the middle. The female is broader and less convex, with a sternal process like that of *Pascoei*, and the sculpture of the elytra is highly remarkable. The puncturation is almost obliterated but there is a finely striated area in the middle of each side, the angles adjoining the scutellum are rugose, and in the middle of each elytron are three deep longitudinal furrows placed close together and about one-third the length of the elytra.

The next group, represented by the common *P. bimaculata*, has all the claws quite simple, in the male as well as the female, and the mesosternum is not produced. In the typical species the sexes show no conspicuous difference, but a closely related species by which it is represented in New Caledonia and the New Hebrides has very distinct sexual forms. This is *P. Percheroni* of Montrouzier (Plate XVII, figs. 9 and 10), who correctly associated the two forms but, being ignorant of sexual differences, regarded them as due only to the age of the specimens. He has therefore unconsciously described accurately the two sexes of the species, that which he regarded as the extreme pale variety being the male. Besides the colour differences described by him, this has a somewhat longer antennal club and the prothorax is very different in shape, being smaller, less convex, and sharply angulated at the sides. The female varies greatly in coloration, but according to the considerable number of specimens I have examined in

various collections, even the palest individuals have a black scutellum, two spots on the thorax and bars on the pygidium of the same colour, all of which are absent in the males.

This insect has been commonly regarded as identical with the variable *P. bimaculata*, but the recognition of the pale form as the male will show the range of variation to be much less than has been supposed and render the two species immediately recognisable. The geographical distribution of *P. bimaculata* seems to me to be much more restricted than is at present supposed. The New Caledonian insect, besides the black scutellum of the female and the absence of markings in the male, is distinguished by its larger size. Smaller forms occur in which the scutellum is black, but these will probably be found to be also specifically distinct from *P. bimaculata*.*

A very prettily marked little insect belonging to this division is *P. Carolinæ*, Gestro, the position of which is suggested by the two-spotted thorax. A specimen in the British Museum is a male and has all the claws simple, a condition which so far as is known occurs in this sex in no other group of the genus. It appears to me highly probable that the other sex of this insect, which inhabits New Guinea, is the female described by Dr. Ohaus from that island as *P. Weberi*, which is a black form agreeing in size and sculpture as well as in the formation of the claws.

P. marginata, Boisd., which seems to occupy an intermediate position between this section and the next, agrees with no other known species in claw-structure. All the tarsi have divided claws in the male, and only the second and third pairs in the female, as also occurs in the next group, which, however, is strongly differentiated from all the rest of the genus by the form of the middle tarsi of the male. Of sixteen individuals of *P. marginata* which I have examined in the British and Oxford Museums only one, an entirely black insect, is a female. Of the males three are testaceous, the head and tarsi only being of a rather darker tint, and the rest have the head, a mark of

* Note. Dr. Ohaus has mentioned the Philippine Is., as well as the New Hebrides and New Caledonia, as included in the habitat of this species, but the true *bimaculata* does not appear to me to occur in any of these islands. The Philippine form is *P. nigriceps*, Westw., a much smaller insect with hardly visible punctuation.

the shape of a mulberry leaf on the thorax, the scutellum and the sides and extremity of the elytra black. The pale variety may be due only to immaturity, for the species does not seem to be a variable one. The apparent rarity of the female accounts for its having remained hitherto unknown. *P. marginata* has been recorded only from New Guinea but was collected by Wallace also in Mysol and Waigiou.

The type of the last section of the genus (the "*bicolor*" group of Dr. Ohaus) is *P. Westwoodii*, Westw., the sexes of which differ only in the remarkable character referred to above, which is common to the whole group. In the male the tarsi of the second pair of legs are very much thickened and shortened, the last joint is extremely large, and the inner division of the outer claw is expanded into a broad blade. This structure was described and figured by Westwood, who did not observe however that the inner side of the last joint is strongly hollowed out and that there is a strong projection from the inside margin of the preceding joint which meets the lobe of the claw. The whole modification thus forms a perfect hollow grasping structure. Such a modification of the middle tarsi is highly remarkable and makes this division of the genus the most distinct of all, and did not the constancy of many essential characters in all these insects render it most natural to retain them all within a single comprehensive genus the present group might be generically separated with much more reason than those forms which I have merged into the large genus.

This section constitutes the old genus *Cælidia* briefly characterised by Burmeister from a still undescribed species in Dejean's collection supposed to be Australian. The original specimen labelled "Cælidia quinquemaculata, hab. in Nov. Holl." is now in the British Museum and proves its association with *nigromaculata*, Bl., in the Munich Catalogue to be entirely erroneous. A similar male specimen in the British Museum was collected by Dr. Horsfield in Java, and M. Oberthür possesses the female from the same island. Both Dejean's locality and that cited by Gemminger (New Guinea), probably by way of improvement, are therefore no doubt wrong. To clear up the confusion I shall describe this insect under the name given to it by Dejean.

Parastasia quinquemaculata (Dej., M.S.), sp. n.

Ovata, paulo depressa, nigra, prothorace elytrisque (maculis exceptis) rufis, maculis 2 prothoracis disco, 2 humeralibus et 1 magna scutellari ; capite vix dentato, haud profunde punctato ; prothorace undique disperse punctato ; scutello fere impunctato ; elytris subtiliter lineato-punctatis ; pygidio punctato, cum pedibus longe fulvo-hirto. ♂ tarsis intermediis crassatis, ungue externo lobato. ♀ tarsorum anticorum unguibus simplicibus. Long. 12 m.m.

Hab. Java.

This insect, with its bright red upper surface and five large black spots, is quite unmistakable. Except in the tarsi the three specimens, representing both sexes, which I have examined are identical, although Dejean's example is somewhat immature and has the spots and lower surface reddish.

I have already pointed out that the species called *bicolor*, Westw., by Dr. Ohaus belongs to this group, whereas the true *P. bicolor*, Westw., belongs to the "rufopicta group." The former should therefore be called *P. femorata*, Burm. According to Dr. Ohaus it is very variable, but the male is chiefly red and the female generally quite black.

The following is nearly allied to *P. nigripennis*, Sharp, regarded by Dr. Ohaus as a variety of *P. femorata*, but as the British Museum possesses a fairly large series of specimens from three different collections, showing practically no variation, it must be regarded as a permanent form. The two sexes are alike except in the structural character referred to.

Parastasia ruficollis, sp. n.

Ovata, nigra, prothorace, coxis femoribusque anticis (intermediis posticisque interdum) rufis ; capite prothoraceque irregulariter punctatis ; scutello fere impunctato ; elytris fortiter lineato-punctatis ; pygidio punctato, cum pedibus longe fulvo-hirto. ♂ tarsis intermediis crassatis, ungue externo lobato. ♀ tarsorum anticorum unguibus simplicibus. Long. 12 m.m.

Hab. Java, Singapore.

This insect is black with the exception of the prothorax and parts of the legs ; whereas *P. nigripennis* is described as red with the exception of head, elytra and markings on the legs.

P. Burmeisteri, Ohaus, is a species of this group differing sexually in a very remarkable way. The male of this has been described under the name of *P. Nonfriedi* by Dr. Ohaus who informs me that he possesses four specimens of the first form and five of the second, of which the former are all females and the latter all males, and he has himself suggested in correspondence with me that they may belong to a single species. Confirmatory evidence is supplied by others which I have examined, and which are of the same sexes respectively, with the exception of a single male in M. Oberthür's collection which has the female coloration. Another male in the same collection shows an approximation to that form. As the two forms have been collected together in the same place there can be no doubt as to their being normally sexual. Both exhibit the same velvety surface upon the elytra shown by the whole surface of *P. Westwoodi*, but whereas in the male the ground-colour of the elytra is a reddish-chocolate marked only with two small black spots near the suture, in the female the black has spread over the whole surface leaving only two transverse crescent-shaped marks of the lighter shade. In the male the thorax and scutellum are testaceous and the head only black, and in the female all are black except the thorax at the sides.

The British Museum contains male and female specimens of another new species isolated as regards its claw structure, and apparently representing an intermediate stage in the process by which the peculiar condition characterising the male in the last group has been arrived at. The two sexes are alike except in this respect. The claws of the second and third pairs of legs are divided in both sexes but in the male one claw on each tarsus is thickened, the ungual lobe of the middle feet showing an approximation to its form in the *Westwoodi* group, while the expanded inner anterior claw is like that so common in the males of the *Anomalinæ*, to which the present genus shows otherwise few structural resemblances. There is a second male of this species in M. Oberthür's collection.

Parastasia anomala, sp. n.

Elongata, paulo depressa, rufa, capite, scutello, tarsisque (corpore subtus, femoribus tibiisque plus minusve) nigris ; capite grosse, prothorace crebre, punctatis, hoc parum convexo antice valde

attenuato ; scutello parvo, subtiliter punctato ; elytris grosse striato-punctatis, punctis tuberculiferis, interstitiis subtilissime punctatis ; pygidio rugoso, cum propygidio, pectore segmentorumque abdominalium marginibus fulvo-hirtis ; pedibus validibus, intermediorum et posticorum unguibus divisis.

♂ unguibus exterioribus pedum 4 anticorum lobis internis crassatis. Long. 14 m.m.

Hab. N.W. Borneo, Penang.

This species shows a rather deceptive resemblance in size, form and colour to certain males of *P. discolor*, Westw., with which, of course, it has no near relationship. It is easily distinguished by its coarser puncturation, smaller scutellum and hairy pygidium.

A remarkable species from Japan having no close affinity with any other at present known and also dimorphic may be mentioned here. It has been recently described by Herr Nonfried as *Parastasia Ferrieri* and is at once distinguished by the short pubescence with which its entire surface is clothed. The sexes of this insect, of which I have been enabled to examine a considerable series in M. Oberthür's fine collection, show no difference in outward form, but are immediately recognisable by the pygidium, which in the male is red and in the female black. The structure of the claws also differs, that of the latter sex being quite peculiar to this species. The outer claw upon each of the four posterior tarsi is armed with a small tooth at its base in the female, while in the male it is simply divided at the tip. These interesting sexual characteristics were not noticed by Herr Nonfried, nor was another striking peculiarity of the species, namely the form of the hind femora. These are very broad and their upper edge instead of being gently curved is produced into a sharp angle.

I drew up a Latin diagnosis of this species before I had access to Herr Nonfried's description, and as the latter is in German and contains no reference to those characters by which the affinities of the insect may be determined nor to the sexual differences, I shall allow this to remain.

Parastasia Ferrieri, Nonf., Berl. Ent. Zeit., 1895, p. 289.

Fusco-niger, undique fulvo-pubescens, prothorace (margine excepto) maculaque magna utriusque elytri fulvo-rufis ; capite equaliter rugoso, clypei margine fere recto, quadridentato ; prothorace punctato, valde transverso, antice medio parum profunde excavato,

processu mesosternali nullo, scutello punctato, fere semicirculari; elytris brevibus, postice paulo ampliatis, rugose punctato-striatis; pygidio rugoso-punctato; abdominis segmento primo subtus femorumque posteriorum macula obscure rufis, horum margine superiore prope apicem acute angulato. Long 13—17 m.m.

♂ pygidio læte rufo, tarsorum mediorum et posticorum unguibus externis apice fissis; ♀ pygidio nigro, nonnunquam linea media obscure rufo, tarsorum mediorum et posticorum unguibus externis basi dente minuto.

Hab. S. Japan: Oshima.

It will be seen from this account that sexual dimorphism is almost universal in this genus and the forms which it takes are very varied. In about half the species the claw-structure differs according to sex, but upon no uniform plan, although, contrary to the condition found in the dimorphic insects I have already described belonging to the Anomalinæ, the males invariably have the claws more divided when there is a difference. In colouring, whereas in that group the male is almost invariably darker than the female, the reverse again seems usually to occur in Parastasia, the female being in many cases quite black while the male is more or less marked with red or yellow. In *P. binotata* however the black female alone possesses light markings, the male, rather lighter in ground-colour, being without them. Other strange sexual characters noticed here are the modified middle tarsus in the male of the group last mentioned, the deep grooves on the elytra of the female *P. canaliculata* and *P. mirabilis*, the sternal process of the latter, the presence of hairs on the pygidium in the females of two species, the peculiar sooty propygidium of others, and the differentiated cephalic horns in the "heterocera group."

These facts show that, whereas, in general, secondary sexual modifications are restricted to the male, in the genus *Parastasia* they occur in about an equal degree in both sexes. As to the meaning of the phenomenon it seems premature as yet to speculate. There is no doubt that it is of much more frequent occurrence than has been generally supposed and that the forms it assumes are more varied than has yet been revealed. Until these are more completely known no explanation can be final. Meanwhile it will be well if entomologists will devote more attention than they have hitherto done to the question of sex.

Systematic and Synonymic Table of Species exhibiting Sexual Dimorphism.

A. 1st claw only simple in both sexes	
I. No mesosternal process	*P. canaliculata*, Westw. ♂ *bipunctata*, Westw. *rufopicta*, Westw. *birmana*, sp. n. *basalis*, Cand. *sumbawana*, Ohaus. *cingala*, sp. n. *timoriensis*, sp. n. *andamanica*, Ohaus. *binotata*, Westw. ♂ *Horsfieldi*, Westw. *ephippium*, v. Voll. ♂ *niasiana*, Ohaus.
II. Mesosternal process long	*heterocera*, Ohaus. *nitidula*, Erichs. *dimidiata*, Erichs. ♂ *ometoides* (*Urleta*), Westw.
B. Middle and hind claws toothed in ♀	*Ferrieri*, Nonf.
C. Claws simple in ♀	
I. Antennal club long	*melanocephala*, Burm. *dolens*, Fairm. ♀ *vitiensis*, Nonf.
II. Antennal club short	
(*a*) Claws cleft at tip in ♂	*confluens*, Westw. *rugosicollis*, Bl. *Montargisii* ♀ *pilea*, v. Voll.
(*b*) Claws cleft to base in ♂	
1. No mesosternal process	*discolor*, Westw. *scutellaris*, Erichs. *unicolor*, sp. n. *alternata*, sp. n.

2. Mesosternal process in ♂ and ♀	*vittata*, v. Voll. ♀ *atra*, v. Voll. *Pascoei* (*Echmatophorus*), Waterh.
3. Mesosternal process in ♀	*mirabilis*, sp. n.
D. Claws simple in both sexes	*Percheroni*, Montr. *Carolinæ*, Gestro. ? ♀ *Weberi*, Ohaus.
E. 1st claw simple in ♀ only	
I. 2nd claw not lobed in ♂	*marginata*, Boisd. *Zoraidæ*, Gestro.
II. 2nd claw lobed in ♂	*Westwoodi*, Westw. *sordida*, Sharp. *Burmeisteri*, Ohaus. ♂ *Nonfriedi*, Ohaus. *ruficollis*, sp. n. *quinquemaculata*, sp. n.
F. Claws thickened in ♂	*anomala*, sp. n.

THE

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

LONDON

FOR THE YEAR 1899.

February 1st, 1899.

Mr. GEORGE H. VERRALL, President, in the Chair.

Nomination of Vice-Presidents.

The President briefly returned thanks for the honour conferred upon him by his election, and announced that he had nominated the Rev. CANON FOWLER, M.A., F.L.S., Mr. EDWARD SAUNDERS, F.L.S., and Mr. ROLAND TRIMEN, F.R.S., as Vice-Presidents for the Session.

Election of a Fellow.

Mr. HENRY WILLIAM ANDREWS, of 9, Victoria Road, Eltham, was elected a Fellow of the Society.

Exhibitions, etc.

Mr. CHAMPION exhibited three specimens of an interesting species of Fulgoridæ, *Atalanta auricoma*, Burm., recently received from British Honduras, from M. Blancaneaux. He stated that he had found Lepidopterous larvæ in the white waxy matter attached to the body of an allied species, *Enchophora stellifer*, Burm., in Central America, of which insect he exhibited a specimen, together with a larva taken from it.

This larva was very like that of *Epipyrops anomala*, Westw., a species of Arctiidæ which is attached to *Fulgora candelaria* in a similar way, figured on Plate VII of our Transactions for the year 1876.

He also showed numerous specimens of both sexes of an undescribed species of *Apiomerus* (Family Reduviidæ) found by himself in Chiriqui. In the female of this insect, the last connexival segment of the abdomen has a long bright red foliaceous appendage on each side, movable at the will of the insect, these appendages in the male being shorter and connate, forming a broad plate round the apex of the abdomen. The females, which have the ventral segments closely pilose and the hind tibiæ furnished with a short dense brush of hairs on the upper edge, have the power of exuding a viscous liquid from the ventral surface (possibly from the hairs), and perhaps from the tibiæ also, by which they are enabled to hold their prey while in the act of sucking it. Mr. Champion said he had observed the *Apiomerus* attacking soft freshly emerged Longicornes nearly as large as itself. The males have a shorter brush on the hind tibiæ, and the ventral surface sparsely pilose.

Mr. Tutt exhibited on behalf of the Rev. G. H. Raynor a large series of *Spilosoma lubricipeda*, Linn., inbred from specimens that came originally from Louth, Market Rasen, Panton and Holton Beckering, in Lincolnshire. The series was mostly bred in 1898, from various pairings of 1897 imagines, also inbred, and showed a great range of variation from examples with typical forewings and no markings on the hindwings to examples having the forewings strongly shaded with black and the hindwings entirely black except for the pale nervures and a large pale blotch at the base of the wings. There appeared to be a general tendency for the normal dark markings of the forewings to become much increased along the outer margin, costa and inner margin, leaving the central area clear; but a few examples had the nervures in the centre of the wing black in colour. The hindwings presented all the intermediate forms from those with a transverse band made up of short united longitudinal streaks to those that were entirely dark with pale nervures.

Mr. Tutt was unable to separate the various broods, and stated that for this reason much of the scientific interest that would otherwise attach to the exhibit was lost. Its chief interest seemed to be its demonstration of the fact that the extreme aberrations of this species could be produced by in-breeding from comparatively normal forms, a fact of all the more importance considering how much uncertainty there had been as to the real origin of the race which was first sent out from Yorkshire and is now to be seen in many collections of British insects.

He also exhibited for Mr. Raynor an aberration of *Epinephele tithonus*, taken at Hazeleigh in August 1898, in which the bright fulvous areas were pale yellow in colour; and a somewhat strange aberration of *Noctua rubi* which showed considerable difference from the normal form in the arrangement of the transverse lines of the forewings.

Mr. Tutt then exhibited a number of closely allied forms of *Anthrocera*, received from M. Oberthür of Rennes, and comprising among others the following :—*A. medicaginis*, Dup., and *A. medicaginis*, Bdv., from the Alpes Maritimes (Nice), May 1897, *A. charon*, Dup., from Larche, Aug. 1896, and *A. charon*, Bdv., taken at Vernet-les-Bains in 1895. The first two of these, as probably also the fourth, Mr. Tutt referred to *medicaginis*, Bdv. (Mon. des Zyg.), considering them to be possibly forms of *Anthrocera lonicerœ*; while the specimens of *A. charon*, Dup., were almost indistinguishable from typical *A. lonicerœ*. Having shown also some examples of *A. seriziati* from Collo, and one, with very dark hindwings, from Bona, he said he had no hesitation in referring these to *Anthrocera palustris*, as an extreme southern form. He called attention also to the fact that the *A. trifolii*, found flying in the dry upland meadows in Algeria, was quite indistinguishable from those found in the meadows of Kent, whilst the marsh *A. palustris* (*seriziati*), although greatly modified in the intensity of its coloration in Algeria, carried the same facies as the *A. palustris* from Kent and the Isle of Wight. He was inclined to think that *A. palustris* was specialised to *Lotus uliginosus* as a food-plant. Examples of *Anthrocera hippocrepidis* from Lardy and Digne, and the six-spotted *A. charon* of Boisduval's "Mon. des

Zygénides," from Turbie, were also shown ; and Mr. Tutt, in bringing this interesting series of exhibits to a close, expressed thanks to M. Oberthür for his kindness in sending them, and regretfully pointed out that the antennæ of several of the specimens had suffered in transit.

Mr. Tutt next exhibited specimens of *Anthrocera filipendulæ*, captured by Mr. W. H. Harwood near Colchester, which showed remarkable colour-aberrations extending from terra-cotta red to orange as described at length in the account which he had recently given of the genus. He remarked on the peculiarity of these specimens inasmuch as they appeared more closely to resemble Lederer's well-known Asiatic races of the species than any other yet described.

Mr. A. H. Jones exhibited a fine specimen of *Cordyceps hügelii*, Corda, one of the Pyrenomycetous fungi which are parasitic in the caterpillars and pupæ of butterflies and other insects, this specimen being attached to the larva of *Charagia virescens* ?

Papers.

Mr. Percy I. Lathy communicated " A Monograph of the genus *Calisto* ;" and the Rev. F. D. Morice papers, entitled, " Illustrations of specific characters in the armature and ultimate ventral segments of *Andrena* ♂," and " Notes on *Andrena taraxaci*, Giraud, and the species most resembling it, with synoptic tables, and descriptions of two new species."

February 15th, 1899.

Mr. G. H. Verrall, President, in the Chair.

Election of a Fellow.

Mr. James E. Collin, of Sussex Lodge, Newmarket, was elected a Fellow of the Society.

Exhibitions.

Mr. B. A. Bower exhibited perfectly black, melanic examples of *Boarmia abietaria*, Hb., bred from ova laid by a female of the ordinary Box Hill form, which was captured on the 9th of July 1897. They were part of a brood of seventeen, seven of which were of the black aberration ; and for comparison with them, he showed specimens from Box Hill, South Devon and the New Forest.

Mr. Blandford exhibited some small lumps of common salt burrowed by larvæ of *Dermestes vulpinus*, to which he had incidentally referred in a letter appearing in "Nature." They were sent to Sir H. T. Wood, Secretary of the Society of Arts, by a correspondent in Australia, who wrote concerning them as follows:—

"— Meat Works,
"*The Secretary*, Queensland.
Society of Arts.

"My Dear Sir,—I am sending you by same mail, per packet post, in a small tin, a specimen of some entomological dweller in regions of salt. I hope the insects, which are now alive and in various stages of development, will arrive safe and well into your hands. During the whole course of my experience as a preserver of meats and other provisions I never yet have discovered or known that *salt* has a *weevil* or grub which obtains its sole sustenance therein whilst locked in a tin for weeks and weeks, as has been the case with the specimens I am sending your Society. The grub develops a fly or beetle, and you should be careful upon opening the lid that the fly does not fly away immediately, as occurred with me here. I would be glad to know how the specimens reached you and what is the history of the creatures therein," &c., &c., &c.

Mr. Blandford said it was a mistake to suppose that the larvæ burrowed in the salt for the sake of obtaining food, although a very natural mistake for an unentomological observer to make. He himself had on several occasions called attention to depredations of *Dermestes vulpinus*, arising from a habit possessed by the larvæ of burrowing into different materials in order to find a shelter in which to undergo pupation; but this was the first time that salt, as a substance attacked in that way, had come under his notice.

Mr. J. J. Walker, in remarking upon the exhibit, said he believed one of the earliest references to injuries caused by *Dermestes* was to be found in "The Last Voyage of Thomas Candish," published in Hakluyt's Collection of Voyages, where there was an interesting but somewhat exaggerated account of certain worms which, bred from a stock of dried

penguins, proceeded to devour the whole of the ship's stores and then to gnaw into the timbers, creating great alarm lest the ship should spring a leak. This voyage took place in the year 1593; and the worms, he thought, could only have been the larvæ of *Dermestes vulpinus* or some closely allied species.

Papers.

Dr. T. A. Chapman read a "Contribution to the life-history of *Micropteryx* (*Eriocephala*) *ammanella*, Hübn."

March 1st, 1899.

Mr. G. H. Verrall, President, in the Chair.

Election of Fellows.

Mr. G. J. Arrow, of the British Museum (Natural History); Mr. C. E. Collins, of Stoneham, Calcot, Reading; Mr. Percy W. Farmborough, F.Z.S., of Lower Edmonton; Mr. Montague Gunning, of Narborough, Leicester; Mr. Harry Moore, of 12, Lower Road, Rotherhithe; and Mr. H. S. Woolley, of 7, Park Road, Greenwich, were elected Fellows of the Society.

Exhibitions, &c.

Mr. J. J. Walker exhibited a specimen of a rare British beetle, *Quedius longicornis*, Ktz., recently taken at Cobham Park, Kent.

Mr. M. Jacoby exhibited a Halticid beetle from Sumatra, of the genus *Chalœnus*, Westw., and called attention to the remarkable position of its eyes, these organs being placed at the end of two very distinct lateral processes of the head, somewhat resembling the stalked eyes of crabs and other Crustacea. He said this character was peculiar to the male sex, and was very exceptional in Coleoptera, not being met with in any other genus of Phytophaga, and only occurring in a few Anthribidæ, and in isolated cases in one or two other families. He also showed a beetle from Peru, and said he was for the present unable to express any decided opinion as to its affinities. It was sent to him in a collection of Phytophaga, and, superficially, was very like certain

members of that group; but from the structure of the antennæ and other characters, it appeared to be out of place in the Phytophaga, and probably belonged to some other family.

Mr. GAHAN remarked that this beetle, although looking so very like one of the Phytophaga, probably was a Longicorn; but, until there was an opportunity of examining it more closely, he could not speak with any confidence in regard to its systematic position. It was not referable to any genus with which he was acquainted, and, to whatever family it might prove to belong, was very interesting, not only from its structural peculiarities, but also from the fact that it had the colour and markings characteristic of certain species of Galerucidæ, a family to which it undoubtedly was not in any way closely related. This fact seemed to show that it was a mimetic form, and thus helped to explain the present obscurity surrounding its affinities.

Mr. J. J. WALKER read the following extract from the account given in "The Last Voyage of Thomas Candish" (Hakluyt's Voyages, ed. Goldsmid, Edinburgh, 1890, vol. xvi, p. 112), to which he had referred in the course of his remarks on Mr. Blandford's exhibit at the previous meeting.

"But after we came neere vnto the sun, our dried Penguins bagan to corrupt, and there bred in them a most lothsome and vgly worme of an inch long. This worme did so mightily increase and deuoure our victuals, that there was in reason no hope how we should auoide famine, but be deuoured of these wicked creatures: there was nothing they did not deuour, only yron excepted: our clothes, boots, shooes, hats, shirts, stockings: and for the ship they did so eate the timbers, as that we greatly feared they would vndoe vs, by gnawing through the ships side. Great was the care and diligence of our captaine, master, and company to consume these vermine, but the more we laboured to kill them, the more they increased; so that at the last we could not sleepe for them, but they would eate our flesh, and bite like Mosquitos."

Mr. BARRETT asked whether, in this account, it was stated that beetles were seen? It seemed to him that the size

mentioned, viz., an inch long, was too great for the larvæ of *Dermestes*, and he thought it possible that the worms referred to might have been Lepidopterous larvæ. Mr. Walker replied that beetles were not mentioned; the larvæ of *Dermestes* were by no means small, and it would not be a very great exaggeration to describe them as being an inch long; the fact, moreover, that these creatures were spoken of as worms, that they were bred from decayed penguins, and had gnawed into wood, seemed in favour of their being the larvæ of some species of *Dermestes*.

Papers, &c.

Mr. G. J. Arrow contributed a paper "On Sexual Dimorphism in Beetles of the Family *Rutelidæ*," and sent for exhibition a series, including both sexes of six species of *Anomala*, selected to illustrate the subject. He called attention to the serious complication in nomenclature resulting from the neglect on the part of many systematists to notice what characters were sexual when describing new species, and observed that the number of recorded instances of sexual dimorphism would doubtless be much greater but for this cause. He then briefly described the known cases in *Anomala* and allied genera of Rutelidæ, and pointed out a considerable number of additional instances, ten of which related to species described as new. The sexual differences referred to were of two kinds: (1) in the structure of the claws, these being cleft in the female and entirely or partly simple in the male; and (2) in colour or marking. Several cases of the latter kind had already been noticed by Burmeister and Fairmaire; and Mr. Arrow pointed out that in these and similar instances, the males were invariably characterised by a greater exuberance of colouring matter, or the superposition of a darker hue. In the rare cases of aberration from the distinctive sexual forms, all the instances observed were those of females which had adopted the coloration proper to the males, thus associating them with the cases of gynandromorphism familiar in animals of higher type.

March 15th, 1899.

Mr. G. H. Verrall, President, in the Chair.

Election of Fellows.

Mr. William Martin Geldart, M.A., of 15, Park-road, Norbiton; and Mr. Hugh Main, B.Sc., of 45, The Village, Old Charlton, Kent, were elected Fellows of the Society.

Exhibitions, etc.

Mr. J. J. Walker exhibited several specimens of *Longitarsus rutilus*, Ill., a rare British species of Halticidæ, taken by him on March 11th at Halstow in Kent.

Mr. Tutt exhibited a series of *Epunda lutulenta*, and read the following notes thereon:—

"In the *British Noctuae and their Varieties*, iii, p. 53—59, I gave a critical review of *Epunda lutulenta* as a British species, and described the known forms of the species. At that time, our best-known forms were those received from Ireland and Scotland, and comprised among others—ab. *lüneburgensis*, Frr., ab. *tripuncta*, Frr., ab. *sedi*, Gn. and ab. *albidilinea*, n. ab. The typical form from the southern counties of England was much less satisfactorily known, and its range of variation scarcely surmised. Last autumn, the Rev. C. R. N. Burrows captured near Mucking in Essex, a very fine series of this insect agreeing in the main with Borkhausen's typical form, but varying *inter se*, in such a manner as to give almost parallel forms to the well-known Scotch and Irish insects, yet having the well-known blackish-fuscous ground colour with a sprinkling of grey scales, instead of the intense black ground colour peculiar to the named forms from the extreme west and north of our islands. It will be observed that in the Mucking examples the tendency is distinctly towards the type form 'dull brown-black, slightly glossy, tinted with red-brown,' with three indistinct, somewhat darker bordered, transverse lines. A second set are practically unicolorous blackish-fuscous = ab. *unicolor*, with no very distinct tranverse lines, the central band being, however, rather darker in some specimens. A third form approaches ab. *sedi*,

but is without the extreme grey outer and inner areas that make the black central band so conspicuous. On the other hand, three examples are of the ashy-grey tint of Stephens' ab. *consimilis*, but with the stigmata more distinct and the transverse lines definitely marked; while a few of the darkest examples must undoubtedly be referred to ab. *lüneburgensis*, having even the black dots on the nervures of the hind wings, so characteristic of the Irish race and so generally absent in the south English examples."

Mr. Merrifield showed some Lepidoptera collected in the latter half of May and the first week of June near Axolo (Venetia), Riva, and Bozen. They included some very fine specimens of *Syrichthus carthami*, a very large *Syntomis phegea*, and examples of *Pararge egeria* intermediate in colour between the Northern and Southern European forms.

Mr. G. T. Porritt exhibited a series of extreme forms of *Arctia lubricipeda*, var. *fasciata*, and also some examples of what appeared to be a new form of the species, of which he had bred a few during each of the past two seasons.

Mr. O. E. Janson exhibited an inflorescence of *Araujia albens*, Don., together with a butterfly which had been entrapped by getting its proboscis jammed in the slit between the anther-wings of one of the flowers. It was found by Mr. C. J. Pool at Monte Video.

Mr. Gahan stated that having since examined the beetle from Peru shown by Mr. Jacoby at the previous meeting, he was now able to say definitely that it was a Longicorn, and represented a new genus to be placed in the group Acanthocinides of the family Lamiidæ. He exhibited this beetle along with a species of *Diabrotica* and a species of *Lema* from Peru, in order to show the remarkably close resemblance in coloration between the three species.

Mr. Gahan then referred to an interesting discovery made a few years ago by Herr Wandolleck, whom he was glad to see present that evening as a visitor. Herr Wandolleck, by means of sections and other microscopical preparations, had found that the sting-like terminal segment of the antenna of the Longicorn beetle, *Onychocerus albitarsis*, Pasc., possessed the characters of a true stinging organ, his attention having

been previously directed to the matter by a collector, whose good faith he had no reason to doubt, and who told him he had been stung by the beetle. Mr. Gahan exhibited the drawings illustrating the account of this discovery given in "Sitzungs-Bericht der Gessellschaft naturforschender Freunde zu Berlin. Jahrgang 1896," pp. 51, *et seq.*

April 5th, 1899.

Mr. G. H. Verrall, President, in the Chair.

Election of Fellows.

Dr. Frederick George Dawtrey-Drewitt, M.A., M.D., F.R.C.P., F.Z.S., of 2, Manchester Square, W.; Mr. William E. Ryles, B.A., of 11, Waverley Mount, Nottingham; and Mr. Albert Wade, of 1, Latham Street, Preston, were elected Fellows of the Society.

Exhibitions, etc.

Mr. Blandford exhibited insects of different orders collected by Dr. Albert L. Bennett in West Africa, and read the following:—

Notes on the habits of *Goliathus druryi*. By Dr. Bennett.

"While in the Bulu country behind the coast belt from Gross Batangu, German sphere of influence, in West Africa, I had ample opportunity on two occasions for observing some of the habits of the Goliath beetles. These beautiful insects are indigenous to the West Coast of Africa, and although some years ago they were considered very rare, they are now frequently obtained in the hinterland of the Kamerúns and Congo français.

"In Bululand I was able to add to my collection several fine specimens of *Goliathus druryi*, *Goliathus polyphemus*, and the handsome green glittering *Goliathus micans*. The latter species is said to be indigenous to Senegal, but it is frequently found in the French Congo.

"In November 1897, being then in the Bulu country, I

started up the side of a mountain with a native guide to hunt monkeys. The side of the mountain was thickly and finely wooded; and the ascent, though difficult and tiring, was made less irksome through the coolness and shade which we enjoyed. While taking a short rest during the climb, my attention was arrested by a sound overhead not unlike that of steam escaping from a small safety-valve. The noise was made by a large beetle, which was soaring around a vine hanging from an immense tree. The movements of the beetle were so rapid that I did not at the time recognise it. Seated on a fallen tree I watched it soaring round and round, giving forth the strange sound that first arrested my attention. It was an interesting sight. Rays of light penetrating the forest foliage caused the large wings to glitter and scintillate with a most beautiful greenish lustre. The insect finally paused in its circling and settled upon the vine high up and out of reach. Even with wings folded it looked very large and formidable. My guide said he could capture it for me, but I bade him wait awhile. The beetle seemed to be digging away a portion of the bark from the vine and to be feeding. I cut away some of the bark, and a white milky juice not unlike that obtained from the rubber-vine trickled forth. The beetle worked hard, small portions of bark fell steadily from above, and soon the breach it had made was clearly visible. Shortly after a smaller beetle appeared, evidently a female, and the male who had been at work on the vine, gave place to the new arrival. The female was soon busy at work, and seemed to be engaged in abstracting the juice from the vine. My Bulu guide contrived to capture in a very clever manner the largest of the two insects, which to my surprise and delight proved to be a perfect specimen of *Goliathus druryi* ♂. I was about to place the beetle in my killing-box, but my guide took it from me and began to fasten a strong piece of native string around the two horny projections on its head. The old man was delighted with my puzzled look, and said he would make the "Indingdang talk," Indingdang being the Bulu name for the beetle, which I am told is very nice to eat. Having made the string fast, the old man whirled the beetle around in the air. Quickly the wings unfolded from beneath the elytra and a loud sound was given forth, but no

sooner was the whirling motion stopped, than the wings were as quickly folded away and the sound ceased.

"During my residence in the Congo français I had further opportunity on three different occasions of observing these insects and watching them feed. At one time I was able to stand within a few feet of a male beetle for a long time without disturbing it. I noticed that it seemed to collect the juice of the vine on the hairs about its mouth and then suck in the fluid. The whole process of digging away the bark and feeding on the juice was extremely interesting."

In reply to remarks from Canon Fowler and others, Dr. Bennett stated that the male beetles use their cephalic horns in fighting with one another, as well as for puncturing the bark of vines in order to bring about a flow of the sap upon which they feed.

The Rev. Canon Fowler showed a photograph of a large bee's nest found in an open hedge near Wragby in Lincolnshire; he exhibited also a specimen of *Cerastis vaccinii*, L., which was very closely covered with parasites.

Mr. McLachlan exhibited young larvæ of a "Locust," received from Mr. E. A. Floyer, Director-General of Telegraphy in Egypt, and said by him to have reduced the *Calotropis* trees in Nubia to a moribund condition. The larvæ were identified by Mr. Burr as those of a species of *Pœcilocerus*, probably *P. vittatus*, Klug.

Mr. Burr exhibited a specimen of *Acridium ægyptium* which was found at Maidenhead. He also showed a remarkable clay model of a Locustid with a Chinese inscription underneath, and requested information as to the origin of such models.

Mr. Blandford gave an account of a paper by Dr. A. Ribaga, published in the "Rivista di Patologia Vegetale," v, p. 343, on an asymmetrical structure occurring in the adult female of the common bed-bug, and apparently hitherto overlooked, although it communicated with the exterior by a conspicuous notch in the fourth abdominal segment, midway between the median line and the lateral margin. This structure consisted of a large quasi-glandular mass of unknown nature in which was encapsuled an organ consisting of fibres,

the free ends of which terminated in minute chitinous spines in a recess lying under the fourth abdominal segment. The adjacent margin of the fifth segment was thickened and set with strong teeth. The non-glandular part of this singular structure was conjectured by its discoverer to be a stridulating organ; but no evidence of stridulation had been obtained. It was certainly far more complex than most, if not all, other stridulating organs known to exist in insects.

Papers.

Mr. G. J. Arrow communicated "Notes on the Rutelid genera *Anomala*, *Mimela*, *Popillia*, and *Strigoderma*."

May 3rd, 1899.

Mr. R. McLachlan, F.R.S., in the Chair.

Exhibitions, etc.

Dr. A. L. Bennett exhibited various insects which he had collected in the French Congo. They included a species of Mantidæ remarkable for its very striking resemblance in coloration to a piece of bark.

Mr. F. Enock exhibited a living specimen of *Nepa cinerea* infested with a number of minute red *Acari* on the ventral surface of the abdomen. He also showed eggs of *Nepa* lying *in situ* in decayed leaf-stalks of *Alisma*. Most authors, he said, described the eggs of *Nepa* as being laid end to end in a chain, with the long filaments of each grasping the egg next above it; but this was an error. The eggs were laid in an incision made by the female, each being pushed in up to the base of the expanded filaments at an angle of about 30°; the next egg above was placed close to the first and cemented to it, the filaments interlacing with one another. Sometimes a row of nine or ten were laid in this manner; but the eggs were never placed end to end, as such an arrangement would prevent the young from emerging. Showing also some eggs of *Notonecta in situ* in a stem of *Alisma*, Mr. Enock stated

that when ovipositing the female invariably clasps the plant-stem in an inverted position—head downwards, the eggs being extruded and driven into the stem in the same relative position, so that on emerging the young dive down head foremost. Mr. Enock next exhibited a living example of the remarkable aquatic Hymenopteron—*Prestwichia aquatica*, Lubb., and said it was one of a brood of nine, including 8 ♀♀ and 1 ♂, that issued on May 1st from a single egg of *Pelobius* found on September 5th, 1898. He was thus enabled to complete the life-history of this strange creature which was parasitic in the eggs of no less than six different kinds of aquatic insects.

Mr. Merrifield showed some specimens of *Hemaris bombyliformis*, Esp., with the scales still covering the central portions of the wings. He said these scales, which are present immediately after the emergence of the insect, but soon become detached, may be rendered adherent by allowing a very weak solution of indiarubber in benzoline to run over the wings.

Mr. Kirkaldy referred to the account given by Mr. Blandford at the previous meeting, of Signor Ribaga's discovery of a supposed stridulating organ in the female of the bed bug. He called attention to two recent papers by Signor Antonio Berlese ("Fenomeni che accompagnano la fecondazione in taluni insetti" mem. I and II, 1898, "Rivista Patologia Vegetale," vi, No. 3, pp. 1—16, Tav. xii—xiv; and vii, No. 1, pp. 1—18, Tav. i—iii) confirming Signor Ribaga's investigations, and naming the stridulating organ the "organ of Ribaga." Signor Berlese also announced the discovery in the same sex of the bed bug, of a bursa associated with the spermatheca, the cells of which apparently ingest and destroy the excess of spermatozoa. The learned Italian entomologist proposed to term this the "spermatophagous organ."

Papers.

Mr. C. H. Dolby-Tyler communicated a paper on "The development of *Ceroplastes roseatus*, Towns. and Cockl."

June 7th, 1899.

Mr. G. H. Verrall, President, in the Chair.

Election of a Fellow.

Mr. Edgar Greenwood, of Frith Knowl, Elstree, Herts, was elected a Fellow of the Society.

Exhibitions, etc.

Mr. J. J. Walker exhibited on behalf of Mr. G. F. Mathew, R.N., a number of interesting Lepidoptera, chiefly from the Mediterranean region, and including amongst others the following:—Examples of *Thais polyxena*, Schiff., var. *ochracea*, Staud., having an unusually deep and rich colour, bred from larvæ found at Platæa, Greece; male and female of *Thestor ballus*, Hb., from Alexandria, taken on 23rd Jan., 1898, the male remarkable in being largely marked with orange on the upper side of the front wings; unusually large specimens of *Lycæna baton*, Berg., from Vigo, N. Spain; a singular aberration, from Corfu, of *Melitæa didyma*, Ochs., with central band of black spots very strongly marked on both wings, the other spots being obsolete and the ground colour pale fulvous, in appearance recalling *M. deserticola*, Klug; very dark and strongly marked examples of *Cœnonympha pamphilus*, Linn. v. *lyllus*, Esp., from Corfu; and examples of *Eriopus latreillei*, Dup., bred from larvæ found feeding on *Asplenium* at Pirano, Dalmatia.

Colonel Yerbury exhibited the pupa-case of a Hymenopterous insect which appeared to be parasitic in the weevil—*Barynotus mœrens*, Fab.

Dr. Chapman showed a large Ant-Lion-larva from Cannes, probably that of *Acanthaclisis occitania*; it was one of those that do not make pit-falls.

Mr. E. E. Green exhibited a teratomorphic specimen of a zygænid moth, *Chalcosia venosa*, Walk., which he had found at rest on a leaf, at Udagama, Ceylon, in October 1898. In this specimen four wings were present on the left side, the hindmost being almost as fully developed as the normal hind wing on the right side, while the other three appeared to be attached to the

meso-thorax. He also showed larvæ and pupæ of insects in air-tight glass tubes in which a little cotton wool, sprinkled with formalin, had been placed. The specimens, which had been thus preserved for nearly two years, had lost little of their original colour or brilliancy.

Mr. Gahan exhibited pupa-cases of a Longicorn beetle, *Plocederus obesus*, Gah., which were remarkable in being composed almost wholly of carbonate of lime. It was not known how the pupa-cases were fabricated, but presumably the larvæ must possess special lime-secreting glands.

Papers, etc.

Mr. R. McLachlan, F.R.S., read a paper on "A second Asiatic species of *Corydalis*," and exhibited the male type of the species described, which he proposed to name *Corydalis orientalis*. He said the first Asiatic species of *Corydalis* was described and figured by Prof. Wood-Mason in 1884, the genus up to that time having been considered to be peculiarly American. Mr. H. J. Elwes, F.R.S., communicated a paper "On the Lepidoptera of the Altai Mountains"; and the Rev. A. E. Eaton a paper entitled "An Annotated List of the *Ephemeridæ* of New Zealand."

October 4th, 1899.

Mr. G. H. Verrall, President, in the Chair.

The President announced the death, at the advanced age of eighty-six years, of M. Hippolyte Lucas, an Honorary Fellow of the Society. He gave a brief account of the career, and eulogised the work, of the distinguished French Entomologist.

He also announced the death of Mr. Samuel Stevens, and in reference thereto said the Society had to deplore the loss of one of its oldest and most highly esteemed Fellows. Mr. Stevens was formerly for many years Treasurer, and had also been a Vice-President, and during the whole period of his long connexion with the Society had always shown the greatest interest in its welfare. That this interest had up to the last continued unabated was manifested by the terms of his will, in which he had made a bequest to the Society.

Exhibitions.

Mr. J. J. Walker exhibited, on behalf of Mr. E. G. Bayford, a specimen of *Galerita bicolor*, Drury, a North American beetle of the family Carabidæ, said to have been taken many years ago at Doncaster. He also exhibited a remarkable variety of *Vanessa urticæ*, L. (*ichnusoides*, De Selys), which was captured in the Isle of Sheppey on August 28th, 1899.

Mr. B. A. Bower showed dark aberrations of *Boarmia rhomboidaria*, Hb., in which the normal colour of the fore wings is replaced by dark brown, causing the fuscous markings to stand out very prominently.

The President exhibited a specimen of the "Spanish-fly"—*Lytta vesicatoria*, which was taken last June near Newmarket. He remarked that this handsome beetle was now becoming very rare in England.

Mr. Colbran J. Wainwright exhibited a number of Dipterous insects, including a long series of *Anthrax paniscus*, Rossi, taken in Cornwall at the end of July and beginning of August; a series of *Eumerus ornatus*, Mg., from Herefordshire, and *Eumerus lunulatus*, Mg., from Cornwall; and a specimen of *Mallota eristaloides*, Lœw, taken near Hereford last July.

Mr. H. J. Donisthorpe exhibited specimens, including both sexes, of *Dytiscus dimidiatus*, Berg., and *D. circumcinctus*, Ahr., three females of the latter species belonging to the form with smooth elytra. These rare beetles were taken last August in Wicken Fen. He also showed eight specimens of *Athous rhombeus*, Oliv., including one of the black aberration, which were taken last June in the New Forest.

Prof. T. Hudson Beare exhibited a specimen of *Hypera elongata*, Payk., taken last July near Edinburgh in a grassy spot under a stone. He referred to Canon Fowler's statement that this species is doubtfully indigenous, and said the previous records certainly are scanty and somewhat untrustworthy; the specimens in the Stephens collection at the British Museum do not belong to the species, and of the two in the Power collection only one is at all like it. Continental authorities give northern localities only for the species, which is therefore probably con-

fined to boreal regions; and Scotland, where it was taken, is the most likely place for its occurrence in Great Britain.

The Rev. F. D. Morice exhibited three female specimens of *Exoneura libanensis*, Friese, taken at Brumana on Mt. Lebanon, near Beirut; and, for comparison with them, he showed two specimens of *Ceratina cucurbitina*, Rossi, from Switzerland. He commented upon the remarkable distribution of the genus *Exoneura*, Smith, this genus having been hitherto recorded only from Australia.

Mr. Gahan remarked upon the difficulty of accounting for the distribution of many genera of insects, and pointed out that the case brought under their notice by Mr. Morice was closely paralleled by that of the Coleopterous genus *Pelobius*, of which two species were, so far, known only from Australia, while the third was almost entirely confined to Europe.

Papers.

Mr. G. J. Arrow read a paper "On Sexual Dimorphism in the Rutelid genus *Parastasia*." Mr. W. L. Distant contributed "Descriptions of four new species of Cicadidæ," and Mr. Claude Fuller a paper "On some species of Western Australian Coccidæ."

November 1st, 1899.

Mr. G. H. Verrall, President, in the Chair.

Election of Fellows.

Mr. Arthur M. Lea, of Hobart, Tasmania; and Mr. Charles P. Lounsbury, B.Sc., of Cape Town, were elected Fellows of the Society.

Exhibitions, etc.

Mr. J. J. Walker exhibited two living specimens of *Bostrychus cornutus*, Fab., received from Dr. Basset Smith who obtained them from a wooden stool brought from Zanzibar.

Mr. C. O. Waterhouse showed a living example of *Mœcha hecate*, Chev., a West African species of Longicornia.

On behalf of Mr. W. Purdey, of Folkestone, Mr. C. G. Barrett exhibited the following species and varieties of

Lepidoptera :—*Stigmonota trauniana*, one specimen, with the costa less spotted than usual ; *Lozopera beatricella*, six examples together with the pupa-skins protruding from a stem of *Pastinaca sativa ; Peronea cristana*, two examples of a very fine variety ; *Cledeobia angustalis*, two deeply coloured examples ; *Crambus inquinatellus*, var. ; *Eudorea dubitalis* var. *ingratella*, two examples ; and *Endotricha flammealis*, four examples of a dark variety.

Mr. McLachlan showed four examples of *Deilephila lineata*, taken by Mr. E. W. Hainworth at Victor, Colorado, at an elevation of 9000 ft., on July 23rd, 1899 ; also an ash-twig which had been girdled by hornets, the observation of this curious fact having been made by Mr. W. C. Boyd, of Cheshunt, from whom he received the twig.

Dr. T. A. Chapman exhibited specimens of *Erebia flavofasciata* taken at Campolungo at an elevation of 7000 ft. He stated that the species occurred only in those places where there was an outcrop of dolomitic strata belonging to the crystalline schists, and was not met with elsewhere at that elevation, nor was it to be found in association with the same strata at lower levels. Some rare plants occur in the locality, but he did not know whether any particular species of grass, which might serve as the food-plant, was restricted to the same area.

In further reference to this species, Dr. Chapman remarked that the yellow fascia underneath seemed strange in an *Erebia*, but it may be noted that in other species of the genus, as for instance *ceto* or *medusa*, the yellow of the ocelli varies so much, that in some specimens it would, with a little further expansion, be converted into a similar fascia. *Psodos alpinaria* flies abundantly along with *Erebia flavofasciata*, and when the latter species delays putting in an appearance, one is sometimes deceived by a specimen of *alpinaria*, or even by one of *C. arcania*, with its pale straw-coloured band in the same position. What the precise use and signification of the black and yellow colours seen in *alpinaria* and *flavofasciata* (and *Catastia auriciliella* and some *Cœnonymphas* might be included) is not very evident, but some relation probably subsists between these species or between them and their common habitat.

Dr. Chapman showed also an example of *Erebia goante* with a weakly scaled area on both sides of the centre of each wing.

Mr. H. J. Elwes exhibited, and gave a brief account of a collection of Lepidoptera made by Mrs. Nicholl and himself in a part of Bulgaria which had not previously been visited by entomologists. *Lycæna eroides*, *L. anteros*, *L. zephyrus*, *Melitæa cynthia*, *Erebia gorge*, and a species which he believed to be *Cœnonympha typhon*, were a few of several interesting forms to which he directed attention.

Mr. Tutt congratulated Mrs. Nicholl on the result of her plucky and successful attempt to make known to us the lepidopterous fauna of some of the least-known districts of Europe, and Mr. Elwes for bringing this last difficult and arduous journey to a successful issue. He considered the specimens obtained to be among the most interesting of the many exhibits of Palæarctic Lepidoptera brought before the Society by its own Fellows in recent years. In commenting upon the various species, he suggested among other things that the so-called *Erebia gorge* probably was not that species, while he expressed considerable doubt also as to the specific identity of the *Cœnonympha* exhibited, with *C. typhon*.

November 15th, 1899.

Mr. G. H. Verrall, President, in the Chair.

The President announced the death of Dr. C. G. Thomson, one of the Honorary Fellows of the Society.

Election of Fellows.

Mr. Ernest Charles Bedwell, of 27, Loughborough-road, Brixton, S.W.; Mr. Harry Haden May, of Redlands, Hillbury-road, Upper Tooting, S.W.; and Mr. H. A. Varty, of 61, Queen's-road, Aberdeen, were elected Fellows of the Society.

Exhibitions, etc.

Mr. J. J. Walker exhibited four examples of a species of Curculionidæ—*Cleonus sulcirostris*, taken on red sandy soil at

Barr's Hill, near Oxford. These examples, he pointed out, were of a reddish tint, harmonising with the colour of the soil on which they were found, and in marked contrast to that of normal grey specimens, some of which, taken at Deal and Reading, he showed for comparison.

The PRESIDENT exhibited specimens of *Chersodromia hirta*, a Dipterous insect, which were found by Colonel Yerbury under sea-weed at Brora in August 1899.

Mr. G. W. KIRKALDY exhibited three species of Rhynchota of economic interest, to which he referred as follows:—(1) *Brachytes bicolor*, Westw., a Cinghalese Lygæid (= Coreid, auctt), sent by Mr. E. E. Green as infesting, though scarcely injuring, a species of *Asparagus*. (2) *Dysdercus cingulatus*, Fabr., a Cinghalese Pyrrhocorid, also sent by Mr. Green; the nymphs congregate in the flowers of the Cotton-plant and injure them by staining. The genus is well known both in the Old World and the New for the damage its species occasion to cotton crops. (3) *Aleyrodicus dugesii*, Cockl., a Mexican Psyllid, forwarded by Dr. Dugès, who stated that it is now attacking the white mulberries at Guanajuato.

Mr. GAHAN, referring to a subject to which he had called attention at a previous meeting (see Proceedings, p. x), said that some interesting observations by Mr. H. H. Smith, on the habits of the beetles of the Longicorn genus *Onychocerus*—wrongly named *Scorpionus* by Mr. Smith, were published in the American Naturalist for 1884 (vol. xviii. pp. 727–8); and he then read the following extract from Mr. Smith's paper:—"While engaged in collecting near Rio de Janeiro, I found one of these beetles clinging as usual to the lower side of a log. Seizing it with my forefinger and thumb, I was about to transfer it to the collecting-bottle when, to my surprise, it inflicted on me a pretty sharp sting or prick, which caused me to drop it quickly. In defending itself thus, the insect used its antennæ, spreading them out and then throwing them backward and upward with a strong jerk, so as to strike my finger and thumb just behind the nails with the scorpion-like terminal joint. I tried the experiment many times with this and with other specimens, and always with the same result; I have also noticed it in other species of the genus. The little wound

produced by the insect caused a slight swelling and irritation, much like a mosquito bite, for an hour or two. Possibly this arises from a poisonous exudation from the surface of the joint; so far as I can discover there is no true poison gland."

He remarked that Mr. Smith's observations, so far as they related to the habits of the beetles and the effect produced by their sting, agreed with those mentioned in Herr Wandolleck's paper, and entirely confirmed them; but it was to be regretted that he did not state the names of the species, or describe the method he employed in investigating the nature of the sting-like segment of the antennæ. Herr Wandolleck professed to have discovered a poison gland in one species only—*O. albitarsis*, Pasc., and expressly stated that he failed to find it in another species which he examined.

The PRESIDENT said that the facts related by Mr. Smith tended to confirm the view that these insects possessed a true stinging organ, and inclined him to believe in the accuracy of Herr Wandolleck's investigation.

The Rev. F. D. MORICE remarked that spines or similar sharp structures were present on the antennæ of certain male Hymenoptera, and he asked whether the sting-like segment was found in both sexes of the beetle referred to. In reply, Mr. Gahan said the terminal segment had the same form in both sexes, but was longer and larger in the male in correspondence with the greater length and proportion of the antennæ in that sex; the resemblance to the sting of a scorpion was very pronounced in *O. albitarsis*, in which the basal portion of the segment was much swollen; it was less so in the other species of the genus.

Paper.

Mr. J. H. LEECH contributed Part III. of his paper on "Lepidoptera Heterocera from Northern China, Japan, and Corea."

December 6th, 1899.

Mr. G. H. Verrall, President, in the Chair.

Election of Fellows.

Mr. Francis Gayner, of 20, Queen Square, W.C., and Mr. F. B. Jennings, of 152, Silver Street, Upper Edmonton, N., were elected Fellows of the Society.

Exhibitions, etc.

Mr. J. J. Walker exhibited a specimen of *Colias marnoana*, Rogenh., taken, with other examples, by Lieut. Constable, R.N., at Massowah, on the Red Sea. He considered this form to be only a dwarfed race of *C. hyale*, Linn.; and for comparison with it, he showed specimens of the var. *nilgherriensis*, Feld., from Central India, and of the var. *simoda*, De L'Orza, from Japan.

Dr. Chapman exhibited a series of specimens, selected from various English collections, together with a few foreign examples, in order to illustrate the English forms found within the genus *Fumea*. He also showed specimens of *sepium*, *betulina* and *salicolella*, and remarked that the first of these species was very properly placed by Mr. Tutt in a new genus (*Bacotia*), since it is a transitional form, having as great affinities with *Solenobia* as with *Fumea*; while the other two species, though perhaps not distantly allied to *Fumea*, did not truly belong to that genus, and were well placed by Tutt in a new genus (*Proutia*). The specimens of *sepium* were, he said, some of those taken by Mr. W. H. B. Fletcher in the New Forest; those of *betulina* were bred from larvæ taken by Mr. Whittle and by Mr. Prout in Essex; and those of *salicolella* were bred by Mr. Prout from Essex larvæ, with the exception of one of unknown origin, found in Dr. Mason's collection along with his *betulina*, which included two of Mr. Mitford's specimens.

Dr. Chapman then proceeded to refer to the genus *Fumea*, and the forms included in it, as follows:—

"The genus *Fumea* contains the species that have the antennal pectinations scaled.

"*F. crassiorella* has a comparatively short spur to the anterior tibia (length $\frac{7}{10}$ths of the tibia), over twenty joints to the antenna, and rarely has the median accessory cell. The female has a diminished number of tarsal joints. These characters always suffice to separate it from all other British forms.

"*F. casta.* This name, having priority over the well-known name of *nitidella*, may be taken to cover the remaining British forms of *Fumea*. In endeavouring to determine whether any of these forms deserve separate specific rank, I have come to the conclusion after examining a great deal of material, that the size or material of the case, the size or colour of the imago, and the form of the wing afford no definite data for specific distinction. Size is perhaps the most reliable of all these; but it is unnecessary to point out how rarely this character is of much value.

"The females present no definite characters, at least so far as I have been able to examine them from the material at my disposal. All have five joints to all the tarsi, and the only differences are slight ones in the form of the tarsal joints, probably due to drying, and a difference in the bristles with which the legs are clothed, due perhaps to the state of preservation of the specimens.

"The question as to whether we have more than one species under the name of *casta* must remain more or less doubtful, until the several forms have been bred largely from the egg, which seems to be an easy process under proper arrangements. In the meantime the following forms are distinguishable, some of them obviously being local races with many of the features of distinct species.

"The *nitidella* form is probably the commonest and most widely distributed; it expands 12—13 mm., and is, when fresh, very dark in colour; it has eighteen joints to the antenna, and a tibial spur of a length equal to $\frac{8}{10}$ths of the tibia. This is probably Bruand's *roboricolella*, the anal tuft of the female being often pale, but never white. (Bruand notes that in his *anicanella* it is snow-white, and in *roboricolella*, white.) There is a larger form which I take to be *intermediella*. It differs in having 18 to 20 joints to the antennæ, a tibial spur of $\frac{8}{10}$ths the length of the tibia, and a wing-expanse of 13—14 mm.

This leads to a still larger form, found chiefly in Scotland and Ireland, which has a wing-expanse reaching to 15 mm., but in which the tibial spur remains of a length equal to ·8 of the tibia, and the antennæ have from 18 to 20 joints. This variety might be called *scotica* or *hibernica*. I incline to the belief that it is very much the same as Heylaert's *norvegica*, but if so, Heylaert is in error in identifying it with some Southern French forms, with the result that his description, partly perhaps founded on the French examples, reads as if it were meant to apply to a dark form of *reticulatella*. Apart from structural characters, this form is not easy to distinguish from *crassiorella* either by size, form, or colour.

"There is a very small form which goes below 11 mm. in expanse but has 18 antennal joints, and a tibial spur of practically the same length as in the preceding forms. This is perhaps an aberration rather than a race, as no one appears to possess a series of it. It might be called ab. *minor*.

"Two sets of specimens remain, which come nearer than any of these to specific distinctness. The first is represented by some insects in Mr. Clarke's collection which were derived from the collection of Mr. Mitford, and labelled by the latter *n. sp.*, on what grounds I do not know. These look very like ordinary *nitidella*, but have 19 joints to the antennæ, usually only present in larger forms, and, what is more distinctive and important, the length of the tibial spur approaches that of *crassiorella*, viz. ·73. The female with these specimens is of the *casta*, not the *crassiorella* type. This form may be provisionally called var. *mitfordella*.

"The second is a series of specimens bred by Mr. Bower from a Kentish source. These are fractionally smaller than *nitidella*, and have a similar tibial spur; the antennæ have only 16 to 17 joints, and, what is perhaps a more fundamental difference, the pectinations are much shorter than in any other form of *casta*, being about equal to, or rather less than, 2 antennal joints in length, whereas $2\frac{1}{4}$ to $2\frac{1}{2}$ denotes the length in all the other forms which I have examined. I propose to name these provisionally var. *bowerella*.

"I have also some German specimens labelled *intermediella* and *affinis*, which nowise differ in appearance from *intermediella*,

and which possess 19 antennal joints. They have however a much longer tibial spur, measuring ·86."

Mr. Tutt said he considered that Lepidopterists were under great obligation to Dr. Chapman for the care he had taken in working out what was possibly the most difficult group of the most difficult family of Lepidoptera. The separation of *Bacotia sepium* and of *Proutia betulina* from the genus *Fumea* had been thoroughly substantiated by Dr. Chapman's careful investigations; and it was clear from the material exhibited that he had also made good headway in explaining the nature of the constituent elements still remaining in the genus *Fumea*. He trusted, at any rate, that the combined efforts of those who were now at work on this group of the Psychids would have the result of clearing up some of the difficulties that had hitherto surrounded these insects, difficulties so great that species belonging to different sub-families had been united in the same genus.

Mr. Malcolm Burr called attention to Dr. Sharp's paper on "The modification and attitude of *Idolum diabolicum*," recently published in the "Proceedings of the Cambridge Philosophical Society" (Vol. X, Part iii.). He exhibited the plate, drawn after nature by Mr. Muir, which illustrates the paper, pointing out that no drawing of this kind showing a Mantid in its natural colours simulating the petals of a flower, had hitherto been published. He also exhibited species of Mantodea of various genera, to show the different modifications by means of which insects of this group are made to resemble leaves and flowers.

Paper.

Mr. Kenneth J. Morton communicated a paper entitled "Descriptions of new species of Oriental *Rhyacophilæ*."

ANNUAL MEETING.

January 17th, 1900.

Mr. George Henry Verrall, President, in the Chair.

Mr. A. Hugh Jones, one of the Auditors, read the Treasurer's Balance Sheet, showing a balance in favour of the Society of £181 16*s.* 8*d.*, less liabilities for about £67 in connection with printing and plates.

Mr. C. J. Gahan, Secretary, read the following

Report of the Council.

During the year 1899, two Honorary and five Ordinary Fellows have died, viz. M. Hippolyte Lucas; Dr. C. G. Thomson; Dr. Charles Brongniart; Mr. R. W. Fereday; Mr. Hildebrand Ramsden; Mr. Samuel Stevens; and the Rev. W. Farren White. The death of one other Fellow, Mr. George Bryant, has also to be recorded. He died in 1898, but his death was not known to the Council at the time of the last Annual Report.

Eight Fellows have resigned during the Session; the names of eleven Fellows, who were in arrear with their subscriptions, have, in accordance with Sec. 3 of Chap. xiv. of the Bye-laws, been struck off the List; and twenty-one new Fellows have been elected.

The number of new Fellows elected is not large enough to be considered as satisfactory; it is not only considerably less than the number elected in 1898, but is even below the average for the preceding ten years.

The Society now consists of 10 Honorary, 56 Life, and 352 Fellows liable for the Annual Subscription, the total number of Fellows on the Society's List being 418, or 6 less than at this time last year.

The Transactions for 1899 form a volume of 499 pages, showing an increase of 55 pages over those for the previous year. They consist of sixteen Memoirs, contributed by the following authors: Mr. Gilbert J. Arrow (3 papers); Dr. Thomas A. Chapman; Mr. W. L. Distant; Mr. Charles H. Dolby-Tyler; the Rev. A. E. Eaton; Mr. Henry J. Elwes,

F.R.S.; Mr. Claude Fuller; Mr. Percy I. Lathy; Mr. John Henry Leech; the Rev. T. A. Marshall; Mr. Robert McLachlan, F.R.S.; Mr. F. Merrifield and Prof. E. B. Poulton, F.R.S.; the Rev. F. D. Morice; and Mr. F. M. van der Wulp.

Eleven of these papers are descriptive, systematic or faunistic, and relate: one to Coleoptera, one to Diptera, two to Hemiptera, three to Lepidoptera and two to Neuroptera. Of the remaining papers two have reference to life-histories in Coccidæ and Lepidoptera, two to sexual dimorphism in Coleoptera, and one treats of the colour-relation between the pupæ of certain Lepidoptera and the surroundings of the larvæ.

The Memoirs are illustrated by 17 plates, of which 8 are coloured.

The cost of Plate I. has been paid for out of the income derived from the Westwood Bequest; and the Society is indebted to Mr. H. J. Adams for a contribution of £10 towards the cost of Plate IV.; to Mr. H. J. Elwes for half the cost of Plates XI.—XIV.; to Mr. Claude Fuller for the cost of Plate XV.; and to Mr. J. H. Leech for a portion of the cost of printing Paper III.

The Journal of Proceedings, containing an account of the Exhibitions and Discussions at the Meetings, as well as Notes of interest and short Papers read before the Society, is of much shorter length than usual, the number of pages, exclusive of those taken up by the Report of the Annual Meeting, being 27, as compared with 43 in the previous year. Although this may in some measure be attributed to the fact that the Proceedings have not at all times been reported at quite their full length, it seems chiefly to be accounted for by the small number of Exhibitions during the year, and the shortness of the discussions owing to the absence of any topics of sufficiently wide interest to induce a larger number of those Fellows present at the Meetings to speak. It has been noticed, moreover, that many of the Fellows take a less active interest than they might in the proceedings, and show a tendency to rely too much upon a few of their number to promote the success of the Meetings.

The preparation of the Supplementary Catalogue of the Library has made considerable progress, and it is hoped that this Catalogue will be ready for issue early in the present year.

The financial condition of the Society continues to be exceedingly sound. The Subscriptions received for 1899 are greatly in excess of those for any previous year; while the amount received in Admission Fees and in payment of Arrears is about the same as in the year preceding. A substantial recovery is noticeable in the sale of the Publications of the Society. The Legacy of £100 received from the Executors of the late Mr. Samuel Stevens has been invested in Consols; and the amount so invested is now £681 18*s.* 0*d.*, producing £684 12*s.* 11*d.* Consols. Four Life Compositions were received during the year; and this amount (£63) has been held over against the expenses of the Supplementary Catalogue of the Library. The balance in hand at the end of 1899 was £181 16*s.* 8*d.*; but this apparently large sum includes the four Life Compositions just referred to, and against it there are to be set Liabilities for about £67 in connection with printing and plates, the exact cost of which could not be ascertained at the close of the year.

11, Chandos Street, Cavendish Square, W.
17*th January*, 1900.

The Balance Sheet and Report of the Council having been unanimously adopted, it was announced that no notice had been sent to the Secretaries proposing to substitute other names for those in the lists prepared by the Council. The following Fellows therefore are elected Members of the Council for the Session 1900—1901: Charles G. Barrett; George C. Champion, F.Z.S.; Thomas A. Chapman, M.D., F.Z.S.; W. Lucas Distant; H. St. J. K. Donisthorpe, F.Z.S.; Charles J. Gahan, M.A.; F. DuCane Godman, D.C.L., F.R.S.; A. Hugh Jones; R. Wylie Lloyd; Robert McLachlan, F.R.S.; the Hon. Walter Rothschild, D.Sc., M.P., F.Z.S.; Edward Saunders, F.L.S.; George H. Verrall; and Charles O. Waterhouse.

The following are the Officers elected: *President*, Mr. George

Henry Verrall ; *Treasurer*, Mr. Robert McLachlan ; *Secretary*, Mr. Charles J. Gahan ; *Librarian*, Mr. George C. Champion.

The election to fill two vacancies, one in the Council and one in the Office of Secretary, caused by the resignation of Mr. J. J. Walker, R.N., was adjourned to March 7th, the Council having signified their intention to announce at the Meeting on Feb. 7th, the name or names of the person or persons whom they shall recommend to be elected.

The President read a letter from Mr. Walker in which he expressed regret at having to resign his position as Secretary and Member of the Council, stating that he had received an appointment to H.M.S. *Katoomba*, at Sydney, N.S.W., and would, in consequence, be absent from England for some years.

The President then delivered an Address, and at its conclusion a vote of thanks, proposed by Prof. Meldola and seconded by Mr. Blandford, was unanimously accorded to the President for his Address, and to the President and the other Officers for their services to the Society during the past year. Messrs. Verrall, McLachlan, Gahan and Champion spoke in reply.

ENTOMOLOGICAL SOCIETY OF LONDON.

Balance Sheet for the Year 1899.

Receipts.	£	s.	d.	Payments.	£	s.	d.
Balance in hand, 1st Jan., 1900	86	4	2	Printing Transactions, &c.	146	3	2
Subscriptions for 1899 ...	337	1	0	Plates, &c.	78	8	0
Arrears	18	18	0	Rent and Office Expenses	165	14	6
Admission Fees	42	0	0	Books and Binding	41	5	5
Life Compositions	63	0	0	New Bookcases	40	14	0
Donations	25	0	4	Catalogue Expenses ...	17	11	2
Legacy from Executors of the late S. Stevens, Esq.	100	0	0	Investment in Consols ...	100	0	0
Sales of Transactions, &c.	76	17	5	Subscriptions in advance carried to 1900	14	14	0
Interest on Investments:—				Balance	181	16	8
Consols £15 13 0							
Westwood Bequest 6 19 0							
	22	12	0				
Subscriptions in advance	14	14	0				
	£786	6	11		£786	6	11

ASSETS.

Subscriptions in arrear considered good (say) £21 0 0

Investments:—

Cost of £684 12*s.* 11*d.* Consols ... ... £681 18*s.* 0*d.*

Cost of £239 12*s.* 4*d.* Birmingham Corporation 3 per cent. Stock (Westwood Bequest) £250.

Balance in hand £181 16 8

LIABILITIES.

(Since discharged.)

Printing £52 9 0

Plates 14 18 0

Robert McLachlan,
Treasurer.

Audited and found correct,
A. Hugh Jones.
Louis B. Prout.
Robt. Adkin.
R. Wylie Lloyd.

10th January, 1900.

THE PRESIDENT'S ADDRESS.

GENTLEMEN,

I think I may say that the Report of the Council is in many respects the most satisfactory one that has ever been presented in the history of the Society. Financially we began the year with £86 4*s*. 2*d*. in hand, and we leave off with £181 16*s*. 8*d*. less the liabilities; this balance by no means indicates any unusual economy of expenditure, as we have spent more than usual in proceedings and plates. Of course we have, I may say unfortunately, received a legacy of £100 from Mr. Samuel Stevens—I wish the legacy might have been deferred for several years—and we have received £63 in Life Compositions, but the encouraging increase in recent years in the number of Fellows testifies to the stability and value of the Society. It is to be regretted that this increase in numbers has not been so fully maintained during the past session; but the slight falling off will, I trust, prove to be only temporary. Dr. Sharp remarked on January 16, 1889, that in 1868 there were less than 200 Members and only £100 invested, while in 1889 there were 300 Members and £400 invested, now there are 418 Members and nearly £1000 invested. When I joined the Society in 1866 it consisted of 207 Members, of whom I regret to find that only 34 survive, and that 9 out of those 34 preceded me by one year only, while one was elected in the same year as myself. It is however noticeable that among the remaining 24 there exists one original Member, William Blundell Spence, whom however we never see, who has consequently been a Member of this Society for 67 years, while Mr. Samuel Stevens who died last year had been an active working Member of the Society for 62 years—well

may one recommend Entomology as an aid to old age. I may further add that of these remaining 24 Fellows I can only remember having seen 8 at the Meetings of the Society ever since I was a Member, but while personally I may regret that I am becoming one of the veterans, I can correspondingly congratulate the Society upon the enormous amount of youth and vigour which must exist among the other Fellows, and the consequently confident future of the Society.

As a rule our Meetings have been well attended, but on some occasions when a second Meeting has been held in one month there has been a falling off in both attendance and interest, and it may well be considered both by the Council and the Society whether some re-arrangement might be made concerning the dates of the Meetings. I am bound to acknowledge that the real work of the Society has been done by our Secretaries and the Treasurer. Knowing what the duties of Secretaries are in such a Society as this, I can testify that their hard work has been made to appear easy work because of the smoothness and accuracy with which all has been executed, and that the work of the Council has been therefore of an uneventful nature; consequently all the more do I regret that we are losing the services of Mr. J. J. Walker, who has been ordered abroad, though we are all proud that one of our body should be called to the service of our Queen and Country. I sincerely hope that at the end of his term of service we may welcome him again amongst us, and that he may hold high office in our Society in years to come. I can here endorse the remarks made by Mr. Trimen in his Presidential Address of last year, for I think the Society is now in a position to appoint a paid Assistant-Secretary to conduct under the direction of the Secretaries the ordinary routine business; at present the duties of a Secretary are so exacting that Fellows hesitate at accepting the office, but if the routine business could be taken off their hands I believe we could always obtain the services of our most capable men. As to our Treasurer, it is quite unnecessary for me to say much; he is well known to you all, or else soon makes himself well known, and he has proved himself to be a most worthy guardian of our finances, though I think I never knew him

hold the purse-strings so loosely as in the past year, but that is probably because he had a full purse; I trust that he will continue as our Treasurer for many years to come and that he may have ample funds to deal with.

OBITUARY.

Our losses by death in 1899 were few in number (7), but very important as regards our Honorary Members, since M. Hippolyte Lucas who was elected only last year, and Dr. Carl Gustaf Thomson who was elected in 1895, died during the year. It is not often that men become elected Honorary Members until well advanced in life, which naturally accounts for frequent changes in that list, but it is interesting to note that we possess (out of our twelve Honorary Members) one who was elected in 1871 (Baron M. E. de Selys Longchamps) and another in 1872 (Henri F. de Saussure). Our two deceased Honorary Members are of course men who had attained a very high reputation in Entomology.

M. Hippolyte Lucas began his Entomological writings about 1830, and by 1861 had over 200 papers and works attached to his name, which alone is proof of the energy he threw into his studies. His lines of Entomology have very rarely come across my own, as he wrote but little on Dipterology. He was 86 years old at the time of his death.

Prof. C. G. Thomson was another Entomologist who caused his name to be known in almost every order. I believe that his best and most celebrated work was done in Coleoptera, upon which he began to write in 1851, but he has written more or less upon most orders of Insects, and even in Dipterology he has done good and very original work. He was 75 years old at the time of his death.

Very notable among our Fellows is the loss of Mr. S. Stevens; and the other Fellows who have died are Dr. Charles Brongniart, R. W. Fereday, Rev. W. Farren White, and Hildebrand Ramsden.

Samuel Stevens, F.L.S., was the senior but one of the Fellows of our Society, as he was elected in 1837; he was the

only well-known Fellow who was left to connect us with the far-away past of the foundation of the Society (as his only senior, William Blundell Spence—a son I believe of the original Spence of Kirby and Spence—has resided at Florence for a very long time). The break which his death has caused with the past may be realised when I state that the next oldest Fellow left is Mr. John William Douglas (1845), next to whom comes Dr. W. H. Lowe (1850), and Sir John Lubbock, whose title as a Peer I do not know (1850); none of these have been at all familiar to the present Fellows of the Society, and I think we shall now have to consider as our *doyen*, in the sense of one who comes among us, the Rev. Henry Stephen Gorham, who was elected in 1855, because we now rarely see Dr. Frederick Moore, who was elected in 1853. For real long active work and regular attendance at the Society one Fellow stands out pre-eminently, and that is our Treasurer, Mr. Robert McLachlan, who was elected in 1858, and who has I believe held every office that this Society could give, including that of President (1885—1886); I consider therefore that the gap with the past, caused by the death of Mr. Samuel Stevens, is really one of 21 years as far as the active work of this Society is concerned. We who are now in this room can only connect back intimately to 1858 instead of to 1837.

Mr. S. Stevens represented an exceedingly useful type of English Entomologist, though not an eminently scientific one, as his studies were mainly devoted to collecting Coleoptera and Lepidoptera, while trusting to others to assist him in identifying his captures, but his value lay in the interest with which he would follow up any supposed rare species which suddenly occurred somewhere in abundance—I remember his trusting to my guidance to find *Agrotera nemoralis* at Abbotts Wood in Sussex—and in his collection, which has been accumulating for about 60 years, and which consequently often produced old unrecognised species, such as *Acidalia immoraria*. Beyond this Mr. Stevens' acquaintanceship and friendship with so very many Fellows of the Society united him with us and cause us all to deplore his loss. Personally I feel his loss in connection with the Entomological Club even more

than I do in connection with the Society, as his loss will be felt there even more than in this Society.

Dr. Charles Brongniart was elected a Member in 1879, and although he was a comparatively young man, being only 40 years old, he had attained a very wide-spread reputation by his studies of fossil insects. He had also been appointed Secretary to the Committee dealing with "Insectes et Cryptogames utiles ou nuisibles à l'Agriculture" at the forthcoming Paris Exhibition of 1900.

R. W. Fereday lived in New Zealand for about the last 30 years. He joined our Society in 1881, and did a good deal of valuable Lepidopterological work on New Zealand species.

Rev. W. Farren White had been a Member since 1865, but his Entomological studies are not much known, though he published a work on "Ants and their ways."

Hildebrand Ramsden joined in 1882 and was a life-Member; but I do not know anything about his Entomological studies.

The Society has consequently been exceedingly fortunate in having lost scarcely any of its scientific power, while the actual obituary loss from more than 400 Fellows is very slight.

Outside our own Society the most notable deaths are those of F. M. Van der Wulp, James Hardy, Prof. J. J. Alexandre Laboulbène, Charles Stewart Gregson, Prof. Achille Costa, Dr. William Nylander, Dr. Alexander Wallace, John Brooks Bridgman, and Dr. R. H. Meade. I must refer to many of these as they are names which have left so strong an impress on the Entomological world.

First and foremost stands Frederik Maurits Van der Wulp, because of the high rank which he held for about 40 years in Dipterology. For a long time past he has been one of the leading authorities on Diptera in the northern half of Europe, and had he confined himself more to his original studies of the Netherland Diptera there can be no doubt but that he would have been the leading authority in North Europe after the death of Loew in 1879; as it was, he was attracted away from his earlier studies towards Exotic forms,

and in those, he has made a name for himself which will never be forgotten. He lived all his life at the Hague, and died there when nearly 81 years old.

James Hardy has been forgotten for more than a generation ; but in the fifties and sixties he did a lot of useful work in the North of England, and many almost overlooked papers by him in the Proceedings of the Berwickshire Naturalists' Club will have to be carefully examined by the present generation.

Professor J. J. Alexandre Laboulbène is another name which appeals to past generations, and it seems impossible to those of the present day who have occasion to study his writings to realise that he has been amongst us until last year. He began to write in 1848, and was three times President of the French Entomological Society.

C. S. Gregson was one of the old school of hard-working British Lepidopterists, but was very little known to the present generation.

Professor Achille Costa was one of the best known of that family of Italian Entomologists, and was a most prolific writer, though his writings were very little known in England.

Dr. William Nylander, who was born in Finland in 1822, had made a name for himself among the workers at *Hymenoptera*.

Dr. Alexander Wallace was for about 20 years a Member of this Society, and was probably best known from his attempts to introduce sericiculture into England from the large *Ailanthus* and other *Bombyces*.

John Brooks Bridgman was also at one time a Fellow of our Society, and did a vast amount of exceedingly useful work in the British *Ichneumonidæ*.

Dr. R. H. Meade of Bradford died, as I have been at the last moment informed, on December 23rd last. He was 86 years old, and was working at Entomology up to the time of his death. It is with sincere regret that I received this information, as the few students in British Dipterology can ill afford to lose so good a worker as he was. Even during the last few years he had done a great deal to bring two of the least-known

families of British Diptera, the *Tachinidæ* and *Anthomyidæ*, into shape and order.

Gentlemen, I must utter a strong protest against the Presidential Addresses for many years past. Surely a Presidential Address should be simply a review of what has taken place in the past year or series of years, firstly with regard to this Society, and secondly with regard to the Entomological world in general. Naturally deductions may be drawn from what has taken place, and elaborations may be expended on even that, but in my opinion there should be nothing in a Presidential Address which should more properly appear in the Transactions of the Society. I say this in the interests of the Presidents as well as in the interests of the Society. With the greatest respect to our late President, Mr. Rowland Trimen, I would urge that his essay last year on the Seasonal Dimorphism of Rhopalocera was a most excellent paper for our Transactions, but was out of place in a Presidential Address. I say this again in the interests of the Author as well as in the interests of the Society. Mr. Trimen's learned essay sank at once as a Presidential Address into almost the same ephemeral category as the Annual Report of the Council, but if it had appeared in our Transactions it would have possessed infinitely greater scientific weight. I have noticed this for year after year. When we had such a President as the late Professor Westwood, we had one who could review the Entomological work of the whole world for the past year, and in my opinion that was the ideal of a Presidential Address, but we shall never again have an Entomologist with the universal grasp over the whole world of Entomology which Professor Westwood possessed. We are all now Specialists.

I have therefore determined to simply put a few points before you this evening, which may cause us to realise a little what Entomology is at the close of this nineteenth century, as compared with what it was at its commencement, and to call attention to some of the advantages which we now possess as against the disadvantages at the commencement of the century, as well as to call attention to some of the dis-

advantages under which we now labour as compared with our predecessors. First and foremost among the present advantages of course comes the FACILITY OF INTERCOMMUNICATION. Journeys to foreign lands were then matters of months, and often years; now one may examine nearly all the type collections of Europe in a few weeks—I hope however that in the next few years much more will be done to systematise this, as at present one day is often lost after arrival at some city in finding out where a type collection is located, while perhaps when the museum is found it may turn out that it is not open on that day in the week. As a rule these difficulties are not insurmountable to any well-known student in any special group; but an immense gain to science could be given by the production of a small international guide to all the important collections, stating when they were open for examination by students, where they were situated in the various cities and towns, and who was the best person to apply to for assistance when the collection was found. I mention for instance one of my own out of many such experiences: when I went to Stockholm the only clue I could find to the Natural History Museum was that it was in the Prinzenpalais. The collection in the Prinzenpalais was very soon found, but it was mainly geological and archæological, and it took some time to find out that I must go to the K. vetenskaps Academie, at 94 Drottninggade, where the collections are open from ten to four daily, and as soon as I made the acquaintance of Professor Aurivillius my troubles were at an end, and every possible assistance was given to me. Time is of even more value now for a journey of a few weeks than it used to be for one of as many months. POSTAGE now is a matter of infinitely less time and expense than in the earlier half of the century, and here we gain additional advantages almost every year. LANGUAGE ought to be a gain, inasmuch as education should enable a student to comprehend the meaning of descriptions and notes in any civilised language, and it is very encouraging to us Englishmen to notice how much more frequently our own language is made use of by foreigners, even in their own Transactions, because of the more universal knowledge of that language. Papers by Englishmen in their

own language are accepted for publication in the Transactions of all foreign societies, with I believe the exception of one, and by nearly all foreign magazines. This is an immense advantage to English students, though for a time perhaps a disadvantage to the students of other nationalities, though even to them the disadvantage is not very great, inasmuch as it is now impossible for any good work to be done unless the student can comprehend English and German. This tendency is likely to increase with the vast amount of work done by our Transatlantic cousins, and it is of course admitted that works in Russian, Hungarian, Japanese, etc., are outside anything that a scientific student must examine.

Societies. Perhaps the greatest advance which has taken place in the nineteenth century has been the formation of Entomological and other Scientific Societies. These societies have enabled the students in various countries to combine together, and, by their mutual work and subscriptions, to issue a very great amount of exceedingly useful scientific work to the public which would otherwise have failed to find an outlet. Of course even this has not been entirely a gain, as our own minutes would show that we have at times published such worthless papers from certain prolific authors that a resolution has been passed that no more papers should be accepted from such and such an author. Naturally the simple result has been that the discarded author has tendered his rejected paper to some other society, and the Entomological Society has heard of him no more, but his more than worthless articles may continue to be published to the world by some other society. On the other hand these societies cannot help having an eye to their own continuance, and consequently to their own funds, and therefore at times a valuable communication may be looked at askance, because it may be expensive to publish, and command very little return, though even then the support of the Royal Society often enables the publication of such valuable but expensive papers.

I believe that the Société Entomologique de France, which was founded in 1832, is the oldest of the existing Scientific Entomological Societies—I omit the Entomological Club, which met last night, as, although older, I consider it more

social than scientific. The French Society was very quickly followed by our own Society in 1833, which by some curious fatality called itself The Entomological Society of London—why not of Great Britain, or Britain, or even England? From these the number of Entomological Societies increased and multiplied wonderfully, until the danger now is the other way, inasmuch as it is almost impossible to keep abreast with the enormous amount of literature which is now published. This is one of the disadvantages of the present end of the century as against the beginning, as I find that the number of Natural History Transactions, Proceedings, Bulletins, and Magazines amounted to nearly 950, as noted in the Zoological Record for 1898. Our grandparents had difficulty in obtaining descriptive material published in other countries, but there was but little to obtain, and we know that they commonly did exchange their publications, and the point I wish to urge is that those publications were well-thought-out publications, over which the author had probably spent many years before issuing them to the world. We now have such a considerable number of Societies with their Transactions and Proceedings, besides innumerable Magazines devoted wholly or partly to Entomology, that it is impossible for anybody to be quite level with the literature of the day, and this leads me to the statement that there is growing on the one side a tendency to issue loose crude descriptions of so-called new species by students who have worked at an order for a few months, because of the facilities given for such publications; on the other side the old authors waited and thought out their whole volume, while the new age dashes into print in the next monthly magazine. I wish we could go back more to the ponderous tomes which represented years of well-digested work. The loose crude descriptions tend to choke the flow of knowledge, because the tangle of synonymy becomes so overwhelming that nothing but the arrival of the monographer can cut the "sudd."

Just however as difficulties increase so do methods of coping with those difficulties increase, and the establishment of Gerstæcker's Bericht, and our own Zoological Record, should prevent any careful student from being much behind

the actual living working world of science Nevertheless it must be recognised as an absolute impossibility that a student in any place, except such as London, Paris, Vienna, Berlin, etc., can by any means whatever obtain ready access to the hundred and one more or less obscure publications in which descriptions of new species are sometimes published, and as this evil is likely to increase indefinitely, a limit must be put to what are to be considered scientific publications, just as there is a limit to the number of languages we are compelled to recognise. I live in a small town of about ten thousand inhabitants—may I describe a new species of Diptera in my most approved style in our local journal, which circulates for a few miles round, and claim priority of nomenclature? The natural answer would be that it would be so absurd that the description *ought* to be ignored; nevertheless nobody now-a-days dares to say it *must* be ignored because the publication is practically unknown and inaccessible to the scientific world. I go so far as to say that the scientific world will *have* to draw a line sooner or later between recognised scientific and unscientific works. I have taken an extreme case in referring to my local journal; but I will take the next stage. The *Field* is a newspaper well known to all of you, and is included in the publications enumerated in the Zoological Record of 1898; but does any one wish to contend that the *Field* is a right and proper medium for the publication of, say, a new species of Ichneumonidæ? The Rev. J. G. Wood, who was one of our best popular writers on Natural History, described and gave a new name to a species of Millepede in one of his chief popular works. Does anybody consider that description to have been sufficiently introduced to the notice of the scientific world? It is obvious that a compulsory limit must be defined as to what should be considered scientific publications, and the sooner that limit is defined so much the better. There would be no hardship on new describers, as it would only be necessary for them to get their description published in some recognised scientific paper, as soon as possible after their unrecognised description had appeared; and if, as might happen, an author should be unable to get his paper published in any of the recognised scientific journals,

he would be wise to consider it as a strong proof that his description deserved to be ignored ; or again, if while waiting to see his description published in the approved manner, good descriptions from some other hand and relating to the same subjects should in the meantime appear in a recognised scientific publication, then the popular author would have to be content with seeing his own name take second place. If an international agreement could be arrived at in regard to the recognised scientific publications, which from 950 (in addition to hundreds of others not included) might easily be reduced to 200, some control could also be placed over the surviving 200, so that if any of them persistently published papers unworthy of publication in a scientific journal, the guilty ones should be excluded from the recognised list. It is all very well to say that you must have a universal agreement to such a matter as this ; it seems to me that you never will get a universal agreement to anything, but if you can get a majority to work upon certain lines, you can afford to ignore the minority, as the world is certain in the long run to agree with the majority, even if only for the sake of convenience.

This raises another subject which *must* come before the scientific world before long, and that is, that there must be a punishment for offenders. We all know the description of a beetle, "*rufus, oculis nigris,*" but many descriptions of recent times convey no more information, and it is most manifestly unfair that such descriptions should have the slightest right of priority. I can show you in this library close to us a new species of *Pulex* described by a Fellow of this Society in the following words, "*pallide piceo-fusca !*" without a word on structure or comparison. I am a strong believer in the rule of Priority just as I am in the rule of Honesty, but while the offender who breaks the rule of Honesty is punished, the offender concerning Priority, because of the very heinousness of his offence, is at first overlooked and is subsequently pardoned *and rewarded !* There is something wrong here. Bigot for instance described in the Ann. Soc. Ent. France for 1880 a large number of new species of *Syrphidæ*, and amongst them a new European *Orthoneura* (*O. varipes*), of which he states that the face was partly yellowish, which is a character im-

possible for a species of *Orthoneura;* a moment's examination of the specimen showed it to be *Paragus tibialis*, one of the very commonest European *Syrphidæ;* surely such a paper should be ruled as valueless and excluded from all rights to priority; in fact, let it be as has been the case with a most elaborate paper on Diptera, published by Lioy in 1864, in which innumerable new genera were proposed on most inadequate grounds, and on which Baron C. R. Osten-Sacken once rallied Rondani as to his neglect to notice his fellow-countryman's work, which produced from Rondani the retort, "*C'est de la Poésie.*" I heartily agree in referring Lioy's work to something outside science; and the scientific world must soon refuse to accept crude and ill-digested material as part of its natural sustenance. There must be some method evolved of punishing ignorance or carelessness, or else ignorance and carelessness will by their very volume overwhelm knowledge and study.

There is another saying in connection with scientific work which is too good to be lost, and I have always wished that it were better known. It might serve as a motto to those Entomologists who are in such a hurry to describe new species from insufficient material and without adequate knowledge. The tale occurs in Robineau Desvoidy's 'Essai sur les Myodaires,' page 686, in the description of *Limnia marginata*, and is as follows:—"Cette espèce et le *L. limbata* sont les vrais *Muscæ marginata et limbata*, ainsi nommés par M. Bosc, et ainsi étiquetés par lui dans sa collection, où Fabricius en prit la description. Je rapporte ce fait, parce que, dans une autre collection de Paris, j'ai vu le *Musca marginata* étiqueté du nom de *Musca limbata.* L'étiquette était de le main même de Fabricius. Fabricius venait chaque année *compter* avec la nature dans les différentes collections de notre capitale: sa méthode de description, qu'il ne modifia jamais, l'empêcha bientôt de comprendre dans les cercles trop reserrés qu'il s'était tracés toutes les espèces qui passaient sous ses yeux. Un jour M. Bosc surprit son embarras sur une boîte de mouches qu'il était prié de lui nommer: après plusieur tentatives, Fabricius quitte la plume, referme la boîte, et la remet à M. Bosc en riant et en disant ces paroles remarquables: *Est aliquid*

posteris relinquendum. On voit que Fabricius ne pouvait plus faire avancer la science, et qu'il sentait la nécessité de larges innovations ; mais il ne se doutait pas encore de l'immensité de l'héritage laissé derrière lui."

An enormous scientific improvement has developed in the improved labelling of species both as to locality and date, and also as to the authorities for the nomenclature of the specimens in difficult cases. It is impossible that too much care can be taken in such matters. We know now by experience from the past the trouble which incorrect labels of locality may cause, and we also know the immense loss of value attached to interesting specimens which are without a history. Although I hate the need of reference to type specimens, because if the description is adequate no reference to a type should be necessary, and if the description is inadequate it should not hold priority over the next adequate description, yet I know that the examination of a well-authenticated type will often open a student's eyes to the fact that a mistake has been copied from author to author which a close examination of an original description would have shown to be unpardonable. For instance, *Musca œstracea* of Linné has been accepted for a very long period as a species of *Chilosia*, but the slightest examination of Linné's original description, which contains the words "scutello albido," would have shown that his species was no *Chilosia*, and then the knowledge that the well-known Scandinavian *Eristalis apiformis* exactly answered to Linné's *M. œstracea*, would have been quite enough to identify the species without the need for Haliday, in 1851, to call attention to Linné's original type. The careless error arose because the Mid-European Dipterists wanted to recognise *M. œstracea* in one of their own species, while it happens to be a species confined to the extreme north.

Another point on which great improvement has occurred is in the accumulation of longer series of specimens. It is simply marvellous to me to notice the wonderfully good descriptions made by Meigen from one, two, or three specimens of a species, yet of course when one comes to an exceedingly variable species one can see the trap into which the old authors were sometimes led. We have not quite passed that

danger yet; I dare say you are most of you acquainted with the genus *Hæmatopota* in Diptera!—well, it is an exceedingly difficult thing to name a British or European species of *Hæmatopota*, because we meet with them in hundreds, though only in three or four species, but it is easy to name a South-African *Hæmatopota* because we have so few specimens for examination that almost each specimen can be clearly distinguished from the others. I prophesy that when we have hundreds of specimens of North-African, Mid-African, and South-African *Hæmatopota*, we shall be infinitely less certain about the nomenclature than we are now. It is only by the accumulation and examination of long series of specimens that difficult groups of species can be effectually dealt with.

There is another most extreme advantage that British Entomologists possess now as compared with the first half of the century, and that is the difference which was caused by a very few individuals who reduced chaos to symmetry. Any one who attempted to work at British Coleoptera before the publication of the late G. R. Waterhouse's "Catalogue of British Coleoptera," which appeared in 1858, will know the absolute revolution which enabled the British student to escape from the awful labyrinth of synonymy which had previously almost hopelessly checked any advance to the comparative subsequent symmetry; but since that date the study of Coleoptera in Britain has advanced by leaps and bounds, until I believe that it is now as fully advanced as in any country in the world. Again, in Lepidoptera it seems impossible to realise the jumble of genera which existed, especially in the Micro-Lepidoptera, until the late H. T. Stainton began to study them in conjunction with a number of European workers and several enthusiastic English helpers. Stainton, like Waterhouse, attacked the most difficult and neglected groups, but at the same time both of them endeavoured to put their whole order into symmetrical shape, and it may clearly be said that the honour is due to those two men above all others that the two most conspicuous orders of Insects have become so well arranged and so much studied in Britain. It was a close race between those two men in arranging those two great orders: Waterhouse was born in 1810, and published his first

writing in 1833, and arranged the whole Order of Coleoptera in his Catalogue in 1858; while Stainton was born in 1822, and began to publish in 1848, and first dealt with the whole Order of Lepidoptera in 1856 to 1859 in his "Manual of British Butterflies and Moths." Since those two works the study of British Lepidoptera and Coleoptera has been comparatively easy. The other Orders of Insects have since then been very largely consolidated into shape, though a vast amount remains yet to be done, and in the Diptera I can with very great earnestness wish that some young student with sharp eyes and infinite patience would study the *Cecidomyidæ*, for which most extensive outdoor work is necessary for collecting the galls and other habitations, and also most minute indoor microscopical work in describing the imagines and life history.

I find it difficult to give an opinion between the merits of the short succinct descriptions which used to be given to new species, as compared with the exceedingly verbose descriptions which are often given now-a-days. It is notable that more than 90 per cent. of Linné's Diptera, described in few words in 1753, are recognised, while it is more than probable that not 20 per cent. of Walker's or Bigot's lengthier and more recent descriptions are identifiable, though on the other hand the exceedingly lengthy descriptions of new species in recent periodicals are impossible to be mistaken if one will only take the trouble to wade through the descriptions. There is beyond any doubt a genius in the power of describing. The most perfect describer of a new species or genus in my experience was the late Mr. A. H. Haliday, of Belfast. It was simply wonderful how he would in a few words describe a species beyond all possible doubt. There is another point in regard to descriptions upon which I think a much greater insistence ought to be enforced, and that is "comparative distinctions." I should like to see it a rule of nomenclature that no new name should stand unless the author pointed out, not so much the characteristics of the species or genus itself, as its distinctions from its allies; it is the duty of the describer to make himself acquainted with at least the descriptions of allied species, and if he will not take the trouble to do this, and compare his new genus or species, his description should be ignored. As

far as lies in my power as a President of this Society, I wish to impress this point: we are now sufficiently advanced in Entomology that we may well insist upon comparative distinctions in all cases.

I have not intended my address to be a purely scientific one, as I have never found the time to dig deeply into the recesses of science because I have had so many other interests in life. It may be said that a man may have many interests and yet be a profound scientific student in his own branch —perhaps it is so—yet I have had cause in my own small study of Dipterology to see the vast amount of good scientific work which has been done, committed to MSS., and—lost! because the necessary funds for issuing the valuable work or the business-like ability for obtaining the same have not been forthcoming. I think it was Professor Huxley who said, "We scientific men have no time to make money;" that might be all very well for Professor Huxley, who had at that time made a world-wide fame, and for whose publications publishers and scientific societies were clamouring, but I know that several most laborious works of our greatest Dipterologists have never seen the light of day because of the lack of funds or patrons. I believe that an exceedingly elaborate work of Professor Hermann Loew on the Amber Fauna was never published, and is now naturally out of date, so that we are never likely to see it. It is believed also that lost MSS. and drawings of Meigen still exist (probably in the Jardin des Plantes, where they may rest in peace another hundred years); while references often occur to 'Diptéres des Environs de Paris,' by Macquart, and numerous specimens exist which are labelled with references to it, but no one has seen the work.

In conclusion I desire to say that the pressing changes compulsory upon the new Century consist, (1) in drawing a much sharper line between scientific and unscientific work, with the full understanding that unscientific work should hold no priority rank, and in fact might be altogether ignored, and it may possibly and even probably be necessary to relegate a large amount of work already published to the unscientific category, so that any synonymy subsequently discovered in this unscientific work would sink as subordinate synonymy;

(2) that such scientific work must be published sufficiently for recognition, in some recognised scientific publication ; (3) that the rules of priority shall not apply to inaccurately and insufficiently described species and genera, and that in all descriptions comparative distinctions should be given against the allied species or genera, or else they should be considered insufficiently described ; (4) something should be done to prevent the giving of new names to species (which possibly required a new name because of pre-occupation) in passing notes in which no attempt is made to describe the new species or genus, but simply a remark is made that such and such a name has been pre-occupied, and the writer substitues such and such a name in its place. I would like to see all such names "*nomina nuda*" unless a description and comparative distinction be associated ; (5) above all it is the duty of the new Century to codify and condense the work of the past Century, so that new work should be done with a full knowledge of the work which has been done and with a due appreciation of it, and not with the recklessness which has been exhibited of late in many quarters, especially in my own Order of the Diptera.

Gentlemen, I thank you for your attention to my remarks, and I only wish that I could have given you an Address upon the course of Entomology during the past year, upon all Orders and upon all subjects connected with Entomology, such as the late Professor Westwood would have done.

INDEX.

NOTE.—Where the name only of the Genus or Species is mentioned, the description will be found on the page referred to.

The Arabic figures refer to the pages of the 'Transactions'; the Roman numerals to the pages of the 'Proceedings.'

New Genera and Species, and those which have been redescribed, will be found in detail, but in faunistic papers the contents are arranged *generically* under the headings of those papers.

The President's Address is not separately indexed.

GENERAL SUBJECTS.

HEMIPTERA.

HYMENOPTERA.

LEPIDOPTERA.

NEUROPTERA.

ORTHOPTERA.

Explanation of Plate I.

Illustrating the Rev. T. A. Marshall's "Monograph of British *Braconidæ*."

Dacnusidæ.

Fig. 1. *Polemon liparæ*, Giraud, ♂.

Aphidiidæ.

2. *Praon flavinode*, Haliday, ♀.
3. Cocoon of *P. flavinode*, surmounted by the empty skin of *Siphonophora absinthii*.
4. *Ephedrus validus*, Haliday, ♀.
5. *Toxares deltiger*, Haliday, ♂.

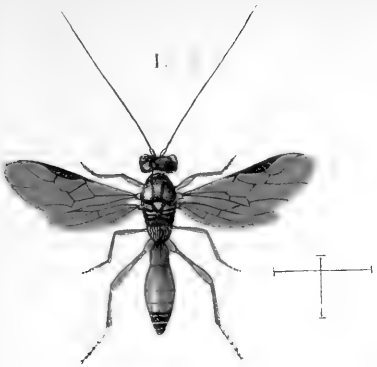
5*a*. Fore wing of *Toxares*.

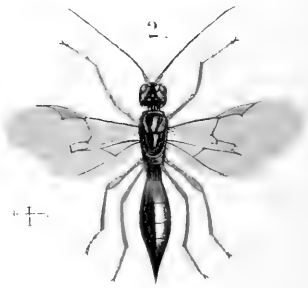
6. *Monoctonus paludum*, Marshall, ♀.

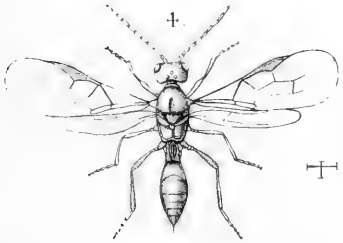
6*a*. A valve of the terebra of *Monoctonus* seen sideways.

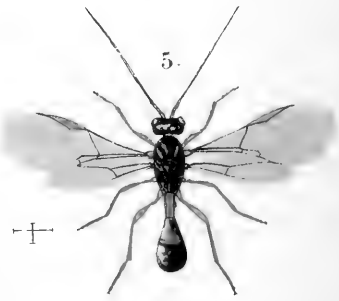
7. *Aphidius pini*, Haliday, ♀.
8. *Aphidius gregarius*, Marshall, ♀.
9. *Dyscritus planiceps*, Marshall, ♀.

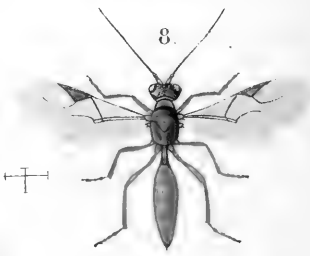
Trans. Ent. Soc. Lond. 1899. Pl. I.

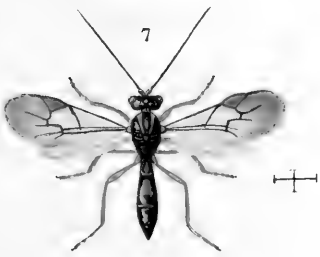


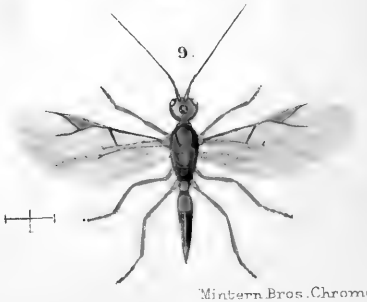












T.A. Marshall del

Mintern Bros. Chromo.

British Braconidæ.

Explanation of Plate II.

Illustrating Mr. F. M. van der Wulp's paper on "*Asilidæ* from Aden and its neighbourhood."

Fig. 1. *Saropogon incisuratus*, n. sp. Wing.
2. *Saropogon pulverulentus*, n. sp.
3. *Leptogaster nitidus*, Wied. Wing.
4. *Rhadinus ungulinus*, Löw. Head.
5. „ „ Fore leg.
6. „ „ Wing.
7. *Psilinus cinerascens*, n. sp.
8. „ „ Head, front view.
9. „ „ „ in profile.
10. *Sisyrnodytes brevis*, Macq. Wing.
11. *Acnephalum futile*, n. sp. „
12. *Holcocephala punctulata*, n. sp. Head, front view.
13. „ „ „ in profile.
14. „ „ Wing.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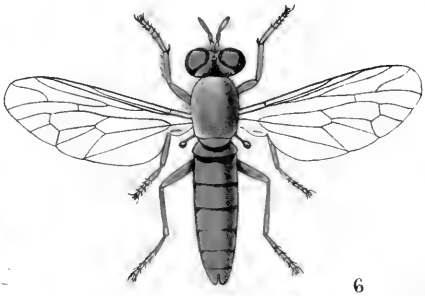


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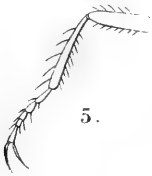
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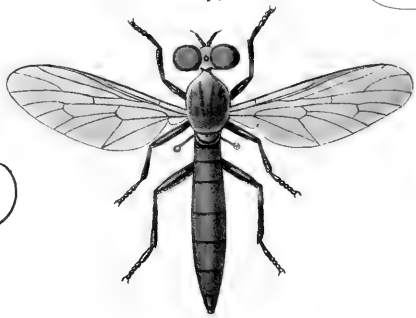


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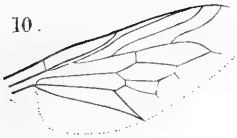
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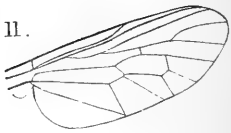
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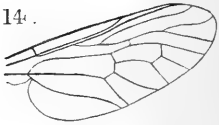
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V.D.W. del. R.E. Mintern lith.

Mintern Bros. imp.

Asilidæ from Aden.

Explanation of Plate III.

Illustrating Mr. F. M. van der Wulp's paper on "*Asilidæ* from Aden and its neighbourhood."

Fig. 1. *Stichopogon inconstans*, Wied. Wing.
2. *Hoplistomera caliginosa*, n. sp. „
3. *Dasythrix ruficornis*, n. sp. „
4. *Promachus rectangularis*, Löw. „
5. *Philodicus gracilis*, n. sp. „
6. *Apoclea femoralis*, Wied. „
7. „ *heteroclita*, n. sp. „
8. *Protophanes costalis*, n. sp. Head.
9. „ „ Male genitalia.
10. „ „ Wing.
11. *Itamus sodalis*, n. sp. Male genitalia.
12. „ „ Ovipositor.
13. „ „ Wing.
14. *Ommatius tenellus*, n. sp. Head.
15. „ „ Wing.

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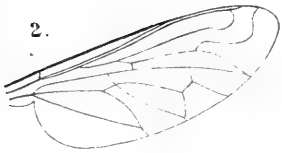

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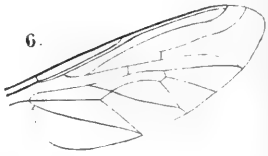

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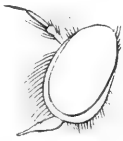

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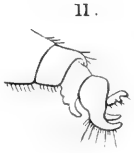

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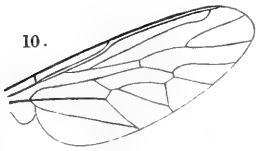

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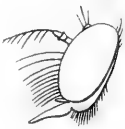

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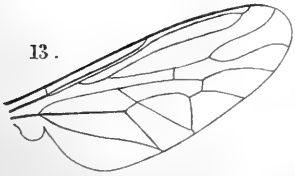

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V.D.W. del. R.E. Mintern lith.

Mintern Bros. imp.

Asilidæ from Aden.

Explanation of Plate IV.

Fig. 1. *Calisto zangis*, Fabr., ♂.

2. „ „ ♀.

3. *C. nubila*, sp. nov., ♂.

4. *C. archebates*, Mén., ♂.

5. *C. pulchella*, sp. nov., ♂.

6. „ „ ♀.

7. „ ab. *tenebrosa*, ab. nov., ♀.

8. *C. herophile*, Hübn., ♂.

9. „ „ ♀.

10. *C. hysius*, Godt., ♂.

11. „ „ ♀.

12. *C. confusa*, sp. nov., ♂.

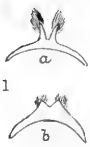
13. „ „ ♀.

West, Newman Chr

THE GENUS CALISTO.

Explanation of Plate V.

1*a*. 7th ventral segment, *A. coitana.*
1*b*. „ „ *A. labialis.*
2. Position of 6th and 7th ventral segments, *A. bimaculata.*
3. „ 7th and 8th „ „ *A. bimaculata.*
4*a*. Stipes in Andrena (*morio*) diagram.
4. Stipites of ♂ genitalia, *A. morio.*
5. „ „ „ *A. fulvicrus.*
6. „ „ „ *A. gwynana.*
7. „ „ „ *A. florea.*
8. „ „ „ *A. cingulata.*
9. „ „ „ *A. bucephala.*
10. „ „ „ *A. suerinensis.*
11. „ „ „ *A. schencki.*
12. „ „ „ *A. tscheki.*
13. „ „ „ *A. chrysosceles.*
14. „ „ „ *A. angustior.*
15. „ „ „ *A. ovina.*
16. „ „ „ *A. scita.*
17. „ „ „ *A. flessæ.*
18. „ „ „ *A. hattorfiana.*
19. „ „ „ *A. nycthemera.*
20. „ „ „ *A. circinata.*
21. „ „ „ *A. analis.*
22. „ „ „ *A. nigro-olivacea.*
23. „ „ „ *A. tibialis.*



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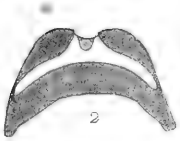

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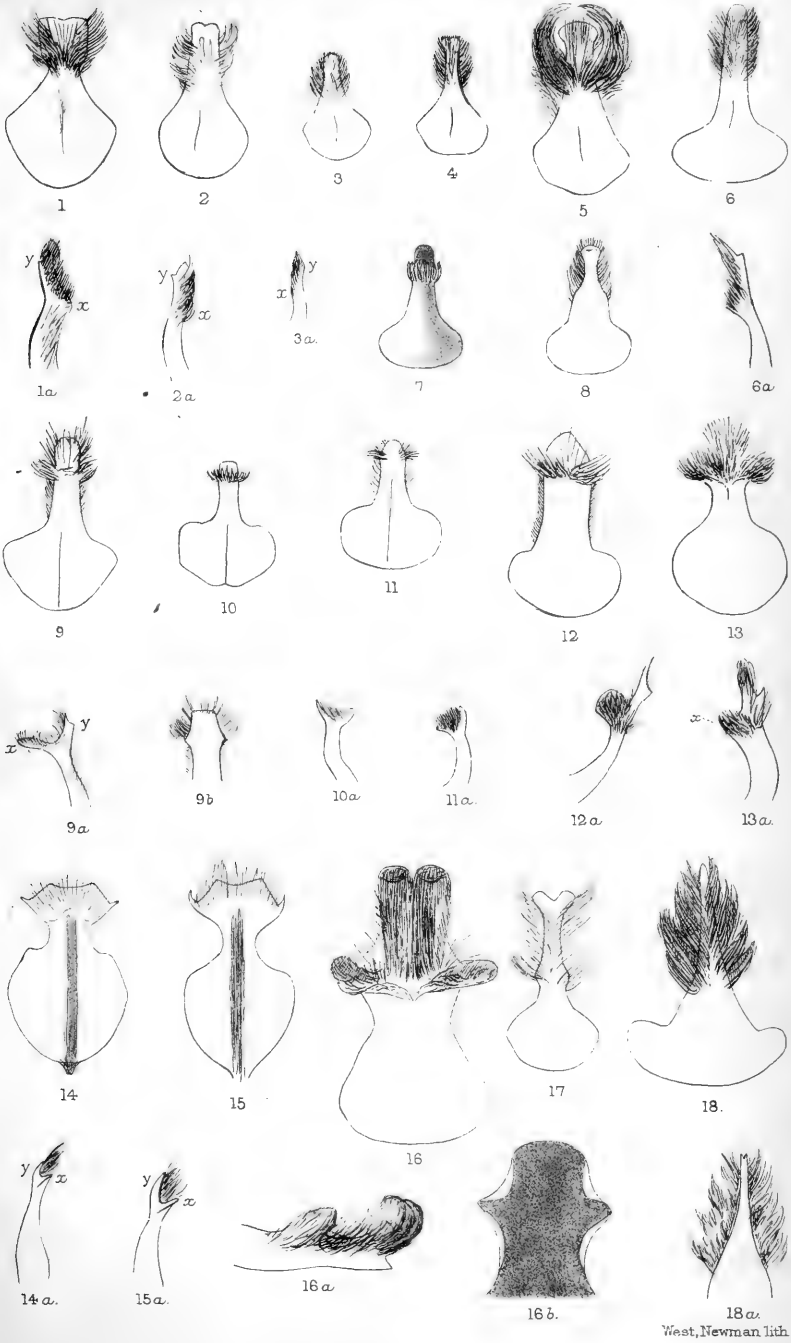
West, Newman lith.

Explanation of Plate VI.

8th ventral segment (*valvula ventralis*) in—

1. *A. thoracica*, ventral view (1*a* do., lateral view).
2. *A. braunsiana*, „ „ (2*a* „).
3. *A. rufohispida*, „ „ (3*a* „).
4. *A. megacephala*, „ „
5. *A. tscheki*, „ „
6. *A. schencki*, „ „ (6*a* do., „).
7. *A. albicrus*, „ „
8. *A. fucata*, dorsal „
9. *A. ovina*, ventral „ (9*a* lateral, 9*b* dorsal).
10. *A. labialis*, „ „ (10*a* lateral).
11. *A. decipiens*, „ „ (11*a* „).
12. *A. suerinensis*, „ „ (12*a* „).
13. *A. ephippium*, „ „ (13*a* „).
14. *A. circinata*, „ „ (14*a* „).
15. *A. rufiventris*, „ „ (15*a* „).
16. *A. scita*, „ „ (16*a* „ , 16*b* dorsal).
17. *A. bucephala*, „ „
18. *A. flessæ*, „ „ (18*a* „).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12a
13a
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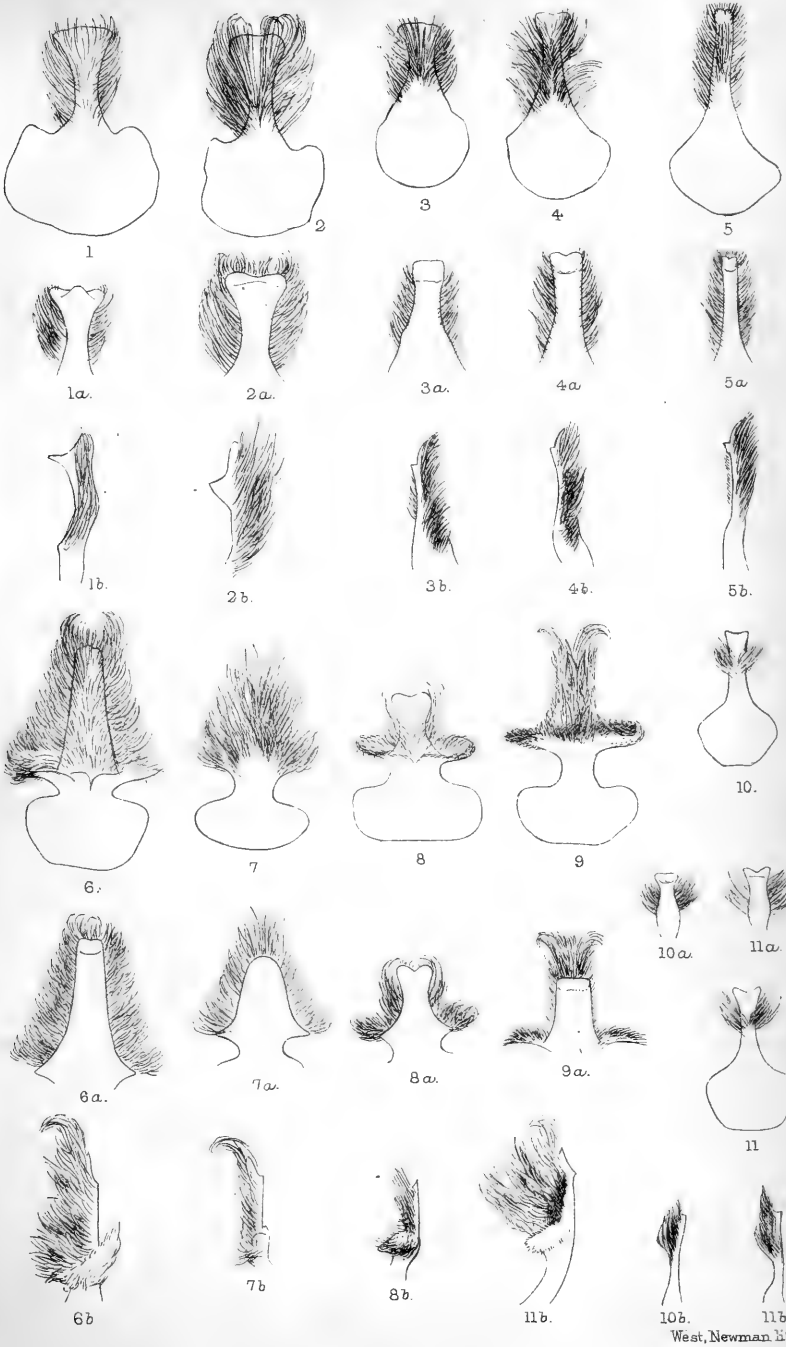
18.
14a.
15a.
16a
16b.
18a.
West, Newman lith.

Explanation of Plate VII.

8th ventral segment (*valvula ventralis*) in—

1. *A. nigro-olivacea*, ventral view (1*a* dorsal, 1*b* lateral).
2. *A. livens*, „ „ (2*a* „ 2*b* „).
3. *A truncatilabris*, „ „ (3*a* „ 3*b* „).
4. *A. ferrugineicrus*, „ „ (4*a* „ 4*b* „).
5. *A. giraudi*, „ „ (5*a* „ 5*b* „).
6. *A. taraxaci*, „ „ (6*a* „ 6*b* „).
7. *A. curtivalvis*, „ „ (7*a* „ 7*b* „).
8. *A. stabiana*, „ „ (8*a* „ 8*b* „).
9. *A. senecionis*, „ „ (9*a* „ 9*b* „).
10. *A. humilis*, *var.* with black clypeus „ „ (10*a* „ 10*b* „).
11. Do. *var.* with white clypeus (= *fulvescens*, Sm.), „ „ (11*a* „ 11*b* „).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9
10.
10a.
11a.
6a.
7a.
8a.
9a.
11
6b
7b
8b.
11b.
10b.
11b.
West, Newman Lith.

Explanation of Plate VIII.

(Figures 1—3 magnified; 4 and 5 natural size.)

Fig. 1. Larval form, 40 hours after fixation.

2. „ „ 10 days „ „ (*a*) seen from above.
„ „ „ „ „ „ (*b*) lateral profile view.

3. „ „ 21 „ „ „

4. „ „ 55 „ „ „

5. Adult ♀♀.

F. del. ad nat.
R. Mintern lith.

Mintern Bros. imp.

Ceroplastes roseatus, Towns & Ckll

Explanation of Plate IX.

Fig. 1. *Corydalis orientalis*, McLach., ♂ (less than natural size).

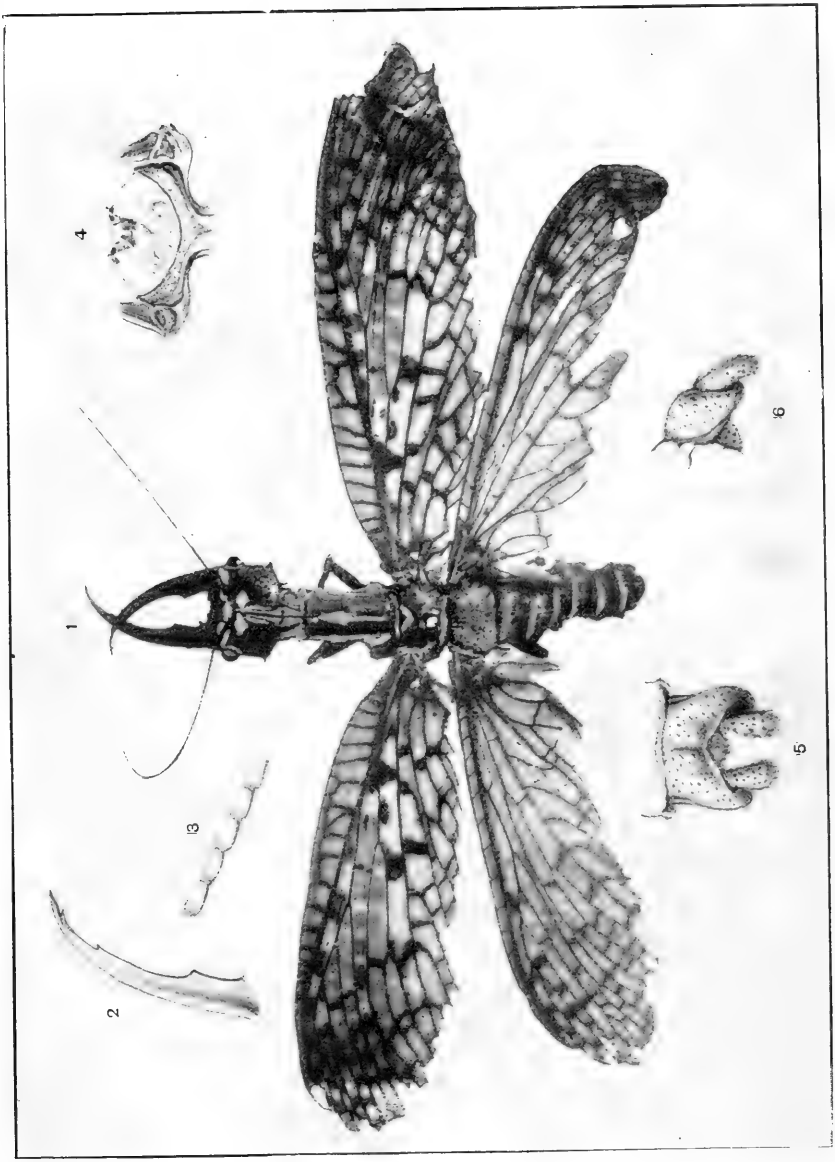
2. Left mandible, enlarged.

3. Portion of an antennæ, much enlarged.

4. Sub-mentum, etc., enlarged.

5. Apex of abdomen, from above, enlarged.

6. „ „ „ side, enlarged.



Corydalis orientalis, McLach., ♂.

Explanation of Plate X.

(Figures of details diversely enlarged.)

Fig. 1*a* to 1*d*. *Ichthybotus Hudsoni*:—*a* and *b*, neuration of base of disk and pterostigmatic region of fore-wing: *c*, legs of imago, 1, 2, 3 ♂ and 1 ♀, with tarsus 2 and claws 1 of ♂ more enlarged: *d*, ventral view of part of the extremity of the ♂ abdomen showing one forceps-limb and in stippled outline the median and part of an outer caudal seta.

2*a* and 2*b*. *Atalophlebia versicolor*:—*a*, fore-wing of ♂ subimago: *b*, penis from beneath.

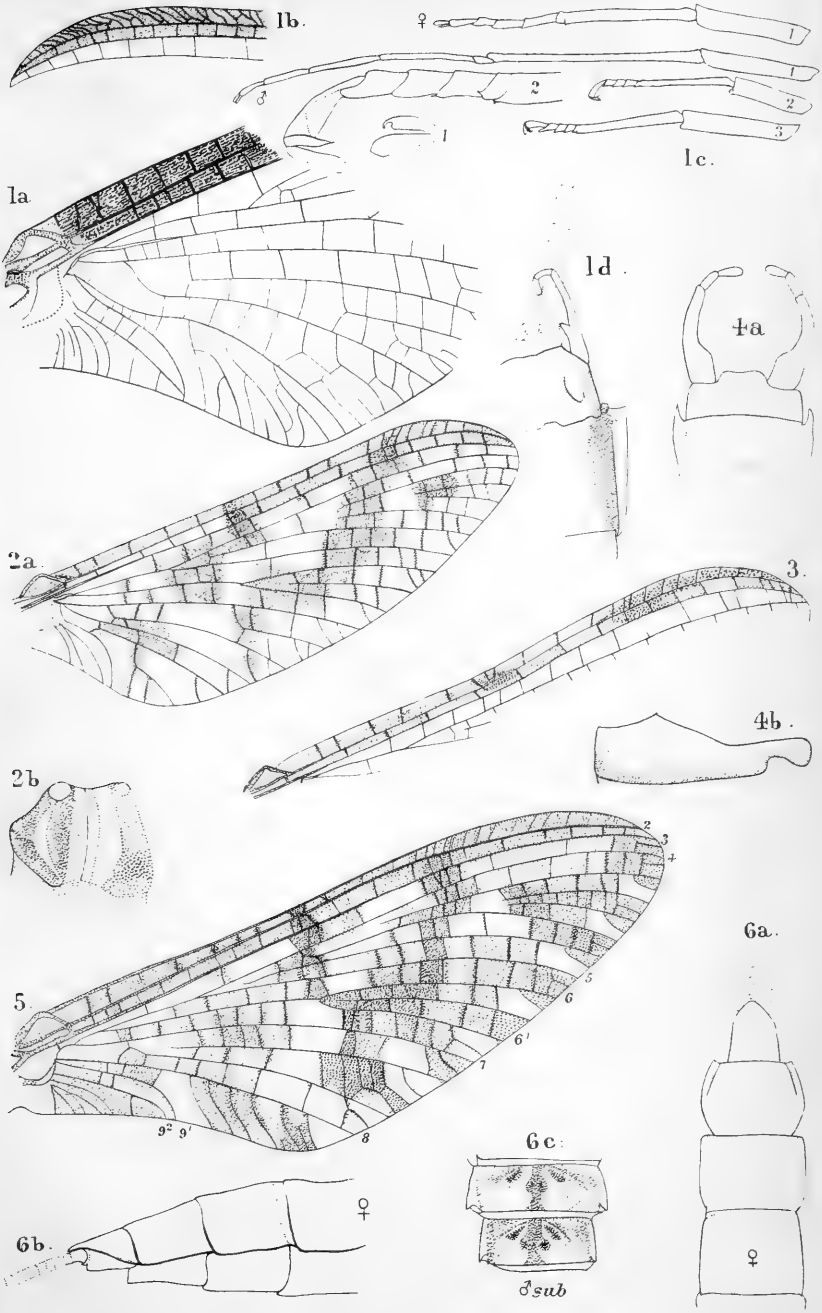
3. . . *A. dentata*:—anterior portion of fore-wing of ♂ imago.

4*a* and 4*b*. *Deleatidium Lillii*:—*a*, forceps of ♂ imago from beneath: *b*, penis from the side.

5. . . *Ameletus ornatus* (?):—fore-wing of ♀ subimago.

6*a* . . *Oniscigaster intermedius*:—posterior dorsal segments of ♀ imago.

6*b* and 6*c*. *O. distans*:—*b*, posterior abdominal segments of ♀ imago, from the side: *c*, ventral markings of 4th and 5th abdominal segments of ♂ subimago.

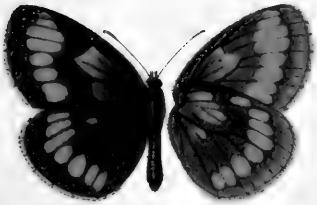


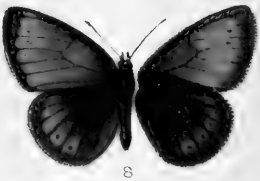
A.E. Eaton del.
R.E. Mintern lith.

Mintern Bros. imp.

Explanation of Plate XI.

Fig. 1. *Erebia maurisius*, ♂.
2. „ „ ♀.
3. „ „ ♂.
4. „ „ ♀.
5. „ *theano*, ♂.
6. „ „ ♀.
7. „ *kefersteini*, var. vel ab.? ♂.
8. „ *kefersteini*, ♂.
9. „ „ ♂.
10. „ „ ♀.





H. Knight ad nat. lith.

West, Newman chromo

BUTTERFLIES FROM THE ALTAI MOUNTAINS

Explanation of Plate XII.

Fig. 1. *Erebia rossii*, var. *ero*, ♂.

2. „ „ ♀.

3. „ „ ab., ♂.

4. „ *fletcheri*, ♀.

5. „ *dabanensis*, ♂.

6. „ „ ♀.

7. „ „ var. vel species nova, ♀.

8. „ „ „

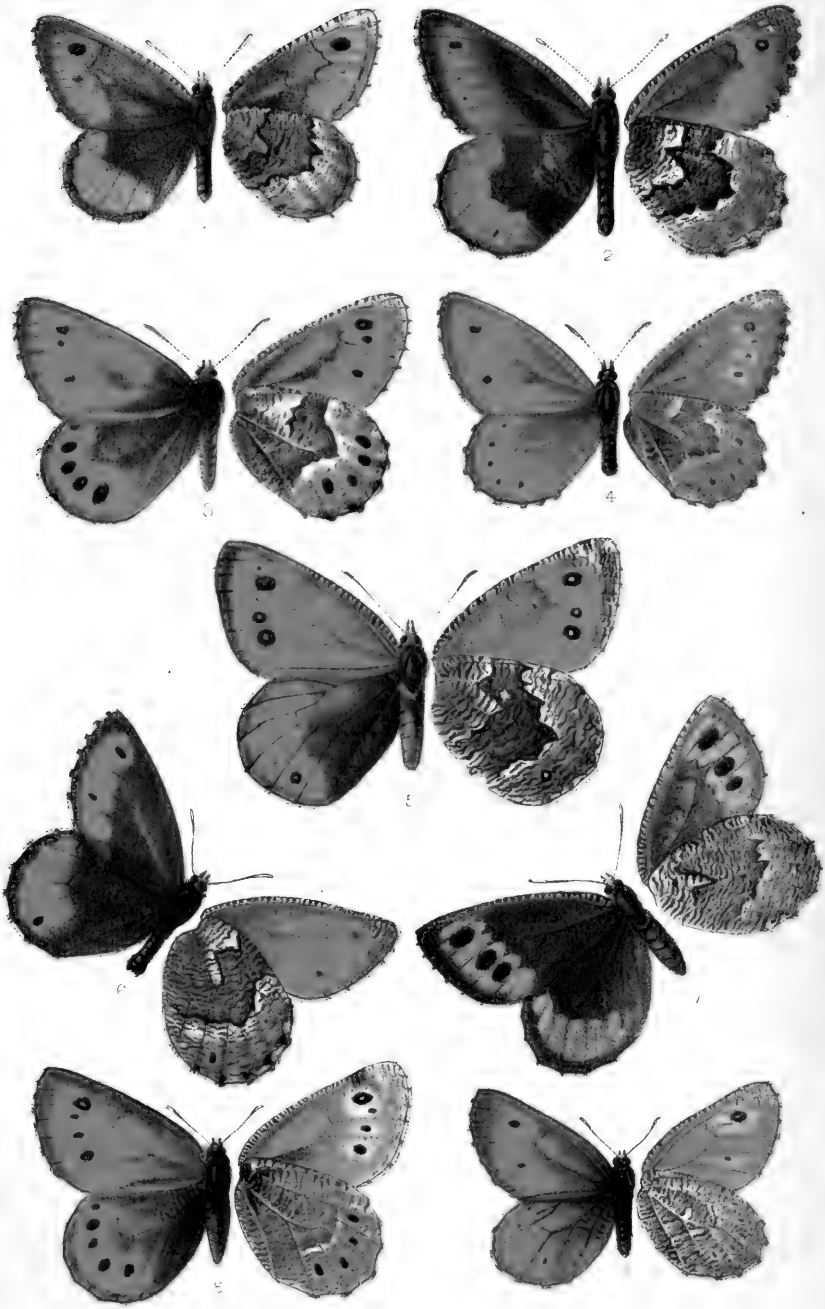
H Knight ad nat lith.

West, Newman chromo

BUTTERFLIES FROM THE ALTAI MOUNTAINS

Explanation of Plate XIII.

Fig. 1. *Œneis mulla*, Stgr.? ♂.
2. „ *norna*, var. *altaica*, ♂.
3. „ *nanna*, ♂.
4. „ „ ab.? ♂.
5. „ *norna*, var. *altaica*, ♀.
6. „ *dubia*, ♂.
7. „ *mulla*, Stgr.? ♀.
8. „ *nanna*, ♀.
9. „ *sculda*, ? ab vel species nova, ♂.



H.Knight ad nat. lith.

West, Newman, imprint

BUTTERFLIES FROM THE ALTAI MOUNTAINS.

Explanation of Plate XIV.

Fig. 1. *Œneis hora*, var. *verdanda*, ♂.
2. „ *bore*, var. *ammon*, ♂.
3. „ *dubia*, ♀.
4. „ *bore*, var. *panza*, ♂.
5. „ *sculda*, ♂.
6. „ *hora*, var. *verdanda*, var.? ♀.
7. „ *bore*, var. *ammon*, ♀.
8. „ *tunga*, ♀.
9. „ *sculda*, ♀.

W. Wright ad nat. lith.

West, Newman, chromo

Explanation of Plate XV.

Fig. 1. *Callipappus farinosus*, adult ♀ side view ; 1 *a*, diagram of section of same ; A, the marsupium ; B, the genital orifice ; C, the larval exit ; D D D, the body cavity ; 1 *b*, posterior view, showing the slit-like larval exit (all natural size) ; 1 *c*, fragments of secretion (enlarged).

2. *Callipappus bufo*, adult ♀ side view ; 2 *a*, posterior view, showing triangular larval exit (both natural size) ; 2 *b*, antennæ of larva ; 2 *c*, end of abdomen of larva (both enlarged).

3. *Callipappus westwoodi*, adult ♀ side view, the ventral, larval exit at *a* (natural size) ; 3 *a*, fragment of secretion (enlarged).

4. *Eriococcus elegans*, adult ♀s *in situ* (× 1.5).

5. „ *cypræformis*, adult ♀s *in situ* (× 2).

6. „ *tricarinatus*, test of adult ♀, dorsal view ; 6 *a*, end view (enlarged).

7. „ *hakeæ*, anal tubercle of adult ♀ (enlarged).

8. „ *apiomorphæ*, „ „ „

9. „ *gurneyi*, filament of immature ♀ (enlarged).

10. *Olliffia eucalypti*, anal tubercles, etc., of adult ♀ (enlarged).

11. *Rhizococcus tripartitus*, adult ♀s *in situ;* 11 *a*, *side view* (× 2) ; 11 *b*, antenna of ♀ (enlarged).

12. *Apiomorpha helmsii*, galls of adult ♀ ; 12 *a*, immature ♀ gall ; 12 *b*, ♀ gall (all natural size).

13. „ *cucurbita*, apex of ♀ gall ; 13 *a*, section of same (natural size).

14. „ *maliformis*, section of apex of ♀ gall (reduced).

15. „ *pomiformis*, „ „ „ „

16. *Sphærococcus tepperi*, social gall (natural size).

17. „ *socialis*, social gall (natural size).

18. „ *tormentosus*, test of adult ♀ (natural size).

19. „ „ antenna of ♀ (enlarged).

20. „ *ethelæ*, twig aborted by attack of (natural size).

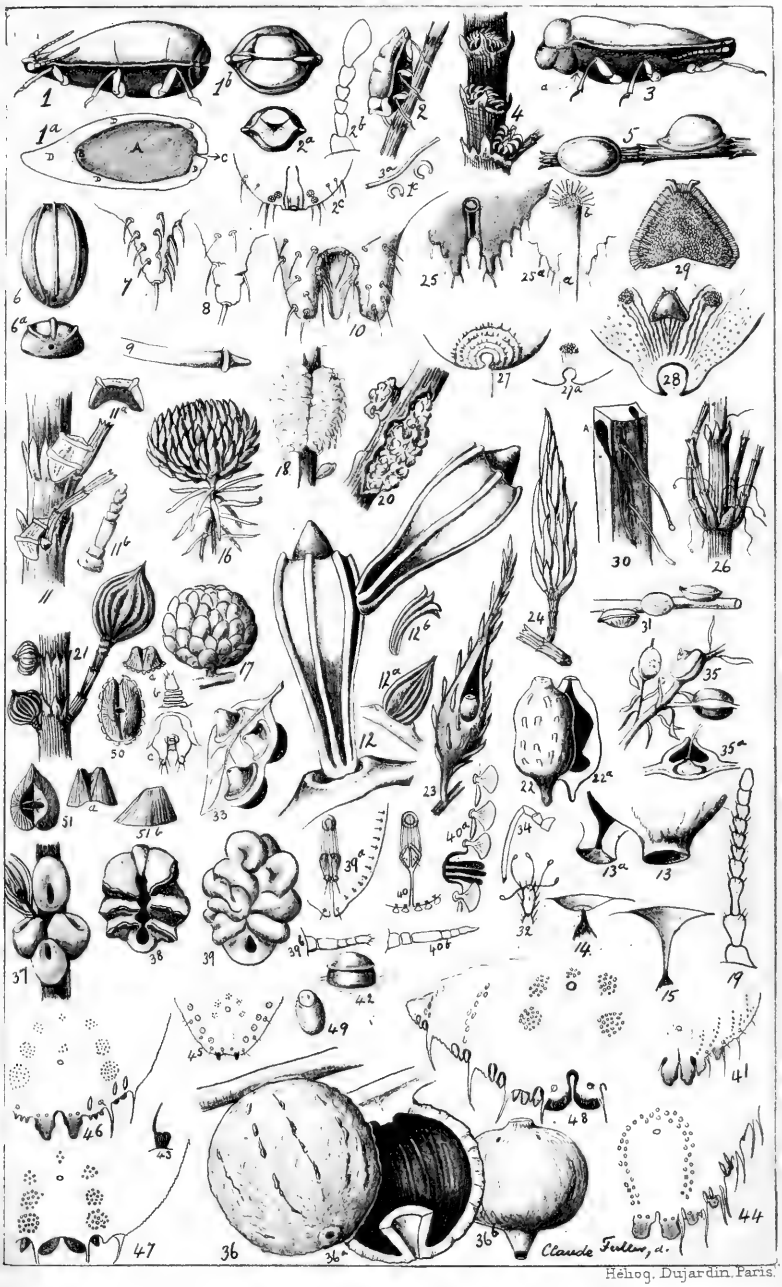
21. „ *leaii*, adult and immature ♀ galls (natural size).

22. „ *morrisoni*, gall of ♀ (natural size) ; 22 *a*, section of same.

23. „ *morrisoni*, var. *elongata*, gall of ♀ (natural size).

Explanation of Plate XV. (*continued*).

24. *Cylindrococcus gracilis*, gall of ♀ (natural size).
25. *Ourococcus casuarinæ*, tubercles of adult ♀; 25 *a*, the same with glassy tube or tail and internal secretory organ at *b*.
26. *Ourococcus casuarinæ*, infested twig showing glassy tails.
27. „ *cobbii*, anal extremity of ♀; 27 *a*, the same with secretory organ and tail indicated (enlarged).
28. „ *eucalypti*, extremity of ♀'s abdomen showing 3 internal secretory organs (enlarged).
29. „ „ central, cordate organ (more enlarged).
30. „ „ section of infested bark, *a* ♀ cavity.
31. *Lecaniodiaspis melaleucæ*, adult ♀s *in situ* (natural size).
32. *Tarchardia melaleucæ*, apical joint of antenna of ♀ (enlarged).
33. *Opisthoscelis conica*, galls of ♀ on leaf (natural size).
34. „ „ leg of adult ♀ (enlarged).
35. *Ascelis melaleucæ*, galls (natural size); 35 *a*, section of gall (enlarged).
36. *Cystococcus echiniformis*, gall of ♀; 36 *a*, section of same; 36 *b*, adult ♀ (natural size).
37. *Lichstensia hakearum*, adult ♀s *in situ* (natural size).
38. *Ceronema banksiæ*, adult ♀ (enlarged).
39. „ *dryandræ*, adult ♀; 39 *a*, end of abdomen; 39 *b* antenna (all enlarged).
40. *Lecanium frenchii*, var. *macrozamiæ*, adult ♀, end of abdomen; 40 *a*, marginal fringe; 40 *b*, antenna (enlarged).
41. *Aspidiotus dryandræ*, pygidium.
42. *Gymnaspis perpusilla*, ♀ scale (enlarged).
43. *Parlatoria dryandræ*, antenna of adult ♀.
44. *Mytilaspis elongata*, pygidium.
45. „ *spinosa*, „
46. *Poliaspis intermedia*, „
47. „ *nitens*, „
48. *Chionaspis ethelæ*, „
49. *Inglisia foraminifer*, var. *loranthi*, adult ♀ dorsal view; *a*, end view (× 2); *b*, antenna; *c*, anal lobes (enlarged).
50. „ *fossilis*, adult ♀ dorsal view; *a*, end view; *b*, side view (× 2).

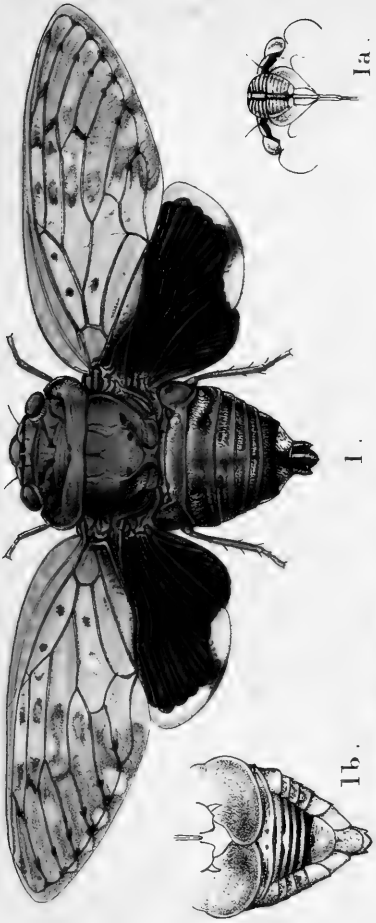


Western Australian Coccidae

Explanation of Plate XVI.

Illustrating Mr. W. L. Distant's paper "Descriptions of four new species of *Cicadidæ*.

Fig. 1. *Platypleura heathi*, n. sp.
2. ,, *andriana*, n. sp.
3. ,, *quanza*, n. sp.



1a.

1.

1b.

2a.

2.

2b.

3b.

3.

3a.

Horace Knight del. et lith.

Mintern Bros Chromo.

New Ethiopian Cicadidæ.

Explanation of Plate XVII.

Illustrating Mr. G. J. Arrow's paper on Sexual Dimorphism in the genus *Parastasia*.

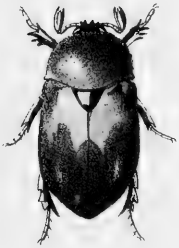
Fig. 1. *Parastasia Pascoei*, Waterh., ♂.
2. „ „ „ ♀.
3. *P. birmana*, Arrow, ♂.
4. „ „ ♀.
5. *P. andamanica*, Ohaus, ♂.
6. „ „ ♀.
7. *P. timoriensis*, Arrow, ♂.
8. „ „ ♀.
9. *P. Percheroni*, Montr., ♂.
10. „ „ ♀.
11. *P. unicolor*, Arrow, ♂.
12. „ „ ♀.

5.

3.

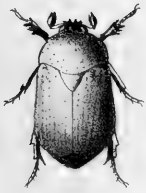
1.

6.



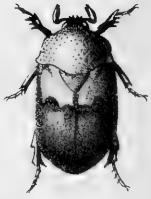
4.

2.



11.

9.



7.

12.

10

8.

F.O.Pickard-Cambridge del. et lith. Mintern Bros. imp.

Sexual Dimorphism in Parastasia.