





SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM

PROCEEDINGS

OF THE

UNITED STATES NATIONAL MUSEUM

VOLUME XXIX



WASHINGTON
GOVERNMENT PRINTING OFFICE
1906



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RICHARD RATHBUN,

Acting Secretary of the Smithsonian Institution.

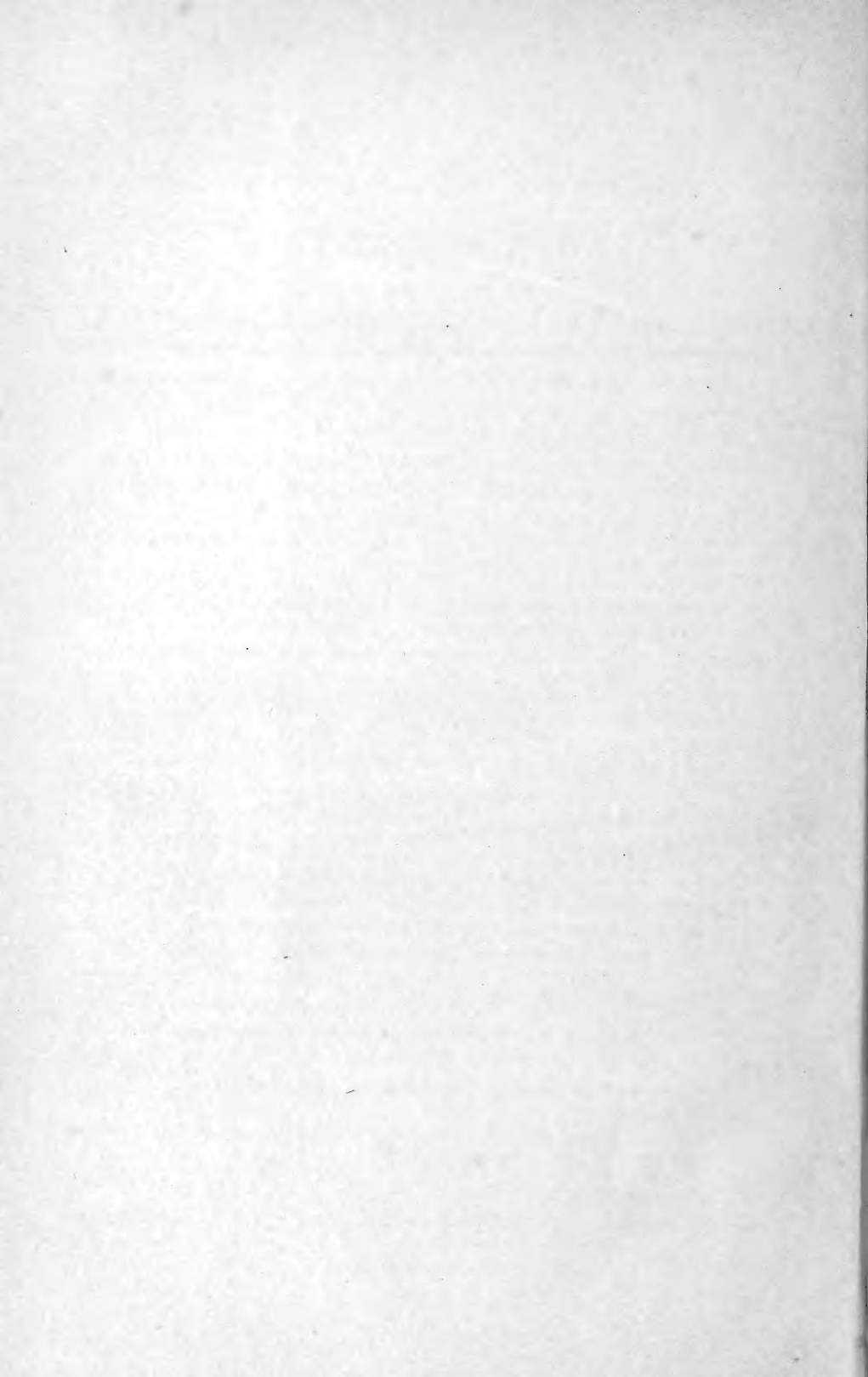


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^a Date of publication.

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New species: *Mammia alutacea*, *Hypermegethes schucherti*, *Eurytania virginiana*, *Eurythmopteryx antiqua*, *Heolus providentia*, *Polycreagra elegans*, *Eubleptus danielsi*, *Metropator pusillus*, *Ænigmatodes danielsi*, *Cumpteroneura reticulata*, *Orthogonophora distincta*, *Bathytaptus falcipennis*, *Palaiotaptus mazonus*, (*Palæodictyopteron*) *mazonum*, (*P.*) *latipenne*, (*P.*) *virginianum*, *Palæotherates pennsylvanicus*, *Adiapharsia ferrea*, *Hudentomum americanum*, *Hapaloptera gracilis*, *Spaniodera ambulans*, *Gyrophlebia longicollis*, *Metryia analis*, *Progenentomum carbonis*, *Gerarus longus*, *G. danielsi*, *G. angustus*, *Oryzoblattina americana*, *O. latipennis*, *Blattinopsis anthracina*, *Glaphyrophlebia pusilla*, *Eucænus rotundatus*, *Gerapompus schucherti*, *Megalometer lata*, *Polyetes furcifer*, *Polyetoblatta calopteryx*, *Plagioblatta campbelli*, *Schizoblatta alutacea*, *Atinoblatta curvipennis*, *A. reniformis*, *Asemoblatta pennsylvanica*, *A. danielsi*, *Archoblattina scudderi*, *Phoberoblatta grandis*, *Metaxyblatta hadroptera*, *Phyloblatta cassvilleana*, *P. regularis*, *P. abbreviata*, *P. elatior*, *P. dichotoma*, *P. fracta*, *P. arcuata*, *P. mortua*, *P. vulgata*, *P. virginiana*, *P. debilis*, *P. scudderiana*, *P. dimidiata*, *P. rebaptizata*, *P. sellardsii*, *Olethroblyblatta americana*, *Stygetoblatta latipennis*, *Metachorus striolatus*, *Oryzoblatta alutacea*, *Sysciophlebia whitei*, *S. scudderi*, *S. hybrida*, *S. sellardsii*, *S. lawrenceana*, *S. affinis*, *S. schucherti*, *S. pieta*, *S. adumbrata*, *S. rotundata*, *S. nana*, *S. obtusa*, *S. acutipennis*, *S. fenestrata*, *Syscioblatta obscura*, *S. anomala*, *S. minor*, *S. steubenvilleana*, *S. misera*, *Spiloblattina perforata*, *Arrhythmoblatta scudderiana*, *Atactoblatta anomala*, *Doryblatta longipennis*, *Hemimylacris ramificata*, *Exochomylacris virginiana*, *Orthomylacris analis*, *O. rugulosa*, *O. truncatula*, *O. elongata*, *O. alutacea*, *O. pennsylvanica*, *Anomomylacris cubitalis*, *Stenomylacris elegans*, *Actinomylacris vicina*, *Phthinomylacris cordiformis*, *P. medialis*, *Chalepomylacris pulchra*, *Brachymylacris elongata*, *B. cordata*, *B. rotundata*, *B. mixta*, *Goniomylacris pauper*, *Mylacris sellardsii*, *M. similis*, *M.*

dubia, *Aphelomylacris modesta*, *Sphenomylacris singularis*, (*Mylacridæ*) *pseudo-carbonum*, (*M.*) *carbonina*, *Neomylacris major*, *N. pulla*, *N. paucinervis*, *Pteridomylacris paradoxa*, *Idiomylacris gracilis*, *Poroblattina brachyptera*, *P. lata*, *P. richmondiana*, *Achmavoblatta lanceolata*, (*Blattoidea*) *melanderi*, (*B.*) *schuchertiana*, (*B.*) *sellardsii*, (*B.*) *sellardsiana*, (*B.*) *schucherti*, *Pseudogerarus scudderi*, *Acilologus thoracicus*, *Endoiasmus reticulatus*, *Archimastax americanus*, *Archæologus fulcatus*.

New families: *Hypermegethidæ*, *Lithomantidæ*, *Lycocercidæ*, *Heolidæ*, *Polycreagruidæ*, *Eubleptidæ*, *Metropatoridæ*, *Paoliidæ*, *Æmignatodidæ*, *Spanioderidæ*, *Ædischiidæ*, *Geraridæ*, *Oryctoblattinidæ*, *Æthiophlebuidæ*, *Cheliphlebuidæ*, *Eucanidæ*, *Gerapompidæ*, *Adiphlebidæ*, *Anthracothrennidæ*, *Archimylacridæ*, *Spiloblattinidæ*, *Dictyomylacridæ*, *Neomylacridæ*, *Pteridomylacridæ*, *Idiomylacridæ*, *Neorthroblattinidæ*, *Poroblattinidæ*, *Mesoblattinidæ*, *Diechoblattinidæ*.

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JORDAN, DAVID STARR, and ALVIN SEALE. List of Fishes collected in 1882-83 by Pierre Louis Jouy at Shanghai and Hongkong, China.—No. 1433. December 6, 1905^a 517-529

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———, and JOHN OTTERBEIN SNYDER. A List of Fishes collected in Tahiti by Mr. Henry P. Bowie.—No. 1422. October 7, 1905^a 353-357

New species: *Holocentrus bowiei*.

KLAGES, EDWARD A. On the Syntomid Moths of Southern Venezuela collected in 1898-1900.—No. 1434. January 31, 1906^a 531-552

New genus: *Pseudargyroceides*.

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MACGILLIVRAY, ALEXANDER DYER. A Study of the Wings of the Tenthredinoidea, a Superfamily of Hymenoptera.—No. 1438. February 10, 1906^a 569-654

MILLER, GERRIT S., JR. The Monkeys of the Macaca Nemestrina Group.—No. 1436. February 3, 1906^a 555-563

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- REHN, JAMES A. G. Notes on Exotic Forficulids or Earwigs, with Descriptions of New Species.—No. 1432. December 2, 1905^a 501-515
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- RICHARDSON, HARRIET. Description of a New Species of *Livoneca* from the Coast of Panama.—No. 1430. December 2, 1905^a 445-446
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- RILEY, J. H. A New Subspecies of Ground Dove from Mona Island, Porto Rico.—No. 1418. September 30, 1905^a ... 171-172
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- ROSE, J. N. Five New Species of Mexican Plants.—No. 1427. September 30, 1905^a 437-439
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- . Two New Umbelliferous Plants from the Coastal Plain of Georgia.—No. 1428. October 5, 1905^a 441-442
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- , and H. D. HOUSE. Descriptions of Three Mexican Violets.—No. 1429. October 6, 1905^a 443-444
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- SCHAUS, WILLIAM. Descriptions of New South American Moths.—No. 1420. October 11, 1905^a 179-345
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 New species: *Rothschildia aroma*, *R. roxana*, *Dysdermonia lemoulti*, *Eacles guianensis*, *E. barnesi*, *E. acuta*, *Adelocephala purpurascens*, *A. plateada*, *A. oda*, *A. pelota*, *Sphecosoma abdominalis*, *Bombiloides cincta*, *Gymnelia tarsipuncta*, *Loxophlebia geminata*, *Mesothera ceruleicorpus*, *M. nanum*, *Chrostosoma pellucida*, *Leucotmensis albivittata*, *L. thoracica*, *Cosmosoma thoracicum*, *Pacilosoma respoides*, *Ichoria chrostomides*, *Pseudomya nigrozonom*, *Saurita perspicua*, *S. tricolor*, *Sauritinia dubiosa*, *Macrocneme maroniensis*, *Phaio ceruleonigra*, *Homoneuronia modesta*, *Chrysostola discoplaga*, *Pseudactyltia minor*, *P. unimaculata*, *Cyanopepla perspicua*, *Trichodesma aurimaculata*, *Antaxia meridionalis*, *Ptychotrichos elongata*, *Helvira dolens*, *H. umbrimaculata*, *Eucereon carabayana*, *E. flavicincta*, *E. meruloides*, *E. lemoulti*, *Metaerocea postflava*, *Apocerea sobria*, *Correbia obscura*, *Propyria atroxantha*, *Epectaptera discalis*, *E. umbrescens*, *Celama*

^a Date of publication.

albirufa, *Nola mesographa*, *Roeselia niveicosta*, *R. divisoidea*, *R. polydonta*, *Agylla delicia*, *A. auranticaria*, *A. subrolata*, *A. sancte-johannis*, *Arilonea judaphila*, *Parapatlosia cinderella*, *Pronola fraterna*, *Dipana incerta*, *Eudoliche longa*, *Thyone muricolor*, *T. perbella*, *Hypermerpha marionensis*, *Odozana unica*, *Prepiella convergens*, *Callisthenia angusta*, *Illice abala*, *I. subrubra*, *I. pygmaea*, *I. rubricollis*, *Metabolosia inwards*, *Archabdosia subvada*, *Ascpatesyle submarginata*, *Nodozana bellicula*, *Lycomorhodes epatra*, *Talara ornata*, *T. subcoccinea*, *T. decepta*, *T. unimoda*, *T. diversa*, *T. rugipennis*, *Pavatalara inversa*, *Clemensia brunneomedia*, *C. subleis*, *C. distincta*, *C. inleis*, *C. abnormis*, *Epitalara reversa*, *Diarhabdosia strigipennis*, *Euzeugapteryx speciosa*, *Robinsonia rockstonia*, *R. eranida*, *Idalus rubens*, *I. laurentia*, *I. neja*, *I. flavoplaga*, *I. albicoxæ*, *I. catenata*, *Prun la hieroglyphica*, *Premolis amaryllis*, *Zatrephes arenosa*, *Z. modesta*, *Z. ossea*, *Eupseudosoma aberrans*, *Neavia gnosis*, *N. bella*, *Eriostepta bacchans*, *Amacia consistens*, *Evius albiscripta*, *Parexia methemia*, *Automolis alateria*, *A. ochreatea*, *A. asteroides*, *A. pulverosa*, *A. carinosa*, *A. irrupta*, *A. formosa*, *A. sulfurea*, *A. chrysoptera*, *A. neira*, *A. zonana*, *A. moma*, *A. apicata*, *A. crocopera*, *A. albiplaga*, *A. polystria*, *A. bonora*, *A. ilioides*, *Hypidalia sanguirena*, *Melese castrena*, *M. chiriquensis*, *Glaucostola flarida*, *G. metaxantha*, *G. binotata*, *Hyperthema ruberrima*, *H. coccinata*, *Pachydota ducasa*, *Dialeucias violascens*, *Baritius hæmorrhoides*, *Elysium phantasma*, *Halisidota racema*, *H. marionensis*, *H. apicepunctata*, *Neritis carmen*, *N. coccinea*, *N. gaudialis*, *N. tremula*, *N. maculosa*, *N. chrysozona*, *N. prophæta*, *N. sanguidorsia*, *Emilia melanchnra*, *Hypomolis minca*, *Tessellota apostata*, *Paranerita carminata*, *P. complicata*, *Hyponerita interna*, *H. lucens*, *H. furva*, *H. carinaria*, *H. declivis*, *H. incerta*, *Calledema argenta*, *C. arena*, *C. siva*, *Pronerice (?) cymantis*, *Dyasia viviana*, *Nystalea porgana*, *N. sequora*, *N. marona*, *Heorta carena*, *Ctianopha argentilinea*, *C. serena*, *Proelyniotis joanna*, *Pseudantiora rufescens*, *Marthula griseescens*, *M. castrensis*, *M. hirsuta*, *M. minca*, *Antiopha albolinea*, *Eragisa boera*, *Poresta sericea*, *P. olivescens*, *Lepasta maonica*, *L. maltha*, *L. viridis*, *Tachuda angustipennis*, *T. discreta*, *Eumaschane laura*, *Dasytophia abnormis*, *Farigia magniplaga*, *F. fragilis*, *Hippia salandera*, *Archacia elongata*, *Cerura gonema*, *C. lancea*, *Peroara sylvestris*, *Gopha niveigutta*, *Malupa elongata*, *Salluca psittica*, *Dicentria vallina*, *D. stridula*, *D. palmita*, *D. drucei*, *Notoplusia eugenia*, *N. sabrena*, *Heterocampa lama*, *H. gravis*, *H. infanda*, *H. habilis*, *H. bactrea*, *H. echina*, *H. delira*, *H. foliata*, *H. cariota*, *H. marginalis*, *H. annula*, *H. notabilis*, *H. otiosa*, *H. patricia*, *H. caluna*, *H. poulsoni*, *H. subalbida*, *Malocampa paramaribena*, *M. piratica*, *M. marionensis*, *M. amanthis*, *M. gastrica*, *M. eugenia*, *M. sorex*, *M. tetrica*, *M. gemonia*, *M. spurca*, *M. bromia*, *M. mayeri*, *Rhuda dissona*, *R. geometrica*, *R. minor*, *Talmeca perplexa*, *T. biplaga*, *T. invisita*, *T. scirpea*, *T. pulchra*, *T. consociata*, *Boriza povera*, *Blera nitida*, *B. lauta*, *Chadisa multijida*, *C. (?) cucullioidea*, *Meragisa arida*, *M. arenosa*, *M. submarginata*, *Phastia ochreatea*, *P. umbrata*, *Maschane frondea*, *Rifargia lemoulti*, *R. mistura*, *R. notabilis*, *R. condita*, *R. demissa*, *R. extranea*, *R. merita*, *R. mortis*, *R. occulta*, *R. onerosa*, *R. discrepans*, *R. tulira*, *R. indecora*, *R. litura*, *Lobeza minor*, *Lusura plorabilis*, *Nesebra norema*, *Dylomia ochreatea*, *D. delicata*, *D.*

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SEALE, ALVIN. See under JORDAN, DAVID STARR 517-529

SNYDER, JOHN OTTERBEIN. See under JORDAN, DAVID STARR. 353-357

STEJNEGER, LEONHARD. A New Lizard of the Genus *Phrynosoma*, from Mexico.—No. 1437. February 2, 1906^a 565-567

New species: *Phrynosoma ditmarsii*.

^a Date of publication.

WALCOTT, CHARLES D. Cambrian Faunas of China.—No.

1415. September 6, 1905 "----- 1-106

New genera: *Dorypygella*, *Damesella*, *Anomocarella*, *Pagodia*, *Shantungia*.

New species: *Globigerina* (?) *mantoensis*, *Protospongia chloris*, *Syntrophia orthia*, *Scenella clotho*, *Straparollina circe*, *Platyceras chromus*, *P. clytia*, *P. pagoda*, *Stenotheca* (?) *clivius*, *Hyalithes cybele*, *H. daphnis*, *H. delia*, *Orthotheca cyrene*, *O. daulis*, *O. delphus*, *O. doris*, *Cyrtoceras cambria*, *Agnostus kusanensis*, *Microdiscus orientalis*, *Redlichia chinensis*, *R. finalis*, *R. nobilis*, *Olenoides* (?) *cilia*, *Dorypyge bispinosa*, *D. typicalis*, *D. alator*, *D. alcon*, *Damesella blackvelderi*, *D. bellagramulata*, *D. brevicaudata*, *D. chione*, *Agraulos abaris*, *A. abrota*, *A. acalle*, *A. agenor*, *A. dirce*, *A. divi*, *A. dolon*, *A. dryas*, *Anomocare alcinae*, *A. bergioni*, *A. bianos*, *A. biston*, *A.* (?) *butes*, *A.* (?) *daulis*, *A. daunus*, *A. decelus*, *A. tation*, *A. temenus*, *Anomocarella albion*, *A. baucis*, *A.* (?) *buru*, *A. carme*, *A. chinensis*, *Arionellus agonius*, *A. ajar*, *A. alata*, *Menocephalus acerius*, *M. acis*, *M. admeta*, *M. adrastia*, *M. agave*, *M. belenus*, *M.* (?) *depressus*, *Pagodia lotos*, *P. bia*, *P. dolon*, *P. macedo*, *Pterocephalus asiatica*, *P. busiris*, *Ptychaspis acamus*, *P. cacus*, *P. cadmus*, *P. calchus*, *P. callisto*, *P. calyce*, *P. campe*, *P. ceto*, *Ptychoparia aelis*, *P.* (?) *batia*, *P.* (?) *bromus*, *P. ceus*, *P. constricta*, *P. dryope*, *P. granulosa*, *P. impar*, *P. ligea*, *P. mantoensis*, *P. tellus*, *P. tenes*, *P. titiana*, *P. theano*, *P. tolus*, *P. (liostracus) toxeus*, *P. (liostracus) trogus*, *P. (liostracus) tutia*, *P. (liostracus) thraso*, *P. (proampyx) burea*, *Shantungia spinifera*, *Solenopleura abderus*, *S. acantha*, *S. acidalia*, *S. ageno*, *S. belus*, *S. beroe*, *Dikelocephalus* (?) *baubo*, *D.* (?) *brizo*, *Crepicephalus damia*, *C. magnus*, *Dolichometopus alceste*, *D. deois*, *D. derecto*, *D. dirce*, *Illæmurus canens*, *I. ceres*, *I. dictys*, *Bradoria bergeroni*, *B. enyo*, *B. eris*, *B. fragilis*, *B. sterope*, *B. woodi*.

New varieties: *Acrothete matthewi eryx*, *Stenotheca rugosa chinensis*, *S. rugosa orientalis*, *Orthotheca cyrene dryas*, *Ptychoparia impar*, var. ?

Species undetermined: *Scenella*, *Straparollina*, *Orthotheca*, *Redlichia*, *Menocephalus*, *Ptychaspis*, *Ptychoparia*.

WARREN, WILLIAM. Some New South American Moths.—

No. 1421. October 6, 1905 "----- 347-352

New genus: *Macroprota*.

New species: *Belonoptera sanguinea*, *Brizina neapolitana*, *B. guttulosa*, *Draconia basipecta*, *Iza lilacina*, *Letchena furca*, *Rhodogonia subfusca*, *Striglina brunneata*, *Hemioptisis immaculata*.

^a Date of publication.

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CAMBRIAN FAUNAS OF CHINA.

By CHARLES D. WALCOTT,

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INTRODUCTION.

The presence of Cambrian fossils in China was first announced by Baron Richthofen in 1883.^a

The material gathered by him was studied by Dr. E. Kayser, to whom the brachiopods were intrusted, and by Doctor Dames, who described the trilobites.

Doctor Kayser^b described and named the following brachiopods:

Orthis linnarssoni
Lingulella sp.
L. sp.

Of the above we have identified from the collections of the Carnegie Institution of Washington Expedition to China *Orthis* [*Plectorthis*] *linnarssoni*.

Doctor Dames^c described and named the following trilobites:

<i>Agnostus chinensis.</i>	<i>Conocephalites quadriceps.</i>
<i>Dorypyge richthofeni.</i>	<i>Conocephalites subquadratus.</i>
<i>Anomocare latilimbatum.</i>	<i>Conocephalites typus.</i>
<i>Anomocare majus.</i>	<i>Liostracrus megalurus.</i>
<i>Anomocare minus.</i>	<i>Liostracrus talingensis.</i>
<i>Anomocare nanum.</i>	? <i>Liostracrus.</i>
<i>Anomocare planum.</i>	? <i>Liostracrus.</i>
<i>Anomocare subcostatum.</i>	2 Pygidia, genus and species undetermined.
<i>Conocephalites frequens.</i>	

Of the above we have identified from the collections of the Carnegie Institution of Washington Expedition to China:

<i>Agnostus chinensis.</i>	<i>Anomocare latilimbatum.</i>
<i>Dorypyge richthofeni.</i>	<i>Anomocare minus.</i>
<i>Conocephalites</i> [<i>Ptychoparia</i>] <i>frequens.</i>	<i>Ptychoparia</i> (<i>Liostracrus</i>) <i>megalurus.</i>

^a China, Richthofen, IV.

^b Idem, pp. 34-36.

^c Idem, pp. 3-33.

Doctor Dames compared the Cambrian trilobites with those of Europe, America, and India, and concluded that the trilobitic fauna of Sai-ma-ki and Taling were about the age of the Scandinavian Andrarum limestone and the Potsdam group of North America. He did not find any Chinese species that could be identified with those of Scandinavia and America; but the general appearance of the fauna as a whole was so similar that he said that their equal age may be considered proven.

He further states that the age of the rocks containing *Dorypyge richthofeni* from Wu-lo-pu is probably the same as that of the Quebec group, basing this upon comparisons with species from Utah, which he referred to the genus *Dorypyge*.^a

The collections made by the Carnegie Institution of Washington Expedition prove that *Dorypyge richthofeni* occurs in the central portion of the Chang Hsia formation and is of Middle Cambrian age. Baron Richthofen's means of comparison were with the fauna referred to the Quebec group, which was at that time supposed to be of Lower Silurian (Ordovician) age.

In 1899 M. Bergeron^b described the following Cambrian fossils from some shaly limestones collected in the province of Shangtung, China:

<i>Agnostus douvillei.</i>	<i>Arthrocephalus chauveaui.</i>
<i>Olenoides liblanci.</i>	<i>Dicelloccephalus ? sinensis.</i>
<i>Drepanura premesnili.</i>	<i>Calymmene ? sinensis.</i>

Of the above we have identified the following from the Ku San shale of the section made by Mr. Blackwelder:

<i>Olenoides liblanci.</i>
<i>Drepanura premesnili.</i>
<i>Calymmene ? [Damesella] sinensis.</i>

From the Cambrian formations of Siberia, Dr. F. Schmidt^c described the following fossils:

<i>Agnostus ezekanowskii.</i>
<i>Anomocare paulowskii.</i>
<i>Liostracus maydeli.</i>

This fauna was subsequently reviewed by Edward von Toll,^d who added the following:

<i>Confervites primordialis</i> Born.	<i>Coscinoxyathus corbicula</i> Born.
<i>Archæoxyathus acutus</i> Born.	<i>Coscinoxyathus dianthus</i> Born.
<i>Archæoxyathus aduncus</i> Born.	<i>Coscinoxyathus calathus</i> Born.
<i>Archæoxyathus patulus</i> Born.	<i>Coscinoxyathus campanula</i> Born.
<i>Archæoxyathus proskurjakowi</i> von Toll.	<i>Coscinoxyathus vesica</i> Born.
<i>Archæoxyathus sibiricus</i> von Toll.	<i>Coscinoxyathus elongatus</i> Born.
<i>Archæoxyathus ijizkii</i> von Toll.	<i>Coscinoxyathus irregularis</i> von Toll.

^aChina, Richthofen, IV, pp. 31-33.

^bBull. de la Société Géol. de France, 3 ser., XXVII, p. 499.

^cBull. de l'Acad. Imp. des Sciences de St.-Petersb., 1886, XII, p. 407.

^dMém. de l'Acad. Imp. des Sciences de St.-Petersb., 8th ser., VIII, No. 10.

<i>Coscinoecyathus cf. cancellatus</i> Born.	<i>Microdiscus kochi</i> von Toll.
<i>Spirocyathus</i> , species undetermined.	<i>Microdiscus</i> , species undetermined.
<i>Rhabdocyathus sibiricus</i> von Toll.	<i>Agnostus schmidti</i> von Toll.
<i>Protopharettra</i> , species undetermined.	? <i>Olenellus</i> , species undetermined.
<i>Helminthoidichnites</i> sp.	<i>Dorypyge slatskowskii</i> Schmidt.
<i>Kutorgina cingulata</i> Bill.	<i>Ptychoparia czekanowski</i> von Toll.
? <i>Obolella chromatica</i> Bill.	<i>Ptychoparia meglitzkyi</i> von Toll.
<i>Hyalithes</i> , species undetermined.	? <i>Solenopleura sibirica</i> Schmidt.
<i>Microdiscus lenaicus</i> von Toll.	<i>Bathyriscus howelli</i> Walcott.

In the autumn of 1903 the Carnegie Institution of Washington sent an expedition to China under the direction of Mr. Bailey Willis, with Mr. Eliot Blackwelder as assistant in stratigraphic geology. One of the objects of the expedition was to obtain data of the Cambrian formations and contained faunas for the purpose of comparison, and correlation, if practicable, with the North American sections and faunas. Mr. Willis delegated to Mr. Blackwelder the study of the sections and very largely the collecting of the fossils. It was understood that the collections of Cambrian fossils should be studied by Mr. Walcott and the stratigraphic sections elaborated by Mr. Blackwelder.

A considerable quantity of material was collected and received in Washington in the fall of 1904. The preparation of the specimens for labeling was given to Mr. Henry Dickhaut, with instructions to work them up carefully and secure every species possible from the mass of fragments of trilobites, brachiopods, etc., of which nearly all the specimens of rock are composed. The material when thus prepared was labeled with locality and formation numbers and taken in hand by Miss Elvira Wood, who separated the species and selected and indicated specimens for illustration. I first studied the brachiopods in connection with my systematic study of the Cambrian brachiopoda, and published descriptions of 23 species in 1905.^a Mr. Willis and Mr. Blackwelder informed me that they would like, in July, 1905, a list of all the species in the collections in order to use them in the correlation of the various sections and the discussion of the stratigraphic geology. To meet this request, I made a preliminary study of the fauna, and now publish it in advance of the illustrated report, which will not be ready to go to the printer before the spring of 1906. Many drawings have been prepared, but it will require several months to complete them.

In this preliminary study a number of free cheeks and pygidia of trilobites have been passed over, as the time available before I go to the field is not sufficient for the extended examinations and comparisons needed for a final paper.

The large fauna discovered in the reconnaissance made by Messrs. Willis and Blackwelder is an indication of the richness of the Cambrian faunas of eastern Asia, and of the great results that may be

^aProc. U. S. Nat. Mus., XXVIII, 1905, pp. 227-337.

expected when systematic, thorough exploration and collecting is undertaken. The following is a synopsis of the fauna as now known:

Name.	Genera.	Species.
Protozoa.....	1	1
Porifera.....	1	1
Brachiopoda.....	13	29
Gastropoda.....	4	8
Pteropoda.....	2	8
Cephalopoda.....	1	1
Trilobita.....	25	118
Ostracoda.....	1	6
Total.....	48	172

ASSOCIATION OF GENERA AND SPECIES.

In order that the student may be saved the labor of making lists of the species from the various localities, the following lists are inserted. The species given in each list do not all occur in the same layer of rock, but they are from the same band of layers. The number of layers and their thickness will be given in Mr. Blackwelder's report on the detailed sections. The stratigraphic range is limited so as to avoid the commingling of faunas from distinct faunal zones.

The line between the Middle and Upper Cambrian faunas is placed at the top of the Ku San shale. The fauna of the Ku San shale includes species of *Damesella*, *Dorypyge*, and genera that are typical of the Middle Cambrian fauna, while the fauna of the Chao Mi Tien limestone, above the Ku San shale, is more nearly related to that of the Upper Cambrian of North America and northwestern Europe.

The line of the Lower Cambrian is placed at the top of the Man To formation, as the predominant trilobite, *Redlichia*, is more closely related to *Olenellus* than to the trilobites of the Middle Cambrian fauna.

Upper Cambrian.....Chao Mi Tien formation.....	}	Brachiopoda:
		<i>Craniella</i> ?? sp.
		<i>Obolus matinalis</i> , <i>O.</i> sp.
		<i>O.</i> (<i>Lingulella</i>) <i>damesi</i> .
		<i>Syntrophia orientalis</i> , <i>S. orthia</i> .
		<i>Plectorthis doris</i> , <i>P. kayscri</i> , <i>P. limarssoni</i> , <i>P. pagoda</i> .
		<i>Billingsella pumpellyi</i> .
		Gastropoda:
		<i>Scenella</i> , species undetermined.
		<i>Straparollina circe</i> .
		<i>Platyceras clytia</i> , <i>P. pagoda</i> .
		<i>Stenothecha</i> , species undetermined.
		Pteropoda:
		<i>Hyolithes daphnis</i> .
		<i>Orthotheca cyrene</i> , <i>O.</i> , species undetermined
Cephalopoda:		
<i>Cyrtoceras cambria</i> .		
Trilobita:		
<i>Agnostus chinensis</i> .		
<i>Anomocare bergioni</i> , <i>A. bianos</i> .		
<i>Anomocarella baucis</i> , <i>A. carme</i> .		
<i>Menocephalus</i> (?) <i>depressus</i> .		

- Upper Cambrian.....Chao Mi Tien formation.....
- Trilobita—Continued.
Pagodia bia, *P. dolon*, *P. tolos*, *P. macceo*.
Pterocephalus basiris.
Ptychaspis acamus, *P. caeus*, *P. cadmus*, *P. calchas*, *P. callisto*, *P. calyce*, *P. campe*, *P. octo*.
P. sp.
Ptychoparia (?) *batia*, *P. dryope*.
P. (Proanopyx) burea.
Solenoptera betus, *S. beroc*.
Dikelocephalus (?) *baubo*, *D. (?) brizo*.
Ilkenurus caneus, *I. ceras*, *I. dictys*.
- Brachiopoda:
Obolus (Westonia) blackwelderi.
Dicellomus parvus.
Acrothele minuta.
- Gastropoda:
Straparollina, species undetermined.
- Middle Cambrian....Ku San formation.....
- Trilobita:
Agnostus chinensis, *A. kusanensis*.
Redlichia finalis, *R. species undetermined*.
Olenoides (?) *cilia*.
Dorypyge leblanci.
Damesella chione, *D. sinensis*.
Drepanura prenesnili.
Ptychoparia (?) *bromus*, *P. ceus*, *P. tenes*.
Shungtungia spinifera.
- Foraminifera: *Globigerina* (?) *mantocensis*.
- Porifera: *Protospongia chloris*.
- Brachiopoda:
Obolus minimus, *O. obscurus*, *O. shensicensis*.
O. (Lingulella) chinensis, *O. (L.) damesi*.
O. (Lingulepis) eros.
O. (Westonia) blackwelderi.
Micrometra labradorica orientalis, *M. pumula ophirensis*.
Dicellomus parvus.
Acrothele mathevi crux, *A. rarus*.
Acrotreta tiani, *A. pacifica*, *A. shungtungensis*.
Obotella asiatica.
Plectorthis limarssoni.
Billingella pumpellyi (?)
- Gastropoda:
Scenella clotho.
Platyceeras chronus.
Stenothecca (?) *clarius*, *S. rugosa orientalis*.
- Middle Cambrian....Chang Hsia formation.....
- Pteropoda:
Hyalithes cybele.
Orthotheca cyrene dryas, *O. dautis*, *O. delphus*,
O. doris.
- Trilobita:
Agnostus chinensis, *A. kusanensis*.
Microdiscus orientalis.
Dorypyge bispinosa, *D. richthofeni*.
Dorypygella alastor, *D. alcon*, *D. typicalis*.
Damesella bellagranulata *D. blackwelderi*, *D. brevicaudata*.
Agraulos abaris, *A. abrota*, *A. acalle*, *A. agenor*,
A. dirce, *A. divi*, *A. dolon*, *A. dryas*.
Anomocare aleimoe, *A. biston*, *A. (?) butes*, *A. dautis*, *A. dunnus*, *A. decclus*, *A. latulimbatum*,
A. minus, *A. tatian*, *A. tenuis*.
Anomocarella albion, *A. (?) burea*, *A. chinensis*.
Arionellus agonius, *A. ajax*, *A. alata*.
Menocephalus acerius, *M. acis*, *M. admcta*, *M. adraslia*, *M. agave*, *M. belemus*, *M. species undetermined*.
Pterocephalus asiatica.
Ptychaspis acamus, *P. sp.*

	Trilobita—Continued.
	<i>Ptychoparia frequens</i> , <i>P. tellus</i> , <i>P. tenes</i> , <i>P. tiana</i> , <i>P. theano</i> , <i>P. tolus</i> .
	<i>P. (Liostracus) megahurus</i> , <i>P. (L.) thraso</i> , <i>P. (L.) toxcus</i> , <i>P. (L.) trogus</i> , <i>P. (L.) tutia</i> .
	<i>P. (Proampyx)</i> sp.
Middle Cambrian.....Chang Hsia formation.....	<i>Solenopleura abderus</i> , <i>S. acantha</i> , <i>S. acidalia</i> , <i>S. aquo</i> .
	<i>Crepicephalus damia</i> , <i>C. magnus</i> .
	<i>Dolichometopus alceste</i> , <i>D. deois</i> , <i>D. denceto</i> , <i>D. dirce</i> .
	Ostracoda:
	<i>Bradoria bergeroni</i> , <i>B. enyo</i> , <i>B. eris</i> , <i>B. fragilis</i> , <i>B. stereope</i> , <i>B. woodi</i> .
	Brachiopoda:
	<i>Obolella asiatica</i> .
	<i>Billingsella pumpellyi</i> (?), <i>B. richthofeni</i> .
	Gastropoda: <i>Stenotheca rugosa chinensis</i> .
Lower Cambrian.....Man To formation.....	Pteropoda: <i>Hyalithes delia</i> .
	Trilobita:
	<i>Redlichia chinensis</i> , <i>R. nobilis</i> .
	<i>Ptychoparia acis</i> , <i>P. constricta</i> , <i>P. granulosa</i> , <i>P. impar</i> var., <i>P. mantoensis</i> .
Pre-Cambrian.....Tai Shan Complex.	

TABLE SHOWING GEOLOGIC AND GEOGRAPHIC DISTRIBUTION OF THE FAUNA.

	Horizons.			Localities.								
	Cambrian.			Near Yen Chuang.	Near Chang Hsia.	Chen Ping Hsien.	Near Chao Mi Tien.	Ting Hsiang Hsien.	Tai An Fu.	Kao Chia Pu.	Hsin Tai Hsien.	
	L.	M.	U.									
FORAMINIFERA.												
<i>Globigerina mantocensis</i> , new species.....		✓		×								
PORIFERA.												
<i>Protospongia chloris</i> , new species.....		×		×								
BRACHIOPODA.												
<i>Obolus malinalis</i> Hall.....			✓						×			
<i>Obolus minimus</i> Walcott.....		✓		×								
<i>Obolus obscurus</i> Walcott.....		✓		×								
<i>Obolus shensiensis</i> Walcott.....		✓		×								
species undetermined.....			×									
<i>Obolus (Lingulella) chinensis</i> Walcott.....		✓		×					×			
<i>Obolus (Lingulella) damesi</i> Walcott.....		✓		×								
<i>Obolus (Lingulepis) eros</i> Walcott.....		×		×								
<i>Obolus (Westonia) blackwelderi</i> Walcott.....		×		×					(?)			
<i>Dicelionus parvus</i> Walcott.....		×		×								
<i>Micrometra labradorica orientalis</i> Walcott.....		✓		✓								
<i>Micrometra pumula ophirensis</i> Walcott.....		×		✓								
<i>Acrothete matthewi eryx</i> , new variety.....		×		×								
<i>minuta</i> Walcott.....		×		×								
<i>parva</i> Walcott.....		×		×					(?)			
<i>Acrotreta liani</i> Walcott.....		×		×						×		
<i>pacifica</i> Walcott.....		×		×								
<i>shangtungensis</i> Walcott.....		×		×								
<i>Cranilla?</i> sp.....			×						×			
<i>Obolella asiatica</i> Walcott.....	×	✓		×	✓	×			×			
<i>Smtrophia orientalis</i> Walcott.....		×		×					×			
<i>orthia</i> , new species.....			×	×					×			

TABLE SHOWING GEOLOGIC AND GEOGRAPHIC DISTRIBUTION OF THE FAUNA—Cont'd.

	Horizons.			Localities.								
	Cambrian.			Near Yen Chuang.	Near Chang Hsia.	Chen Ping Hsien.	Near Chao Mi Tien.	Ting Hsiang Hsien.	Tai An Fu.	Kao Chia Pu.	Hsin Tai Hsien.	
	L.	M.	U.									
TRILOBITA—continued.												
<i>Drepanura premesnili</i> Berg		x		x					x			
<i>Agraulos abaris</i> , new species		x		x								
<i>abrola</i> , new species		x		x	x							
<i>acalle</i> , new species		x		x								
<i>agnor</i> , new species		x		x								
<i>dirce</i> , new species		x		x								
<i>diri</i> , new species		x		x							x	
<i>dolon</i> , new species		x		x								
<i>dryas</i> , new species		x		x								
<i>Anomocare alcinoe</i> , new species		x		x								
<i>bergioni</i> , new species		x		x							x	
<i>bianos</i> , new species		x		x								
<i>biston</i> , new species		x		x								
<i>butes</i> , new species		x		x							x	
<i>daulis</i> , new species		x		x								
<i>daunus</i> , new species		x		x								
<i>declus</i> , new species		x		x								
- <i>ladinbatan</i> Dames		x		x								
<i>minus</i> Dames		x		x								
<i>talian</i> , new species		x		x								
<i>temeus</i> , new species		x		x								
<i>Anomocarella albion</i> , new species		x		x								
<i>baucis</i> , new species		x		x								
<i>bura</i> , new species		x		x								
<i>carne</i> , new species		x		x								
<i>chinensis</i> , new species		x		x								
<i>etes</i>		x		x								
<i>Arionellus agonus</i> , new species		x		x								
<i>ajax</i> , new species		x		x								
<i>alata</i> , new species		x		x								
<i>Menocephalus acerius</i> , new species		x		x								
<i>acis</i> , new species		x		x								
<i>adnata</i> , new species		x		x								
<i>etes</i>		x		x								
<i>adrasia</i> , new species		x		x								
<i>etes</i>		x		x								
<i>agare</i> , new species		x		x								
<i>belenus</i> , new species		x		x								
<i>etes</i>		x		x								
(?) <i>depressus</i> , new species		x		x								
species undetermined		x		x					x			
<i>Pugodlia bia</i> , new species		x		x								
<i>dolon</i> , new species		x		x								
<i>lotos</i> , new species		x		x								
<i>macdo</i> , new species		x		x								
<i>Pterocephalus asiatica</i> , new species		x		x								
<i>etes</i>		x		x								
<i>busiris</i> , new species		x		x								
<i>Ptychaspis acamus</i> , new species		x		x								
<i>cacus</i> , new species		x		x								
<i>cadmus</i> , new species		x		x								
<i>calchas</i> , new species		x		x								
<i>callisto</i> , new species		x		x								
<i>calyce</i> , new species		x		x								
<i>campé</i> , new species		x		x								
<i>cto</i> , new species		x		x								
species undetermined		x		x								
species undetermined		x		x								
species undetermined		x		x								
<i>Ptychoparia actis</i> , new species	x			x								
(?) <i>balia</i> , new species		x		x								
(?) <i>bronius</i> , new species		x		x								
<i>etes</i>		x		x								
<i>ecus</i> , new species		x		x								
<i>constricta</i> , new species		x		x								
<i>etes</i>		x		x								
<i>dryope</i> , new species		x		x					x			

TABLE SHOWING GEOLOGIC AND GEOGRAPHIC DISTRIBUTION OF THE FAUNA—Cont'd.

	Horizons.			Localities.							
	Cambrian.			Near Yen Chuang.	Near Chang Hsia.	Chen Ping Hsien.	Near Chao Mi Tien.	Ting Hsiang Hsien.	Tai An Fu.	Kao Chia Pu.	Hsin Tai Hsien.
	L.	M.	U.								
TRILOBITA—continued.											
<i>Ptychoparia frequens</i> , Dames		×		×							
<i>granulosa</i> , new species	×					×					
<i>impar</i> , new species	×					×					
<i>impar</i> var. ? new variety	×					×					
<i>ligea</i> , new species	×					×					
<i>mantoensis</i> , new species	×					×					
<i>tellus</i> , new species		×		×							
<i>tenes</i> , new species		×				×					
<i>tiliana</i> , new species		×		×	×					×	
<i>thacano</i> , new species		×					×				
<i>tolus</i> , new species		×									×
species undetermined		×								×	
<i>Ptychoparia (Liostracus) megalurus</i> Dames		×									
<i>Ptychoparia (Liostracus) thraso</i> , new species		×		×							
<i>Ptychoparia (Liostracus) toxus</i> , new species		×				×					
<i>Ptychoparia (Liostracus) trogus</i> , new species		×				×					
<i>Ptychoparia (Liostracus) tutia</i> , new species		×				×					
<i>Ptychoparia (Proampyx) burea</i> , new species		×	×	×			×				
<i>Ptychoparia (Proampyx) sp.</i>		×		×							
<i>Shangtungia spinifera</i> , new species		×		×							
<i>Solenopleura abderus</i> , new species		×				×					
<i>acantha</i> , new species		×				×					
<i>acidalia</i> , new species		×				×					
<i>agno</i> , new species		×				×					
<i>belus</i> , new species		×				×					
<i>beroe</i> , new species		×	×	×							
<i>Dikelocephalus (?) bambo</i> , new species			×	×							
<i>Dikelocephalus (?) brizo</i> , new species			×								
<i>Crepicephalus damia</i> , new species		×				×					
<i>magnus</i> , new species		×				×		×			
<i>Dolichomctopus alceste</i> , new species		×		×							
<i>deois</i> , new species		×		×	×						×
<i>derecto</i> , new species		×		×							
<i>dirce</i> , new species		×			×						
<i>Illaenurus canens</i> , new species							×	×			
<i>ceres</i> , new species				×			×				
<i>dictys</i> , new species				×					×		
OSTRACODA.											
<i>Bradoria bergeroni</i> , new species		×						×			
<i>enyo</i> , new species		×						×			
<i>erts</i> , new species		×						×			
<i>fragilis</i> , new species		×						×			
<i>stereope</i> , new species		×						×			
<i>woodi</i> , new species		×						×			

FORAMINIFERA.

Genus GLOBIGERINA d'Orbigny.

GLOBIGERINA (?) MANTOENSIS, new species.

A single specimen of what is probably a species of Foraminifera occurs in a compact gray limestone. It is elongate-oval in shape, convex, and divided longitudinally by a narrow furrow into two lobes, which are marked by more or less irregularly arranged and not very deep depressions at right angles to the central furrow.

Formation and locality.—Middle Cambrian, upper portion of Man To shale formation; 3.2 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PORIFERA.

PROTOSPONGIA Salter.

PROTOSPONGIA CHLORIS, new species.

Of this species only the large primary spiculæ are known. The skeleton is not preserved. The silicious spicules vary in size, but they all appear to be four-rayed. The rays are slender, extending out usually at right angles to each other from the center, but in some specimens one or more of the rays is occasionally slightly diverted from the right angle; they slope slightly downward from the center to their extremities, which gives a low pyramidal form to the spicule; there is no trace of a central, downward-pointing ray on the under side. Each ray has a rounded angle on its upper side; it is slightly angular at the sides and subangular on the lower side. In many examples the narrow rounded ridge of the upper side is exfoliated, leaving a V-shaped groove lengthwise of the ray; the grooves from the four rays unite at the center.

As a result of the exfoliation of the upper side of the ray there appear to be three forms of spicules: First, the complete spicule, as above described; second, a very slender spicule with the rays rounded on the upper side and angular on the lower side; and, third, a spicule having a V-shaped groove on the upper side of the rays.

The spicules above described resemble in general form those of *Protospongia fenestrata* Salter; they differ in the absence of the central ray and the exfoliation of the upper side of the ray.

Formation and locality.—Middle Cambrian, central portion of Chang Hsia formation, in compact gray limestone; at Yen Chuang and 2 miles south and 3 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

BRACHIOPODA.

Genus ACROTHELE Linnarsson.

ACROTHELE MATTHEWI ERYX, new variety.

In form, convexity, and size the ventral valve of the only specimen representing this variety is very similar to the typical forms of *Aerothele matthewi*. The shell is partially exfoliated, and shows the cast of the boss as a small oval pit about the pedicle opening and two narrow vascular sinuses that extend from a point nearly back of the pit, forward and a little outward, about one-third the length of the valve.

The shell is built up of several layers of lamellæ that are smooth and shiny on the interior, except where slightly roughened by slight vascular markings and obscure radiating striæ; the outer surface is dull and marked by concentric striæ and lines of growth and numerous fine, irregular, often anastomosing, elevated lines that give the surface a rough appearance.

The valve is nearly circular, with a diameter of 6 mm. If this shell were associated with *Aerothele matthewi* in the Middle Cambrian rocks of New Brunswick, I should not hesitate to identify it with that species. In the absence of a series of specimens and specimens of the dorsal valve, it is not certain that it is identical with *Aerothele matthewi*. On this account the varietal name is given it.

Formation and locality.—Middle Cambrian, central portion of Chang Hsia formation; 3 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus SYNTROPHIA Hall and Clarke.

SYNTROPHIA ORTHIA, new species.

General form irregularly oval, with the ventral view obtusely angular toward the apex; rounded, biconvex, with a deep mesial sinus at the ventral valve and a strong median fold on the anterior half of the dorsal valve.

Surface smooth with the exception of a few concentric striæ and lines of growth.

The ventral valve has a strong median sinus that occupies about one-third of the width of the valve at the anterior margin and projects forward to fit into the sinus in the front of the margin of the dorsal valve; the sides of the median sinus are elevated, and with the downward curving lateral slopes form a strong, rounded ridge on each side of the sinus; none of the specimens in the collection show the area, but from the profile of the valve it must have been of moderate height with a rather sharp apex curving over it.

Dorsal valve with a minute apex from which a narrow, slightly developed median fold extends out to about the center of the shell, where it becomes elevated and projects forward to the front margin; the remaining portions of the surface are uniformly convex, sloping away from the median fold to the margins of the valve.

Nothing is known of the interior of either valve.

Observations.—In general form this species resembles *Syntrophia primordialis* of the St. Croix sandstone of Wisconsin.^a It differs in its more rounded irregularly oval form and the very large median sinus of the ventral valve.

Formation and locality.—Upper Cambrian. Central portion of Chao Mi Tien limestone, Pagoda Hill, 1 mile southwest of Tai An Fu, and at a somewhat lower horizon two-thirds of a mile west of Tai An Fu, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

GASTROPODA.

Genus SCENELLA Billings.

SCENELLA CLOTHO, new species.

Shell small, moderately convex; apex elongate, slightly eccentric, elevated; aperture irregularly oval; a narrow carina extends from the apex down to the broader end, and several obscure carinae radiate from the apex toward the margin.

Surface marked by fine concentric striae and very fine radiating striae.

The type specimen has a length of 4.25 mm.; greatest width 3 mm.; elevation of apex about 1.5 mm.

This species is clearly distinguished by the broad, elliptical, or subovate form of its aperture and elongated apex; the latter feature is determined from the interior of the shell, which indicates that the apex was situated somewhat nearer the narrower end of the aperture; this feature suggests that if there were perfect specimens representing the species, it might be found to be more nearly related to some forms of *Stenotheca* than to *Scenella*.

Formation and locality.—Middle Cambrian, upper portion of Chang Hsia formation, 1 mile east of Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

SCENELLA, species undetermined.

This species is represented by a cast of the interior of a small, patelloid shell, with an oval aperture measuring 2 by 3 mm. and

^aProc. U. S. Nat. Mus., XXVIII, 1905, p. 292.

having a slightly eccentric elevated apex. It does not appear to be identical with *Scenella clotho*, of the Chang Hsia formation, as the apex is more eccentric and there is no evidence of any carinae.

Formation and locality.—Upper Cambrian, lower portion of Chao Mi Tien formation; Pagoda Hill, 1 mile west-southwest of Tai An Fu, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus STRAPAROLLINA Billings.

STRAPAROLLINA CIRCE, new species.

Shell small, hemispherical, spire depressed and rounded in outline; whorls probably about three; only two are preserved; suture shallow; the whorls are gently and uniformly rounded from the suture down to the more rapid curve to the basal side; as far as can be determined a section of the outer whorl has the form of an ellipse, the narrower parts toward the dorsal furrow and the outer basal margin.

The greatest diameter of the type and only specimen is 3.5 mm.; greatest diameter near aperture 2 mm.; diameter of whorl opposite aperture 1.5 mm.

The surface is marked by concentric elevated lines that extend obliquely backward from the dorsal suture to the base of the whorl, where they are concealed by the matrix. This species differs from *Straparollina remota* Billings in the more rapid expansion of the outer whorl and more elevated spire.

Formation and locality.—Upper Cambrian, lower portion of Chao Mi Tien formation; Pagoda Hill, 1 mile west-southwest of Tai An Fu, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

STRAPAROLLINA, species undetermined.

This form is represented by the lower portion of a single whorl, that is rounded in outline and suggestive of *Straparollina remota*. The greatest diameter across the volution is 6.5 mm., and of the whorl 2.5 to 3 mm.

Formation and locality.—Middle Cambrian, in shales just below the Chao Mi Tien formation, corresponding to the Ku San shales; isolated hills 12 miles S. 80° E. of Tai An Fu, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus PLATYCERAS Conrad.

PLATYCERAS CHRONUS, new species.

Shell minute, consisting of two whorls somewhat irregularly incurved, the inner whorl being on the plane of the dorsal (outer) side; the outer whorl expands rapidly toward the aperture, increasing more on the right ventral (inner) side; a cross section of the outer whorl shows the outer side to be slightly convex and the inner side strongly convex, a rather sharp dorsal angle being formed where the two unite on the outer side.

A narrow, sharp ridge occurs about midway of the outer side of the whorl, that is seen only when the outer surface is very perfectly preserved; in one example the ridge has a narrow depression on the outer side which makes a rather prominent feature of the surface; the striae of growth arch backward to this ridge, indicating a sharp but small dorsal sinuosity in the peristome; on casts of the interior neither the ridge nor the arching backward of the striae is shown.

The surface of finely preserved specimens is marked by concentric lines of growth, a sharp ridge, and one or two very fine, elevated lines subparallel to the ridge.

Greatest diameter of shell 1.5 mm.; dorso-ventral diameter of whorl at aperture 0.75 mm.; lateral diameter 0.5 mm.

This species appears to be most nearly related to *Platyceras primum* Billings. It differs in its stronger dorsal angle and more rapidly expanding outer whorl.

Formation and locality.—Middle Cambrian, central portion of Chang Hsia formation; at Yen Chuang and 2.5 miles south of Yen Chuang; also in cliffs 1 mile east of Chang Hsia, in upper portion of Chang Hsia formation; Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PLATYCERAS CLYTIA, new species.

Shell minute, consisting of about two whorls. Whorls regularly incurved, the plane of the coiling being nearly perfect with the exception of a very slight inclination to the left when looking down upon it from above (dorsally). Outer whorl very minute at origin, increasing slightly for the first half of its turn and then rapidly toward the aperture, which is rounded ovate, being narrowest at the dorsum; a rounded dorsal ridge is formed on the outer whorl by the convex slope of the two sides meeting at the dorsum.

Surface apparently smooth in the half dozen specimens in the collection.

Greatest diameter 2.75 mm.; dorso-ventral diameter of whorl near aperture 1.5 mm.; greatest lateral diameter 1.25 mm.

This species differs from *Platyceras chronus* and *P. pagoda* in the form of the outer whorl, which expands more uniformly and has a broadly ovate section; its form also distinguishes it from *P. primævum*.

Formation and locality.—Upper Cambrian, upper portion of Chao Mi Tien formation, in gray oolitic limestone; Chao Mi Tien, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PLATYCERAS PAGODA, new species.

Shell minute, consisting of about two whorls, of which the inner whorl is very minute and incurved so as to be seen best from the right dorsal or outer side. Whorls regularly incurved, with the plane of the coiling toward the right dorsal side. The section of the outer whorl near the aperture is elongate oval, with the left ventral side somewhat flattened. The outer whorl widens rapidly toward the aperture, especially on the right ventral (inner) side, which gives the outline, when looked at from the dorsal ridge, an oblique, unsymmetrical appearance.

Surface marked by concentric lines of growth which arch backward upon the dorsum, indicating a dorsal sinuosity in the peristome.

Greatest diameter of the shell 2.5 mm.; dorso-ventral diameter of whorl near the aperture 1.75 mm.; greatest lateral diameter not measurable, but apparently not more than one-half the antero-posterior diameter.

This species differs from *Platyceras chronus* in the size of the outer whorl, minute inner whorl, and the absence of longitudinal ridges, features which also distinguish it from *P. primævum* Billings^a and allied forms.

Formation and locality.—Upper Cambrian, lower portion of Chao Mi Tien formation; Pagoda Hill, 1 mile west-southwest of Tai An Fu, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus STENOTHECA Salter

STENOTHECA (?) CLURIUS, new species.

This form is represented by the interior cast of a large, slender, slightly curving shell. The cast has a length of 16 mm., with a diameter where it is broken off at the end of 4 by 5 mm. The largest diameter at the aperture was probably about 10 mm.

^a Can. Nat. and Geol., VI, 1871, p. 220.

The generic reference of this specimen is doubtful, but in the absence of the outer shell it is not possible to determine the generic relations.

Formation and locality.—Upper Cambrian, lower portion of Chao Mi Tien formation; Pagoda Hill, 1 mile west-southwest of Tai An Fu, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

STENOTHECA RUGOSA CHINENSIS, new variety.

In its general form this shell is closely related to *Stenotheca rugosa*; it is, however, more elevated and more broadly oval in outline than the typical forms of *S. rugosa*. The surface is marked by a number of moderate undulations, or low concentric ridges, and numerous very fine concentric striae of growth; with a strong lens fine radiating striae are visible. The type and only specimen in the collection has a longer diameter at the aperture of about 10 mm., with a height of 7 mm. to where the apex is decorticated; at this point the oval section has a length of 2.5 mm., with a width of 1.5 mm. The apex is broken off at a smooth, slightly convex septum.

This specimen is of unusual interest, owing to the presence of a septum toward the apex. In form it resembles most closely *S. rugosa acuticosta* Walcott, but differs from that variety in the presence of rounded instead of acute costae. From *S. rugosa* it differs in being elevated and more or less conical.

Formation and locality.—Lower Cambrian, Man To formation, in a hard, blue-gray limestone, 2.5 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

STENOTHECA RUGOSA ORIENTALIS, new variety.

This variety is founded upon a small, slender shell with a rounded, oval aperture. In form it is between *Stenotheca rugosa acuticosta* and *S. rugosa erecta*, being slender, slightly arched, and cornucopia-like. Surface marked by strong, sharply angular concentric ridges, with broader U-shaped furrows between them, and numerous fine concentric striae. The average length of the shells of this species is 3 mm., with a diameter at the aperture of 1.5 to 1.75 mm.

Formation and locality.—Middle Cambrian, upper portion of Chang Hsia formation; at Chang Hsia and 1 mile east of Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTEROPODA.

Genus HYOLITHES Eichwald.

HYOLITHES CYBELE, new species.

Form an elongate, subtriangular pyramid, gradually and regularly tapering to an acute extremity. The apical angle of the dorsal side is about 15° . Transverse section rounded subtriangular; the ventral angle is rounded and the lateral angles slightly rounded off. Dorsal face moderately convex and curving very slightly from the apex to the anterior, spatulate portion. Ventral face strongly and regularly convex transversely. Aperture oblique, the margin extending on the dorsal side; the peristome on the ventral side is slightly curved forward.

Surface marked by concentric, transverse, more or less obscure lines and striae of growth; the cast of the interior shows on the ventral face three or four obscure longitudinal lines, the central one of which is the strongest.

The largest specimen in the collection has a length of 24 mm., with a width of 7 mm. at the aperture.

The body of the associated operculum is semicircular, moderately convex on the outer side externally, and concave within. The ventral wing as seen on the outside is semicircular-convex, rising toward a point at the center of the transverse side. The dorsal limb is nearly flat, rising, as far as can be determined from a broken specimen, at an angle of about 100° from the plane of the body of the operculum.

In the slope of the sides toward the apex, character of surface, and the transverse section this species may be compared with *Hyolithes princeps* Billings,^a of the Lower Cambrian of Newfoundland, *H. tenuistriatus* Linmarsson, and *H. arenophilus* Holm.^b *H. cybele* is, however, much smaller than the first two species mentioned, and its section is much more convex, both on the dorsal and ventral sides, than that of *H. arenophilus*.

Formation and locality.—Middle Cambrian, central portion of Chang Hsia formation; at Yen Chuang, 2 miles and 2.5 miles south and 3 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China. Also near the top of the Chang Hsia formation at Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

^aTenth Ann. Rept. U. S. Geol. Survey, 1890, pl. LXXVI, figs. 1 to 1 *al.*

^bGeol. Surv. Sweden, Ser. C, No. 112, pl. I, figs. 78-81 and 82-93.

HYOLITHES DAPHNIS, new species.

The type and only specimen of this species in the collection has a length of 26 mm., with a width at the larger end on the dorsal side of 11 mm., and a dorso-ventral thickness of 9 mm. At a distance of 21 mm. from the larger end the smaller end has a width of 5 mm. on the dorsal side. Nothing is known of the outer surface. The section shows a very strongly convex ventral side, with rounded ventral angle; the dorsal side is gently convex, with the lateral angle slightly rounded.

This species is represented by a cast that might have been taken from some of the more convex specimens of *Hyolithes princeps* Billings, of the Lower Cambrian rocks of Newfoundland. It differs from these in the more convex dorsal side.

Formation and locality.—Upper Cambrian, summit of the Chao Mi Tien formation; 2.7 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

HYOLITHES DELIA, new species.

This species is represented by the dorsal side of a single specimen. It resembles the dorsal side of *Hyolithes billingsi* Walcott.^a The dorsal surface is gently convex and is marked on each side, parallel to and a little distance within the margin, by a very shallow groove which outlines a central, more slightly convex area. This specimen is probably the interior cast. It shows a few forward-arching concentric lines of growth. The type and only specimen representing the species has a length of 5 mm., with a width of 1 mm. at the smaller end and 2.25 mm. at the larger end.

From the means of comparison afforded by the single specimen this species appears to be most closely related to *Hyolithes billingsi*. It differs in the more slender tube.

Formation and locality.—Lower Cambrian, in hard, blue-gray limestone, lower part of Man To formation; 2.5 miles south of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus ORTHOTHECA Novak.

ORTHOTHECA CYRENE, new species.

Form, an elongate, slender, subtriangular tube, with the lateral margin rounded, tapering gradually from the base to an acute extremity.

^aBull. No. 30, U. S. Geol. Survey, 1886, p. 134, pl. XIII, figs. 1b, 1c.

Transverse section rounded subtriangular, transverse, and slightly concave toward the center on the dorsal side, rounded at the lateral angles, highly arched on the ventral side, with the ventral angle broadly rounded. Dorsal face of the lateral angles rounded, with a shallow depression, with rounded lateral slopes, a little more than one-third the width of the face. Ventral face strongly and regularly convex transversely, and without any ventral angle. Aperture, as far as known, transverse, at right angles to the axis of the shell. Operculum unknown. Shell of moderate thickness and made up apparently of several layers or lamellæ.

Surface of the shell concentrically or transversely finely striated; a few longitudinal striae may be seen by turning the specimen in the light.

The largest specimen, which is broken off at the apical end, has a length of 9 mm., with a width on the dorsal side at the larger end of 2 mm.; a specimen with a diameter of 3 mm. on the dorsal face has a dorso-ventral diameter of 2 mm.

What appears to be a transverse septum occurs in one of the shells about 9 mm. from the apical end.

The elongate form of the tube and the shallow groove on the center of the dorsal face are not unlike *Hyolithes communis emmonsii* Ford.^a The two species, however, differ in the outline of the transverse section and in the more rapidly expanding tube of *Orthotheca cyrene*. There is a number of species from the Swedish Cambrian, illustrated by Holm, that have the central depression on the dorsal face. Of these *Orthotheca affinis* Holm is most nearly related to *O. cyrene*.

Formation and locality.—Upper Cambrian, upper portion of Chao Mi Tien formation; Chao Mi Tien and 2.7 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ORTHOTHECA CYRENE DRYAS, new variety.

This variety is characterized by having a broader, more shallow furrow on the dorsal face; otherwise it appears to be identical with *O. cyrene*. On some specimens the shallow groove is scarcely perceptible, the face being practically transverse and smooth.

Formation and locality.—Middle Cambrian, central portion of Chang Hsia formation; 2 miles south of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

^aTenth Ann. Rept. U. S. Geol. Survey, 1890, pl. LXXVII, fig. 4b.

ORTHOTHECA DAULIS, new species.

Shell elongate, slender, tapering gradually to an acute point. Transverse section subcircular, slightly flattened on the dorsal side. Ventral face strongly and regularly convex transversely; the dorsal and ventral faces meet to form the rounded lateral angles of the shell, the dorsal face being narrow and slightly flattened. Aperture transverse, as indicated by the transverse lines of growth.

Surface of the shell smoothed and polished, with only a very few obscure traces of transverse concentric lines of growth.

The largest specimen in the collection has a length of 16 mm., with a diameter at the larger end of 4 mm., and at the smaller end, where it appears to be broken off at a transverse septum, of 1.25 mm.

This species resembles, in its slender tube and nearly circular section, *Orthotheca communis* Billings.^a It differs in expanding a little more rapidly toward the larger end and in its smooth surface. It may be compared with *Orthotheca stylus* Holm, except that it does not have the curvature of that species nor the cancellated surface. Its slender tube and nearly circular section are much like those of *Orthotheca tervetinsculus* Linnarsson,^b as illustrated by Holm in his memoir on Hyolithidæ.

Formation and locality.—Middle Cambrian, lower portion of Chang Hsia formation, in gray oolitic limestone; 50 feet below base of cliffs, Chang Hsia; also central portion of Chang Hsia formation, 2.2 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ORTHOTHECA DELPHUS, new species.

Shell straight, elongate, slender, tapering gradually to an acute point. Transverse section subelliptical, with the dorsal side flattened. Dorsal face gently convex, lateral angles rounded. Ventral face moderately convex. Aperture about transverse, as indicated by the concentric striæ and lines of growth. Shell of medium thickness.

Surface of the shell transversely or concentrically striated by somewhat irregular, raised, sharp, fine, closely arranged striæ; on the rounded ventral side a few slightly oblique, longitudinal, elevated lines occur near the larger end.

The largest specimen has a length of 9 mm., with a width of 1 mm. at the smaller end and 1.75 mm. at the larger end.

There is some variation in the transverse section of the shell owing to the variation in the convexity and flattening of the dorsal face. In some specimens toward the apical end the section is a rather narrow ellipse.

^aTenth Ann. Rept. U. S. Geol. Survey, 1890, pl. LXXVII, figs. 3, 3 a-g.

^bGeol. Surv. Sweden, Ser. C, No. 112, pl. I.

The elliptical section and the fine, raised, transverse striae serve to distinguish this species from any other known to me.

Formation and locality.—Middle Cambrian, central portion of Chang Hsia formation, in limestone nodules at the base of a stratum of green shale, a local phase of the Chang Hsia oolite formation; 3 miles south of Kao Chia Pu and 3 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ORTHOTHECA DORIS, new species.

Shell elongate, slender, and regularly tapering. Transverse section oval or circular; in the type and only specimen the shell is somewhat crushed, which leaves the original form in doubt. The dorsal face appears to have been moderately convex, with rounded lateral angles that pass into the convex, rounded ventral side. Transverse striae and lines of growth indicate that the aperture was probably transverse. Shell apparently strong.

Surface of shell transversely or concentrically marked by lines of growth, with more or less irregular striae between them; in addition there is a finely pitted surface between the striae, and sometimes on them, that gives a very peculiar aspect to the surface under a strong lens.

The fragment representing this species has a length of 7.5 mm., with a transverse diameter at the larger end of 5 mm.

This species is characterized by the peculiar, irregularly pitted surface.

Formation and locality.—Middle Cambrian; collected from river drift rock on gravel bar in the Lan Hö, 1 mile south of Chên Ping Hsien, southeastern Shensi, China, near the extreme southeastern corner of the Province of Shensi, adjoining on Hupeh and Ssuch'uan.

Collected by Bailey Willis and Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ORTHOTHECA, species undetermined.

Fragments of a small, elongate, slender Orthotheca occur in the upper Cambrian. The species has a transverse section much like that of *O. daulis*, except that the dorsal face is much broader, which gives a rounded, subtriangular outline to the section, resembling in this respect *O. cyrene*, but the latter has a shallow groove on the dorsal face which is absent in the fragments under consideration.

Formation and locality.—Upper Cambrian, upper part of Chao Mi Tien formation; Pagoda Hill, 1 mile west-southwest of Tai An Fu, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

CEPHALOPODA.

Genus CYRTOCERAS Goldfuss.

CYRTOCERAS CAMBRIA, new species.

Shell gently curved, laterally compressed. Section ovate, dorso-ventral diameter as compared with the lateral diameter toward the last chamber being nearly as four to three, the greatest lateral diameter being nearer the dorsal than the ventral side; dorsal side more obtusely rounded than the ventral. Septa arching slightly forward from the dorsal side; short, about five in a distance of 2.5 mm. where the shell has a diameter of from 1 to 1.5 mm. Chamber of habitation supposed to be of moderate depth; none of the specimens clearly show the margin of the aperture.

This species is represented by a number of more or less fragmentary specimens. The largest has a dorso-ventral diameter near the aperture of 3 mm., with a length of 7 mm. to where the diameter is 1.25 mm.; chamber of habitation appears to have a depth of 2 mm. The siphuncle in a specimen 2.25 mm. in the dorso-ventral diameter has a diameter of less than 0.2 mm.; it is situated on the dorsal side, and almost reaches the exterior surface of the thin shell, which is somewhat thickened on the dorsal side.

This little shell appears to be a true *Cyrtoceras*. Occurring as it does well down toward the base of the Chao Mi Tien limestone, the fauna of which is of upper Cambrian age, makes it of great interest, as it is the oldest known representative of the genus, and, unless *Volborthella* is considered to be a cephalopod, is the oldest known representative of that class.

Formation and locality.—Upper Cambrian, lower portion of Chao Mi Tien limestone; Pagoda Hill, 1 mile west-southwest of Tai An Fu, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

TRILOBITA.

Genus AGNOSTUS Brongniart.

AGNOSTUS KUSANENSIS, new species.

Cephalic shield moderately convex, a little wider than long, semi-circular in outline, and slightly contracted at the posterior lateral angles; the narrow, rim-like, rounded border is broadest at the front, narrowing toward the postero-lateral angle, around which it curves, and extends about one-fourth the distance across the posterior margin of the head; dorsal furrow well defined on the sides, but rather faint in front of the large posterior lobe of the glabella.

The glabella is formed of a posterior, slightly convex lobe that is little more than one-fourth the width of the head and less than one-half its length; it is marked a little in advance of its center by a small, pointed tubercle; in front of the posterior lobe there is a faintly outlined conical extension of the glabella that differs more or less in form and strength in nearly every specimen of the head; it is usually very obscure; lateral lobes moderately convex and uniting in the front without interruption in the convexity or surface.

The thoracic segments associated with the cephalic and caudal shields have a convex axial lobe with narrow pleural lobes; the axial lobe is divided into a central portion and two lateral portions by narrow furrows, giving the effect of two large oval tubercles between the dorsal furrow and the central portion of the segment; the short pleural lobe is marked by a very narrow pleural furrow a short distance back of its center.

The caudal shield associated with the cephalic shield is slightly shorter in proportion to its width and less convex; it is bordered by a flat, rather broad rim, that is narrow at the front margin, gradually increasing to its greatest width behind, where its inner margin curves inward to form a blunt angle at the point opposite the axial lobe; the front margin is narrow and elevated in front of the lateral lobes and bordered with a narrow, slightly convex, sharply defined axial segment.

Axial lobe about one-third the entire width, moderately convex, and marked on its anterior third by an elongate, slightly elevated tubercle from which on some specimens, but not on others, two very faint grooves extend outward and then curve obliquely backward to the dorsal furrow, the front groove being opposite the apex of the tubercle; in some examples the axial lobe contracts opposite the central tubercle and expands at the frontal margin, where an oblique, very faintly defined furrow outlines a small oval lobe; dorsal furrow narrow and sharply defined all about the central axis; back of the axis it unites and passes back into the furrow within the border; lateral lobes gently convex, usually about the width of the axial lobe near the central portions, narrowing posteriorly, and dying out at the short, shallow furrow at the posterior point of the axial lobe.

Surface of cephalic and caudal shields and thoracic segments minutely punctate.

This species differs from *Agnostus chinensis* Dames, which occurs abundantly in the Chang Hsia formation, in having a short glabella and broader lateral lobes on the cephalic shield, and broader lateral lobes and flat border on the pygidium. It is of the type of and very closely related to *A. parvifrons* Linnarsson, from which it differs in the proportion of the glabella to the length of the cephalic shield and in the flatter margins of the cephalic and caudal shields.

Formation and locality.—Middle Cambrian, upper portion of Chang Hsia formation, 3 miles south of Kao Chia Pu, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus MICRODISCUS (Emmons) Walcott.^a

MICRODISCUS ORIENTALIS, new species.

There is in the collection but a single specimen of the matrix of a portion of the head of this species. This indicates the head to have been semicircular in outline, with a strong, rounded, frontal border, marked by ten or more transverse furrows, very much in the same manner as *M. connexus*. In front of the border there is a very narrow, slightly elevated rim.

Cheeks convex, and sloping from the center toward the narrow, sharp dorsal furrow about the glabella and to the furrow within the border of the head. A very narrow ridge extends just back of the antero-lateral angles of the glabella outward so as to disappear in the furrow within the outer border.

Glabella very narrow in front, gradually widening toward the base, and from the slight indication in the specimen is continued backward in an occipital spine; it is marked by two transverse, lightly impressed furrows, and what may be a faintly impressed occipital furrow.

This species shows characters that occur in two described forms: The border of the head and the occipital spine are much like those of *M. connexus*; the transverse furrows of the glabella recall those of some specimens of *M. speciosus*.

Its occurrence in the Cambrian rocks of China is most interesting.

The fossils associated in the bluish-gray limestone are *Acrotreta shangtungensis*, *Dicellomus parvus*, *Obolella asiatica*, *Obolus shensiensis*, *Hyalolithes*, undetermined fragments of trilobites, and a small ostracod.

Collected by Bailey Willis and Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Formation and locality.—Middle Cambrian.

The type specimen is from dark, bluish-gray, compact limestone, in the river drift of the Lan Hō, near the extreme southeastern corner of the province of Shensi, joining on Hupeh and Ssuch'uan, one mile south of Chên Ping Hsien, Shensi, China.

Genus REDLICHIA Crossman.

Redlichia CROSSMAN, Revue Critique, Paléozoologie, 1902, Sixième Ann., p. 52.

Haferia REDLICH, Mem. Geol. Sur. India, new ser., I, 1901, p. 2.

Not *Haferia* BITTNER, 1895.

^a Bull. U. S. Geol. Surv., No. 30, 1886, p. 152.

Original description by Doctor Redlich: "The head shield is almost semicircular, slightly elevated, possesses movable cheeks and two long cheek-spines. The glabella is cylindrical, slightly contracted toward the middle, provided on each side with four lateral furrows. The palpebral lobes, which surround the glabella in one continuous curve, are completely separate from it and not confluent as in *Olenellus*. The facial sutures are well developed in all the specimens and, in consequence of this, free cheeks are present.

"The suture begins in the first quarter of the external margin (reckoned from the glabella), extends along the eyes, and toward the posterior margin is again directed outward. The fixed cheeks are very narrow, whilst the free cheeks, which are provided with long cheek-spines, are almost double the width.

"Of the thorax only isolated segments are preserved. The axial part is elevated; the pleuræ are grooved (*'pleures à sillon'* of Barande), and end in a backwardly directed spine.

"On the glabella the surface of the test shows fine backwardly directed ridges, which are, however, so fine that they are visible only under the lens. On the thickened margin they are also present, but so much stronger that they can easily be shown in the figure. The cheeks, even when highly magnified, show nothing of the sort, but at most a fine punctation, which, however, is mainly due to the structure of the test."

Doctor Redlich compares this form with the genera *Protolenus*, *Paradoarides*, and *Metatorides*, but does not note its close resemblance to *Zucanthoides* of the Middle Cambrian fauna of Nevada.

In India the type species *R. noetlingi* occurs near the summit of the Cambrian series of formations. In China *R. nobilis* occurs near the base of the Man To formation, not far above the Archean complex. *R. chinensis* is found in the central portions of the Man To formations, and *R. finalis* occurs nearly 1,000 feet or more higher in the section near the top of the Chang Hsia formation. This distribution indicates that *Redlichia* is a Middle Cambrian genus; also that it may be in the upper portion of the Lower Cambrian, but with our present information this is somewhat doubtful, as the fauna of the Man To formation is not distinctly Lower Cambrian.

Genotype.—*Redlichia noetlingi* Redlich.

REDLICHIA CHINENSIS, new species.

This species differs from *Redlichia noetlingi*, the type of the genus from India, in its more conical glabella and smaller anterior lobe of the glabella; otherwise the two forms are very much alike, as far as can be determined by the present means of comparison. From *Redlichia nobilis* it differs in having a proportionately less cylindrical glabella and much larger anterior fixed cheeks.

The stratigraphic range of the species is from the lower to the central portions of the Man To formation.

Formation and locality.—Lower Cambrian. Man To formation. Bluish-gray shaly and thin-bedded limestone, south slope of Man To Shan at Chang Hsia and 2 miles south, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

REDLICHIA FINALIS, new species.

This species is represented by one imperfect head, several free cheeks, and several long spines similar to those occurring with *R. chinensis*, which were probably attached to a segment of the thorax as in *Zacanthoides typicalis* Walcott.^a The fragment of the head indicates an almost cylindrical glabella and elongate eye lobe; the free cheek indicates a shorter anterior fixed cheek than that of *R. nobilis*. The material representing this species is imperfect, but the fact that it occurs near the top of the Chang Hsia limestone, 1,000 or more feet above *R. chinensis* and *R. nobilis*, in a strongly marked Middle Cambrian fauna, makes it desirable to give the form a specific name. It probably approaches the type of the genus *R. noetlingi* from India more closely than the other two species from China.

Formation and locality.—Middle Cambrian. Lower portion of Ku San formation. Shaly limestone. Two miles south-southeast of Kao Chia Pu, Shangtung, China.

REDLICHIA NOBILIS, new species.

This species is closely related to *Redlichia noetlingi*; it differs in the form of the posterior segment of the glabella and the somewhat less cylindrical form of the glabella.

From *Redlichia chinensis* it differs in its less tapering glabella and shorter anterior fixed cheeks.

As far as known, it occurs only in the lower portion of the Man To formation.

Formation and locality.—Lower Cambrian. Man To formation, in a hard bluish-gray limestone. Southeast slope of Hu Lu Shan, 2½ miles south of Yen Chuang, Hsin Tai, Shangtung, China.

REDLICHIA, species undetermined.

A large free cheek and two thoracic spines, much like those found with *R. chinensis*, are all that is known of this species. The angle of divergence of the lateral spine is much greater than in other species, and the stratigraphic horizon is higher in the section.

^a Bull. U. S. Geol. Surv., No. 30, 1886, pl. xxv, fig. 2.

Formation and locality.—Middle Cambrian. Shaly limestone in upper portion of Ku San shale, 2.5 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus OLENOIDES Meek.

OLENOIDES (?) CILIX, new species.

This species is founded on a pygidium that is semicircular in outline, moderately convex, and with a spinose margin. Axis moderately convex, conical, with a broadly rounded posterior end. It is divided by three clearly marked, transverse, rounded furrows into a strong anterior ring, next to the thorax, two moderately convex rings, and a long terminal portion, which has a slight fourth depression, indicating a fourth ring. The posterior portion of the axis slopes rather rapidly down to the margin. Owing to an abrasion, the presence or absence of the nodes usually present at the end of the axis can not be determined.

Dorsal furrow rounded and shallow.

Pleural lobes flat for a short distance from the axis, and then curve gently downward to the border. They are marked by a deep anterior furrow within the narrow, anterior, elevated margin and three furrows that terminate at the margin. The furrows outline three rather broad, slightly convex segments and a posterior area opposite the postero-lateral angle of the axis. The border is practically a continuation of the slope of the segments and furrows of the pleural lobe. It is marked opposite the segments by five short, backward-pointing, flat, broad spines, and diagonally opposite the lateral angle of the axis by two long, strong, backward-extending spines. In addition, there are two short spines with broad bases back of the axis between the two long spines.

Outer surface unknown, as the crust has been removed by abrasion or solution.

The type and only specimen of the pygidium has a length of about 12 mm., with a width at the front margin of 19 mm.; the axis has a length of about 9 mm., with a width in front of 6 mm. and at the terminal segment of 3.5 mm.

This species is characterized by the two long posterior spines and the short backward-extending lateral spines; the latter spines are essentially of the type occurring on the pygidium of *Peltura* and *Protopeltura*, but the general character of the pygidium and spines relate it to the group of trilobites here brought together under the genera *Dorypyge*, *Dorypygella*, *Damesella*, and *Olenoides*.

Formation and locality.—Middle Cambrian, in shales corresponding to the Ku San shale formation; isolated hills 12 miles S. 80° E. of Tai An Fu, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus DORYPYGE Dames.

DORYPYGE BISPINOSA, new species.

This species is based on a pygidium having a strong, broad axis, narrow pleural lobes, and two long, strong spines that project obliquely backward from the postero-lateral angle of the pygidium.

The central axis has a length of 10 mm., with a width at the anterior end of 6 mm. and at the posterior terminal lobe of 6 mm., narrowing slightly at the second and third rings; it is divided by three shallow, rounded, transverse furrows into three slightly convex rings and a terminal ring nearly as long as the two posterior rings; there is also a narrow anterior ring that connected the pygidium with the thorax; the terminal ring is convex and slightly overhangs the margin; a node or slight swelling is indicated on each side of the median line where the ring slopes abruptly down to the margin.

Dorsal furrow rounded and somewhat irregular.

Pleural lobes slightly narrower than the axis and arching from the dorsal furrow directly down to the border; the lobes are divided by three broad furrows into an anterior, marginal, elevated rim and two slightly concave segments; a third and posterior segment is indistinctly outlined; the furrows and segments terminate within a slightly thickened border. Three pairs of short spines occur on the border opposite the two anterior segments and frontal rim of the pleural lobe; opposite the faintly defined posterior segment there is a long, strong spine, and from the space between the latter spine and where the dorsal furrow intersects the border there is another longer and stronger spine that extends obliquely outward and backward.

The surface is marked by a few pustules that occur on the elevated portions of the rings of the axis and the pleural lobes; under a strong lens the crust appears to be slightly roughened and apparently minutely punctate.

Dimensions.—Length, 11 mm.; width at the anterior border, 16 mm.; width of axis, 6 mm.; width of pleural lobe at anterior portion, 5 mm.

Observations.—In general outline this pygidium is somewhat like that of *Dorypyge richthofeni* Dames. It differs in the proportionately broader axis, narrower pleural lobes, and the pair of strong spines at the postero-lateral angle.

Formation and locality.—Middle Cambrian, central portion of Chang Hsia formation, in hard, dove-colored limestone; 2 miles south of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

* Genus DORYPYGELLA, new genus.

This genus is founded on the heads and pygidia of a trilobite associated with *Damesella blackwelderi*.

Diagnosis.—Head transversely semicircular, with a truncato-conical glabella, having a postero-lateral lobe in the dorsal furrow and a narrow frontal rim and border, fixed cheeks medium to broad, with relatively large, elevated, palpebral lobes; facial sutures, cutting the anterior rim in front of the anterior base of the eye lobe, extend inward and backward in a slight outward curve to the eye lobe; arching about the eye lobe they extend outward and backward with a sigmoid flexure, cutting the posterior rim within the postero-lateral angle.

Associated pygidia transversely semicircular, axis conical, with two or more rings, marginal border spinose, with the anterior pair of spines, in the type species, very strong.

It may be that some of the pygidia described under *Olenoides* and *Damesella* belong to this genus, but with our present knowledge it would be difficult to identify them.

The genus is characterized by the peculiar glabella, narrow frontal margin, and spinose pygidium. It is assumed that the pygidia associated with the heads belong to the genus, as there is no other associated form to which they could be referred except *Damesella blackwelderi*, and from this the pygidium differs in its short conical axis and the character of the spinose border.

Genotype.—*Dorypygella typicalis*.

The species referred to the genus are: *Dorypygella typicalis* Walcott, *Dorypygella alcon* Walcott, *Dorypygella alastor* Walcott.

DORYPYGELLA TYPICALIS, new species.

Head transversely semicircular, moderately convex. Glabella truncato-conical, with the sides converging gently to the rounded front; three pairs of glabellar furrows are indicated by slight, short depressions at the sides next to the dorsal furrow; back of the posterior pair of depressions a low rounded ridge extends out onto the fixed cheek, forming a low, oval-shaped tubercle or lobe that is apparently the continuation of the postero-lateral lobe of the glabella; a small pit occurs just back of it, from which the occipital furrow starts; the latter is shallow, clearly defined, and extends slightly backward and then forward toward the center; occipital ring of medium width at the sides, broadening out to a somewhat flat, rather strong, segment at the

center; dorsal furrow obscure, and interrupted by the small lobe at the postero-lateral angle of the glabella and by the ocular ridge at its antero-lateral angle.

Fixed cheeks about two-thirds the width of the central portion of the glabella; they rise somewhat rapidly from the dorsal furrow to the palpebral lobe, and slope gently back to the posterior furrow and in front of the ocular ridge rather rapidly to the furrow within the frontal rim; ocular ridges strong and rather prominent; they originate against the antero-lateral angle of the glabella and extend obliquely backward across the fixed cheek and merge into the rim of the palpebral lobe; palpebral lobe elevated above the fixed cheek, prominent, and about one-third the entire length of the head; a shallow groove extends from the thick, strong, broad, elevated rim down to the fixed cheek; postero-lateral limb about as long from the dorsal furrow to its extremity as the length of the glabella and occipital ring; a narrow furrow within the sharp posterior margin gives it an almost concave form; frontal border transverse or slightly incurved; it is elevated, rounded, and separated from the front of the glabella by a narrow sharply defined furrow that extends outward and slightly forward between the rim and the fixed cheeks; it is nearly flat, broad at the center, narrowing toward the facial suture.

The associated free cheek is subrhomboidal in outline, with a narrow rim that is slightly flattened in front, becoming more rounded toward the posterior lateral angle, which has a short, sharp, backward-extending spine; the body of the cheek is slightly convex, rising broadly from the border to the base of the eye lobe; the posterior border is short, being cut a short distance within the postero-lateral angle by the facial suture; facial sutures, cutting the frontal limb, extend directly backward, with a slight outward curve to the eye lobe, around which they curve; back of the eye lobe the sutures continue with a slight sigmoid flexure outward and backward, cutting the posterior margin a short distance within the postero-lateral angle.

The associated pygidium, which is referred to this species, is transversely semicircular, with a short, conical, convex axis. The axis is divided by two narrow, shallow, transverse furrows into two anterior segments and a terminal segment about as long as the two anterior segments. Pleural lobes depressed, nearly flat for a short distance, and then sloping gently down to a narrow, flattened margin; they are marked by three shallow furrows, which separate a strong, anterior, narrow, elevated rim, two slightly convex segments, and a posterior segment at the end of the axis; the furrows and segments stop at the line of the flattened margin, with the exception of the anterior elevated rim, which continues across the margin, and is extended into a strong spine that curves outward and backward; the border is narrow, slightly flattened and transverse, but somewhat incurved posteriorly; it has four or more short, broad, backward-extending spines.

The surface of the central portions of the head is apparently smooth under a strong lens, with the exception of a few scattered, depressed tubercles; the free cheeks have a few irregular, raised, inosculating lines extending from the base of the eye outward toward the rim; the surface of the associated pygidium appears to have a few very minute tubercles that can be seen only with the aid of a strong lens.

Observations.—The transverse front of the head of this species suggests the head of *Conocephalites frequens* Dames, but the glabella is entirely different in form. It differs from *Dorypygella alcon* and *D. alastor* Walcott by the narrower free cheeks and glabella, and the form of the frontal rim.

Formation and locality.—Middle Cambrian. In gray, crystalline limestone; 3.25 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

DORYPYGELLA ALASTOR, new species.

This species is represented by a single specimen of the central portions of a moderately convex head and several associated pygidia that occur at the same horizon as *Dorypygella alcon*.

Head, as indicated by the specimen, transversely semicircular and moderately convex. Glabella broadly truncato-conical, narrowing to the gently rounded front; two pairs of narrow, short furrows extend obliquely inward and backward; the posterior pair outline a rather large postero-lateral lobe, which is confluent with an oval-shaped lobe that interrupts the dorsal furrow and on one side merges into the fixed cheek; a second pair of furrows outlines a small, narrow lobe that is scarcely separated from the fixed cheek by the dorsal furrow; occipital furrow narrow, transverse; occipital ring broken away; dorsal furrow slightly outlined in front and at the anterior lateral angles of the glabella, and practically nonexistent back of that at the sides, owing to interruption by the merging of the lobes of the glabella, and the fixed cheeks.

Fixed cheeks nearly as wide as the anterior portion of the glabella, interrupted by strong, low, ocular ridges that originate at the anterior lateral angle of the glabella and extend obliquely outward and backward to the palpebral lobe; palpebral lobes large, about one-half the length of the head, and rising abruptly from the nearly flat, fixed cheek; their outer margin is broad, rounded, elevated, semicircular, with a deep groove sloping down to the fixed cheek; frontal limb very narrow, merely a rounded ridge between the glabella and the flat frontal rim; to the sides it merges into the strong ocular ridge and downward slope of the fixed cheek in front of the ridge; frontal rim narrow, nearly flat, and rising to the slightly rounded margin.

Surface apparently smooth with the exception of a few small, scattered pustules on the glabella.

At this same locality and horizon, and in limestone of the same character but not in the same hand specimen, there is a number of pygidia which appear to possess characteristics distinct from those of any described species, and which have been referred to *D. alastor*. They are of the same type as those that have been referred to *D. typicalis*. They are transversely semicircular in form, exclusive of the spines on the border. Axis elongate conical, convex, divided by five shallow furrows into five transverse, very slightly convex rings, and a terminal section a little longer than the greatest width of any ring; the terminal section ends somewhat abruptly and slopes rapidly downward to the margin; it is marked at the point where it slopes downward by a small node each side of the center. Dorsal furrow very slight, as the pleural lobes are nearly flat but slightly convex before reaching the margin; the pleural lobes are divided by five shallow furrows into a narrow frontal rim or segment and a posterior obscure segment; the furrows and segments, with the exception of the anterior furrow and segment, terminate at the inner margin of the border; the anterior furrow crosses the border, and the anterior segment is continued out across the border, merging into the anterior spine. Border flat, distinctly defined except opposite the anterior segment, and bordered with a series of marginal spines; these include a long anterior spine, which is a continuation of the anterior margin and a part of the first segment; back of this there are four pairs of short spines which may be considered in a general way as opposite the four anterior segments; the sixth pair of spines project backward; they are long, broad, flat, and opposite the obscure terminal segment of the pleural lobe; between the two large spines, opposite the dorsal furrow at the side of the axis, are two short spines; all of the spines are more or less flat and merge directly into the flat border with the exception of the two anterior, which are connected with the anterior segment and frontal rim.

The surface of the rings and segments is marked by minute granules; otherwise it appears to be smooth under a strong lens.

A specimen 7 mm. in length has a width of 12 mm., exclusive of the spines; axis 3 mm. in width in front, 1.75 mm. at the posterior end; pleural lobe back of the first segment 3 mm. in width.

This species is characterized by the absence of a frontal limb on the head, and the pygidium differs from that of *Dorypygella typicalis* in having a narrow axis, broad, flat margin, and in the arrangement of the spines of the border.

Formation and locality.—Middle Cambrian, central portion of Chang Hsia formation, in hard, gray, fine-grained limestone; 3.25 miles southwest of Yen Chuang, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

DORYPYGELLA ALCON, new species.

This species is represented by a single, somewhat imperfect specimen of the central portions of the head.

Glabella broadly truncato-conical, its width at the base and its length being the same; a pair of short, shallow, posterior furrows occur, which outline a postero-lateral lobe that extends out into and crosses the dorsal furrow; a second pair of furrows is very slightly indicated a short distance in advance of the posterior pair; back of the postero-lateral lobe there is a deep, sharp, narrow furrow on the slope into the occipital furrow; occipital furrow strongly defined, shallow near the center, and deeper laterally; occipital ring unknown; dorsal furrow well defined at the sides in front of the postero-lateral lobe.

Fixed cheeks about as broad as the glabella; they rise rather rapidly from the dorsal furrow to a height slightly greater than that of the glabella, and slope gently backward to the posterior furrow and rather abruptly downward in front of the ocular ridges; ocular ridges broad and rounded; they originate opposite the glabella, somewhat interrupt the dorsal furrow, and extend outward subparallel to the frontal margin of the head to the palpebral lobe; palpebral lobes broken away, but from the configuration of the broken part of the fixed cheek they appear to have been nearly one-half the length of the head and placed on the most elevated portion of the cheek; frontal rim narrow and nearly flat, transverse, and sloping upward from in front of the glabella and the fixed cheeks.

One of the peculiarities of this head is the blending of the ocular ridge and the downward slope of the fixed cheek, so that it appears to be a strong ridge just back of the frontal rim; another peculiarity is the interruption of the dorsal furrow by the ocular ridges and the postero-lateral lobes of the glabella.

The inner surface of the crust is minutely punctate, as shown by the minute papillæ on the cast; this may indicate that the outer surface was finely granulose.

Length of the head, exclusive of the occipital ring, of the type and only specimen, is 6 mm., with a width near the edge of the palpebral lobes of 10 mm.

This species is distinguished from *D. typicalis* by its broader glabella and fixed cheeks and upward sloping frontal rim, and from *D. alastor* by the absence of a frontal limb and the character of the lobes of the glabella. The pygidia, which are referred to *D. alastor*, may possibly belong to *D.alcon*; but from the fact that they are evidently from a different bed of limestone, and that there are no specimens of the head associated with the pygidia, I do not think it best to include them under this species, especially as the head of *D. alastor* and the pygidia appear to be from the same bed of limestone.

Formation and locality.—Middle Cambrian, central portion of Chang Hsia formation, in hard, gray, fine-grained limestone; 3.25 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus DAMESELLA, new genus.

Diagnosis.—General form elongate, ovate, distinctly trilobate, moderately convex. Head transversely semicircular, with the posterolateral angles rounded or spiniferous; the anterior and lateral margins have a thickened or elevated border, within which there is a well-marked furrow. Glabella truncato-conical, marked with two or more pairs of short furrows; occipital furrow strongly defined; occipital ring rounded. Fixed cheeks rather broad. Free cheeks subtriangular in outline, rising with a gentle curvature to the base of the eye lobe; the border is extended into a lateral spine a short distance in advance of where it is cut by the facial suture. Facial suture, cutting the anterior border nearly opposite the base of the inner margin of the palpebral lobe, extends with slight curvature backward to the palpebral lobe; curving about the latter it extends outward and backward, cutting the posterior margin a little in front of the rounded posterolateral angle. Eyes small, elevated, and situated about midway of the glabella.

Hypostoma sub-rhomboidal in outline; central portion strongly convex, elevated, with an irregular border at the back and sides, broadening out in front to a greater width than at the back.

Thorax with twelve or more transverse segments; axis about one-third the width of the thorax, gradually narrowing posteriorly. Pleuræ nearly horizontal, at right angles to the axis out to the point where they curve gently backward before terminating in a falcate extremity; pleural groove long, deep, and broad, starting at the dorsal furrow near the front and extending out on the falcate end.

Pygidium sub-semicircular; axis convex, broadly conical, and divided into four or more rings by transverse furrows; lateral lobes depressed, convex, and divided by furrows into four or more segments; border rounded, and bearing five or more spines on each side.

Surface in the type species granulose.

This genus differs from *Dorypyge*, with which it appears to be most nearly related, in the character of the head; as far as known the thorax and pygidium are essentially of the same type, as far as fragments of *Dorypyge* can be compared with *Damesella*. The pygidium of *Damesella* is of essentially the same type as that of *Olenoides*, and the pleural lobes of the thoracic segments are also of the same type; but the thorax of *Olenoides* has eight segments and a strong median spine on the axis, while the thorax of *Damesella* has twelve or more seg-

ments and is without a median spine; from what is known of the head of *Olenoides* it is probably the same as that of *Dorypyge*.

Genotype.—*Damesella blackwelderi* Walcott.

The species referred to the genus are: *Damesella blackwelderi* Walcott, *D. bellagranulata* Walcott, *D. brevicaudata* Walcott, *D. chione* Walcott, *D. sinensis* Bergeron = *Dicellocephalus?* *sinensis* Bergeron.

The genus *Dinesus* Etheridge, jr.,^a appears to be more nearly related to *Dorypyge* Dames than to *Damesella* or *Dorypygella* Walcott. Its marked characteristics are: the elongate oval glabella, with the small, distinct antero-lateral and postero-lateral lobes; the small palpebral lobes; and the large pygidium with a spinose border. Only one species is known—*Dinesus ida* Etheridge, jr.

Under the definition of Proparia, Dr. C. E. Beecher gives as an ordinal character "Free cheeks not bearing the genal angles,"^b and under Opisthoparia he said "Free cheeks generally separate, always bearing the genal angles."^c In *Damesella* the facial suture cuts the postero-lateral margin outside of the genal angle, so as to leave the genal angle on the fixed cheeks and at the same time the spine corresponding to the genal spine in other genera of the order Proparia on the free cheek. In other characters *Damesella* belongs with the Proparia, and I think that the definitions of the orders Proparia and Opisthoparia need to be modified in relation to the exception made by *Damesella* in the position of the genal angle on the fixed cheek.

DAMESELLA BLACKWELDERI, new species.

General form ovate, moderately convex; distinctly trilobed, the central axis rather strongly convex, and the pleural lobes more or less flattened.

Head transversely semicircular; frontal margin rounded and narrow in young individuals, becoming broader and more flattened with increase in size; it continues around the sides and the postero-lateral angle to unite with the narrowing posterior margin. A postero-lateral spine projects backward and slightly outward from a point on the margin a little in advance of the postero-lateral angle.

Glabella large, truncato-conical in outline, and marked by three pairs of short furrows; the posterior pair of furrows form a rounded pit near the margin and continue obliquely outward as a shallow furrow to the central third of the glabella, separating a short, rounded lobe on each side; the middle pair of furrows are short and very lightly impressed; the anterior pair of furrows are indicated by a short, smooth, narrow space at the anterior fourth of the glabella; occipital furrow of medium width, rounded at the bottom and rather deep; it

^a Proc. Roy. Soc. Victoria, VIII, n. ser., 1896, p. 56, pl. 1, figs. 1-5.

^b Am. Jour. Sci., III, 1897, p. 198.

^c Idem, p. 187.

curves backward slightly at the sides and then arches gently forward at the middle; occipital ring of medium width, curving slightly backward at the ends and forward at the center, rounded on top; dorsal furrow strongly marked all about the glabella, and passing posteriorly into a narrow but well-defined furrow within the posterior margin of the postero-lateral limb; the front of the glabella almost overhangs a strong furrow within the frontal border that separates the frontal border from the fixed cheeks; frontal border or rim strong, rounded, and arching slightly upward in front of the glabella.

Fixed cheeks a little more than one-half the width of the glabella. They slope gently back to the furrow on the postero-lateral limb and rather rapidly downward in front of the palpebral lobe to the furrow within the frontal border. A clearly defined, low, rounded ocular ridge extends opposite the anterior fourth of the glabella to the palpebral lobe, into the rim of which it merges; postero-lateral limb about one and one-third times as long as the width of the glabella at its base, and back of the palpebral lobe about one-third the length of the head; palpebral lobe a little less than one-third the length of the head, elevated at the outer rim, and rather narrow.

The facial sutures cut through the rounded frontal margin of the head obliquely and around backward, passing almost directly to the anterior margin of the palpebral lobe; curving around the rather small eye lobe, they pass obliquely outward and backward, cutting the border of the head a little in advance of the postero-lateral angle.

Free cheeks roughly subtriangular, with the outer margin bordered by a thickened, rounded rim, which gradually increases in width to the base of the long postero-lateral spine. Back of the spine to the facial suture the border narrows rapidly. The body of the cheek rises at a uniform slope to the base of the eye lobe.

Thorax with a convex axis that narrows gradually from the anterior segment, where the width is 15 mm., to the twelfth segment, where it is 12 mm. One specimen preserves twelve segments, with the pygidium, and it may be that other segments are broken off. The segments are nearly transverse, except at the geniculation on the pleural lobes, where the falcate extremities bend slightly backward; pleural lobes flattened three-fourths of the distance out, where they curve slightly downward to the extremities of the pleurae; pleural groove occupying nearly the entire width of the pleura, except near the axis, where it narrows toward the front margin. At the outer extremity it fades out where the pleura curves outward and backward. There is some difference in the strength and width of the pleural groove in different specimens. In some it has practically the same width from the axis out to its extremity, while in others it is narrow toward the axis and not quite as broad through the central portions.

Pygidium large, semicircular; axial lobe divided by four well-

defined transverse furrows, that arch slightly forward, into four moderately convex rings and a somewhat elevated terminal portion which has the appearance of a thickened ring, with a strong node on each side of the center and a slightly defined furrow on its front slope; the terminal ring slopes rapidly downward to the border; lateral lobes broad, slightly convex, and marked by a narrow anterior ring, which joins the thorax, and four strong, rather broad furrows that separate three rings and a broad, obscure terminal ring; two obscure ridges run down the posterior slope of the central axis from the two nodes upon the posterior end of the central axis and terminate in spines on the border; each of the rings of the pleural lobe, including the anterior border, terminates in a long, slender spine, that of the anterior border being much longer than the others; this arrangement gives five spines on each side of the axis and two spines back of the axis; the border is rounded and much interrupted by the strong spines extending out from it.

Surface of the crust minutely punctate under a strong lens, and marked by strong pustules, more or less irregularly arranged on the surface, except in the furrows; on the segments of the thorax the pustules are arranged on the front and back margins of the pleura and on the higher portions of the rings on the axis; on the pygidium the pustules occur on the elevated rings and somewhat irregularly on the pleural lobes, but not on the spines. On some portions of the surface, under a very strong lens, there appears to be an irregular, inosculating, elevated series of lines or striæ interrupting the surface, leaving minute depressions or punctæ between them.

The portion of the thorax preserving twelve segments has a length of 50 mm., with a width at the anterior end of the axis of 16 mm., and on the pleural lobes of 24 mm.; the head of this specimen has a length of 26 mm. and a width of 64 mm., exclusive of the postero-lateral spines.

Observations.—The pygidium of this species is not unlike that of *Olenoides leblanci* Bergeron,^a from China, but it differs in the more depressed axis and in the character of the spines on the border. This conclusion is given after an examination of the figures of M. Bergeron and a comparison of specimens which have been identified as *Olenoides leblanci* from the Ku San shale formation, 2.5 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China, which appears to be the horizon from which the various species described by M. Bergeron were obtained. From *Olenoides marcovi* the pygidium of *Damesella blackwelderi* differs in the same manner as from *O. leblanci*. From *Dorypyge slatskowskii* Fr. Schmidt,^b it differs in the character of the head and the general shape of the pygidium and its spinose border. From

^a Bull. Soc. Géol. de France, 3d ser., XXVII, 1899, p. 46.

^b Mém. Acad. Imp. Sci. St.-Petersbourg, 8th ser., VIII, No. 10, p. 33, pl. II, figs. 1-10.

Olenoides dubia and *Dorypygella alastor* it differs in the slender axis and spinose border of the pygidium.

This is one of the finest of the trilobites collected by Mr. Blackwelder; and owing to the fact that there is a number of specimens of the head and pygidium, and one specimen preserving the head attached to twelve segments of the thorax, it is possible to separate it from the genera *Dorypyge* and *Olenoides* and to establish a generic type, the specimens of which have hitherto been confused with *Dorypyge*. It is not impossible that an entire specimen of *Olenoides leblanci* would prove that species to belong to the genus *Damesella*.

Formation and locality.—Middle Cambrian; central portion of Chang Hsia formation, in gray limestone, 3.25 miles and 6 miles southwest of Yen Chuang, Hsin Tai. In talus, in dark limestone; 2.8 miles and 6 miles southwest, and 2 miles south of Yen Chuang, Hsin Tai, Shangtung, China.

The stratigraphic range given this species is based upon the comparison of specimens that appear to be identical.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

DAMESELLA BELLAGRANULATA, new species.

This species is represented by the central portions of the head, exclusive of the free cheeks. These parts indicate that the head was transversely semicircular and moderately convex.

Glabella truncato-conical, moderately convex, and marked by two pairs of very faintly indicated short furrows; occipital furrow narrow, transverse, clearly defined; occipital ring of moderate width and slightly convex; dorsal furrow clearly defined on the sides of the glabella; frontal border narrow, rounded.

Fixed cheeks of nearly the same width as the glabella opposite the palpebral lobes; they slope up very slightly from the dorsal furrow to the palpebral lobe, and gently backward to the slight furrow within the posterior margin; to the front they curve down rather rapidly to the frontal border; ocular ridge narrow and faintly defined; palpebral lobe a little more than one-fourth the length of the head, rising somewhat abruptly from the plane of the fixed cheeks; postero-lateral limb from the dorsal furrow to its extremity about the same length as the width of the glabella at its base; it is marked by a shallow, narrow furrow some distance within the posterior margin.

The surface is ornamented by rather large, closely arranged pustules that cover the glabella and fixed cheeks; the pustules are larger on the occipital segment and its extension on the postero-lateral limbs and on the frontal border; larger pustules are also scattered on the back portion of the head near the dorsal furrow. Over the spaces between the larger pustules and on the pustules there is a minute

granulation that gives a very highly ornamented surface under a strong lens.

The type and only specimen of the head in the collection has a length of 12 mm., of which the glabella occupies 9 mm.; the width at the outside of the palpebral lobes is 17 mm., and at the ocular ridges 5.5 mm.

The head of this species is much like that of *Damesella blackwelderi* in general form, but it differs in the elevated eye lobes and the peculiarly ornamented pustulose surface.

Formation and locality.—Middle Cambrian, central portion of Chang Hsia formation, in a gray slabby limestone; 6 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

DAMESELLA BREVICAUDATA, new species.

This species is based upon a pygidium that is transversely semicircular in shape, with a short, strong, convex axis. The axis is marked by two anterior transverse furrows and a very shallow posterior furrow, that divide the axis into an anterior ring, that joined the thorax, two faintly defined rings, and a rounded terminal section; the axis rounds down abruptly at its broad posterior end, passing into the margin.

The dorsal furrow is narrow and clearly defined on each side of the axis.

Pleural lobes flat for a very short distance, and then rounding downward to the border; each lobe is marked by an anterior, deep, narrow furrow within the margin, and four strong furrows terminate within the border; they divide the lobes into four elevated segments that merge into the irregular border; from the border fourteen spines project; the anterior spines appear to be the continuation of the anterior elevated margin of the pygidium and the first segment; the second, third, fourth, and fifth spines are opposite the furrows between the segments, and do not appear to be the direct continuation of the segments, although a low ridge from each segment crosses the margin obliquely to them; two spines project back of the axis, and one on each side opposite the dorsal furrow on the side of the axis.

Surface marked by an irregular row of rather large tubercles on the rings of the axis and anchylosed segments of the pleural lobes; under a very strong lens the surface appears to be slightly roughened or minutely punctate.

Dimensions.—Length, 7 mm.; width in front of border, exclusive of spines, 16 mm.; width of axis at anterior margin, 5 mm.

Observations.—This species is characterized by its short, wide, convex, central axis, relatively narrow pleural lobes, and very strong spinose border. It differs from *Dorypyge richthofeni* Dames in its

short, broad axis and the character of the pleural lobes and spinose border.

Formation and locality.—Middle Cambrian; upper portion of Chang Hsia formation, in hard gray limestone; Chang Hsia, Shangtung, China.

DAMESELLA CHIONE, new species.

Of this species there are several well-preserved central portions of the head, free cheeks, and pygidia.

The head is transversely semicircular, moderately convex. Glabella convex, truncato-conical, rounded in front; the length is slightly greater than the width at the base; a posterior pair of glabellar furrows extends inward and obliquely backward a short distance, so as to outline a small, oval, slightly convex lobe at the postero-lateral angles, a second pair of very slightly impressed short glabellar furrows occurs about one-half way between the posterior furrows and the front; occipital furrow narrow, transverse, clearly defined; occipital ring narrow at the sides, increasing in width toward the center, slightly convex and a little elevated at the back; dorsal furrow narrow and distinct.

Fixed cheeks about one-half the width of the glabella at the base and moderately convex; they round up from the dorsal furrow and are nearly flat out to the palpebral lobe, back of the line of which they slope gently to the furrow of the postero-lateral limb and in front more abruptly to the furrow within the front margin; palpebral lobe a little more than one-third the length of the head, narrow, distinct, but not rising above the general level of the fixed cheek; ocular ridge indicated only by a very narrow, smooth line between the anterior end of the palpebral lobe and the dorsal furrow; postero-lateral limb narrow, and extending out a considerable distance to a rather blunt, rounded end; front margin of the head badly preserved; it appears to have been short, rounded, and separated from the glabella and fixed cheeks by a narrow furrow.

Free cheeks subtriangular in outline, with a distinct, narrow, slightly elevated border and a sharp postero-lateral spine; from the base of the spine an inner flattened border originates and narrows to a point below the front of the eye lobe; it is defined by a narrow furrow within the sharp rim and the furrow between it and the central portion of the cheek; it is marked by granules in the same manner as the body of the cheek; the narrowing and disappearance of the flat border, leaving only the narrow rim at the facial suture, indicates that the border in front of the fixed cheeks of the glabella was very narrow; body of the cheek moderately convex, rounding up from the furrow at its base to the base of the strong eye lobe; the facial suture extends with a slightly sigmoid curve from the posterior base of the eye lobe outward and backward to the furrow within the rather broad posterior margin of

the free cheek; it there cuts directly across the lobe, leaving a short portion of the broad margin extending obliquely forward and outward to the base of the postero-lateral spine; in front of the palpebral lobe the facial suture extends forward and slightly outward to the front margin.

There are several specimens of an hypostoma associated with the species that appear to belong to it. The central portion is convex, subovate, and crossed toward the front by a strong furrow subparallel to the rounded front margin; a narrow rim surrounds the front and expands into two ear-like flattened projections opposite the strong furrow crossing the central portion; the margin then contracts so as to leave a narrow, rounded rim opposite the convex portion of the posterior part of the central body; it then expands so as to form a subtriangular limb on each side at the postero-lateral angles of the hypostoma. This hypostoma is of the same type as that of *Damesella blackwelderi*.

The associated pygidium is transversely semicircular, with a spinose margin and convex conical axis. The axis is divided into five rings and a subtriangular terminal portion by five transverse furrows; the two anterior rings are rather convex, while the three posterior are but slightly defined by shallow, narrow, transverse furrows. The pleural lobes are slightly convex out to the geniculation, where the slope is somewhat abruptly downward to the end of the falcate termination of the segment outlined on the lobe; the furrows crossing the axis extend out on the pleural lobes, so as to define a narrow anterior segment and four posterior segments and a central portion extending down from the axis; each of the segments terminates in a falcate, backward-curving, short, flat spine, of which there are six on each side, one for each of the segments and two back of the axis; there does not appear to be any clear indication of a border, as the space is occupied entirely by the segments and their falcate ends.

The surface of the glabella, fixed cheeks, free cheeks, and occipital ring is marked by numerous, rather closely set, depressed pustules, between and on which there are very fine punctæ, as determined by a strong lens. The surface of the pygidium is marked by strong pustules or granules that are thickly set on the segments but not on the furrows. There appears to be considerable difference in the strength and size of the granules on different specimens. This may be simply a matter of the state of preservation, or the amount of wear to which the crust has been subjected, or it may indicate a variety or even a different species.

A head 3 mm. in length has a width of 5 mm. at the exterior of the palpebral lobes, and a width at the base of the glabella of 2 mm.

Observations.—The pygidium illustrated by M. Bergeron and named *Dicelloccephalus ? sinensis*,^a which occurs at this same stratigraphic

^a Bull. Soc. Géol. de France, 3d ser., XXVII, 1899, p. 48.

horizon in China appears to resemble more closely than any other form the pygidium of this species. As illustrated and described by M. Bergeron it differs from *Damesella chione* in its shorter axis, five instead of six spines on the margin, and a smooth instead of granulose surface. *Damesella chione* has a head of essentially the same type as that of *D. blackwelderi*; but the pygidium differs in having its anchylosed segments extending out directly across the border into the falcate spinose ends, instead of stopping within the border and having spines representing the extension of the segments extending outward from the border.

Specimens of *Drepanura* Bergeron and *Agnostus douvillei* Bergeron are associated with *Damesella chione*, and *Ptychoparia ceus* Walcott and *Shangtungia spinifera* Walcott occur at the same horizon and in many instances on the same hand specimen with *D. chione*.

Formation and locality.—Middle Cambrian, Ku San shale formation; 2.5 miles southwest of Yen Chuang, Hsin Tai, and in isolated hills 12 miles S. 80° E. of Tai An Fu, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus AGRAULOS Corda.

AGRAULOS ABARIS, new species.

Glabella and fixed cheeks convex, subrhomboidal in outline and strongly rounded in front. Glabella moderately convex; sides slightly converging; front broadly rounded; surface marked by three short and very slightly impressed furrows; occipital furrow shallow and arching slightly forward at the center. Occipital ring narrow at the sides, gradually increasing in width to the broad base and a strong occipital spine.

Fixed cheeks slightly convex, about half the width of the glabella; between the glabella and palpebral lobes the cheeks are almost flat; posteriorly they slope rapidly downward to the short postero-lateral limbs; in front they also slope rapidly downward and merge into the frontal limb; palpebral lobes small; ocular ridges narrow and faintly defined; frontal limb slightly prominent at the central portions, where it merges into the rounded frontal rim, the line of demarcation between the two being very slightly defined; at the sides the frontal rim narrows and is elevated above the lateral extension of the frontal limb; dorsal furrows very distinctly defined.

Surface apparently smooth under a strong lens, with the exception of very indistinct irregular lines that radiate from the front of the glabella outward across the frontal limb.

The one specimen of this species in the collection has a length of 5 mm. exclusive of the occipital spine. The width at the palpebral

lobes is 5 mm. This species is clearly separated from other forms by its strongly defined glabella and prominent limb, which is formed by the union of the true limb and the frontal margin.

Formation and locality.—Lower portion of Chang Hsia formation near base of oolitic limestone. Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

AGRAULOS ABROTA, new species.

This species is represented by several small heads exclusive of the fixed cheeks. It is closely related to *Agraulos dryas* but differs from it in the greater width, stronger convexity of the glabella and greater downward slope of the frontal margin. The surface is also more minutely punctate than that of *Agraulos dryas*. Largest specimen is a little less than 3 mm. in length.

Formation and locality.—Middle Cambrian. Lower portion of Chang Hsia limestone. In gray oolitic limestone, Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, Carnegie Institution of Washington Expedition to China.

AGRAULOS ACALLE, new species.

Central portions of head, exclusive of free cheeks, moderately convex. Glabella truncato-conical, convex, short, scarcely more than one-half the length of the head, and without traces of furrows; occipital furrow not much more than a depressed line; occipital ring broad, almost subtriangular in outline, and rising at the center to a small node.

Fixed cheeks about as wide as the glabella, strongly convex, and merging into a frontal limb of about equal width and convexity; palpebral lobe minute, situated opposite the central portions of the glabella; postero-lateral limbs short and marked by a narrow furrow parallel to the margin.

Surface smooth under a strong lens. The heads vary in length from 3 to 4 mm. A specimen 3 mm. in length has a width of 2.5 mm. at the palpebral lobes.

Formation and locality.—Middle Cambrian. In gray crystalline limestone, 3.25 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

AGRAULOS AGENOR, new species.

Glabella slightly truncato-conical, strongly convex; occipital furrow rounded, clearly defined; occipital ring slightly convex, subtriangular in outline, narrow at the sides and broadening out to an obtuse spine behind; dorsal furrow narrow and clearly defined.

Fixed cheeks about one-half the width of the glabella, convex, rising from the dorsal furrow and arching down to a small palpebral lobe; the fixed cheeks slope rapidly backward to a short postero-lateral limb, and anteriorly to a rather broad, very slightly convex frontal limb; a rather deep, narrow furrow occurs within the elevated margin of the postero-lateral limb.

Surface minutely punctate under a strong magnifier, the punctæ formed apparently by an irregular network of elevated lines. The only specimen of the head representing this species has a length of 2.5 mm.

Formation and locality.—Middle Cambrian, Chang Hsia formation, about 50 feet below the Ku San formation, in conglomeratoid limestone. Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

AGRAULOS DIRCE, new species.

This species is represented by the central portions of the head, exclusive of the fixed cheeks. The surface is depressed, convex, with the glabella rising but little above the general surface at the front, and but moderately convex at the base.

Glabella truncato-conical, indistinctly defined from the frontal rim and at its base from the occipital ring; without traces of furrows; occipital furrow indicated only by the very slight convexity of the occipital ring.

Fixed cheeks about three-fourths of the width of the glabella; posteriorly they merge into the short postero-lateral limbs and toward the front into the broad, gently convex, frontal limb, which continues uninterruptedly to the anterior margin of the head; palpebral lobes small; ocular ridges indicated by a dropping down of the fixed cheek at the place where the ridges usually occur.

This species recalls the general form of *Agraulos strenuus* Billings; it differs in being less convex, in its broader fixed cheek and short occipital ring. It also differs in its wider fixed cheeks from *Agraulos dolon*, which occurs at about the same geologic horizon.

The largest head in the collection has a length of 11 mm. and the same width at the palpebral lobes.

Formation and locality.—Middle Cambrian. Lower portion of Chang Hsia formation near base of oolitic limestone; 3 miles north-northeast of Hsin Tai Hsien, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

AGRAULOS DIVI, new species.

This species is represented by portions of the central parts of the head. The glabella is convex, truncato-conical in outline, the width at the base and the length being the same; three pairs of glabellar furrows are very slightly indicated; occipital furrow shallow and broad; occipital ring narrow at the sides, gradually widening toward the center, very slightly convex, and without an occipital spine.

Fixed cheeks about as wide as the front end of the glabella and nearly flat opposite the palpebral lobes; posteriorly they slope slightly into a strong groove parallel to the posterior margin, and in front the slope is slight down to a broad, slightly indicated, transverse furrow.

Palpebral lobes unknown, only a trace of the ocular ridge is shown; frontal limb convex, broad, and extending to the frontal margin without any trace of a line of demarcation between it and the frontal rim; a broad, shallow, transverse furrow extends in front of the glabella and outward across the cheeks below and in front of the ocular ridges; dorsal furrow broad and shallow; surface finely papillose under a strong lens. The largest head of the collection has a length of 9 mm.

This species is characterized by its short glabella, broad dorsal furrow, transverse furrow in front of the glabella, and strong frontal limb.

Formation and locality.—Middle Cambrian. Either base of Chang Hsia formation or in passage beds between the Man To formation and the Chang Hsia formation; 3.2 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

AGRAULOS DOLON, new species.

This species is represented by the central portion of the head, exclusive of the free cheeks. The glabella and fixed cheeks are convex, somewhat rhomboidal in outline; glabella convex, narrowing slightly toward the broadly rounded frontal margin; posteriorly it is separated from the occipital ring by a very faint, narrow furrow; there are no traces of glabellar furrows; occipital ring strong, and merged into the broad, subtriangular base of a strong, short spine; dorsal furrows shallow, but sufficiently strong to mark the line of demarcation between the glabella, fixed cheeks, and frontal limb.

Fixed cheeks a little more than half the width of the glabella, rising rapidly from the facial suture and merging into the frontal limb anteriorly and into the short postero-lateral limbs at the back; palpebral lobes small and narrow; ocular ridges broad but faintly defined; they extend from the antero-lateral angle of the glabella outward and slightly backward to where they unite with the palpebral lobe; frontal limb slightly convex from the front of the glabella to the broadly rounded front margin.

Surface apparently smooth. The largest specimen in the collection has a length of 9 mm., exclusive of the occipital spine.

This species strongly suggests *Agraulos strenuus* Billings from the paradoxides zone of Newfoundland; it differs in the form of the frontal limb and border. In *A. dolon* the frontal limb arches gently downward and forward to the margin, while in *A. strenuus* it is nearly flat and slightly convex between the glabella and the margin. The glabella of the latter is also proportionally longer.

It differs from *Agraulos dirce* in its greater convexity, more clearly defined glabella, and strong occipital spine.

Formation and locality.—Middle Cambrian. Lower portion of Chang Hsia formation near base of oolitic limestone; 2.2 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, Carnegie Institution of Washington Expedition to China.

AGRAULOS DRYAS, new species.

Glabella and fixed cheeks convex; rhomboidal in outline. Glabella convex, short, narrowing slightly toward the rounded front, without traces of furrows; occipital furrow broad, very faintly defined; occipital ring very narrow at the sides, broadening out rapidly to a blunt point so as to be almost triangular.

Fixed cheeks about two-thirds the width of the glabella, and sloping slightly downward to the small palpebral lobes which are situated about midway between the posterior and the front margin of the head; back of the palpebral lobe the fixed cheeks slope rapidly to broad, short, postero-lateral limbs; palpebral lobes short; form unknown; ocular ridges not distinguished on the downward slope of the fixed cheeks toward the frontal limb; frontal limb and frontal rim nearly as long as the glabella; very slightly convex and separated from each other by a shallow, slightly defined depression; dorsal furrow shallow but clearly defined.

Entire surface marked by numerous, rather strong, punctæ; also very fine, almost microscopic, irregular, elevated more or less concentric, striæ on the glabella. Length of head 3.5 mm.

This species is represented by one specimen. It is strongly characterized by its punctate surface and general form.

Formation and locality.—Central portion of Chang Hsia formation, near the top of the oolitic limestone; 1 mile west of Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus ANOMOCARE Angelin.

ANOMOCARE ALCINOE, new species.

This species is represented by a single specimen, preserving the anterior portions of the central part of the head, exclusive of the free cheeks. These parts indicate that the head was large, moderately convex, and longitudinally quadrilateral, exclusive of the free cheeks.

Glabella slightly convex, rising gently from the dorsal furrow toward the center; faint indications of three pairs of glabellar furrows are shown by reflected light over the smooth surface; sides subparallel to the rather broadly rounded front; occipital furrow and ring unknown.

Fixed cheeks about one-half the width of the glabella, nearly flat opposite the palpebral lobes, and sloping gently to the frontal limb, into which they merge in front of the palpebral lobe; the ocular ridge, starting just back of the antero-lateral angle of the glabella, extends obliquely out to the narrow palpebral lobe; frontal limb nearly flat; it slopes gently from the glabella and palpebral lobes to a raised line which separates it from the broad, slightly concave frontal rim.

The surface appears to be smooth under a strong lens.

An associated pygidium has a broad planulate margin and convex axis, with slight indications of about six segments. The most nearly related form from China is *A. decelus*. In the latter form the frontal rim is slightly convex, while in *A. alcinoe* it is slightly concave.

Formation and locality.—Middle Cambrian, upper portion of the Chang Hsia formation, in limestone nodules; 3 miles south of Kao Chia Pu, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ANOMOCARE BERGIONI, new species.

Head, exclusive of the free cheeks, longitudinally sub-quadrilateral, convex. Glabella truncato-conical, moderately convex, and marked in the cast by two pairs of glabellar furrows; also a low, rounded, median ridge; sides slightly arched outward opposite the palpebral lobes; front broadly rounded; occipital furrow deep, rounded, and arching forward slightly at the middle; occipital ring narrow and rising at the center to form the base of a rather strong spine; dorsal furrow strong at sides and less so at the front.

Fixed cheeks very narrow, forming little more than a convex ridge between the dorsal furrow and the furrow within the palpebral lobe; they slope rapidly to the front, merging into the frontal limb, and posteriorly downward to a very short postero-lateral limb; palpebral lobes narrow, about one-third the length of the head; ocular ridge low and merging into the rim of the palpebral lobe; frontal limb short and sloping downward to a slightly convex frontal rim that is about twice as wide as the frontal limb in front of the glabella; the line of demarcation between the frontal limb and rim is little more than a change in direction of the slope, the slope of the rim being less.

The outer crust is exfoliated over most of the head. Where preserved, the outer surface is smooth under a strong lens. The length of the head of the type specimen is 12 mm.; the glabella, exclusive of the occipital groove, 6 mm.; frontal limb, 1 mm.; frontal rim, 2 mm.

This species is doubtfully referred to the genus *Anomocare*, as the glabella does not have the parallel sides so characteristic of that genus and the palpebral lobes are rather short. The reference to *Anomocare* is based on the character of the frontal rim, narrow fixed cheeks, and the general configuration of the glabella.

Formation and locality.—Upper Cambrian, Chao Mi Tien formation, in coarse, gray limestone; 9 miles north of Hsin Tai Hsien, Shantung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ANOMOCARE BIANOS, new species.

This species is represented by a portion of the glabella and the frontal limb. The glabella appears to have been quadrilateral in outline, broadly rounded in front, and moderately convex. It is marked in the cast of the interior by very slight traces of three pairs of short glabellar furrows and a very slight, narrow, median ridge; dorsal furrow shallow, but well marked; frontal limb nearly flat for a distance of 2 mm. in front of the glabella, where it curves downward at an angle of about 45° for a distance of 3.5 mm. It is quite probable that at the angle between the flat portion and the sloping front there was some indication on the outer crust of a division between the two parts; if so, the shorter inner portion would be the frontal limb, and the sloping outer portion the flat frontal rim. Exterior surface unknown.

This species is very clearly characterized by the form of the frontal limb.

Formation and locality.—Upper Cambrian, upper portion of the Chao Mi Tien formation, in a hard gray limestone; 2.7 miles southwest of Yen Chuang, Hsin Tai, Shantung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ANOMOCARE BISTON, new species.

This species is represented by some fragments of the central portion of a head. Glabella moderately convex, subquadrilateral in outline, narrowing slightly toward the broadly rounded, almost transverse front; surface marked by three pairs of slightly impressed short furrows; occipital furrow rounded, distinctly marked, transverse; occipital ring narrow at the sides, broadening toward the center to form the base of a moderately strong spine; dorsal furrow narrow, rounded, and distinct.

Fixed cheeks narrow, scarcely more than a ridge between the dorsal furrow and the palpebral lobe; palpebral lobe about one-third the length of the head, separated from the fixed cheek by a narrow, deep groove; ocular ridge short, distinct, and merging into the rim of the palpebral lobe; postero-lateral limb about as long as the width of the glabella, narrow, and marked by a longitudinal groove. In front of the glabella a narrow frontal limb slopes downward to a slightly convex, flattened frontal rim about three times as long as the frontal limb.

Surface minutely punctate. Length of the largest head, exclusive of the occipital spine, 8 mm.

This little species appears to be quite distinct from any other form of the genus. Its narrow fixed cheeks, relatively large eye lobe, and flattened frontal rim are the characteristics upon which it is referred to *Anomocare*.

Formation and locality.—Middle Cambrian, in the lower half of the Chang Hsia formation, in a compact gray limestone; 2 miles south of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ANOMOCARE (?) BUTES, new species.

General form of head semicircular, moderately convex. Glabella sub-quadrilateral in outline, narrowing slightly toward the nearly transverse front; marked by three pairs of slightly impressed short furrows and a low, narrow, median ridge; occipital furrow shallow, rounded, and arching very slightly toward the center; occipital ring slightly convex and of moderate width throughout, marked by a minute pointed node at the center; dorsal furrow rounded, distinct.

Fixed cheeks less than one-half the width of the glabella; they rise with a gentle slope from the dorsal furrow to the furrow within the rim of the palpebral lobe, slope back into the postero-lateral limb, and somewhat abruptly downward in front of the ocular ridge into the frontal limb; ocular ridge clearly defined and merging into the rim of the palpebral lobe; the latter is a little more than one-third the length of the head; postero-lateral limb nearly as long as the width of the

glabella at the base, narrow, and marked by a strong groove within the rounded posterior margin; frontal limb slightly convex and curving downward to the flattened frontal rim; the rim is a little longer than the length of the limb in front of the glabella, and the line of demarcation between the limb and the rim is little more than the angle formed by the union of the nearly flat rim with the inclined frontal limb.

Free cheeks irregularly triangular; marginal border flattened, strong, and produced behind into a strong, flattened spine; central area slightly convex, and rising rather abruptly to the base of the eye lobe; anteriorly the border of the cheeks narrows to a slender point.

Thorax unknown.

Associated pygidium semicircular in outline, convex; axis convex, about two-thirds the length of the pygidium, and divided by four furrows into four rings and a terminal, longer ring, upon which a slight depression on each side indicates a fifth furrow; the pleural lobes extend out about one-half of the distance nearly flat, and then curve somewhat abruptly downward to a rather broad, flattened margin, into which they merge; the four grooves on the axis and the fifth groove just within the interior margin extend across the pleural lobes, dying out on the flattened margin. Two small nodes occur at the posterior end of the axis, through which a low, broad, rounded ridge extends backward and downward into the flattened margin.

Surface minutely punctate under a strong lens; fine, radiating, irregular, elevated lines cross the frontal limb from the furrow in front of the glabella and the ocular ridge to the flattened frontal rim, and also from the base of the eye lobe to the margin of the free cheeks.

This species varies from the described forms in the broad, relatively short glabella and the configuration of the frontal rim and limb.

Formation and locality.—Middle Cambrian, lower portion of Chang Hsia formation, in a gray, fossiliferous limestone; 3.2 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ANOMOCARE ? DAULIS, new species.

Of this species the central portions of the head, exclusive of the free cheeks and associated pygidium, are known. Glabella rather strongly convex and faintly marked by three pairs of furrows; it narrows slightly toward the rounded front; occipital furrow narrow and curving slightly forward at the center; occipital ring of medium and nearly uniform width from side to side; dorsal furrow shallow and rounded; posteriorly the latter separates a narrow, elongated lobe from the side of the glabella, and joins the occipital furrow; the narrow lobe mentioned extends backward to the occipital furrow and

laterally merges into the fixed cheek; from another point of view the dorsal furrow might be considered to pass outside of the narrow, elongate lobe, near the base of the glabella, and the furrow between the glabella and the elongate lobe would then be an inner division of the dorsal furrow. The surface of the glabella is somewhat irregular on account of the lateral furrows, and a rather rounded, broad longitudinal ridge which extends its entire length.

Fixed cheeks less than half the width of the glabella; they rise from the dorsal furrow and merge into the large eye lobe, and anteriorly are divided by the strong ocular ridge which passes into the strong palpebral lobe; in front of the ocular ridge the cheeks slope downward to a second ridge which extends from the front line of the glabella sub-parallel to the ocular ridge as far as the facial sutures; frontal limb relatively long, slightly concave to the narrow, very slightly rounded rim; postero-lateral limbs short and marked by a strong curve within the narrow posterior rim.

Surface smooth under a strong lens.

The associated pygidium has a strong central axis marked by five or six rings that are very distinct on the broad planulate margins. This species is strongly characterized by its peculiar glabella with the elongate, narrow lobes near its base; also by the broad, slightly convex frontal rim.

Formation and locality.—Middle Cambrian. Upper part of Chang Hsia limestone, Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ANOMOCARE DAUNUS, new species.

This species is represented by a portion of the glabella and frontal limb, and a fragment of a large, free cheek associated with it; also an associated pygidium which has the same characteristic surface marking.

Glabella slightly convex and marked by three pairs of very faintly indicated furrows; it has a length of 16 mm. with a width of 12 mm. near the base; it narrows slightly toward the rounded front; a fragment of the fixed cheek indicates that the latter was nearly flat between the glabella and palpebral lobe; the frontal lobe is nearly flat for a distance of 4 mm., when it slopes downward to the thickened frontal rim, no line of demarcation distinguishing the frontal rim.

The free cheek indicates a moderate convexity for the head; also that the margin, which is very narrow at the front, widens out gradually toward the postero-lateral angle of the head; the base of the eye lobe shows that the palpebral lobe and eye were relatively small; the line of facial suture, as shown by the free cheek, shows that the postero-lateral limb of the fixed cheek was large and more than half the width of the cheek; also that the antero-lateral limb was strong.

The surface of the glabella is marked by shallow pits varying greatly in size and form; the pits are so closely crowded that the lines of demarcation between them in places form an irregular network; on the posterior portions of the glabella, also on the frontal limb, the shallow pits are more or less scattered, giving a somewhat coarsely punctate appearance; the fixed cheeks and free cheeks are marked by strong, but not large, pits or punctae, scattered somewhat thickly over the surface; the surface of the associated pygidium is much like that of the cheeks.

The associated pygidium has a width of 26 mm. and a length of 12 mm.; it is moderately convex with a prominent axial lobe and a broad, slightly concave border that merges above the slightly convex pleural lobes. Axial lobe convex with the elevated portion about five-sixths of the length of the glabella; it slopes abruptly downward and backward from the elevated portion to a low slightly convex termination near the posterior margin; divided by five well-marked transverse furrows that separate it into five segments and an obtuse terminal segment which has two rather large, rounded nodes, outlined by a slight depression at the center; the pleural lobes are grooved by the extension of the furrows crossing the axis; also by pleural grooves, both of which extend outward across the pleural lobe and curve backward across the broad, planulate border of the margin.

Formation and locality.—Middle Cambrian. Lower portion of Chang Hsia limestone, in green nodular shales of the horizon of the oolitic limestone at the base of the Chang Hsia formation; 2 miles south of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ANOMOCARE DECELUS, new species.

Of this species only the anterior central portions of the head are known. It is characterized by a broad, nearly flat, frontal rim that, with the frontal limb in front of the glabella, has a slightly convex slope interrupted only by a shallow, narrow groove; the frontal limb is ornamented with raised, narrow, irregular, more or less inosculating lines that radiate from the front of the glabella and ocular ridges down to the narrow groove separating the limb from the frontal margin.

The fixed cheeks are about half the width of the glabella. They are nearly flat and interrupted by a rather strong ocular ridge. The glabella is large, broadly rounded in front, with the sides sub-parallel from opposite the center of the palpebral lobes to the broadly rounded front. The palpebral lobes and posterior portions of the head are broken away in the only specimen known.

This species is associated with *Anomocare minus* Dames, from which it differs in the character of the frontal limb and margin, in which respects it also differs from *Anomocare temenus* and *Anomocare tatian*. It may also be compared with the form from the St. Croix sandstones of Wisconsin, illustrated by James Hall as *Conocephalites diadematus*,^a and with *A. alcinoe*, from which it differs in having a convex frontal rim instead of concave.

Formation and locality.—Middle Cambrian. Reddish limestone near base of Chang Hsia formation in oolitic limestone. Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ANOMOCARE TATIAN, new species.

This species is most closely related to *Anomocare temenus*. It differs from it in having a proportionately more convex and broader glabella and stronger dorsal furrows. The associated pygidium is also longer in proportion to its width, and it has eight or nine segments in its axis.

The largest head has a length of 13 mm. exclusive of the frontal rim, which is somewhat broken. This probably had a width of about 2 mm. A glabella 10 mm. in length has a width of 8.5 mm. at the base and 7 mm. at the broadly rounded front.

Formation and locality.—Middle Cambrian. Near base of Chang Hsia formation in gray oolitic series. Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ANOMOCARE TEMENUS, new species.

Head large, moderately convex, and transversely quadrilateral, exclusive of the free cheeks. Glabella slightly convex, rising gently from the dorsal furrow to the center, which is marked by a narrow, longitudinal ridge. A glabella 14 mm. in length has a width of 10½ mm. at the base and 8 mm. at the rounded frontal margin; indications of three pairs of glabellar furrows are shown by reflected light over the smooth surface; occipital furrow very shallow, scarcely more than indicating the line of demarcation between the glabella and the rather narrow occipital ring; dorsal furrows shallow.

Fixed cheeks narrow and nearly flat; they merge laterally into the large palpebral lobe and posteriorly slope down rapidly to the posterior margin; ocular ridges low, rather broad, and clearly marking the division between the central portion of the free cheeks and the rapid slope to the frontal rim; frontal limb in front of the glabella narrower than the frontal rim; it is slightly convex and merges into the narrow

^a16th An. Rept. N. Y. State Cab. Nat. Hist., 1863, pl. vii, figs. 36, 37.

furrow between it and the rather broad frontal rim; the latter in a head 21 mm. in length is $3\frac{1}{2}$ mm. long; postero-lateral limbs narrow, with a length about equal to the width of the base of the glabella. A strong furrow divides it about midway, parallel to the posterior margin.

Minute scattered pores are shown on the surface under a strong lens.

The associated pygidium has a broad planulate margin, convex axis, and slight indications of three or four segments.

The most nearly related form from China is *A. planum* Dames. This species differs from the latter in its narrower fixed cheeks and larger glabella.

Formation and locality.—Middle Cambrian. Upper portion of Chang Hsia formation in oolitic limestone, about a mile southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus ANOMOCARELLA, new genus.

Anomocarella is proposed to include three species from the Middle Cambrian of China that differ from Anomocare in the absence of glabellar furrows and the presence of a relatively narrow, flattened frontal rim. The sides of the glabella are parallel, palpebral lobes of medium size, and ocular ridges more or less clearly defined. The associated pygidium has a narrow conical axis, marked by several transverse furrows which extend out on the pleural lobes and more faintly on the sloping rim.

Genotype.—*Anomocarella chinensis*.

Two other species are referred to this genus: *A. albion* and *A. baucis*, the latter with some doubt.

ANOMOCARELLA ALBION, new species.

This species is represented by three more or less imperfect specimens of the head exclusive of the free cheeks. These indicate that the head was of moderate convexity and semicircular in outline.

Glabella moderately convex, with a gentle and nearly uniform curvature from side to side; on one specimen three pairs of glabellar furrows are very faintly indicated; the sides of the glabella arch slightly inward between the base and the rounded front; occipital furrow shallow, rounded, slightly separating from the glabella a very slightly convex occipital ring; dorsal suture narrow, but distinctly marked.

Fixed cheeks a little less than one-half the width of the glabella and nearly flat; they merge into the furrow within the palpebral lobe and

posteriorly slope gently downward to the posterior margin; ocular ridges low, rounded, and merging into the flattened palpebral lobes; in front of the ocular ridges the cheeks are interrupted by an obliquely transverse ridge that extends subparallel to the ocular ridge to the front of the glabella, where it merges into the frontal limb; frontal limb very narrow, sloping rather abruptly downward from the dorsal furrow to a narrow furrow separating it from a broad, slightly downward-sloping, nearly flat, frontal rim; postero-lateral limb short and marked by a shallow furrow parallel to the posterior margin.

Surface minutely punctate under a strong lens. The largest head of this species has a length of 18 mm. with a width at the palpebral lobes of 19 mm.

This large species differs from other forms by the very narrow frontal limb and the flat, downward-sloping frontal rim.

Formation and locality.—Middle Cambrian, lower central portion of Chang Hsia formation, in thin-bedded limestone interbedded with shale; 2 miles south of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ANOMOCARELLA BAUCIS, new species.

This species is represented by a single specimen of about one-half of the head, exclusive of the free cheeks. This specimen indicates a moderately convex head, somewhat longitudinally quadrilateral in outline.

Glabella moderately convex, with the sides converging slightly toward the front; surface apparently free from furrows; occipital furrow broad, shallow, slightly curving forward near the center; occipital ring low, strong, and slightly convex; dorsal furrow shallow, not clearly defined.

Fixed cheeks a little more than one-half the width of the glabella, nearly flat out to the elevated palpebral lobe and sloping with moderate rapidity to the posterior margin. Ocular ridge low, narrow, and merging into the strong palpebral lobe, which is about one-third the length of the head; frontal limb narrow in front of the glabella, widening at the sides in front of the ocular ridges; it slopes gently down to a rounded shallow furrow that separates it from a slightly convex frontal rim, that is broader than the frontal limb in front of the glabella; postero-lateral limb narrow, about as long as the width of the fixed cheek, and marked by a rather strong border and shallow furrow parallel to the border.

Surface marked by scattered punctæ and very fine punctæ visible only with the aid of a strong lens.

This species is characterized by the shallow, rounded dorsal furrow, elevated palpebral lobe, and the smooth, slightly convex frontal rim.

Formation and locality.—Upper Cambrian, upper portion of Chao Mi Tien formation, in grayish-brown, coarse limestone. Chao Mi Tien, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ANOMOCARELLA (?) BURA, new species.

This species is represented by the central portions of a single head. Glabella convex, subquadrilateral, arching very gently from the occipital ring forward, and near the front rather more rapidly downward to the furrow within the frontal rim; without traces of glabellar furrows; occipital furrow narrow, clearly defined; occipital ring rather wide, slightly convex, and projecting a little backward at the center; dorsal furrow shallow, narrow, but clearly defined.

Fixed cheeks about one-fourth the width of the glabella; palpebral lobe more than one-third the length of the head, with a relatively broad outer rim, outlined by a very narrow, faintly defined furrow; ocular ridge short, broad, low, and merging into the palpebral lobe; postero-lateral limb short; frontal rim slightly rounded, separated from the glabella and fixed cheeks by a narrow furrow.

Surface apparently smooth, but with a few scattered, very fine punctæ as seen with a strong lens. The type and only specimen has a length of 3 mm.

The generic reference of this species is doubtful, as the frontal limb is absent. The quadrangular, smooth glabella, relatively large palpebral lobes, and narrow fixed cheeks relate it more closely to *Anomocarella* than to other genera.

Formation and locality.—Middle Cambrian, upper portion of Chang Hsia formation, in oolitic limestone; Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ANOMOCARELLA CARME, new species.

Outline of head, exclusive of free cheeks, elongate quadrilateral, moderately convex. The convexity of the glabella is so slight that it is scarcely raised above the general surface of the head; its outline is truncate-conical, with the front rounded; the interior cast appears to be without traces of furrows; occipital furrow transverse, narrow, rounded, and shallow; occipital ring of medium width, slightly convex; dorsal furrow lightly impressed on the sides of the glabella and scarcely perceptible in front of it.

Fixed cheeks narrow, scarcely more than a line in front of the palpebral lobes; they widen out slightly in front and merge into the frontal limb, and posteriorly into the postero-lateral limb; postero-lateral limbs narrow, length unknown; frontal limb broad, slightly

convex, sloping obliquely downward and passing into the smooth, nearly flat frontal rim almost without interruption from the very shallow transverse furrow; palpebral lobes small, about one-third the length of the glabella.

The only surface markings are the fine, irregular lines that extend from in front of the glabella outward across the broad frontal limb to the frontal rim. The type and only specimen of the head in the collection has a length of 11.5 mm., with a width at the palpebral lobes of 8 mm.; the glabella is 6 mm. in length, the frontal limb 2 mm., frontal rim 1.5 mm., and occipital ring and furrow 2 mm.

This species is somewhat doubtfully referred to *Anomocarella*, as the frontal limb and rim are relatively long. It resembles *Anomocarella chinensis* in the narrow fixed cheeks and the absence of glabellar furrows.

Formation and locality.—Upper Cambrian, lower portion of Chao Mi Tien formation, in gray, crystalline, fossiliferous lime tone; Chao Mi Tien, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ANOMOCARELLA CHINENSIS, new species.

Head of medium size, moderately convex, and longitudinally irregularly quadrilateral, exclusive of the free cheeks. Glabella moderately convex, rising gently from the dorsal furrow toward the center, so as to give it a slightly ridged appearance. A glabella 5 mm. in width has a length of 7 mm., exclusive of the occipital ring; surface apparently smooth; occipital furrow very slightly defined; occipital ring broad, very slightly convex, with a slight node a little in advance of the center; dorsal furrow shallow, but distinct on the sides and in front of the glabella.

Fixed cheeks about one-half the width of the glabella, slightly convex; they merge laterally into the furrow outlining the palpebral lobe, and posteriorly slope rapidly to the posterior margin; ocular ridges low, rounded, and passing outward and merging into the narrow palpebral lobe; they clearly mark the division between the central portion of the fixed cheeks and the rapid slope to the frontal rim; palpebral lobes about one-third the length of the head; frontal limb narrow in front of the glabella, widening out at the sides and sloping downward with a gentle convexity; frontal rim nearly flat, separated from the frontal limb by a shallow furrow that curves slightly backward near the center so as to form an obtuse angle. In some examples there is a slight deepening of the furrow on each side of the incurved portion of the frontal rim; postero-lateral limbs short, and marked by a rather shallow, broad furrow parallel to their posterior margin.

Surface minutely punctate under a strong lens. The largest specimen of the head has a length of 12 mm.

The associated pygidium has a narrow, planulate margin and rather narrow convex axis, marked by five transverse furrows, which divide it into five rings, and a small terminal portion; the furrows extend across the pleural lobes and faintly on the margin. The most nearly related form is *A. albion*. The latter differs in having a proportionately shorter frontal limb and rim, and in the form of the glabella.

Formation and locality.—Middle Cambrian, lower central portion of Chang Hsia formation, in limestone interbedded in a green nodular shale; 2 and 2.5 miles south of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus ARIONELLUS Barrande.

ARIONELLUS AGONIUS, new species.

Central portion of the head, exclusive of the free cheeks, irregularly sub-quadrilateral, convex. Glabella moderately convex, narrowing slightly toward the front; length and width at the base nearly the same; by reflected light traces of two pairs of glabella furrows may be seen; occipital furrow narrow and shallow; occipital ring narrow at the sides, becoming stronger toward the center, which rises to form the base of a short, strong, backward-sloping spine; dorsal furrow narrow and clearly defined.

Fixed cheeks narrow and nearly flat at the palpebral lobes; they slope rapidly in front toward the frontal margin, and backward toward the postero-lateral limb; palpebral lobes narrow, about one-third the length of the head; frontal limb narrow directly in front of the glabella and rounding over to the rounded frontal rim.

Surface smooth under a strong lens. The type specimen has a length of 4 mm., with a slightly greater width at the palpebral lobes.

This species differs from *A. alala* in having a thickened, rounded frontal rim and a proportionately wider glabella. From *A. ajax* it differs in being broader and in the presence of an occipital spine.

Formation and locality.—Middle Cambrian, lower-central portion of the Chang Hsia formation, in thin layers of limestone interbedded in the green shale; Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ARIONELLUS AJAX, new species.

Outline of head, exclusive of free cheeks, sub-rhomboidal, convex. Glabella moderately and uniformly convex, sides converging very slightly from the base to the rounded front; slight traces of short

furrows are shown by reflected light; occipital furrow a faint transverse depression that separates the glabella from a fairly strong, slightly convex occipital ring; dorsal furrow narrow but clearly defined.

Fixed cheeks very narrow and sloping away from the glabella toward the palpebral lobes; posteriorly they slope downward into a rather large postero-lateral limb; anteriorly they slope rapidly to the frontal limb; palpebral lobes prominent, about one-fourth the length of the head; frontal limb gently convex, rounded in front, and without traces of a frontal rim.

Surface smooth under a strong lens. The type specimen has a length of 4 mm.

In form the head of this species is somewhat like that of *A. alala*. It differs in the absence of an occipital spine and in being proportionately somewhat narrower.

Formation and locality.—Middle Cambrian, central portion of the Chang Hsia formation, in gray crystalline limestone; 3.25 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ARIONELLUS ALALA, new species.

In general form and proportion the central parts of the head of this species are much like *A. agonius*. They differ in the proportionately smaller, elongate glabella, nearly flat frontal limb, and a thin instead of a rounded margin.

Formation and locality.—Middle Cambrian, central portion of the Chang Hsia formation, in gray limestone; Chao Mi Tien, Shangtung, China.

A somewhat similar and possibly identical form occurs at about the same horizon near Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus MENOCEPHALUS Owen.

Menocephalus OWEN, Geol. Surv. Wisconsin, Iowa, and Minnesota, 1852, p. 577.

Doctor Owen proposed this genus for trilobites having a highly convex, hemispherical glabella, with a narrow border and a broadly rounded front; cheeks tumid.

I have referred to this genus, more or less provisionally, several species in which only the central portions of the head are preserved. Further study, or the study of more perfect specimens, will undoubtedly lead to the reference of some of them to other genera.

MENOCEPHALUS ACERIUS, new species.

This species is represented by a single specimen of the glabella, fixed cheek, and frontal limb. The glabella is moderately convex, broadly truncato-conical in outline, and marked by two pairs of faintly impressed, short furrows; the sides approach each other slightly toward the broadly rounded front; occipital furrow rounded and distinct; occipital ring moderately convex and a little wider than the occipital furrow; dorsal furrow well defined.

Fixed cheeks, convex, about two-thirds the width of the glabella; they slope rather rapidly downward to the frontal rim and less so to the postero-lateral limb; ocular ridge not distinctly defined; palpebral lobes small; frontal rim separated from the glabella and fixed cheeks by a strong, narrow furrow; the rim is rounded and of about the same width as the occipital ring.

Surface covered with pustules perceptible to the unaided eye. The head of the type specimen has a length of 10 mm.; the frontal rim and occipital ring are each about 1 mm. in width.

This species is referred to the genus *Menocephalus* on account of the small palpebral lobes, pustulose surface, and the absence of a frontal limb. It differs from the type form in having a less convex, more elongated glabella.

Formation and locality.—Middle Cambrian, upper portion of the Chang Hsia formation, in a coarse, grayish limestone; a mile east of Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

MENOCEPHALUS ACIS, new species.

Glabella prominent, convex, narrowing slightly from its base toward the broadly rounded front; occipital furrow narrow, deep, and separating a rather strong, rounded, occipital ring; dorsal furrow narrow and strongly defined.

Fixed cheeks about one-half the width of the glabella, moderately convex to the base of the palpebral lobe; posteriorly they slope rapidly to the furrow within the posterior margin; anteriorly, rapidly to the frontal rim; palpebral lobe small and somewhat elevated; frontal rim narrow, rounded, and separated from the glabella by the narrow dorsal furrow.

Surface marked by rather strong scattered granules. The only specimen representing this species has a length of 5 mm.

This species is characterized by its narrow, wire-like frontal rim and the scattered granules on its outer surface.

Formation and locality.—Upper Cambrian, upper portion of Chang Hsia formation, in granular gray limestone; Chao Mi Tien, Shangtung, China.

Collected by Eliot Blackwelder of the Carnegie Institution of Washington Expedition to China.

MENOCEPHALUS ADMETA, new species.

Glabella strongly convex, with sub-parallel sides and rounded front; occipital furrow narrow and deep; occipital ring narrow at sides, increasing in width toward the center, slightly convex, rising with a backward slope from the bottom of the occipital groove; dorsal furrow narrow and strongly defined.

Fixed cheeks about two-thirds of the width of the glabella, slightly convex opposite the palpebral lobe, and sloping downward to a strong furrow within the rounded rim of the short postero-lateral limb; frontal rim narrow and slightly rounded.

Surface apparently minutely punctate under a strong lens. The only head of this species in the collection has a length of less than 2 mm.

This species is distinguished from *M. acis* by the form of the convex glabella, flattened instead of wire-like frontal rim, and punctate surface. It does not appear to be closely related to any other species.

Formation and locality.—Upper portion of Chang Hsia formation, in dense mottled and crystalline limestone. Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

MENOCEPHALUS ADRASTIA, new species.

This is a minute head, having a strongly convex, almost globular glabella that rises abruptly from the deep dorsal furrow. A shallow furrow outlines small postero-lateral lobes at the base of the glabella; occipital furrow narrow and distinct; occipital ring slightly convex back of the occipital furrow, narrow at the sides and widening gradually toward the center.

Fixed cheeks about one-half the width of the glabella, strongly convex; frontal limb obsolete; frontal rim about half as wide as the fixed cheeks, slightly convex, and separated from the fixed cheeks by a transverse, narrow, shallow groove.

The above is all that is known of this form. Its globose glabella, convex fixed cheeks, and occipital ring distinguish it from other species. The length of the glabella and frontal rim is 2.5 mm. in one specimen, with an occipital ring about 1 mm. long.

Surface finely granulose under a strong lens, with a few scattered larger granules.

Formation and locality.—Middle Cambrian, upper portion of the Chang Hsia formation, in a compact, hard, dove-colored limestone; Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

MENOCEPHALUS AGAVE, new species.

Another species of *Monocephalus* is associated with *M. adrastia*, in which only the anterior portions of the head and one fixed cheek are preserved. This differs from *M. adrastia* in the proportionately narrower glabella, rounded frontal rim, and less convex fixed cheek. Its surface is very finely pustulose, with scattered larger pustules on the glabella. The palpebral lobe is very small and situated a little back of the center of the head.

Formation and locality.—Middle Cambrian, upper portion of the Chang Hsia formation, in a compact, hard, dove-colored bed; Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

MENOCEPHALUS BELENUS, new species.

This species is represented by a single specimen of a glabella, occipital ring, and frontal rim. It differs from *M. acerius* in having a very narrow, slightly flattened frontal rim, and a very finely pustulose surface. The glabella is also more conical and its front more rounded. A fragment of the fixed cheeks indicates that they were rather convex and rose somewhat abruptly from a distinct dorsal furrow. The general remarks relating to the generic relations of *M. acerius* also apply to *M. belenus*, as they are apparently congeneric.

Formation and locality.—Middle Cambrian, upper portion of the Chang Hsia formation, in a bed above that containing *M. acerius*; Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

MENOCEPHALUS (?) DEPRESSUS, new species.

General form of the head, exclusive of the free cheeks, subrhomboidal, moderately convex. Glabella moderately convex, narrowing slightly from the base toward the rather broadly rounded front; surface marked by two pairs of very shallow, short glabellar furrows; occipital furrow narrow, transverse, and sharply impressed; occipital ring slightly convex and of nearly uniform width; dorsal furrow narrow and sharply defined.

Fixed cheeks about one-half the width of the glabella, convex, arching with about the same slope to the palpebral lobe from the front and back; palpebral lobe small, situated about midway of the cheek; no evidence of the presence of an ocular ridge; postero-lateral limb short, marked by a distinct groove parallel to the narrow, elevated posterior margin; frontal rim narrow, convex, and separated from the glabella and fixed cheeks by a distinct narrow groove.

Surface with numerous low, medium-sized, scattered pustules. The type and only specimen of the head in the collection has a length of 4.5 mm.

This species is doubtfully referred to the genus *Menocephalus*. It is most nearly related to *M. acis*, but differs in having a less convex glabella and narrower fixed cheeks.

Formation and locality.—Upper Cambrian, lower portion of Chao Mi Tien formation, in a fossiliferous gray limestone, where it is associated with *Solenoplura belus*; Pagoda Hill, a mile west-southwest of Tai An Fu, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

MENOCEPHALUS, species undetermined.

This form is represented by the anterior half of the glabella and fixed cheeks. These parts indicate that the glabella was strongly convex, rounded in front, and marked by two pairs of very slight, short furrows. The fixed cheeks are about two-thirds the width of the glabella and moderately convex; palpebral lobes small and placed about their own length from the frontal rim; frontal rim apparently very narrow, and separated from the glabella and fixed cheeks by a narrow distinct groove. Surface finely pustulose under a strong lens.

Formation and locality.—Middle Cambrian, near upper portion of Chang Hsia formation, in a compact, hard, gray limestone, about 3 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus PAGODIA, new genus.

This genus is proposed to include a few species from the Upper Cambrian zone which do not appear to be closely related to any described genus. Only the central portions of the head are available for description.

Diagnosis.—Glabella oblong, with obscure traces of furrows at the sides. Eyes small, central, and without trace of ocular ridge. Facial sutures cut the front margin opposite the eye lobe, and the posterior margin within the postero-lateral angles.

Thorax unknown.

An associated pygidium has a conical, segmented axis, narrow pleural lobes, and smooth, undefined margin.

Genotype.—*Pagodia lotos* Walcott.

The four species of this genus all have a similar type of surface, consisting of shallow punctæ of moderate size, with very fine punctæ, visible only under a strong lens, between the larger punctæ. The species now referred to the genus are *Pagodia bia* Walcott, *P. dolon* Walcott, *P. lotos* Walcott, *P. macedo* Walcott.

I was at first inclined to refer these forms to *Dolichometopus*, but they differ from the type of the latter, *Dolichometopus svecicus* Anglin, in the narrowing instead of widening of the glabella in front, in the presence of small instead of large eye lobes, short instead of long postero-lateral limbs, and obscure glabellar furrows.

PAGODIA LOTOS, new species.

Glabella moderately convex, elongate, with the sides converging very slightly toward the broadly rounded front; obscure traces of two pairs of furrows that extend a short distance inward and backward occur upon the sides; occipital furrow strong, rounded, and arching slightly forward at the center; occipital ring of medium width and rounded; dorsal furrow strong but shallow and merging into the transverse furrow in front of the glabella.

Fixed cheeks about one-half the width of the head opposite the palpebral lobes, slightly convex, and sloping gently posteriorly to the furrow within the margin and anteriorly to the transverse furrow within the frontal rim; palpebral lobes small, short, not much more than one-fifth the length of the head; a very slight trace of an ocular ridge is shown upon the cast of the interior of the crust, but no evidences of it have been seen on the outer surface; frontal rim narrow, rounded so as to give it a thickened appearance, with a slightly flattened slope into the furrow back of it; it is separated from the glabella and fixed cheeks by a sharp furrow that almost cuts back under the front of the glabella.

The crust is thick; it appears to be smooth on the outer surface over the glabella and fixed cheeks, with the exception of scattered, shallow punctæ.

The type specimen has a length of 6 mm., with a width at the palpebral lobes of 8 mm.

The associated pygidium is convex, subsemicircular in outline, and strongly trilobed except at the margin. Axial lobe convex, conical, and divided by three transverse furrows into three rings and a terminal, rounded subtriangular portion. Pleural lobes nearly flat toward the front near the dorsal furrow, and from there curving abruptly downward toward the side and posterior margins; the furrows of the

axis extend about two-thirds of the distance across the pleural lobes and merge with the flat segments between them into the margin; the margin slopes up from the sharp outer edge with a slight concavity where it merges into the pleural lobes and touches the posterior end of the axis.

This species differs from *Pagodina macedo* and *P. dolon* in its frontal rim and the slight convergence of the sides of its glabella toward the front. It is most nearly related to *Pagodina bia*, with which it is associated, but differs from it in its narrower and proportionately longer glabella, the glabella of *P. bia* having a length of 6 mm. with a width at the center of 3 mm., and that of *P. lotos* with a length of 5 mm. has a width at the center of nearly 4 mm.

Formation and locality.—Upper Cambrian, lower portion of Chao Mi Tien formation, in a gray fossiliferous limestone; Pagoda Hill, 1 mile west-southwest of Tai An Fu, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PAGODIA BIA, new species.

Head, exclusive of the free cheeks, subrhomboidal, moderately convex. Glabella slightly convex, subquadrilateral in outline, slightly narrowed along the central portions; and marked by two pairs of short glabellar furrows on the posterior half and a very slight depression indicating a furrow on each side well toward the front; occipital furrow narrow, very clearly defined and arching slightly forward toward the center; occipital ring narrow and rounded; dorsal furrow shallow but distinct.

Fixed cheeks about half as wide as the glabella and sloping gently downward from the dorsal furrow; palpebral lobes small, situated about midway between the front and back margins of the head; no traces of ocular ridges have been observed; postero-lateral limb short, strong, and marked by a rounded furrow within the posterior margin; frontal rim very narrow, rounded, and separated from the glabella and fixed cheeks by a narrow, deep furrow.

Surface marked by a few shallow, scattered puncta, and under a very strong lens it appears to be minutely punctate. The largest specimen of the head in the collection has a length of 8 mm.

The form of the glabella of this species is not unlike that of *Pagodina macedo*, but its anterior lobe is much broader.

Formation and locality.—Upper Cambrian, lower portion of Chao Mi Tien formation, in a hard, dark limestone; 2.7 miles southwest of Chao Mi Tien and Pagoda Hill, a mile west-southwest of Tai An Fu, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PAGODIA DOLON, new species.

This species is represented by two specimens of the head exclusive of the free cheeks. Glabella elongate, subquadrilateral, moderately convex; a very obscure trace of a posterior pair of short furrows is all that can be seen on the outer surface; occipital furrow rather narrow, clearly impressed, and arching slightly forward at the center; occipital ring narrow at the sides, increasing gradually in width to the center, where it is strong and moderately convex; dorsal furrow strong at the sides and front of the glabella.

Fixed cheeks a little more than one-half the width of the glabella, convex, and sloping outward and downward from the dorsal furrow; back of the palpebral lobes they slope gently to the furrow within the posterior margin and anteriorly more rapidly to the furrow within the frontal rim; palpebral lobes small, about one-fourth the length of the head; postero-lateral limb short, and marked by a strong, rounded furrow within the narrow, slightly elevated posterior margin; frontal rim rounded, narrow, and separated from the glabella by a strong, rounded, rather deep furrow, which becomes more shallow in front of the fixed cheeks.

Surface marked by numerous medium-sized punctæ, with very fine punctæ, visible only under a strong lens, between them.

The largest specimen of the species has a length of 5.5 mm., with a width at the palpebral lobes of 8 mm.; the glabella has a length of 3 mm., with a width of 2.5 mm.

This species differs from the other species of the genus in its shorter, broader glabella, and more convex fixed cheeks.

Formation and locality.—Upper Cambrian, lower portion of Chao Mi Tien formation, in hard, dark limestone; 2.7 miles southwest of Chao Mi Tien, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PAGODIA MACEDO, new species.

This species is represented by a single specimen of the head, exclusive of the free cheeks. Glabella elongate, subquadrangular, narrowing very slightly toward the broadly rounded, nearly transverse front, as indicated by the cast of the interior of the crust; surface marked by two pairs of shallow furrows that penetrate a short distance on each side and separate the glabella into three subequal lobes; occipital furrow rounded and strong; occipital ring unknown; dorsal furrow strong, rounded, and clearly separating the moderately convex glabella from the sloping fixed cheeks.

Fixed cheeks slightly convex, sloping gently from the dorsal furrow to the palpebral lobe, more rapidly to the furrow within the pos-

terior margin, and anteriorly to the front margin; palpebral lobes situated about midway between the front and the posterior margins of the head, small and short, not much over one-fifth the length of the head; frontal rim narrow, wire-like, and separated from the glabella and fixed cheeks by a rounded furrow of moderate depth.

The crust is rather thick, the outer surface marked by scattered shallow punctae, with very fine punctae, as shown by a strong lens, between them. Length of head exclusive of occipital ring, 7.5 mm.

This species is closely related to *Pugodiu lotos*. It differs in the form of the frontal rim and the more uniform slope of the glabella toward the front. From *P. bia* it differs in the more rapid downward slope of the front of the glabella and in the parallel or slightly contracting sides of the glabella.

Formation and locality.—Upper Cambrian, lower portion of Chao Mi Tien formation, in gray fossiliferous limestone; Chao Mi Tien, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus PTEROCEPHALUS Roemer.

PTEROCEPHALUS ASIATICA, new species.

This species is represented by fragments of the anterior portion of the head and of the pygidium. Glabella truncato-conical, moderately convex, narrowing gradually toward its rounded front; surface marked by three pairs of short furrows, the posterior of which separate rather small oval lobes at the postero-lateral angles; occipital furrow narrow and slightly impressed; occipital ring of medium width and nearly flat; dorsal furrow narrow, but distinctly marked.

Fixed cheeks about two-thirds the width of the glabella opposite the palpebral lobes, slightly convex, and crossed by strong, low, ocular ridges; postero-lateral limbs unknown; frontal limb very broad and slightly concave; just in front of the glabella there is a faint depression, formed by a slight change in the slope of the frontal limb, that extends across a short distance in front of the palpebral lobe; frontal rim narrow, slightly rounded, and marked by irregular striae parallel to the margin.

Surface of the glabella and fixed cheeks slightly roughened by what appear, under a strong lens, to be very fine granulations; the frontal limb is marked by irregular, raised lines that radiate from the front of the glabella and ocular ridges outward toward the front margin; these raised lines are very irregular and more or less inosculating on and near the transverse depression of the frontal limb in front of the glabella and ocular ridges. On a head 23 mm. in length the frontal limb has a length of 11.5 mm. and the glabella and occipital ring 11.5 mm., with a width at the palpebral lobes of 18 mm.

Fragments of the pygidium associated with the head show that it had a slender, moderately convex axis, with more than 8 rings, and that the pleural lobes were moderately convex, flattening out on a broad, planulate margin, the furrows on the axis extending out across the pleural lobes and nearly fading away on the broad margin; a faint trace of a very narrow, short pleural groove is shown on two of the pleural segments. Surface of the pygidium slightly roughened by what appears to be, under a strong lens, a very fine granulation.

Formation and locality.—Middle Cambrian. In gray crystalline limestone, associated with *Damesella blackwelderi*; $3\frac{1}{4}$ miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTEROCEPHALUS BUSIRIS, new species.

This species is represented by two specimens of a pygidium that is quite distinct from the pygidium associated with *P. asiatica*. The axis is elongate, slightly convex, and converging uniformly to about half its width at the posterior end; marked by eight or more narrow, distinct, transverse furrows that divide it into eight or more transverse rings and an elongate terminal portion. Pleural lobes slope gently from the dorsal furrow down toward the margin; they are marked by the continuation of the distinct transverse furrows of the axis, that extend obliquely backward out to the margin, as far as can be determined; there is a slight indication of a pleural groove on the outer half of the pleural lobe. The pleural lobe is separated from the broad border by a slight elevation of the point of union of the border and pleural lobe, the slope of the two being approximately the same from the margin to the axis; a sharp ridge originates on the front side of each pleural segment a little distance out from the axis, and extends out across the border to the margin, leaving a concave space between the sharp ridges over the entire extent of the border; from the elongate terminal segment of the axis a narrow, double ridge continues backward to the border, which is here slightly incurved.

Surface finely granular under a strong lens.

This species differs from *P. asiatica* in the form of the segments of the pleural lobes and margin.

Formation and locality.—Upper Cambrian, lower portion of Chao Mi Tien formation, in dark, compact limestone; 3 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

A specimen referred to this species also occurs in the lower portion of the Chao Mi Tien formation, two-thirds of a mile west of Tai An Fu, in Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus PTYCHASPIS Hall.

PTYCHASPIS ACAMUS, new species.

This species is represented by specimens of the glabella and fragments of the fixed cheeks. The glabella is moderately convex at the back and strongly convex on the frontal lobe. It is divided by a strong, backward-arching furrow that separates the posterior portion as a transverse lobe and the anterior as a large lobe about as long as broad. The latter is marked by two narrow, short, slightly impressed furrows on the sides of the lobe; occipital furrow strongly rounded, deep, and arching forward at the center; occipital ring about the middle of the posterior lobe of the glabella nearly flat, and with a small, sharp node at the center near the back margin; frontal rim a rounded, narrow border in front of the deep, narrow dorsal furrow; dorsal furrow narrow and deep opposite the palpebral lobe.

Fixed cheeks rise rapidly from the dorsal furrow. They are narrow and convex; palpebral lobes unknown. The anterior lobe of the glabella slightly overhangs the dorsal furrow, which is deep and rounded.

Surface marked with low, large pustules and very faint punctæ. The type specimen of the head in the collection has a length of 11 mm. with a width of 6 mm.

This species is characterized by the form of the large front lobe, the strong transverse furrows, and narrow posterior lobe of the glabella, and its peculiar surface.

Formation and locality.—Middle Cambrian, central portion of the Chang Hsia formation; Chao Mi Tien, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHASPIS CACUS, new species.

General form of head, exclusive of the free cheeks, subrhomboidal, rounded in front, strongly convex. Glabella moderately convex over the posterior portion, strongly convex at the frontal lobe; posterior portion is divided into two lobes, of about equal width, by the broad, rounded, transverse posterior furrow and a narrow, slightly impressed anterior furrow, both of which arch slightly backward toward the center; the frontal lobe is about as long as the two posterior lobes and arches with uniform curve over to the dorsal furrow; it is convex but not globose; it is marked about midway on each side by a short, very lightly impressed narrow furrow, which penetrates it at right angles to the dorsal furrow; occipital furrow broad, strong, and arching slightly forward at the center; occipital ring about as wide as the posterior lobe of the glabella, moderately convex, and arching slightly forward near the center; dorsal furrow strongly

defined at the sides and somewhat less so in front of the glabella; a shallow pit occurs opposite the antero-lateral angle of the glabella.

Fixed cheeks narrow and convex; they slope gently backward and merge into the postero-lateral limb, and forward in advance of the palpebral lobe slope rapidly downward to the rounded frontal limb; palpebral lobes broken away, but from the form of the fixed cheek they appear to have been about one-third the length of the head; postero-lateral limbs about as long as the width of the glabella, and marked by a broad, strong furrow within the narrow postero-lateral margin; frontal lobe and rim united to form a rounded, downward curving frontal border of the head, separated from the glabella by the strong dorsal furrow.

Surface marked by numerous irregularly placed pustules except in the furrows of the glabella, dorsal furrow, and furrow on the postero-lateral limbs. The type and only specimen of the head in the collection has a length of 17 mm., with the glabella 10 mm. in width and 11 mm. long.

In size and general appearance this species may be compared with *P. ceto*. It differs in its strongly pustulose surface, less convex glabella and fixed cheeks, and in the form of the frontal border of the head. At first sight it is apparently identical with *P. calyce*, but it differs in the form of the transverse furrows and the frontal lobe of the glabella, which in *P. calyce* is globose, like that of *P. ceto*.

Formation and locality.—Upper Cambrian, upper portion of the Chao Mi Tien formation; 2.7 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHASPIS CADMUS, new species.

This species is represented by more or less fragmentary specimens of the central portions of the head, exclusive of the free cheeks. Glabella moderately convex at the back and strongly convex at the front, marked by a posterior transverse furrow that arches slightly backward, cutting off a narrow lobe between it and the dorsal furrow; anterior lobe a little longer than wide, and marked by a pair of short, narrow furrows opposite the anterior end of the palpebral lobe; the anterior lobe is convex, but not globose; occipital furrow strong; occipital ring unknown; dorsal furrow strong and rather deep.

Fixed cheeks very narrow and disappearing into the dorsal furrow in front of the palpebral lobe; posteriorly they slope downward as an irregular ridge to the postero-lateral limb; palpebral lobes about one-fourth the length of the head and marked by a deep groove within the narrow rim; frontal limb narrow and sloping outward and downward to the front margin from the broad, strong, dorsal furrow; it is marked by two transverse rows of large tubercles; postero-lateral limbs unknown.

The surface of the head, except the furrows, is thickly covered with large pustules. A glabella 11 mm. in length has a width of 8 mm.; none of the specimens are sufficiently perfect to give measurements for the entire length of the head.

This species is characterized by the very narrow fixed cheeks and strongly pustulose surface. It is associated with *P. calchas*.

Formation and locality.—Upper Cambrian, lower portion of Chao Mi Tien formation, in a gray, somewhat coarse, fossiliferous limestone; 2.7 miles southwest of Chao Mi Tien, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHASPIS CALCHAS, new species.

Of this species only more or less imperfect specimens of the central portions of the head, exclusive of the free cheeks, are known. Glabella slightly convex on the posterior half and moderately convex at the frontal lobe; it is divided by two transverse, rather strong, shallow furrows into two narrow lobes that arch slightly backward and an anterior lobe that measures a little more than half the length of the glabella; a pair of very slightly impressed and short furrows mark the side of the frontal lobe a little back of the center; occipital furrow broad, shallow, and about the same strength as the two furrows crossing the glabella; occipital ring narrow at the sides, increasing in width toward the center, where it rises at the back above the general level of the glabella; dorsal furrow broad and rounded.

Fixed cheeks scarcely more than a very narrow ridge rising from the broad dorsal furrow to the palpebral lobe and sloping gently backward into the postero-lateral limb and forward in front of the palpebral lobe into the frontal border of the head; palpebral lobe about one-fourth the length of the head and marked by a strong furrow within the narrow rim; frontal limb nearly flat, of medium width, and sloping forward and downward from the dorsal furrow to the frontal margin; postero-lateral limbs about as long as the width of the glabella, and marked by a broad, shallow furrow within the narrow posterior margin.

The cast of the interior surface of the test appears to be minutely punctate under a strong lens, and fragments of the exterior appear to be smooth. The largest specimen of the head in the collection has a length of about 22 mm.; a specimen 11 mm. in length has a glabella 5 mm. in width, with a fixed cheek a little less than 2 mm. in width from the sides of the glabella across the dorsal furrow to the furrow on the palpebral lobe.

This species differs from the described species of the genus in the low convexity of the glabella, the uniformity of the occipital and two posterior furrows of the glabella, and the apparently smooth surface.

Formation and locality.—Upper Cambrian, lower portion of Chao Mi Tien formation, in a gray, somewhat coarse, fossiliferous limestone; 2.7 miles southwest of Chao Mi Tien, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHASPIS CALLISTO, new species.

Of this species only the central portions of the head, exclusive of the free cheeks, are known. Glabella moderately convex, and divided into a narrow posterior lobe by a broad, rounded, deep, transverse furrow that curves slightly backward, and an anterior lobe, about as long as wide, marked upon its lateral slopes by two pairs of short, narrow furrows; it is broadly rounded, almost transverse in front, and its sides are sub-parallel; occipital furrow broad and deep and arching slightly forward at the center; occipital ring narrow at the ends, widening and rising gradually toward the center, which appears to have been elevated above the general surface of the head; dorsal furrows strong and deep.

Fixed cheeks narrow, rising abruptly from the dorsal furrow and extending laterally to the furrow within the rim of the palpebral lobe; they slope gently backward to the postero-lateral limb, and more abruptly forward to a strong furrow that separates the frontal rounded margin of the head from the glabella; frontal limb and rim combined in a rounded frontal border, which corresponds in its section to about the same curvature as the section of the furrow between the border and the glabella; postero-lateral limbs about as long as the width of the glabella, and marked by a broad, rather deep groove within the narrow posterior margin.

Surface of the cast of the interior of the test with numerous rather large scattered punctæ and very fine punctæ seen only with the aid of a strong lens; a fragment of the outer surface shows it to have been strongly punctate, with fine punctæ corresponding to the punctæ seen on the cast of the interior. The largest head in the collection has a length of 13 mm.

This species is strongly characterized by the broad, strong posterior furrow and narrow posterior lobe of the glabella, and the sub-quadrate, moderately convex frontal lobe; also the elevated occipital ring and punctate surface.

Formation and locality.—Upper portion of the Chao Mi Tien formation, at the same horizon as *P. cacus* and *P. ceto*; 2.7 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHASPIS CALYCE, new species.

In general form, convexity, and size the corresponding parts of this species follow that of *P. ceto*. It differs from the latter in having a

strongly pustulose surface instead of irregular, more or less concentric ridges and furrows. The largest specimen of the head in the collection has a length of 17 mm.

Formation and locality.—Upper Cambrian, Chao Mi Tien formation, about the middle of the formation; 7.5 miles east of Chao Mi Tien, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHASPIS CAMPE, new species.

This species is represented by a fragment of a small head that is so distinct in its surface granulation, large eye lobe, and frontal portion of the head that it can not be readily confused with any other species. The glabella is divided by two narrow, transverse, slightly backward-curving furrows into two narrow lobes and a large anterior lobe that is marked by two pairs of short, very narrow furrows on the lateral slopes; the anterior lobe is about as long as wide, slightly convex behind and strongly convex in front, but not at all globose or tumid; it is broadly rounded, almost transverse in front, and has parallel sides; frontal limb very narrow in front of the glabella, widening at the sides; it is separated from a downward-sloping frontal rim by a very narrow transverse furrow; the frontal rim is very slightly convex, and from two to three times as wide as the frontal limb in front of the glabella; dorsal furrow narrow and deep on the sides, and little more than a line in front of the glabella.

Fixed cheeks very narrow at the front and back and merging into a large palpebral lobe at the center; they rise rapidly from the dorsal furrow and arch over into the furrow within the narrow palpebral lobe; palpebral lobe extends from opposite the anterior pair of furrows on the frontal lobe of the glabella back to the posterior transverse furrow.

Surface marked by large, low, closely arranged granulations or pustules. This is a small species, the type specimen of the glabella having a length of 4 mm. with a width of 2 mm.

Formation and locality.—Upper Cambrian, Chao Mi Tien formation, about the middle of the formation; 7.5 miles east of Chao Mi Tien, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHASPIS CETO, new species.

Head, exclusive of the free cheeks, sub-rhomboidal in outline, strongly convex. Glabella large, strong, with very convex frontal lobe, sides sub-parallel, front broadly rounded; two strong glabellar furrows cross transversely from side to side, dividing the glabella into two rather narrow posterior lobes and an anterior, globose lobe that

slightly overhangs the frontal rim; occipital furrow about as strong as the two glabellar furrows; occipital ring narrow and slightly rounded, and elevated at the center; dorsal furrows strong and deep on the sides and in front of the glabella.

Fixed cheeks with the dorsal furrow about two-thirds the width of the glabella, the fixed cheeks forming an elevated ridge at the palpebral lobe, with an elevated short ridge opposite the anterior end of the palpebral lobe, that is crossed by three transverse ridges, as seen in the cast of the inner surface; in front of the elevated portion the cheek drops gently to the frontal rim; back of the palpebral lobe the cheek slopes gently and merges into the postero-lateral limb; palpebral lobe narrow, elongate, a little more than one-half the length of the head, and separated from the fixed cheek by a narrow, deep furrow; postero-lateral limb about as long as the width of the glabella at the base, and marked by a broad, deep, rounded groove, within the sharp, elevated, posterior margin; frontal limb very short and sloping downward into the rounded frontal rim; the frontal limb and rim form scarcely more than the outer border of the strong dorsal furrow.

Outer surface unknown, as in all the specimens the test clings to the matrix; this latter fact indicates that it was roughened, probably tuberculose. The cast of the frontal lobe of the glabella shows a number of irregular, concentric ridges and grooves sub-parallel to the frontal margin. The largest head in the collection has a length of 14 mm., with a width at the palpebral lobes of 17 mm.; the glabella was 8 mm. in width, with a length, including the occipital ring, of 14 mm.

This species differs from *Ptychaspis cacus* in the globose, overhanging frontal lobe of the glabella, and the form of the frontal rim, features that also separate it from *P. cadmus* and *P. calchas*. From *P. acamus* it differs in the form of the frontal lobe of the glabella and the transverse lobe back of it. The globose glabella resembles that of *P. granulosa* Owen, except that it is more globose and overhangs the frontal border. *P. granulosa* has a different form from the other Chinese species.

Formation and locality.—Upper Cambrian, in the lower portion of the Chao Mi Tien formation, in a fossiliferous, coarse gray limestone. Chao Mi Tien; two-thirds of a mile west of Tai An Fu; Pagoda Hill, a mile west-southwest of Tai An Fu; 2.7 miles southwest of Yen Chuang, Hsin Tai, Shantung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHASPIS, species undetermined.

There are several species of *Ptychaspis* that occur in the upper Cambrian zone that are too imperfect for description. One of these has the general form of *P. campe*, but it differs in the exceedingly

narrow fixed cheeks and flat frontal border, while having the same type of pustulose surface. It occurs in the upper portion of the Chao Mi Tien formation, at Chao Mi Tien, Shangtung, China. Other fragments representing species of this genus are too imperfect for identification or description.

Genus *PTYCHOPARIA* Hawle and Corda.

PTYCHOPARIA ACLIS, new species.

The slightly convex central portions of the head of this species are preserved. The species is distinguished by the breadth of the glabella in front and three pairs of short, well-defined furrows that divide the sides of the glabella into four subequal lobes; an occipital spine; and narrow rounded frontal rim, cut around in front nearly to the median line by the facial sutures. Ocular ridge well defined. Surface unknown.

Formation and locality.—Lower Cambrian, Man To formation; Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHOPARIA (?) BATIA, new species.

Head, exclusive of the free cheeks, sub-rhomboidal, moderately convex; glabella truncato-conical; a specimen with a length of 11 mm. has a width at the base of 11 mm., and at the broadly rounded, almost transverse front of 7 mm.; very faint traces are shown of a posterior pair of furrows; occipital furrow nearly straight, shallow, rounded, and narrow; occipital ring strong, very slightly convex, and slightly wider at the center than at the ends; it is marked at the center, near the occipital furrow, by a minute node; dorsal furrow distinctly but not deeply marked.

Fixed cheeks wide and slightly convex, nearly flat between the glabella and palpebral lobe, and curved downward in front to the frontal rim and backward to the furrow within the posterior margin; ocular ridge narrow and low, but distinctly shown; posteriorly it passes into the palpebral lobe; palpebral lobe small, and situated a little back of a transverse line drawn through the center of the head; postero-lateral limb large, about as long as the base of the glabella is wide, and marked by a strong furrow within the elevated posterior margin. The front of the glabella and of the fixed cheeks curves down into a shallow furrow, from which the frontal rim rises before curving over to form a thick frontal margin, which is marked by longitudinal raised striae.

Surface smooth under a strong lens. The largest of three specimens of a head has a length of 20 mm., with a width at the palpebral lobes of 26 mm.

This species is characterized by its large size, concave frontal rim, and nearly smooth glabella. In view of the occurrence of heads of the genus *Dorypygella* at about the same horizon, which resemble this, the generic reference is somewhat doubtful. A somewhat similar head occurs in the upper portion of the Chao Mi Tien limestone at about the same horizon, 9 miles north of Hsin Tai Hsien.

Formation and locality.—Upper Cambrian, Chao Mi Tien formation; 2.7 and 3 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China. A form apparently identical was found by Mr. Blackwelder in limestone blocks in talus at Chao Mi Tien.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCOPARIA (?) BROMUS, new species.

This species is represented by the central portions of the head, exclusive of the free cheeks. Glabella moderately convex, truncato-conical, rounded in front, and apparently without furrows; occipital furrow transverse and clearly defined; occipital ring strong and moderately convex; dorsal furrow broad and shallow.

Fixed cheeks nearly as wide as the glabella opposite the palpebral lobe; they rise slightly from the dorsal furrow to the palpebral lobe, and slope gently backward to the postero-lateral limb and forward to the frontal limb; palpebral lobe narrow, about one-third the length of the head; ocular ridge rounded and faintly defined; frontal limb of medium width, slightly convex, and sloping gently down to a rounded furrow that separates it from the flattened frontal rim, which is about one-half as wide as the frontal limb.

The surface is slightly roughened by minute granulations, as seen with the aid of a strong lens. The largest specimen of the head in the collection has a length of 7 mm.

This species is characterized by the rounded, smooth appearance of the glabella, fixed cheeks, dorsal furrow, and frontal limb.

Formation and locality.—Middle Cambrian, Ku San shale formation; 2.5 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHOPARIA CEUS, new species.

Outline of head, exclusive of free cheeks, transversely subrhomboidal, broadly rounded in front, convex; glabella conical, moderately convex, and marked by two pairs of short, shallow furrows that extend in but a short distance on the sides; occipital furrow rounded, very distinct, and continued outward on the postero-lateral limbs, where it is stronger and deeper; occipital ring narrow at the sides, gradually

increasing in width toward the center, where it is slightly convex, and marked at the center by a minute sharp tubercle; dorsal furrow strong and rather deep about the glabella.

Fixed cheeks about the same width as the glabella, moderately convex; they slope gently from the dorsal furrow to the palpebral lobe, and backward to the furrow of the postero-lateral limb; in front they slope rather rapidly and merge into the frontal limb; palpebral lobes small and situated about their own length from the posterior margin of the head; ocular ridge very faint, scarcely perceptible except by turning the specimen in the light; frontal limb slightly convex, sloping gently downward, and divided midway by a longitudinal furrow that extends from the front of the glabella to the furrow within the frontal rim; each side of the longitudinal median furrow the frontal border extends outward and backward, merging into the fixed cheeks without any interruption in the convexity of the slope; frontal rim narrow, nearly flat, and separated from the frontal limb by a very shallow groove which is little more than a change in slope of the frontal limb to the nearly flat frontal rim; postero-lateral limbs very short.

Surface minutely granulose under a strong lens, with a few scattered larger granules. The largest head of the species in the collection has a length of 4 mm., with a width at the palpebral lobes of nearly 5 mm.

This species is characterized by the longitudinal furrow in front of the glabella, which resembles the longitudinal furrow frequently seen in the frontal limb of the heads of *Agnostus*.

Formation and locality.—Middle Cambrian, Ku San shale formation; 2.5 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHOPARIA CONSTRICTA, new species.

The convex central portions of the head, exclusive of the free cheeks, are subquadrilateral in outline; glabella subcylindrical, narrowing slightly toward the front—only faint indications of glabellar furrows; occipital furrow narrow, clearly defined but shallow; occipital ring strong, narrow at the sides and broad at the center; fixed cheeks about as broad as the glabella; ocular ridges strong and merging into the rather long palpebral lobes; frontal limb well defined by the ocular ridges and narrow, slightly flattened, frontal rim.

Surface slightly roughened by minute irregular raised lines.

Formation and locality.—Lower Cambrian, Man To formation, lower part of southeast slope of Hu Lu Shan; 2.5 miles south of Yen Chuang, Hsin Tai, Shangtung, China.

PTYCHOPARIA DRYOPE, new species.

The head representing this species is of the same type as that of *Ptychoparia titiana*, from the base of the Chang Hsia formation. It differs from it in having a more elongate glabella, which is more transverse in front. It is also not probable that species of this character would range through 2,500 feet of limestone. It is often the case that heads that appear to have the general features of *Ptychoparia* are found to belong to other genera when the thorax and pygidium are known. This species is associated with *Ptychaspis ceto*, *Illænurus dictys*, *Menocephalus depressus*, and *Cyrtoceras cambria*.

Formation and locality.—Upper Cambrian, upper portion of Chao Mi Tien formation; Pagoda Hill, 1 mile west-southwest of Tai An Fu, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHOPARIA GRANULOSA, new species.

The gently convex central portions of the head, exclusive of the free cheeks, are all that is known of this species. These indicate a rather broad, semicircular head, with small free cheeks; wide fixed cheeks; narrow, short, convex glabella and narrow, flattened frontal rim; glabella marked by three pairs of faintly impressed but clear glabellar furrows; frontal space between the glabella and rim broader than the frontal rim and slightly convex; ocular ridge narrow, clearly defined, and merging into a rather small eye lobe.

Surface finely granulose.

Formation and locality.—Lower Cambrian, Man To formation; Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHOPARIA IMPAR, new species.

This species is represented by many fine specimens of the rather convex central portions of the head. The form of the parts preserved is not unlike that of *Ptychoparia acbis*. They differ in being more convex and stronger and in the absence of an occipital spine and the presence of rather faint glabellar furrows. Ocular ridge rounded and rather strong. Surface finely punctate.

Formation and locality.—Lower Cambrian. Man To formation. Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHOPARIA IMPAR, variety?.

This variety differs from the type of the species in having more distinctly defined glabellar furrows, slightly narrower frontal rim, and more rounded frontal margin to the glabella. There are several specimens of the head from one locality, which appear to vary among themselves as much as some of them vary from *P. impar*. The latter and the forms referred to the variety come from the upper portion of the Man To formation.

Formation and locality.—Lower Cambrian, upper portion of Man To formation, in shaly sandstone and limestone; Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHOPARIA LIGEA, new species.

Head, exclusive of free cheeks, subquadrilateral in outline, moderately convex; glabella almost of the same width from the posterior margin to the rounded front; three pairs of furrows are faintly but clearly indicated; occipital ring strong; occipital furrow shallow but extended out on the lateral limbs as a strong furrow. Fixed cheeks nearly as wide as the glabella; palpebral lobes short and small; ocular ridges narrow and strongly defined; frontal limb slightly convex to where it merges into the broad, shallow furrow that extends nearly out to the front margin; postero-lateral limbs rather long.

Surface slightly roughened by minute, irregular, raised lines that can be seen only with a strong lens.

Formation and locality.—Lower Cambrian. Middle of Man To formation. Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHOPARIA MANTOENSIS, new species.

Only the central portions of the moderately convex head of this species are definitely known. It is characterized by the broad frontal space and flat frontal rim; the sides of the glabella converge slightly toward the front margin, which is broadly rounded; glabellar furrows indicated by three very faint depressions on each side. Occipital furrow relatively shallow and rounded; fixed cheeks rather broad; eye lobe occupies the central third of the distance from the posterior margin to the anterior flattened rim; ocular ridges not strongly marked.

Surface slightly roughened by almost microscopic, irregular raised lines.

An associated free cheek has a long, slender postero-lateral spine.

Formation and locality.—Lower Cambrian. Man To formation. At Chang Hsia and 1 mile south, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHOPARIA TELLUS, new species.

All that is known of this species is the central part of the head, exclusive of the free cheeks. The specimens occur on the surface of shaly limestone, and are probably somewhat compressed; their convexity is relatively slight. Glabella large, convex, and nearly as wide in front as at the base; three pairs of glabellar furrows are indicated on the somewhat eroded outer surface of two specimens; occipital furrow shallow, narrow, and rounded, but quite distinct; occipital ring narrow at the sides, increasing in width and inclining backward toward the middle, where it rises to the base of a strong spine, which is directed upward and backward; the spine is nearly straight, and about as long as the length of the head; dorsal furrow clearly defined on the sides and in front of the glabella.

Fixed cheeks slightly convex and less than half the width of the glabella; palpebral lobes rather large; ocular ridges clearly defined and merging into the palpebral lobe; frontal limb short, slightly convex, and merging into the flattened frontal rim, the line of demarcation between the two being very slight; posterior lateral limbs small and short.

Surface unknown.

The largest head in the collection has a length of 10 mm. with a width of 11 mm. at the outer edges of the palpebral lobes.

This species is most nearly related to *Lonchocephalus hamulus*. It differs in having wider fixed cheeks and in the proportion of length of the frontal limb and rim as compared with the glabella.

Formation and locality.—Middle Cambrian. Lower portion of Chang Hsia formation. Two miles south of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHOPARIA TENES, new species.

Of this species only the moderately convex central portions of the head are known. Glabella prominent, moderately convex, narrowing very gradually toward the broadly rounded front; furrows only faintly indicated; occipital ring strong and bearing a broad base of a spine that extends obliquely upward and backward; occipital furrow shallow on the sides and scarcely perceptible at the center; dorsal furrow rounded and clearly defined. Fixed cheeks slightly convex and about one-third the width of the glabella; the length of the palpebral

lobes is about one-third the distance from the posterior to the front margin; ocular ridge low, broad, and marking quite distinctly the division between the lateral fixed cheeks and the rather abrupt downward slope of the short frontal limb, which merges into the rather broad, flat, frontal rim.

Surface minutely granulose under a strong lens. The largest head in the collection has a length of about 6 mm., exclusive of the occipital spine. This species is distinguished by the strong, occipital spine, large eye lobes, narrow, fixed cheeks, and the form of the frontal rim.

Formation and locality.—Middle Cambrian. At base of Chang Hsia formation, just above the Man To shale. One mile east-southeast of Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHOPARIA, species undetermined.

A single specimen of the central portion of a head that appears to be closely related to *P. tenes* occurs on the surface of a fragment of limestone. It has a similar slender, long, occipital spine, narrow, fixed cheeks, and flattened frontal rim. It occurs in the upper portion of the Chang Hsia formation, near the middle of the Chang Hsia oolitic limestone, 2 miles south-southeast of Kao Chia Pu, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHOPARIA TITIANA, new species.

Head subquadrilateral in outline, exclusive of the free cheeks; moderately convex. Glabella gently convex; broadest at the base, narrowing midway, and with the sides nearly parallel from the center to the broadly rounded front; glabellar furrows shallow, there are three on each side that penetrate to the central third of the glabella and divide it into two small central lobes, a short terminal lobe, and a posterior lobe that is broad at the sides and narrow toward the central third; occipital furrow narrow; occipital ring narrow at the sides and gradually thickening toward the center to form the base of a rather strong spine of unknown length; dorsal furrow shallow, but clearly defined.

Fixed cheeks of medium width, about two-thirds the width of the glabella; palpebral lobes central and about one-third the length from the posterior to the frontal margins of the head; ocular ridge narrow, clearly defined, it starts near the front line of the glabella and extends obliquely backward and merges into the rim of the palpebral lobe; postero-lateral limbs short and marked by a broad, shallow furrow; frontal limb convex, prominent, about as long as the fixed cheeks at

the eye lobes; at the front it slopes into the rounded groove back of the narrow, slightly flattened, frontal rim.

Surface slightly roughened over the central portions; on the frontal limb a network of fine, irregular, raised lines extends from the dorsal furrow and ocular ridges to the furrow inside the frontal rim.

Observations.—This species is associated with *Ptychoparia Liostracus thraso*. Its strong frontal limb and occipital spine distinguish it from other species.

Formation and locality.—Middle Cambrian. Base of Chang Hsia formation in oolitic limestone about 2 miles southwest of Yen Chuang, and 1 mile east-southeast of Chang Hsia, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHOPARIA THEANO, new species.

Head small, moderately convex; glabella subquadrilateral, moderately convex, a little narrower in front than at the base, and without glabellar furrows; occipital ring practically a continuation of the glabella, as the shallow occipital furrow barely indicates it; dorsal furrows narrow at the sides of the glabella, and very obscure in front of it.

Fixed cheeks a little wider than the glabella and nearly flat from the dorsal suture to the palpebral lobes; palpebral lobes large, situated opposite the central portion of the glabella; ocular ridges low and broad, and very clearly defining the lateral portions of the fixed cheeks from the frontal limb; frontal limb narrow in front of the glabella, sloping downward to the broad, shallow furrow that merges into the broad, almost flat, frontal rim; postero-lateral limbs short; a narrow, sharp furrow extends along their posterior margin from the glabella to the facial suture, just within the posterior margin.

Surface minutely granular under a very strong lens. The largest head has a length of 5 mm.

This species is distinguished by the broad, flat, fixed cheeks, convex, smooth glabella, large palpebral lobes, and nearly flat frontal margin.

Formation and locality.—Middle Cambrian. Base of Chang Hsia formation, in gray oolitic limestone. Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHOPARIA TOLUS, new species.

Of this species only a single fragmentary head is known; this is much like the corresponding parts of the head of *Ptychoparia Liostracus thraso*, but it differs (*a*) in being less convex, (*b*) in having a more coarsely granulated surface, (*c*) stronger posterior glabellar furrows,

(*d*) broader fixed cheeks, and (*e*) more broadly rounded front to the glabella. The length of the head is 10 mm.; of the glabella, 7 mm.; width of the head including palpebral lobes but not free cheeks, 12 mm.

Formation and locality.—Middle Cambrian. Base of Chang Hsia formation in oolitic limestone; 3 miles north-northeast of Hsin Tai, Hsien, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

LIOSTRACUS Angelin, subgenus of PTYCHOPARIA.

PTYCHOPARIA (LIOSTRACUS) TOXEUS, new species.

Of this species only the central portions of the head are known. The glabella and fixed cheeks are rather strongly convex; glabella prominent, truncato-conical, without furrows, except as indicated by a slight darkening of the surface where the furrows usually occur; occipital groove narrow, but very distinct; occipital ring narrow at the sides, rounded, and of medium width at the center; dorsal furrow strong, rounded, and marked by a slight pit at the antero-lateral angle of the glabella.

Fixed cheeks about one-half the width of the glabella at its base; palpebral lobes small and situated about half way between the posterior and front margins; ocular ridges faintly defined. Frontal limb narrow, convex, and sloping downward to a deep, rounded groove which rises in front to a strong, rounded frontal rim; postero-lateral limbs about one-third longer than the width of the fixed cheeks, a strong furrow extends the entire distance within the posterior margin.

The surface under a strong lens appears to be smooth. The largest head has a length of 6 mm. with a width of 7 mm. at the palpebral lobes, exclusive of the free cheeks.

This species may be compared with *Ptychoparia oweni*, a form that has a wide geographic distribution in the United States, and also ranges from the Middle Cambrian into the Upper Cambrian of the Eureka district in Nevada.^a

Formation and locality.—Middle Cambrian. Chang Hsia formation in the basal layers just above the shales; a mile east-southeast of Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHOPARIA (LIOSTRACUS) TROGUS, new species.

Head small, transversely quadrilateral, exclusive of the free cheeks; moderately convex; glabella broadly truncato-conical and without

^a Mon. U. S. Geol. Surv., No. 8, 1884, p. 55.

traces of glabellar furrows; occipital furrow narrow and rather shallow, rising on the back to the rather strong rounded occipital ring; the latter is broad through the central portions, narrowing at the sides; dorsal furrow rounded and well defined. Fixed cheeks about one-half the width of the glabella; palpebral lobes small; ocular ridges very faint; frontal limb very narrow, in fact it is difficult to decide that the dorsal furrows do not unite with a depressed space in front of the glabella that merges into the frontal furrow; the latter is rounded, shallow, and defines the strong, slightly convex frontal rim; postero-lateral limbs short, marked with a very distinct transverse furrow, just within the posterior margin.

Surface apparently smooth under a strong lens.

This species differs from other forms in the very short frontal limb and flattened frontal rim.

Formation and locality.—Middle Cambrian. Chang Hsia limestone, about 50 feet below the Ku San shale. Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHOPARIA (LIOSTRACUS) TUTIA, new species.

Head small, strongly convex; glabella very convex, almost tumid; truncato-conical in outline, and without traces of glabellar furrows; occipital furrow narrow; occipital ring strong and narrow at the sides; none of the specimens show it entire at the center; dorsal furrow narrow and rather deep on the sides of the glabella; not distinctly defined in front.

Fixed cheeks about two-thirds of the width of the glabella; palpebral lobes small, with their posterior end on a line with the longitudinal center of the head; ocular ridges narrow but very clearly defined; frontal limb gently convex, rather short, and very indistinctly separated from the rather broad, almost flattened, frontal rim; postero-lateral limbs strong but short; marked by a strong transverse furrow just within the posterior margin.

Surface minutely granulose. The largest head in the collection has a length of 4 mm. This very pretty little head is of the general type of *Ptychoparia tolus*, but it differs in the greater convexity of the glabella and the form of the frontal limb.

Formation and locality.—Middle Cambrian. Chang Hsia limestone, central portion. Three and one-fourth miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PTYCHOPARIA (LIOSTRACUS) THRASO, new species.

Head subquadrilateral in outline, exclusive of the free cheeks; strongly convex; glabella prominent, convex, sides straight, and converging toward the front from a width of 6 mm. at the base to 4 mm. at the front in a glabella 6.5 mm. long; front arched, and with a pit in the furrow where the sides and front unite; three shallow broad furrows extend nearly to the center from each side, so as to divide the surface into two narrow lobes—a terminal lobe and a strong posterior lobe; occipital furrow strong and arching forward at the center; occipital ring narrow at the sides and gradually increasing in width to the center; dorsal furrow narrow and well defined. Fixed cheeks narrow; palpebral lobes central, and small; postero-lateral limbs short and marked by a broad strong furrow; ocular ridges low, but clearly defined; frontal limb short, gently convex, and sloping into a strong, rounded furrow within the rounded, narrow, prominent frontal rim.

Surface smooth under a strong lens.

A head 10 mm. in length has a width of 11 mm. at the eye lobes.

Formation and locality—Middle Cambrian. Base of Chang Hsia formation, in oolitic limestone, about 2 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

PROAMPYX Frech, subgenus of PTYCHOPARIA.

Proampyx FRECH, 1902; *Lethæa geognostica*, I. Theil, *Lethæa Palæozoica*, II, p. 66.

Dr. Fritz Frech proposed the genus *Proampyx* for *Anomocare acuminatum* Angelin on account of the projection of the frontal border into a strong spine. He said: "The peculiar very variously formed group of *Anomocare acuminatum*^b with pointed glabella, seems to be the forerunner of *Ampyx* and is called *Proampyx*. The difference from the typical *Anomocare* with rounded head shield is striking. The separation of the genus *Proampyx* from the typical *Conocephalidæ* follows from the transitional forms *Arionellus sulcatus*^c and *A. difformis*.^d The spine of *Ampyx acuminatus* is in well preserved examples longer than in Angelin's illustration. The species reminds most of *Ampyx nasutus* Dalman (Orthoceras limestone)."

Doctor Frech in his statement appears to have overlooked the fact that the spine of the genus *Ampyx* is a spinose extension of the front of the glabella, while the nasute projection of the frontal rim of

^a *Lethæa geognostica*, Pt. 1, *Lethæa Palæozoica*, II, p. 66.

^b Angelin, *Tril.* pl. xvii, fig. 7.

^c *Anomocare* Angelin, *Tril.*, pl. xvi, fig. 6.

^d *Idem*, fig. 5.

Anomocare acuminatum is from an entirely different division of the head of the trilobite and in no way can be correlated or compared with the glabella of *Ampyx*. On this account it is unfortunate that the name *Proampyx* was given.

A similar nasute projection of the frontal border occurs on the head of the trilobite described as *Ptychoparia? pernasutus* Walcott.^a The glabella of the latter species is quite unlike that of *Proampyx acuminatum*, being more like that of *Proampyx burea*. On this account it is doubtfully referred to *proampyx* and it is left under the genus *Ptychoparia*, with *Proampyx* as a subgenus, until a further study can be made of all the forms in which the frontal border is extended into the nasute projection.

PTYCHOPARIA (PROAMPYX) BUREA; new species.

Head, exclusive of the free cheeks, quadrilateral in outline, convex. Glabella convex, truncato-conical in outline, with the front broadly rounded; surface marked by two pairs of faintly indicated furrows; occipital furrow rounded, narrow, and distinct; occipital ring narrow at the sides, of medium width, and slightly convex toward the center; dorsal furrow of medium width rather deep and distinct.

Fixed cheeks convex, narrow, and about one-fourth the width of the glabella at the palpebral lobes; they slope gently back to the postero-lateral limbs, and abruptly downward in front of the narrow rounded ocular ridge to the frontal limb; postero-lateral limbs short, marked by a shallow furrow parallel to the margin; frontal limb short, and rising a short distance in front of the glabella into a nasute-like extension of the frontal rim, which rises up in front of the head; to the sides the frontal limb slopes abruptly downward and forward, forming a deep wide groove with the frontal rim; frontal rim not separable from the frontal limb at the sides, but rising immediately in front of the glabella into a broad nasute-like process, the height of which is unknown.

Surface unknown except on the occipital ring, where it is marked by irregular, raised, inosculating lines that give it a granulose appearance. The type and only specimen of the head in the collection has a length of 10 mm., exclusive of the nasute-like projection on the frontal rim.

This species is clearly distinguished by the nasute-like projection on the frontal rim.

This species differs from *Proampyx acuminatum* Angelin, in the short frontal limb and the form of the nasute projection; also in the form of the glabella, and other parts of the central portions of the head.

^aMon. U. S. Geol. Surv., 1884, VIII, pl. x, figs. 8, 8b.

Formation and locality.—Upper Cambrian, base of the Chao Mi Tien formation, in a coarse, fossiliferous gray limestone, 3 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus SHANGTUNGIA, new genus.

As there is but one species of this genus, the description of the species includes all that is known of the genus and species. The genus is characterized by the large palpebral lobes, smooth, truncato-conical glabella, and the long spinose extension of the front, which is unlike that of *Ampyx*, as the latter proceeds from the glabella, while the spine of *Shangtungia* is from the frontal rim, in the same manner as that of *Proampyx acuminatum* Angelin; but it differs radically from the latter genus and species in the character of the glabella and palpebral lobes.

Genotype.—*Shangtungia spinifera*.

SHANTUNGIA SPINIFERA, new species.

Outline of head, exclusive of free cheeks and frontal spine, sub-rhomboidal, moderately convex. Glabella truncato-conical, slightly longer than its width at the base; at the postero-lateral angle of the glabella a small, low lobe extends out into and partially fills up the dorsal furrow; there is also a slight pit in the dorsal furrow opposite a point where a second glabellar furrow usually occurs in similar glabellæ; occipital furrow narrow, distinctly defined at the sides, but very shallow near the center; occipital ring slightly convex, strong, and of equal width from side to side; dorsal furrow deep at the sides and scarcely perceptible in front of the glabella.

Fixed cheeks about two-thirds as wide as the glabella; they rise abruptly from the deep dorsal furrow, and then slope upward to the palpebral lobe; back of the palpebral lobe they drop somewhat abruptly to the postero-lateral limb, and in front to the furrow between the frontal limb and rim; ocular ridge very slight, scarcely perceptible in most specimens; palpebral lobe large, rounded, and rising at the margins above the level of the fixed cheeks; rim of the broad marginal border with an inward slope toward the fixed cheeks, but not any well defined furrow such as usually occurs on the palpebral lobes; the length of the palpebral lobe is about one-half of the distance between the furrow in front of the frontal limb and the posterior margin of the head; postero-lateral limb slender, and extending more than the width of the glabella outward from the dorsal furrow; frontal limb very short and scarcely separable from the downward slope of the front of the glabella; at the sides it merges into the fixed cheeks; it is separated from the frontal rim by a peculiar transverse

furrow; the latter is formed of two slightly forward arching, narrow furrows in front of the fixed cheeks, that merge into a very shallow furrow in front of the glabella; the central portion of the furrow arches slightly backward; the furrows are deepest opposite the antero-lateral angles of the glabella; frontal rim sub-triangular in outline, nearly flat, and extending forward at the center to form the base of a long, slender, rounded spine.

Surface minutely punctate under a strong lens. A head 7 mm. in length, exclusive of the frontal spine, has a width of 9 mm. at the outer margin of the palpebral lobes; the glabella is 2.5 mm. at the base, and with the occipital ring is 5 mm. in length, the flat frontal rim and spine of a head of about the same size has a length of about 8 mm., the spine, at the point where broken off, having a width of 1 mm.

I do not know of any other form closely related to this species. *Proampyx acuminatum* Angelin has a similar nasute projection on the frontal rim, but it differs in the form of the glabella and palpebral lobes and other details of the head. The same is true of the species described as *Ptychoparia pernasutus* Walcott.^a

Formation and locality.—Middle Cambrian, Ku San shale formation; 2.5 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus SOLENOPLEURA Angelin.

SOLENOPLEURA ABDERUS, new species.

This species is represented by the glabella, occipital ring, fixed cheek, and frontal rim. It is most closely related to *S. acantha*, but differs in the narrower fixed cheeks, and short, rounded, frontal rim. The surface is also marked by larger and many more pustules, which are scattered more or less irregularly over the surface. Three pairs of short glabellar furrows are faintly indicated upon the rounded sides of the somewhat convex glabella. The type specimen has a length of 8 mm., and a larger head associated with it of 12.5 mm.

Formation and locality.—Middle Cambrian, upper portion of the Chang Hsia formation, just beneath the Ku San shale, in a gray, rather coarse limestone; Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

SOLENOPLEURA ACANTHA, new species.

General form of head, exclusive of free cheeks, transversely rhomboidal and rather convex. Glabella prominent, convex, truncato-conical, with width at the base and length about the same; a short,

^aMon. U. S. Geol. Survey, VIII, 1884, p. 49, pl. x, fig. 8.

strong furrow marks off two small, sub-triangular lobes at the postero-lateral angle; a second pair of slightly marked furrows occurs upon the sides, next to the dorsal furrow, about midway of the length of the glabella; the sides slope inward from the base, so as to reduce the width of the rounded front to about two-thirds that of the base; occipital furrow narrow, transverse, and deep; occipital ring narrow at the sides, broadening toward the center, where it is thick and convex; dorsal furrow very distinct at the sides and front.

Fixed cheeks convex, but much lower than the glabella; they are about as wide at the palpebral lobe as the width of the glabella in front; their appearance of convexity is given by their downward slope toward the frontal rim and backward to the furrow just within the posterior margin; palpebral lobe small, situated about midway of the fixed cheek; no traces of ocular ridges are shown; a strong, slightly rounded, frontal rim is separated from the glabella and fixed cheeks by a narrow, rounded, transverse furrow; postero-lateral limb short, and marked by a narrow, deep furrow just within the raised posterior margin.

Surface marked by strong pustules in all parts with the exception of the dorsal furrow and furrow back of the frontal rim.

In general form this species resembles *Solenopleura agno* and *S. abderus*. It differs from the former in the shape and convexity of the glabella and broader fixed cheeks and from the latter in the shape of its glabella, fixed cheeks and frontal rim.

Formation and locality.—Middle Cambrian, Chang Hsia formation, just below the Ku San shale; Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

SOLENOPLEURA ACIDALIA, new species.

The description of *S. agno* applies to this species, except that it does not have the short frontal limb of the latter, and its frontal rim is nearly flat instead of rounded. The surface is smooth with the exception of a few large, low, scattered pustules. The head of the type and only specimen in the collection has a length of 4 mm.

Formation and locality.—Middle Cambrian, central portion of the Chang Hsia formation, in a compact, dove-colored limestone; Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

SOLENOPLEURA AGNO, new species.

General form of head, exclusive of free cheeks, transversely sub-rhomboidal, convex. Glabella as long as the width at its base, the sides converging from the base toward the rounded front, so as to

narrow the glabella about one-fourth; a very slight trace of a short, posterior pair of furrows can be seen by reflected light; occipital furrow well defined by the downward curvature of the posterior margin of the glabella, and rising of the surface of the occipital ring; the latter is narrow at the sides, gradually widening toward the center, which is most elevated a little in front of the posterior margin; dorsal furrow narrow, but clearly defined at the sides in front of the glabella.

Fixed cheeks about one-half the width of the glabella at the center, rather convex, and sloping somewhat abruptly to the frontal rim; palpebral lobe small, situated about midway of the cheeks; postero-lateral limbs unknown; frontal limb very narrow in front of the glabella, convex, and curving down to the broad groove within the strong, rounded, frontal rim.

Surface marked by low pustules that give it a roughened appearance. The type and only specimen of the head in the collection has a length of 6 mm.

This species is characterized by its broad, short glabella, narrow frontal limb, and peculiar granulose surface.

Formation and locality.—Middle Cambrian, upper portion of the Chang Hsia formation, just beneath the Ku San shale, in a rather coarse, light-gray limestone. Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

SOLENOPLEURA BELUS, new species.

This species is represented by a fragment of the head that includes the glabella and fixed cheeks. The glabella is moderately convex and narrows slightly toward the rather broadly rounded front; the surface is marked by a pair of short, oblique, posterior furrows and one anterior pair at about the anterior third; occipital furrow narrow, distinct, arching forward at the center and considerably deeper toward the end; occipital ring clearly defined, of moderate width, and slightly convex; dorsal furrow narrow and clearly defined.

Fixed cheeks narrow, scarcely more than a ridge between the dorsal furrow and the palpebral lobe; posteriorly they slope downward to a long postero-lateral limb and anteriorly drop rather rapidly to the frontal limb; palpebral lobe a little more than one-third the length of the glabella; postero-lateral limb about as long as the width of the glabella in front, deeply grooved along its center by a furrow parallel to the elevated posterior margin; frontal limb short and slightly convex in front of the glabella; it passes into a shallow furrow within a slightly rounded frontal rim; the latter is broken away except at the ends.

Surface marked by numerous scattered, rather small pustules. Length of head 6 mm., with a width at the palpebral lobes of 5 mm.

This species at first suggests *S. agno*, but differs from that and other species from China in its very narrow fixed cheeks and relatively large palpebral lobes.

Formation and locality.—Middle (?) Cambrian limestone and shale, probably of the Ku San shale horizon, just below the Chao Mi Tien formation, at an elevation of 380 feet above the Wön Ho River, 12 miles S. 80° E. of Tai An Fu, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

SOLENOPLEURA BEROE, new species.

The description of the general form *S. agno* applies very closely to this species. It differs from the latter in its broader fixed cheeks, shorter frontal limb, more clearly marked glabellar furrows, and minutely pustulose surface. The type and only specimen of the head in the collection has a length of 4 mm.

Formation and locality.—Upper Cambrian, Chao Mi Tien formation, in a compact, gray, very fossiliferous limestone; 2.7 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus DIKELOCEPHALUS Owen.

DIKELOCEPHALUS (?) BAUBO, new species.

The description of *Dikelocephalus* (?) *brizo* applies to this form, with the exception that *D. (?) baubo* has a more rounded front to the glabella, and its frontal rim and border vary somewhat in form. In *D. (?) baubo* the palpebral lobe is preserved, and shows it to have been relatively small and short and marked just within the rim by a rather deep furrow. A head of *D. (?) baubo* 16 mm. in length has a glabella 12 mm. in length, frontal rim and limb 2 mm., and occipital furrow and ring 2 mm. in length; the glabella has a width of 9 mm. opposite the palpebral lobe. The surface is marked by strong scattered pustules over the glabella; but with little trace of them on the fixed cheeks and frontal rim. The two specimens of the head of this species in the collection vary somewhat in the form of the frontal rim, it being nearly flat in one and slightly concave in the other.

The most nearly related form is *D. (?) brizo*.

Formation and locality.—Upper Cambrian, upper portion of the Chao Mi Tien formation, in a compact, hard, fossiliferous, gray limestone; 2.7 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

DIKELOCEPHALUS (?) BRIZO, new species.

This species is represented by the anterior portions of a large, moderately convex head, exclusive of the free cheeks. The glabella is subquadrilateral, with the sides slightly incurved and the front nearly transverse; it is marked by a strong pair of posterior furrows that penetrate obliquely backward nearly to the median line; a second pair incline slightly backward and penetrate to about one-third the distance across; a third pair, narrow and very slightly impressed, extend in at right angles to the sides a little less than one-third the distance; occipital furrow well defined, with a slight, elongate, pit-like depression at the anterior lateral angles of the glabella.

Fixed cheeks very narrow, not much more than a ridge opposite the palpebral lobes; palpebral lobes unknown; ocular ridge rounded, and dividing the fixed cheek into the flat posterior portion and the rather rapidly sloping frontal portion that passes down into the concave frontal limb; frontal limb short, concave, and bordered by a rounded, thick, frontal rim. The fragmentary specimens representing this species indicate a length for the glabella of 22 mm., with a width in front of 14 mm.; the concave frontal limb has a length of 2.5 mm., and the thickened, rounded rim has a length of about 1.5 mm. The fixed cheek at the palpebral lobe has a width of 2 mm.

Surface marked by numerous more or less irregularly placed strong pustules, except in the dorsal furrow and the concave frontal limb. This species is somewhat doubtfully referred to *Dikelocephalus*. The form of the glabella, frontal rim, and narrow fixed cheeks suggest *Dikelocephalus*, but the strongly pustulose surface is not characteristic of the typical forms of the genus.

Formation and locality.—Upper Cambrian, lower portion of the Chao Mi Tien formation, in coarse, gray, fossiliferous limestone; Chao Mi Tien, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus CREPICEPHALUS Owen.

CREPICEPHALUS DAMIA, new species.

Head semicircular in outline, with the postero-lateral angles terminating in round, somewhat incurved, spines. Glabella moderately convex, with the sides narrowing slightly toward the front, which is broadly rounded; length a little greater than its width at the occipital furrow; marked by three pairs of furrows; posterior pair extend obliquely inward and backward so as to almost separate a triangularly shaped lobe; second pair rather faint, extending directly inward a distance of about one-third the width of the glabella, and then curving slightly backward; anterior pair very faint; occipital furrow rather

broad and strongly defined; occipital ring narrow at the ends, rounded, and rather strong in the central portions; dorsal furrows clearly defined on the sides, but obscure in front of the glabella.

Fixed cheeks about one-half the width of the glabella; posteriorly they slope downward into postero-lateral limbs that are about twice as long as the width of the fixed cheeks; toward the front the fixed cheeks slope abruptly downward and merge into the frontal limb; ocular ridges low and broad, merging into the strong palpebral lobe; postero-lateral limbs grooved near the posterior margin by a strong furrow; frontal limb short, almost flat, and sloping abruptly from the front of the glabella down to the strong, nearly flat, frontal rim; the body of the associated free cheek is subquadrilateral in outline, marginal borders strong, clearly defined, and produced behind into a strong, slightly curved, rounded spine.

Thorax unknown.

The associated pygidium is quadrilateral in outline, exclusive of the strong, slightly diverging postero-lateral spines, which are a little longer than the length of the pygidium; sides of the pygidium subparallel or slightly diverging toward the base of the spine; posterior margin nearly transverse; axial lobe prominent, convex, and reaching nearly to the posterior margin; the sides converge slightly toward the bluntly pointed posterior end; divided by three transverse furrows into three segments and a strong terminal portion, which is marked at the point where the axis slopes abruptly downward by the small node on each side; the pleural lobes are limited to a rather large anterior lobe and an obscure secondary lobe, which appears to merge backward into the postero-lateral spine.

Surface apparently smooth under a strong lens; a few scattered punctæ occur on the glabella. The largest head has a length of 10 mm., with a width of 12 mm. at the palpebral lobes.

This species differs from *Crepicephalus iowensis*, to which it appears to be most nearly related, by the form of the frontal limb and rim of the glabella and other details; the pygidium is not as broad, and it also differs in outline.

Formation and locality.—Middle Cambrian, Chang Hsia formation, near upper part, in a dark oolitic limestone; in cliffs 1 mile east of Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

CREPICEPHALUS MAGNUS Walcott.

The only portions of this species in the collection are a fragment of the posterior portion of the glabella and the outer portion of a large free cheek; the fragment shows that the glabella had a width at the base of 12 mm.; also, that there was a narrow, strong occipital groove

and an occipital ring over 3 mm. in width. The surface of the fragment of the glabella is marked by strong pustules, which give it a somewhat granulose appearance. The cast of the fragment of the interior of the free cheek indicates that it was pustulose and that the postero-lateral angle terminated in a long, curved spine.

The two fragments described are so distinctly marked by the coarse granulation and the free cheek by its curved terminal spine that there is little danger of confusing it with any other species.

Formation and locality.—Middle Cambrian, Chang Hsia formation, in a dark oolitic limestone toward the lower portion of the formation; a mile east of Chang Hsia and Chao Mi Tien, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus DOLICHOMETOPUS Angelin.

DOLICHOMETOPUS ALCESTE, new species.

This species occurs at the same locality as *D. deois*, but not in the same bed of limestone. It differs from *D. deois* in having a much more convex glabella, with nearly parallel sides. Glabella marked by a posterior pair of furrows, extending inward and backward so as to nearly cut off a small subtriangular lobe at the base of the glabella, also three pairs of short, faintly impressed furrows that extend in at right angles to the side of the glabella; occipital furrow and ring unknown; dorsal furrow shallow, but well defined.

Fixed cheeks very narrow; they slope down into the strong furrow just within the narrow palpebral lobe and anteriorly slope down to the frontal limb; the rim of the palpebral lobe crosses the narrow free cheek, forming a very short ocular ridge; frontal limb short, nearly flat. The glabella of the only specimen of this species has a length of 12 mm., with a width at the ocular ridges of 8 mm.; the frontal limb has a length of 1.5 mm. The exterior surface under a strong lens shows a few fine scattered punctae. The inner surface of the frontal limb where exposed by a breaking away of a portion of the shell is strongly punctate.

Formation and locality.—Middle Cambrian; near the base of the Chang Hsia formation, in a gray limestone in which great numbers of *Agnostus chinensis*, Dames, occur; 3 miles southwest of Yen Chuang, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

DOLICHOMETOPUS DEOIS, new species.

This species is represented by the central portions of the head. Glabella and fixed cheeks moderately convex; glabella prominent, moderately convex, and marked by three pairs of rather short, very

faintly impressed furrows; the sides of the glabella are sub-parallel for a short distance near the base and then are gently inclined outward to the rounded front margin; occipital furrow shallow, rounded, and merging into the strong occipital ring, the latter is narrow at the sides broadening rather rapidly to the base of a small, backward sloping occipital spine; the front the glabella curves rather abruptly downward, which gives the anterior portion a convex appearance; dorsal furrow shallow and distinctly defined at the sides of the glabella.

Fixed cheeks narrow and slightly convex and sloping posteriorly downward to an elongate postero-lateral limb; in front of the palpebral lobe the cheeks slope abruptly down to the frontal limb; palpebral lobes a little longer than one-third the length of the head. There does not appear to be any definite ocular ridge. The elevated rim of the palpebral lobe approaches closely to the dorsal furrow, where it is merged into the downward slope of the fixed cheek; frontal limb short and slightly convex.

Surface apparently smooth under a strong lens.

On the anterior portion of a cast of the glabella there is indicated a very short fourth furrow close to the antero-lateral angle; the same specimen also shows what is the frontal limb in other heads divided into a short frontal limb and a narrow, slightly upturned rim. The largest head in the collection has a length of 17 mm.

This species differs from the type of the genus *D. socius* Angelin in the greater convexity of the glabella, more convex frontal limb, and other minor details of the glabella and fixed cheeks; from *D. direx* it differs in the greater expansion of the glabella in front, and from *D. derceto* in the configuration of the frontal limb.

Formation and locality.—Middle Cambrian. Near the base of the Chang Hsia formation in a gray limestone, which carries great numbers of *Agnostus chinensis* Dames. Three miles southwest of Yen Chuang and 3 miles west of Kao Chia Pu, Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

DOLICHOMETOPUS DERCETO, new species.

This species is known only by the central portions of the head, exclusive of the free cheeks. Glabella moderately convex and expanding slightly in width from the base to the rounded front; the surface is marked by two pairs of rather strong, short furrows opposite the palpebral lobe; occipital ring strong and rather deep; occipital ring narrow at the sides, rising and widening to form the base for a small, sharp, occipital spine; dorsal furrow strong on the sides of the glabella.

Fixed cheeks narrow, convex; palpebral lobe narrow, elongate, almost touching the dorsal furrow in front; postero-lateral limb of

medium length marked by a strong furrow parallel to the posterior margin; frontal limb narrow, slightly concave, and almost concealed by the overhanging, almost tumid frontal portion of the glabella.

Surface smooth under a strong lens. The largest of the three heads representing this species has a length of 7 mm. exclusive of the occipital spine.

Formation and locality.—Middle Cambrian. Lower portion of Chang Hsia formation in a drab-colored limestone, intercalated in green nodular shale. At Yen Chuang and 2 miles south. Hsin Tai, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

DOLICHOMETOPUS DIRCE, new species.

Only the central portions of the head of this species are known. It differs from *D. deoisi* in the nearly parallel sides of the glabella, the absence of glabellar furrows, and very short, almost flat frontal limb. The occipital lobe is nearly one-half the length of the head.

Surface under strong magnifier smooth. The type specimen of the head has a length of 11 mm.

Formation and locality.—Middle Cambrian. Near the upper portion of the Chang Hsia formation. Two miles east of Chang Hsia, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

Genus ILLÆNURUS Hall.

ILLÆNURUS CANENS, new species.

Head, exclusive of the free cheeks, sub-rhomboidal in outline, moderately convex. Glabella sub-quadrate, moderately convex, length and width the same, without perceptible occipital or dorsal furrows; palpebral lobes small, with their anterior end opposite the center of the glabella; frontal margin broadly rounded; postero-lateral limbs short and subtriangular in outline; the facial suture, cutting the frontal rim on a line with the base of the palpebral lobe, passes directly to the anterior margin of the palpebral lobe; it encircles the latter, and then, curving gently outward, passes in an almost direct line to the posterior lateral margin of the postero-lateral limb.

Surface minutely punctate under a strong lens.

The pygidia associated with the head parts are rounded, subtriangular in outline, and about two-thirds as long as the width at the anterior margin, rather convex, and marked on the interior of the cast by a faintly defined, rather narrow axis, and very slight traces of ten or more transverse furrows on the axis, that are more faintly indicated for a short distance on the pleural lobes.

The largest head in the collection has a length of 14 mm., with the same width at the palpebral lobes; a pygidium 14 mm. in length has a width of 20 mm.

This species appears to be most nearly related to *Illænenurus eurekaensis*,^a which occurs at the base of the Ordovician in the Eureka district of Nevada, but it differs in the smaller palpebral lobes, which are situated farther back on the head; and it differs from *I. ceres* in its proportionately longer head.

This species is quite widely distributed in the Upper Cambrian limestone, in association with the following trilobites: *Illænenurus dictys*, *Menocephalus depressus*, *Pugodibia*, *P. lotos*, *Ptychaspis ceto*.

Formation and locality.—Upper Cambrian, lower portion of the Chao Mi Tien formation. At Chao Mi Tien; 7.5 miles east of Chao Mi Tien; at Pagoda Hill, 1 mile west southwest of Tai An Fu; and two-thirds of a mile west of Tai An Fu, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ILLÆNURUS CERES, new species.

Head, exclusive of the free cheeks, rounded subquadrate, moderately convex; the posterior margin of the head curves slightly upward opposite the glabella, where there is a slight thickening which gives the appearance of a narrow occipital ring; the front margin of the head is broadly curved. Glabella very faintly outlined on the interior of the cast; as thus shown it has a width at the base of 6 mm. and at the front of 4.5 mm. on a head 11 mm. in length; its somewhat rounded front is about 1 mm. from the frontal rim of the head; no traces of glabellar furrows have been observed, and in only one specimen can the very faint dorsal furrow that outlines the glabella be seen.

Fixed cheeks of the same specimen 3 mm. in width at the palpebral lobes, from which they extend with almost uniform width to the front, and broaden slightly backward before merging into the short, triangular postero-lateral limbs; palpebral lobes small and situated back of a line passing through the transverse center of the head.

The associated pygidium in the same fragment of rock is rounded subtriangular in outline, moderately convex, and without any indication of an axis except a very narrow, slightly marked median ridge on the cast of the interior; a specimen 11 mm. in length has a width of 16 mm. at the front margin; a very slight elevation of the front margin near the center indicates that the axial lobe of this specimen had a width of about 6 mm.

Surface minutely but not closely punctate under a strong lens.

^a Mon. U. S. Geol. Survey, VIII, 1884, p. 97, pl. XII, figs. 4 and 4a.

This species differs from *I. canens* by the greater width of the head at the palpebral lobes and less convexity; the associated pygidium is less convex, more subtriangular in outline, and without the indication of a central axis.

The associated species on the same hand specimen are *Ptycaspis ceto* and *Anomocarella carme*.

Formation and locality.—Upper Cambrian, lower portion of Chao Mi Tien formation, in gray, crystalline, fossiliferous limestone; Chao Mi Tien, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

ILLÆNURUS DICTYS, new species.

Head, exclusive of the free cheeks, rounded, subquadrate, gently convex; the posterior margin of the head curves slightly upward opposite the central portion, where there is a slight elevation which gives the appearance of a narrow occipital ring; the front margin of the head is broadly rounded, with a very broad obtuse angle at the center; the cast of the interior of the crust shows a very faint, low, longitudinal median ridge. The glabella is not defined from the fixed cheeks. The palpebral lobes are small and situated nearly opposite the center of the head; postero-lateral limbs small and short.

Surface smooth under a strong lens.

The associated pygidium is transverse, rounded, subtriangular; front broadly rounded; sides gently rounded, forming a rounded obtuse angle at the posterior margin; the cast of the interior of the crust shows a narrow, slightly defined axis, with eight or more very faint transverse furrows and rings. The pleural lobes are gently convex and without any trace of furrows.

A head 6 mm. in length has an equal width at the palpebral lobes. A specimen of the associated pygidium 7 mm. in length has a width of 8 mm. at the front margin.

This species differs from *Illænurus ceres* in the obtusely pointed front margin of the head and its less convexity. From *Illænurus canens* it differs in the direction of the facial sutures from the front margin back to the palpebral lobes; the sutures of *Illænurus dictys* extend slightly outward from the base of the palpebral lobe to the margin, while those of *Illænurus canens* extend directly forward, making the central portion of the head narrower at the front margin.

Formation and locality.—Upper Cambrian. Central portion of Chao Mi Tien formation, Pagoda hill, 1 mile west and southwest of Tai An Fu, Shangtung, China.

Collected by Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

OSTRACODA.

Genus BRADORIA Matthew.

BRADORIA BERGERONI, new species.

General outline broadly semielliptical. Hinge line straight, nearly as wide as the breadth of the valve; anterior cardinal angle about 80° ; posterior cardinal angle slightly obtuse; the anterior margin is very slightly curved from the angle to where it merges into the broadly rounded front; posterior margin somewhat broadly rounded from the angle to the front. Surface convex, the greatest convexity being back of the transverse center between the ocular tubercle and the posterior fourth of the valve. From this elevated portion the surface slopes rapidly and somewhat abruptly to the hinge line and more gently to the lower margin. From the anterior cardinal angle a very short, narrow ridge extends to a small, circular, slightly elevated tubercle which is situated about an equal distance from the hinge line and the anterior margin. The anterior, posterior, and lower margins have a narrow, rounded rim that is slightly flattened on the inner side.

Surface marked by shallow scattered punctæ and very fine punctæ, as seen under a strong lens.

Width of valve 1.8 mm.; length 1 mm.; depth about 0.5 mm.

This species is distinguished from *B. sterope* by its greater width and the form of the ocular tubercle.

Formation and locality.—Middle Cambrian; compact, bluish-gray, thin-bedded limestones; from shingle on gravel bar in the Lan Hö, 1 mile south of Chên Ping Hsien, southeastern Shensi, China.

Collected by Bailey Willis and Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

BRADORIA ENYO, new species.

General outline irregularly oval. Hinge line about four-fifths the width of the valve. Anterior cardinal angle nearly a right angle; posterior cardinal angle slightly obtuse; the anterior margin extends from the angle almost directly downward to where it curves and merges into the broadly rounded lower margin; posterior margin very slightly rounded from the angle downward to where it curves and merges into the lower margin. Surface moderately and uniformly convex, the highest portion being near the center; a very short, narrow, low, and somewhat obscure ridge extends obliquely inward from the anterior cardinal angle to a small, slightly elevated ocular tubercle; a slight furrow appears to extend from the tubercle obliquely to a point about midway of the hinge line; a little posterior to this and near the hinge line there appears to be a minute low tubercle.

The surface appears to be minutely punctate under a strong lens.

Width of valve 1 mm.; length 0.75 mm.; depth about 0.25 mm.

This species is distinguished from *B. sterope* by the difference in the form of the anterior cardinal angle and the position of the ocular tuberele. The latter is in about the same position as the tuberele on *B. bergeroni*, but *B. bergeroni* is quite different in its outline and convexity.

Formation and locality.—Middle Cambrian; compact, bluish-gray, thin-bedded limestone; from shingle on gravel bar in the Lan Hō, 1 mile south of Chên Ping Hsien, southeastern Shensi, China.

Collected by Bailey Willis and Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

BRADORIA ERIS, new species.

General outline obliquely semicircular. Hinge line straight; anterior cardinal angle about 70° ; posterior cardinal angle slightly obtuse; anterior margin nearly straight to where it merges into the rounded lower margin; posterior margin gently rounded from the angle down to where it merges into the lower margin. Surface moderately convex, with the highest point at the tuberele a little in front of the center; a very narrow rim extends from the posterior cardinal angle around to the anterior side, where it broadens out and continues to the anterior cardinal angle; a slight narrow ridge extends obliquely inward a short distance from the anterior cardinal angle to a furrow that extends from the hinge line at right angles a short distance; the ridge and furrow outline a small lobe; from the inner angle formed by the furrow and ridge described a very narrow ridge extends downward subparallel to the anterior margin to the base of a strong, elevated tuberele or spine that is situated on the anterior third a little in advance of the transverse center of the valve.

Under a strong lens the surface appears to be slightly roughened by shallow puncta.

Width, 2 mm.; length, 1.5 mm.; depth, about 0.5 mm.

This species differs from *Bradoria sterope* in the outline of its valve and the presence of an elevated tubercle near the center.

Formation and locality.—Middle Cambrian; compact, bluish-gray, thin-bedded limestone; from shingle on gravel bar in the Lan Hō, 1 mile south of Chên Ping Hsien, southeastern Shensi, China.

Collected by Bailey Willis and Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

BRADORIA FRAGILIS, new species.

Hinge line nearly straight, about one-fifth shorter than the width of the valve. Posterior cardinal angle obtuse, with the marginal curve long and passing into the broad curve of the lower end of the valve; anterior cardinal angle about 75° , with the anterior margin nearly

straight to where it merges into the broad curve of the lower part of the valve.

Surface of the valve wrinkled to such an extent that it looks like wrinkled parchment. What may be an ocular tubercle occurs a short distance from the hinge and anterior margin. Surface minutely punctate under a strong lens.

Width, 2.25 mm.; length, 2 mm.; depth unknown, as the flexible test has been compressed.

This species differs from *Aluta flexilis* Matthew^a in having a straight hinge line; in this respect it resembles some forms of *Leperditia*. For the present it is referred to *Bradoria* on account of its close resemblance to *Bradoria sterope*.

Formation and locality.—The specimens were collected from a fragment of compact, bluish-gray, thin-bedded limestone, containing fragments of a trilobite that suggests *Dorypyge*. On this account the horizon is referred to the Middle Cambrian.

Collected from shingle on a gravel bar in the Lan Hö, 1 mile south of Chên Ping Hsien, southeastern Shensi, China.

Collected by Bailey Willis and Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

BRADORIA STEROPE, new species.

Outline of shell obliquely semicircular. Hinge line straight, nearly as long as the width of the valve. Anterior cardinal angle about 80° ; anterior curve obsolete; from the anterior cardinal angle the margin slopes downward and slightly inward, curving gently into the broadly rounded lower margin; posterior cardinal angle slightly obtuse; posterior margin curves gently from the angle to the broad curve of the lower side of the valve, which gives a broadly rounded posterior end. The valve is rather strongly convex, rising to the greatest height near the center. The surface is marked by a very narrow rim; from the anterior cardinal angle a narrow ridge extends obliquely inward about one-half the distance toward the center, and terminates in a slight tubercle; on the anterior side there are three shallow depressions, as though the surface had been indented; on the posterior side there is one larger depression directly back of the tubercle at the end of the ridge, and a slight depression in the angle formed by the ocular ridge, the hinge line, and the ridge between the two depressions.

Surface with minute scattered punctæ, as seen under a strong lens.

The valve has a width of 1.125 mm.; length, 0.8 mm.; depth, about 0.25 mm.

In outline this species resembles *Bradoria fragilis*; it differs in its stronger shell and distinctly marked ridge and ocular tubercle.

^aTrans. N. Y. Acad. Sci., XV, 1896, p. 198.

Formation and locality.—Middle Cambrian; compact, bluish-gray, thin-bedded limestone; shingle on gravel bar in the Lan Hō, 1 mile south of Chên Ping Hsien, southeastern Shensi, China.

Collected by Bailey Willis and Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

BRADORIA WOODI, new species.

Outline of shell obliquely semicircular. Hinge line straight, a little shorter than the greatest width of the shell. Anterior cardinal angle about 70° ; posterior cardinal angle obtuse. Posterior margin has a gentle curvature from the angle, which gives it a broadly rounded outline down to where it merges into the broadly rounded lower side; anterior margin almost straight and then gently curving into the lower margin. Surface rather convex, with the highest portion at the ridge around the central depression. The outer rim is very narrow and slightly rounded. From the anterior cardinal angle a narrow, sharp ridge extends obliquely inward and forward to a little below the center and arches around a rather large, depressed central space, terminating a short distance before completing a circuit of the space; between the ridge described and the hinge line are two spaces outlined by the main ridge; of these the one nearest the anterior cardinal angle is somewhat depressed and outlined by a shallow furrow extending at right angles to the hinge line from the ridge to the hinge line. At a point about two-thirds the distance of the length of the hinge line a short and very slight ridge extends toward the hinge line from the main ridge; between this and the slight furrow there is a slightly convex area. Two minute tubercles occur on the long central ridge, one at the point where it begins the loop to inclose the depressed central space, and the other on the opposite side of the depressed space.

Surface minutely punctate under a strong lens.

Entire width of valve 2 mm.; length 1.25 mm.; depth about 0.5 mm.

This species is distinguished from *Bradoria sterope* by its wider valve and the presence of the central ridge and depressed space.

The specific name is given in recognition of the most excellent and thorough preparatory work that was done by Miss Elvira Wood in the preliminary study of the Cambrian fossils from China and her work upon the Devonian crinoids.

Formation and locality.—Middle Cambrian; compact, bluish-gray, thin-bedded limestone; from shingle on gravel bar in the Lan Hō, 1 mile southeast of Chên Ping Hsien, southeastern Shensi, China.

Collected by Bailey Willis and Eliot Blackwelder, of the Carnegie Institution of Washington Expedition to China.

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NEW HYMENOPTERA FROM THE PHILIPPINES.

By WILLIAM H. ASHMEAD,
Assistant Curator, Division of Insects.

Nearly all of the species of Hymenoptera described in this contribution were received from Rev. Robert E. Brown, S. J., within the past six weeks, and, since my last paper, Additions to the recorded Hymenopterous Fauna of the Philippine Islands, went to press. Many are in genera not before noticed in the islands. The new genus, *Kiegeria*, was taken by Miss C. S. Ludlow on the Island of Mindanao, and is the first representative of the tribe Xoridini found in the Archipelago.

Family CEROPALIDÆ.

1. PSEUDAGENIA RUFOFEMORATA, new species.

Female.—Length about 7 mm. Black, subopaque, and clothed with an appressed whitish pubescence, slightly silvery beneath the antennæ, on the anterior margin of the clypeus broadly, the cheeks, the pleura, the coxæ beneath, the metanotum posteriorly, and on the sides of the dorsal abdominal segments 2-6; the dorsal abdominal segments 3, 4, 5 and the base of the 6th are rather densely pubescent; the head on the vertex and in front and the thorax are very closely, finely punctate, opaque; the metathorax has a median longitudinal depression or furrow; the palpi, except the first joint of the maxillary palpi, which is fuscous and stouter than the others, are pale ferruginous; the legs, except the front tibiæ and the middle and hind femora which are red, and the front tarsi which are fuscous, are black; claws bifid; the first and second segments of the abdomen are without pubescence and are smooth and shining. Wings hyaline or at most only faintly tinted; the costal veins and the stigma are brown-black, the other veins ferruginous. The pronotum is transverse, not more than half as long as the mesonotum.

Type.—Cat. No. 8436, U.S.N.M.

—Manila. One specimen (Father Robert Brown.)

2. PSEUDAGENIA IMITATOR, new species.

Female.—Length 5.5 mm. Resembles *P. rufofemorata*, but is much smaller, less densely pubescent, and more shining, the punctuation different and with different colored legs, the palpi being entirely ferruginous. The middle and hind coxæ, their femora, and the base of the hind tibiæ, are red; the front legs, except the coxæ, trochanters, except narrowly at apex, and the base of the femora, which are black, are dark brownish, the rest of the legs are black, or fuscous black; the thorax, although shiny, is finely shagreened, the pronotum with some sparse scattered punctures, the mesonotum with coarse, thimble-like punctures on each side of a triangular impunctate space down the center; the metathorax is rugulose reticulately sculptured, without a median sulcus, but with a slight median carina or elevated line toward its base, the pubescence at apex dense is silvery white; the abdomen is smooth and highly polished, the first segment being entirely bare; the whitish or silvery white pubescence is distinct and somewhat dense on the sides of the second and third segments, while on the following segments, except the pygidium and the segments medially, it covers most of the surface. The wings are as in the previous species, except that the front wings have a very faint fuscous tinge across their disks, not sufficiently distinct to be called a band. The pronotum is transverse-quadrate and very nearly as long as the mesonotum.

Type.—Cat. No. 8437, U.S.N.M.

Manila. One specimen (Father Robert Brown).

3. SPILOPOMPILUS STANTONI, new species.

Female.—Length 6 mm. Black and shining, marked with white, as follows: A stripe on hind orbits, the front orbits, a large spot on each side of the clypeus anteriorly, a spot at base of the mandibles, the palpi, except the last two joints, the hind margin of the prothorax, a spot above the base of the front coxæ, a spot at the apex of the front femora, a spot at base of tibiæ, the tibial spurs and some of the spines of the legs, a stripe at base of hind tibiæ *behind*, and two large, transverse spots at base of the third dorsal abdominal segment, are white. Wings fuscous, the stigma, except a spot in the center, and the veins being black or brown-black.

Type.—Cat. No. 8438, U.S.N.M.

Manila. This interesting species was received from Father W. A. Stanton nearly two years ago. It resembles a North American species, *Spilopompilus* (*Pompilus*) *biguttatus* Fabricius, very closely and could be easily confounded with it; but it is much smaller, with the white markings different. *S. biguttatus* has the legs wholly black, without the white stripe at base of the hind tibiæ, so conspicuous in *S. stantoni*.

Family BETHYLIDÆ.

4. EPYRIS TAGALA, new species.

Male.—Length, 3 mm. Black and shining, with the mandibles, the antennæ, except the five last joints which are fuscous, and the legs, except the front coxæ which are black, and the hind femora which are brownish black medially, are ferruginous; palpi yellowish.

The oblong head is very distinctly punctured, but the punctures are separated, or only a few here and there are confluent. The clypeus is triangularly pointed anteriorly, with a distinct median carina that extends between the antennæ. The scape of the antennæ is clavate, slightly curved and a little longer than the pedicel and the first joint of the flagellum united, the pedicel being very little longer than thick. The first three joints of the flagellum are of an equal length, about three and one-half times as long as thick, and cylindrical, the following joints slightly shortening. The depressed collar has some transverse elevated lines. The pronotum is distinctly but sparsely punctate. The mesonotum has two distinct parapsidal furrows that do not quite reach the anterior margin, and on either side is a delicate humeral line. The middle lobe is impunctate, except a row of minute punctures along the parapsidal furrows, the lateral lobes being sparsely but distinctly punctate. The scutellum has a transverse furrow across the base and some sparse minute punctures on its disk. The metathorax is reticulately rugulose. The abdomen is much depressed, highly polished, with pubescence toward apex. The first segment or petiole with five or six grooves at base, separated by folds or carinæ; wings hyaline, with a slight fuscous tinge. The tegulæ and base of costal vein flavo-testaceous; the other veins rufo-testaceous; the stigma darker or reddish brown.

Type.—Cat. No. 8439, U.S.N.M.

Manila. (Father Robert Brown.) This is the first species in the genus noted from the Philippines.

5. DRYINUS BROWNI, new species.

Female.—Length 7 mm. Black; the four terminal joints of the antennæ, the base of the scape, the apical margin of the bidentate clypeus, the palpi, the anterior coxæ beneath and at apex, the middle and hind coxæ very narrowly at apex, and the teeth of the longer jaw of the claspers of the front legs are white; wings hyaline, with two broad fuliginous bands on the front wings, one before the basal nervure, the other much broader extending across the wing from the base of the stigma to the apex of the radius or stigmal vein; the base of the stigma is white, corresponding with the white or hyaline band across the wing.

The sculpture is characteristic; the head is finely rugulose, subopaque, with some elevated lines in front of the ocelli, and a delicate carina extending from the front ocellus anteriorly to between the antennæ; the antennæ are slightly thickened toward apex, the third joint being very long and cylindrical, about three times as long as the scape and pedicel united; the large prothorax has a constriction posteriorly and is longitudinally striated, with a smooth space on its disk and at the lower lateral margins; the mesothorax is rugulose, the pleura with some transverse ridges or carinæ. The mesonotum has two delicate parapsidal furrows, the middle lobe, except just in front of the scutellum, being smooth and shining, the lateral lobes being finely, opaquely rugulose; the scutellum is opaque but not rugulose, and has four foveæ across the base; the metathorax is long and rather coarsely reticulated with irregular elevated lines; the abdomen is smooth and highly polished.

Type.—Cat. No. 8440, U.S.N.M.

Manila. (Father Robert Brown.) This is one of the largest and handsomest species yet discovered, and will be found to be parasitic upon some large Rhyngotous insect belonging to the family *Fulgoroïdæ* or *Membracidæ*. It shows some affinity with *D. stantoni* Ashmead, recently described from the Philippines, but it is fully twice as large, quite differently sculptured, and with different colored antennæ and legs.

Family FORMICIDÆ.

6. COLOBOPSIS ALBOCINCTA, new species.

Worker.—Length, 5 to 6 mm. Head, except a dusky blotch on the forehead, the mandibles, except the teeth, five in number, the antennæ, the prothorax, except the anterior margin narrowly, and the legs, except the coxæ, trochanters, and the tibial spurs, the tibiæ beneath and the middle and hind tarsi, ferruginous or rufous; the blotch on the forehead, teeth of mandibles, middle tibiæ beneath, the middle and hind tarsi, and the thorax, except the prothorax, are black or fuscous-black; the coxæ, trochanters, tibial spurs, and the apical margins of dorsal abdominal segments 1, 2, 3, 4, most of the apical segment, and the venter, white. The head and thorax are very finely, coriaceously sculptured or finely, closely punctate, feebly pubescent, and with some sparse, erect hairs; the head shaped much as in *C. corallina* Roger, oblong-quadrate, obliquely truncate anteriorly; the eyes placed far posteriorly at the posterior lateral third; the mandibles broad, coral red, 5-dentate; the scale of the abdominal petiole is transverse, seen from the side twice higher than long, the upper margin rounded with some sparse, erect hairs; the gaster is opaque or subopaque, microscopically coriaceously sculptured, almost smooth on the white apical margins.

Female.—Length 6.25 mm. Closely resembles the worker in structure and size, but a little more robust, the thorax of a different shape, convex above, the mesonotum being fully twice as long as wide, without parapsidal furrows; the humeral grooved line is slightly indicated posteriorly; the scutellum is well defined, with the axillæ widely separated.

The head and thorax are black, very finely-closely punctulate or shagreened, and opaque, the pronotum and pleura with delicate wrinkles; the legs are mostly black, with the front and hind tibiæ outwardly alone rufous, the tibial spurs being white; the abdomen has the white markings different from the worker. The first and second dorsal segments have an oblong white spot at their apical middle and a white spot at their lower hind angles; the apex of the third dorsal segment is margined with white; while some of the ventral segments are also margined with white, the second broadly so. The scale of the petiole is transverse, rounded above. Wings hyaline, or only faintly dusky, the stigma and veins yellowish, the basal nervure straight, the cubitus arising from above its middle and forked far beyond its union with the radius, which is straight and almost perpendicular.

Type.—Cat. No. 8441, U.S.N.M.

Manila. (Father Robert Brown.)

7. APHOMYRMEX EMERYI, new species.

Female.—Length 2.8 mm. Luteous, smooth and impunctate, without pubescence, the disks of the dorsal abdominal segments broadly tinged with brownish, the tarsi whitish. The head is oblong, quadrangular, fully one and a half times as long as wide, the hind margin almost straight, very slightly emarginate, the angles rounded, the eyes oval, black, faceted and placed much before the lateral middle; mandibles rather large, triangular, decussate, the masticatory margin very broad, the apical half armed with four distinct teeth, the basal half apparently edentate; the antennæ are apparently 10-jointed and widely separated at base, the scapes not quite attaining the apex of the head; the pedicel is obconical, longer than wide at apex, the flagellum subclavate, gradually thickened toward apex, the club not distinctly differentiated. The thorax is about three times as long as wide, not wider than the head, rounded anteriorly, but with a short, distinct neck; posteriorly it is slightly narrowed, the metathorax with a rounded slope; the mesonotum is convex above, without a trace of parapsidal furrows. The abdomen is comparatively large, elongate oval, considerably longer than the head and thorax united and much stouter, its base pressing close to the metathorax and entirely concealing the scale; the scale as seen from the side is wedge-shaped, the gaster is composed of only four visible segments, all of an equal length; legs bare, the hind tibial

spurs well developed, their tarsi much longer than the hind tibiae. Wings hyaline, the veins pale.

Type.—Cat. No. 8442.

Manila. Described from a single specimen, received from Father Brown, found in a vial of alcohol with other small Hymenoptera.

The species is named in honor of Prof. C. Emery, the eminent European myrmecologist, who only recently characterized the genus *Aphomyrmea*.

Family SCELIONIDÆ.

8. HOPLOTELEIA PACIFICA, new species.

Female.—Length 2 mm. Black, with the legs, except the coxæ and a spot toward the apices of the femora, the last joint of the front tarsi, the three last joints of the middle tarsi, and the whole of the hind tarsi, which are black or fuscous, red. Head above and on the temples and cheeks reticulately punctate, the face with a deep, smooth emargination; thorax reticulately punctate, the four lobes of the mesonotum finely shagreened, the surface near the insertion of the wings lineated, the scutellum and the metathorax reticulated; the abdomen has the three basal segments finely punctate, the base of the second and the petiole crenulated, the three apical segments smooth. Wings subhyaline, the tegulæ black, the subcostal vein testaceous, the marginal, postmarginal and stigmal veins black.

Type.—Cat. No. 8443, U.S.N.M.

Manila. (Father Brown.) This is the first species in the genus to be described from Asia, the others being peculiar to North and South America.

Family FIGITIDÆ.

9. PENTAMEROCERA PACIFICA, new species.

Female.—Length 0.8 mm. Black, highly polished; the antennæ, except the last five joints, which are enlarged, are dark red, the last five joints, which constitute the club, are black or dark fuscous; the legs, including the coxæ, are yellowish red; wings hyaline, the veins light brownish, yellowish in the thinner parts. The cup of the scutellum is small, oval, with a puncture anteriorly, and a row of microscopic punctures at the lateral margins. The first two joints of the antennæ are oval, about equal in size and much stouter than the funicle; the first joint of the funicle is subelavate, about thrice as long as thick at apex; the following joints to the club gradually become shorter but thicker; the club joints are enlarged, oval, all a little longer than thick.

Type.—Cat. No. 8444, U.S.N.M.

Manila. (Father Robert Brown.) This is the first species described in the genus from the Philippines.

10. HEXAMEROCERA KIEFFERI, new species.

Female.—Length 1.3 mm. Black, highly polished; the antennæ are very dark red, the joints of the 6-jointed club ellipsoidal, nearly thrice as long as thick, and beautifully fluted; the scape is a little longer than the pedicel, which is almost round; the funicle is slender, the first joint being about thrice as long as thick, the second joint hardly two-thirds as long as the first, while the following joints gradually become shorter and shorter, the last joint being scarcely longer than thick.

The cup of the scutellum is oval, flat above, with a large puncture posteriorly and two minute punctures near each lateral margin. Wings hyaline, the veins brownish yellow, the subcostal vein pale yellowish.

Type.—Cat. No. 8445, U.S.N.M.

Manila. (Father Brown.)

This species is named in honor of Abbé J. J. Kieffer.

Family EULOPHIDÆ.

11. TETRASTICHOIDES BROWNI, new species.

Female.—Length 1.3 mm. Aeneous black, the thorax above with a slight brassy tinge in certain lights; scape of the antennæ and the legs, including the coxæ, pale yellow; pedicel and flagellum brown-black, the latter pubescent. Wings hyaline, pubescent, the veins, except the stigmal vein which is brown, yellowish. The whole insect is smooth and impunctate, the punctures usually present on the mesonotum, especially along the parapsidal furrows, being entirely absent. The absence of punctures and the color of the legs and antennæ render the species easily recognized.

Type.—Cat. No. 8446, U.S.N.M.

Manila. Only one specimen found in a vial of alcohol with other microhymenoptera.

Family ICHNEUMONIDÆ.

12. CRATICHNEUMON MANILÆ, new species.

Female.—Length 7 mm. Black; a spot on each side of the clypeus, the face, except a median black spot, the front orbits to back of the eyes, the palpi, an annulus on the antennæ, the upper margin of the pronotum broadly on each side to the tegulæ, a spot beneath the tegulæ, a large spot on the mesopleura, the post-tegulæ and the extreme base of the costæ, the scutellum, a spot on each hind angle of the metathorax, the front coxæ, except a reddish spot beneath, the front trochanters, the apex of the middle coxæ and their trochanters, the apex of the first joint of the hind tarsi, joints 2 and 3 entirely and the fourth joint beneath, a band at apex of the first segment of abdomen, a spot on the hind angles of the second and third segments, a spot on

the middle of the fifth segment and the dorsums of the sixth and seventh segments, white; the rest of the legs, except the hind tibiae outwardly and at apex, the tibial spurs and the rest of hind tarsi which are black or fuscous, are red. The head is sparsely punctate, the mesonotum more closely, distinctly punctate, the metathorax with some small, sparse punctures but completely areolated, the areola being horse-hoof shaped; the abdomen is sparsely punctate on the petiole, thickly, finely, opaquely punctate on the second and third segments, while the following segments, except some minute punctures on the fourth segment basally, are smooth and shining; the gastrocoeli on the second segment are represented by shallow transverse cicatrices near the basal lateral angles. Wings hyaline, the veins black or brown-black, the inner apical margin of the stigma broadly yellowish.

Type.—Cat. No. 8447, U.S.N.M.

Manila. (Father Brown.) A beautiful little species and the first representative of the tribe Ichneumonini to be discovered in the Philippines.

13. *APSILOPS NIGRICEPS*, new species.

Female.—Length, 6 mm.; ovipositor less than one-third the length of the abdomen. Head and the abdomen, except the first segment and a spot at apex, black; the thorax, first segment of abdomen, and the legs, except as hereafter noted, are red; a line on the front tibiae outwardly, the first joint of the middle trochanters, the middle tarsi more or less, the hind tibiae, except a broad annulus at base and the hind tarsi more or less, except a narrow annulus at base, are black or fuscous black; the annuli at base of the hind tibiae and tarsi, and the incisions of the tarsal joints, the palpi, and the large spot at the apex of the abdomen, are white.

The wings are hyaline, but the front pair have two brown-black transverse bands—a narrow one across from and including the basal nervure, and the other, a very broad band, across from the stigma, leaving only the apex of the wings hyaline; the veins are black or brown-black. The head is transverse, subenticular, the temples very flat, the eyes very large, occupying the whole sides of the head; the thorax is opaque or subopaque, but with the mesosternum and a large spot at the upper hind angles of the mesopleura smooth and shining; the mesonotum is opaque, with two distinct parapsidal furrows that converge posteriorly; the metathorax is more or less shining, clothed with a whitish pubescence at apex and completely areolated; the abdomen is smooth and shining, except segments two and three which are finely, closely, opaquely punctate, except a large spot at their apical middle; the other segments, except the first which has some sparse, minute punctures toward the base, are smooth and practically impunctate.

Type.—Cat. No. 8445, U.S.N.M.

Manila. (Father Brown.)

14. STREPSIMALLUS BICINTUS, new species.

Female.—Length 3.6 mm.; ovipositor the length of the abdominal petiole. Red, with the metathorax, the hind legs except sutures of trochanters, femora, an annulus at base of tibiæ and tibial spines, apex of the third abdominal segment and the following segments, black; scutellum yellow; eyes large, white; the nine or ten basal joints of the antennæ dusky or blackish above. Wings hyaline, the front pair with two transverse bands—a narrow one from the basal nervure, and a much broader one across from the stigma.

The head is finely rugulose; the thorax also is more or less rugulose, but the mesonotum, except the middle lobe anteriorly, is transversely striated, the middle lobe anteriorly very smooth; the metathorax is rugose, opaque, and completely areolated, the areola being pentagonal, pointed at base; the abdomen is slightly longer than the head and thorax united, smooth and shining, except the first three segments; the first segment is longitudinally striated, except a space at its apex; the second and third segments are finely, opaquely sculptured, except at apical margins where the surface is smooth and shining.

Type.—Cat. No. 8449, U.S.N.M.

Manila. (Father Brown.)

15. CHROMOCRYPTUS ALBOMACULATUS, new species.

Female.—Length 10 mm.; ovipositor half the length of the abdomen. Head, except two large yellowish white spots on vertex, the antennæ, except joints 7–13 above which are white, the thorax, except a spot on the middle mesothoracic lobe posteriorly, the scutellum, a spot beneath the tegulae, a larger spot beneath the insertion of the hind wings, the posterior face of the metathorax, including the metanotal teeth, and a spot at apex of abdomen, which are white, base of abdominal petiole, and the sheaths of the ovipositor, black; rest of the abdomen and the legs, except the front coxæ and trochanters and the first three joints of the hind tarsi which are mostly white, red. Wings hyaline, the veins blackish or fuscous, the narrow stigma testaceous. The eyes are large and occupy nearly the whole sides of the head; the face below the insertion of the antennæ is rugulose wrinkled, the clypeus smooth but with some sparse microscopic punctures; the pro- meso- and meta-pleura are more or less longitudinally striated, or with longitudinal elevated lines or wrinkles; the metathorax is rugulose, with the upper hind angles toothed; the first transverse carina is distinct, the basal median area very short, transverse, the lateral basal areas large, the surface of these areas being smooth basally. The abdomen is smooth, shining, and impunctate.

Type.—Cat. No. 8450, U.S.N.M.

Manila. (Father Robert Brown.)

KRIEGERIA, new genus.

This new genus is based upon a single male specimen, not in the best condition, the tarsi being more or less broken and not a single claw left, taken by Miss C. S. Ludlow, on the island of Mindanao. It is, however, a true Xoridini, but not closely allied to any of the known genera.

The head is subquadrate, deeply, semicircularly concave behind, the temples and cheeks buccate; the mandibles are strong, bidentate at apex and project sufficiently to leave a slight opening between them and the clypeus; the clypeus has a slight median tooth anteriorly; the thorax is long, about five times as long as wide, the pronotum deeply, concavely depressed into a neck anteriorly; the mesonotum is about two and a half times as long as wide, with deep punctate parapsidal furrows that converge posteriorly and then curve and meet just before reaching the base of the scutellum; the metathorax is much longer than wide, with a transverse carina toward the base, inclosing two large basal areas, but without other carinae or areas; the legs are normal; the abdomen is elongate, much longer than the head and thorax united, slightly narrowed anteriorly, the first segment petioliform, only a little thicker at apex than at base. Seen from the side it is slightly curved, with the spiracles placed a little behind the middle but far from its apex; the following segments are closely punctate, opaque, without furrows or swellings of any kind; segments 3 to 6 are very nearly equal in length, wider than long, about two-thirds the length of the second, which is much longer than wide at apex—as long, or nearly as long, as the first. The wings have a venation similar to a Cryptine, the areolet being pentagonal, the sides strongly convergent above, the stigma lanceolate, the submedian cell a little shorter than the median; the transverse median nervure in the hind wings is angularly broken just a little below the middle.

This interesting new genus is named in honor of Dr. Richard Krieger, of Leipzig, Germany, whose excellent contributions on the exotic *Pimplinæ* are well known to all active Hymenopterologists.

16. KRIEGERIA HEPTAZONATA, new species.

Male.—Length 12 mm. Black; the hind orbits broadly, the inner upper orbits, a broad band across the face beneath the antennae, a transverse spot on the disk of the clypeus, the palpi, the front and middle coxae and trochanters, a broad annulus near the base of the middle and hind tibiae, the hind coxae at base and a longitudinal stripe above, the anterior margin of the prothorax, the upper hind angles of same, the tegulae, a spot beneath, a large spot on the mesopleura, an elongate spot on the middle mesothoracic lobe posteriorly, the scutellum, the space back of the insertion of the hind wings, a large quadrate spot at the apex of the metanotum, and bands at apex of all the abdominal

segments, yellowish white, or pale yellowish; rest of legs mostly red, but with a spot on the first joint of the middle trochanters above, the middle tibiae toward apex, the middle tarsi, the hind coxae beneath, first joint of hind trochanters, their femora toward apex, an annulus at base of their tibiae and the apical two-thirds of same *above* and the tarsi, black. Wings hyaline, the stigma and veins, except the subcostal vein and the parastigma, which are whitish, black.

Type.—Cat. No. 8470, U.S.N.M.

Mindanao. (Miss Clara S. Ludlow.)

17. *METOPHIUS BROWNI*, new species.

Male.—Length 12 mm. Black, with the face, front orbits to summit of eyes, labrum, spot on mandibles, two basal joints of antennae beneath, a stripe on the upper hind margin of the prothorax, a spot beneath the tegulae, a very large spot just beneath it on the mesopleura anteriorly, the scale on each side of the base of the scutellum, the apical half of the scutellum, the postscutellum, two spots on the metathorax, the first segment of the abdomen, except narrowly at base, bands at apex of all the following segments, and the genitalia, yellow; the flagellum beneath is fulvous; the palpi and the front and middle legs are yellowish white, the hind legs brown with the coxae, the trochanters, and a spot at apex and base of femora, lemon-yellow; wings hyaline; the veins, except the subcostal vein, the parastigma, the stigma, the median, and submedian veins which are pale yellowish, are black or fuscous black. The head and thorax are closely, reticulately punctate.

Type.—Cat. No. 8451, U.S.N.M.

Manila. (Father Brown.)

18. *CHAROPS LONGIVENTRIS*, new species.

Female.—Length 7 mm. Head and thorax black, closely reticulately punctate and clothed with a glittering white pubescence; the abdomen is mostly ferruginous, the petiole medially pale yellowish, at base black, the second segment black above, the rest ferruginous; the abdomen is very long and strongly compressed, about twice as long as the head and thorax united; the palpi, front coxae, and trochanters, front tarsi, middle trochanters, basal joint of middle tarsi, except extreme apex, the hind trochanters, a narrow annulus at base of hind tibiae and at base of first joint of hind tarsi, white; the rest of the legs (except the front and the middle legs), and the middle coxae, black, the front and middle legs yellowish white. Wings hyaline, the tegulae base of the costal, subcostal, and submedian veins yellowish white, the other veins brown-black.

Type.—Cat. No. 8452, U.S.N.M.

Manila. (Father Robert Brown.)

Family BRACONIDÆ.

19. *CARDIOCHILES PHILIPPENSIS*, new species.

Female.—Length 4 mm.; ovipositor about one-third the length of the abdomen. Black, shining, and impunctate, except the metathorax, which is rugulose and areolated, the areola large and lozengoidal; a spot toward base of mandibles and the apex of front femora yellow, the front tibiæ pale fuscous; the three terminal joints of the maxillary palpi, all tarsi, and the hind tibial spurs white; antennæ long, about 34-jointed. Wings hyaline, the front wings with their apical third fuscous, the hind wings with the base and apex fuscous, the stigma and veins black or brown black.

Type.—Cat. No. 8453, U.S.N.M.

Manila. (Father Robert Brown.) This species differs from the European and American species in having very many more joints in the antennæ, but otherwise it seems congeneric.

20. *UROGASTER OPACUS*, new species.

Female.—Length 3 mm.; ovipositor as long as the abdomen. Black, the head and thorax very finely, closely, opaquely punctate, clothed with a whitish pubescence; the palpi, the costal veins to the stigma, and the other veins, except the stigmal vein, front knees, spot at base of middle and hind tibiæ, the front and middle tarsi more or less, and all tibial spurs, white or yellowish white; the rest of the legs, except the front femora and tibiæ, middle tibiæ, and basal half of hind tibiæ, which are yellowish, black; the stigma and the post stigmal vein are brown-black; the metathorax is areolated, the areola rather large, pentagonal; the plate of the first abdominal segment is about four times as long as wide, the sides parallel, and finely wrinkled; the other segments are smooth.

Male.—Length 2.5 mm. Agrees well with the female, except that the front and middle legs from the coxæ, the hind trochanters, and the basal two-thirds of the hind tibiæ are brownish yellow, the first joint of the hind tarsi whitish at base, the ventral membrane of abdominal segments 1 to 4 or 5, yellowish white, while the plate of the first abdominal segment is rugulosely sculptured, the sides slightly convergent posteriorly.

Type.—Cat. No. 8454, U.S.N.M.

Manila. (Father Robert Brown.)

21. *UROGASTER ALBINERVIS*, new species.

Male.—Length 2 mm. Black, very minutely punctate, but shining, the mandibles flavo-testaceous with black teeth; the front and middle legs, except the coxæ and the hind femora more or less, are brownish-yellow, the coxæ, the middle femora more or less, and the middle

tibiae toward apex are dusky, the trochanters, knees, and base of tibiae are paler yellowish than the rest of the legs; the metathorax is areolated; the abdomen, except the plate of the first segment, is smooth and shining; the plate of the first segment is hardly twice as long as wide and finely rugulose. Wings hyaline, the stigma and veins, except the parastigma, the outer edge of the stigma, and the post-stigmal vein, which are dark fuscous, are white or clear hyaline.

Type.—Cat. No. 8455, U.S.N.M.

Manila. (Father Brown.)

22. *BRACON ALGUÉI*, new species.

Female.—Length 3 mm.; ovipositor extremely short, projecting just beyond the tip of the abdomen, the sheaths black. Pale brownish yellow, the cheeks and head in front below whitish; the eyes, the middle mesothoracic lobe anteriorly and a streak or line on each side of the three basal segments of the abdomen are black; antennae long, fuscous; the wings hyaline, the stigma, except the outer margin, and the veins yellowish, the costae and poststigmal vein black. The head and thorax are smooth and shining, impunctate, but the abdomen is closely rugulosely punctate, the three or four terminal segments with a transverse line near apex making the segments appear as if rimmed.

Type.—Cat. No. 8456, U.S.N.M.

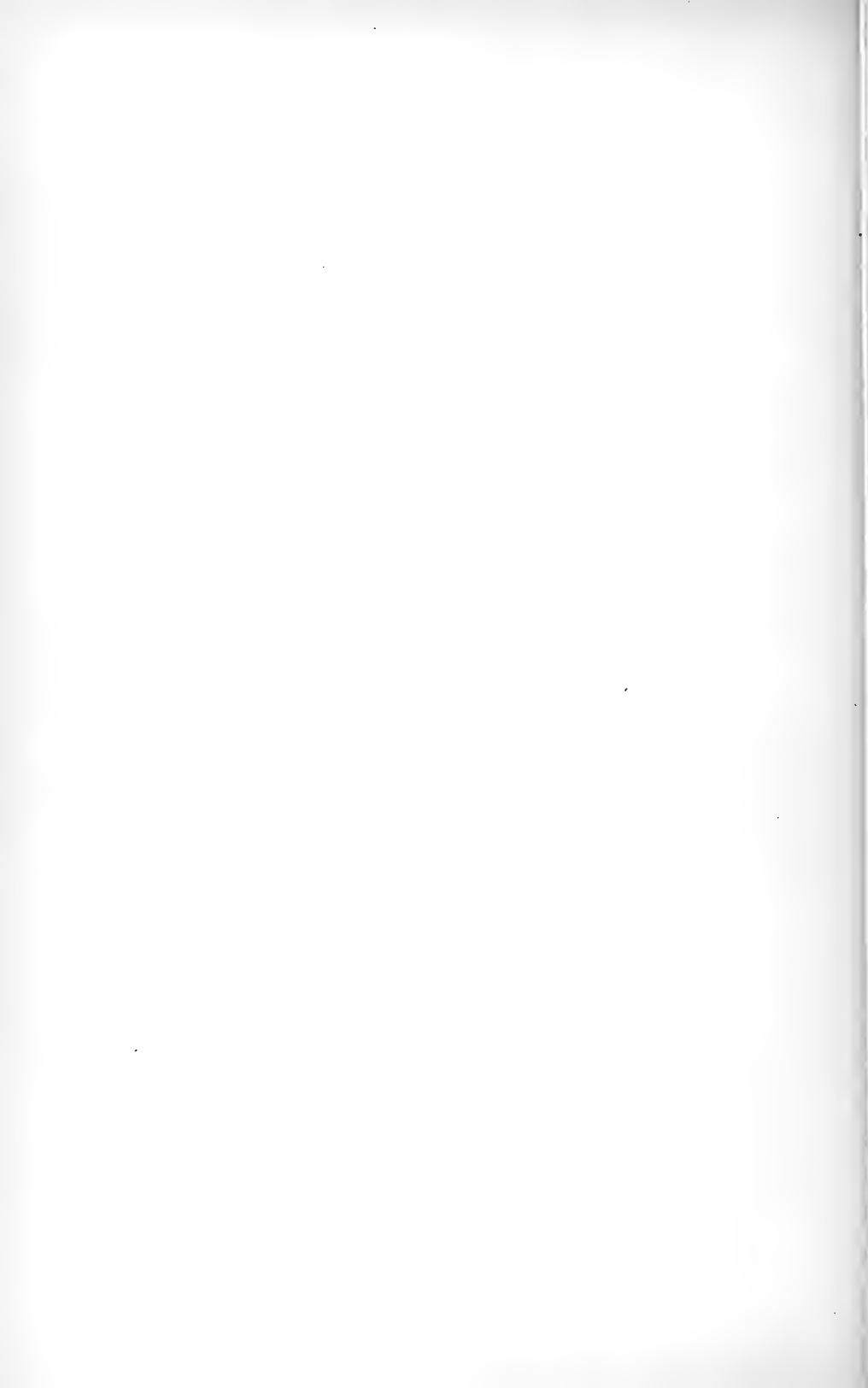
Manila. (Father Robert Brown.) Only a single specimen was taken, but it is quite distinct from all other forms known to me. It is named in honor of the Rev. Jose Algué, the able director of the Philippine weather bureau.

23. *SPATHIUS FUSCIPENNIS*, new species.

Male.—Length 3 mm. Head, mesothorax, and scutellum reddish brown, the rest of the thorax and the abdomen black, or the latter is very dark castaneous; the antennae are very long and slender, about twice as long as the whole body, fuscous, except the five or six basal joints, which are yellowish; the legs, or at least the anterior pair (the middle and hind pairs being broken off), are pale yellowish. The mesonotum is shagreened, more or less rugulose posteriorly in front of the scutellum, the latter has a crenulate furrow across its base; the metathorax is rugulose and areolated; the abdomen is very longly petiolated, the petiole being very slender, nearly as long as the thorax, very delicately longitudinally aciculated at the sides, and wrinkled or shagreened above; the body of the abdomen is nearly pear-shaped, concave beneath, and smooth and highly polished.

Type.—Cat. No. 8457, U.S.N.M.

Manila. (Father Robert Brown.)



THE CLASSIFICATION OF THE AMERICAN SIPHON- APTERA.

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A previous paper, entitled *A Revision of American Siphonaptera*, by the present author, which had been completed March 1, 1903, did not finally appear until 1904.^a In the meantime, and immediately following the publication of this paper, there occurred a most extraordinary activity among students of this group. In 1903 alone at least seventeen papers relating to Siphonaptera were published. New and extensive material was rapidly brought together from all parts of the world, and a more comprehensive classification of the group was gradually evolved. In the extensive paper by Tiraboschi,^b we have the first conception of subfamilies. Several new genera have been added by Wagner, Rothschild, Wahlgren, and Enderlein.

All of this has profoundly affected the classification of American fleas proposed in my *Revision*. The bringing up to date of that work became increasingly urgent, since it was already being widely used by American students, and quoted by those of other countries.

The writer has had continuously under way extensive supplementary studies of the older species. In addition new material of a very important nature has been accumulating. The following paper is a preliminary study necessary before the new material could be worked up. In the former paper attention was called for the first time to the fact that, as a whole, rat fleas of the Tropics were far more nearly related to the fleas of human beings than were those of temperate regions. Tiraboschi, in his monographic study of the relation of rats to the bubonic plague, does not emphasize this fact, which appears to the writer to be the most important connected with the whole matter. The outbreaks of plague in Mazatlan, and now in Chile, remind us that it may soon come our turn, and that a thorough understanding of the problems involved—as in the case of mosquitoes and yellow fever—is a matter of inestimable importance.

^a Proc. U. S. Nat. Mus., XXVII, pp. 365-469, pls. x-xxvi.

^bArchiv. de Parasit., VIII, 1904.

The interest in this subject is further accentuated by the statement that Doctor Carrasquillo, of Bogota, has found the bacillus of Hansen in the intestinal contents of fleas. It is thus open to question if the fleas are not the agents for the communication of leprosy. In accordance with the above generalization it becomes of pressing importance to examine large series of rat fleas from the various tropical and subtropical ports, and likewise those of human beings and cats and dogs from the same places. This will be a difficult matter to accomplish unless the interest of resident physicians and scientific men generally can be enlisted. Their attention is herewith invited to these problems. Material can be gathered very readily, the apparatus needed being simply a rat trap, vials of alcohol, and tweezers. The services of the author are freely offered in connection with the working up of the material, and prompt reports will be submitted. The residence of the author in the vicinity of Habana—a leprosy center—offers exceptional opportunity for an investigation first hand of the problem for Cuba, and this is being carried out as rapidly as possible.

Doctor Lutz, of the Instituto Bacteriologico in São Paulo, Brazil, was one of the first scientists in the Americas to turn his attention to this important problem. The author had the honor of examining the material gathered by Doctor Lutz as long ago as 1899, and it was reported on in the Revision, with most interesting results. This was, however, but a limited material, taken at a single locality, and that in the interior of the country. It sharply emphasized the great importance of gathering a copious material from all the seaport towns of tropical America. Doctor Lutz has lately been making other sendings, from which we expect some very interesting results. Doctor Carter, of Galveston; Doctor Davidson, of Los Angeles, and Mr. W. J. Rainbow, of Sydney, have been making valuable contributions of material.

Collections of fleas actually found biting human beings throughout all the warmer regions of the earth are much needed for this study. It rests with the bacteriologists to prove the actual transmission of disease. If a flea will leave a diseased rat and then bite a human being, this fact should be made known. Fleas of species commonly known to bite human beings may be observed here in Cuba crawling about on foul sores on the innumerable miserable dogs of the streets. Surely this should have a keen interest for all persons concerned—scientist and layman. The actual introduction of bacilli into the intestinal canal of the flea is not an essential premise if dried blood may be found on the rostrum of the flea. Whether a careful study of the species actually occurring on man and the lower animals may show that the transmission of disease in this way is improbable, it remains none the less true that this phase of the problem should be thoroughly worked out. The writer is progressing with a considerable contribution on this subject.

The following paper is to be considered only as a supplement to the Revision. The bibliographical references are either entirely new or are made necessary by changes in nomenclature. For completeness the two papers should always be used together.^a Repetitions have been avoided wherever possible. The subjects in the body of the paper have been arranged in the same order as in the Revision, so that cross references may be readily made.

The following grouping into families is made with a very meager characterization. Numerous other differential characters of family value can be added. The families as indicated here are sharply defined, the difference in the general habitus of the groups being very clear to anyone who has handled specimens of this order in any numbers. Their fuller characterization must be accomplished by some one who has access to the material sufficient for working out the taxonomy of the whole group for the entire world. General classification can only be built upon a very wide and very special knowledge of the anatomy of species. Hence the classification is here only carried far enough to make clear the relationships of the various groups for the use of American students. It is, however, evident that we can not hope to get even the American forms properly classified without taking cognizance of all that is being done in other parts of the world.

Order SIPHONAPTERA Latreille.

1904. *Siphonaptera* TIRABOSCHI, Archiv. de Parisit., VIII, p. 302.

SYNOPSIS OF FAMILIES.

- A. Thoracic segments strongly shortened and constricted; labial palpi without pseudo-joints; third joint of antennæ without completely separated pseudo-joints.
- B. Maxillæ without or with very short and broad projecting laminae, their palpi extending beyond anterior coxæ; head strongly angulated anteriorly in both sexes; metathoracic epiphyses extending over nearly two or even three abdominal segments; the female becoming endoparasitic when gravid, with globose, enormously dilated abdomen, in which the original chitinous sclerites are mostly obliterated..... RHYNCHOPRIONIDÆ
- BB. Maxillæ with a long, narrow, curved lamina which projects downward and backward, their palpi equaling the anterior coxæ, or shorter; head evenly rounded in both sexes; metathoracic epiphyses extending over but one abdominal segment; gravid female with abdomen vermiform.....HECTOPSYLLIDÆ
- AA. Thoracic segments not strongly shortened and constricted, their epiphyses extending over but one abdominal segment; labial palpi with three or more pseudo-joints; maxillary palpi almost always shorter than anterior coxæ; third joint of antennæ with nine more or less distinctly separated pseudo-joints.

^a A complete index (p. 167) has been prepared to accompany this paper in which references to the earlier paper are indicated by italics.

- B. Fifth tarsal joint broadly dilated and greatly lengthened beyond the fourth pair of lateral spines; fore tibiæ armed on posterior border, very large black teeth or a few heavy spines; fifth tarsal article on forelegs as long as rest of tarsus, on all the legs with the claws nearly as long as the fifth joint; fore coxæ nearly nude, with but few long spines.....MALACOPSYLLIDÆ
- BB. Fifth tarsal joint never greatly enlarged, never as long as the rest of tarsus, the claws shorter; fore tibiæ armed on posterior border with slender spines; fore coxæ always clothed on outer side with several to numerous oblique rows of bristles.
- C. Gena with a large recurved process on lower margin extended downward and backward; labial palpus five-jointed; mandibles not distinctly serrate; maxillæ long, rather narrow, and obtuse at apex; eye distinct; ctenidia absent; antepygidial bristles absent; anal style of female absent.....LYCOPSYLLIDÆ
- CC. Gena never with a recurved process; mandibles usually distinctly serrate; anal style present in female.
- D. Maxillæ triangular, acute at apex.
- E. Posterior tibial spines in pairs and few in number, not in a very close-set row.....PULICIDÆ
- EE. Posterior tibial spines numerous, mostly single and in a close-set row.....CTENOPSYLLIDÆ
- EEE. Posterior tibial spines in numerous, short, close-set transverse rows on posterior border with about four spines in each row.
HYSTRICHOPSYLLIDÆ
- DD. Maxillæ clavate or subquadrangular; face strongly sloping forward and recurved just above the mouth, where there are two tooth-like plates on each side; eyes absent; pronotum and usually abdomen with ctenidia; confined to bats...CERATOPSYLLIDÆ

Family RHYNCHOPRIONIDÆ.

1880. *Sarcopsyllidæ* TASCHENBERG, Die Flöhe, p. 43.

It was suggested in the Revision that the name *Rhynchoprion*—based as it was upon a well-known species as a type—should be used instead of *Sarcopsylla*, though in the body of the text the author did not then have the courage to make the change. Since then no dissenting voice has been heard. No less than twenty-seven years after *Sarcopsylla* had been proposed, with the same type, the eminent entomologist, Karsten, adhered to *Rhynchoprion* as the correct name. It is a pity that his judgment could not have been followed, since we are compelled now, after a considerable literature has accumulated under the name *Sarcopsylla*, to use again the older and only correct name.

Mr. W. J. Rainbow, of the Australian Museum, has recently kindly sent to me sketches made from the types of *Echidnophaga ambulans* Olliff, which fortunately are preserved in that museum. These sketches, while they do not enable me to present a diagnosis of the genus, are very important, in that they indicate this form as unmistakably of the Rhynchoprionidæ, a fact wholly impossible to obtain

from the original description. The statement that the insect does not jump is true only, of course, when it fastens itself to the host. The same habit is characteristic of *Argopsylla gallinacea*. Indeed Olliff's species is very close to *Argopsylla*, if not actually a member of that genus. Carefully made detail drawings of its head, mouth parts, and legs are especially needed.

Genus RHYNCHOPRION Oken.

1815. *Rhynchoprion* OKEN, Naturgesch. f. alle Stände, III, p. 402.

1840. *Sarcopsylla* WESTWOOD, Trans. Ent. Soc. Lond., II, p. 202.

1893. *Sarcopsylla* BEZZI, Rev. Ital. Sci. Nat. y Boll. Nat., XIII, p. 23.

1904. *Sarcopsylla* TIRABOSCHI, Archiv. de Parasit., VIII, p. 302.

Oken used this name for this genus first, and indicated a well-known species as its type, thus definitely establishing it.

SYNOPSIS OF SPECIES.

- A. Last article of anterior and middle tarsi almost spineless; the head angled at about a third of the distance from mouth to base of vertex.....*penetrans*
 AA. Last article of anterior and middle tarsi normally spined; the head angled at about one-seventh of the distance from mouth to base of vertex*cucata*

Genus ARGOPSYLLA Enderlein.

1901. *Argopsylla* ENDERLEIN, Deutsches Tief-see Exped., 1898-99, III, p. 263.

1904. *Xestopsylla* BAKER, Proc. U. S. Nat. Mus., XXVII, p. 374.

Between the dates of the conclusion of the Revision and its publication there appeared a new generic name—*Argopsylla*—antedating by publication the name *Xestopsylla*. It was published in the advance sheets of a general article in a rather remote work. Except for the kindness of the author, it would have remained unknown to the writer even now.

SYNOPSIS OF SPECIES.

- A. Mandibles a third longer than the length of head from base of mandibles to base of vertex; abdomen in the pregnant female long, subcylindrical, with a broad membranous separation at the pleuræ, the stomata thus high up toward the dorsal line*rhynchopsylla*
 AA. Mandibles about as long as length of head; abdomen of normal form, and with the tergites and sternites overlapping even in the pregnant female ...*gallinacea*

Family MALACOPSYLLIDÆ.

1898. *Megapsyllidæ* BAKER, Journ. N. Y. Ent. Soc., VI, p. 53.

1903. *Megapsyllidæ* WAHLGREN, Archiv für Zool., I, p. 191.

With the recognition of the proper name for the unique genus, the name of the family changes also.

Genus MALACOPSYLLA Weyenbergh.

1881. *Malacopsylla* WEYENBERGH, Periodico Zoologico, III, p. 271.

1898. *Megapsylla* BAKER, Journ. N. Y. Ent. Soc., VI, p. 53.

1903. *Megapsylla* WAHLGREN, Archiv für Zool., I, p. 191.

1904. *Malacopsylla* ROTHSCHILD, Novitat. Zool., XI, p. 603.

This is another case of a genus published in so remote a place that reference to it had not been found in any of the bibliographies, though it may occur in some to which access was not had. This correction is due to Rothschild, though to other European students the genus had remained unknown down to 1903. The full account by Rothschild, including the description of two new species, enables the writer to straighten out a bad lot of errors in connection with these very interesting forms.

As to species, the errors in the Revision date to receiving from Doctor Berg specimens said by him to be male and female of the true *Pulex grossiventris* of Weyenbergh. This statement was accepted as conclusive, and deductions were based on it. Afterwards Wahlgren unfortunately used the same foundation. As soon as Rothschild's paper was received, the original material was reexamined with the most critical care. What had been called the male of *grossiventris* Weyenbergh turned out to be *agenoris* Rothschild. A proper male was found for the female previously called *grossiventris*. Very little comparison was necessary to determine that *androcli* differed widely from anything we had. A further study of the original description by Weyenbergh convinced me that the female originally called *grossiventris* and the newly found male were of the same species originally examined by Weyenbergh. The detail work in Weyenbergh's description is of little value, and expectedly so, since he could have had no conception of the importance of the minute exactness that is now found to be so necessary. Rothschild says, "According to the description, the four segments of the maxillary palpi of *grossiventris* Weyenbergh are the same in length, the first being a little longer than the others." However, in the language of the original we read, "les articles sont presque tous de même longueur, quoique, pour dire vrai, l'article basal semble un peu plus court que les autres." When we consider this in the light of his statement as to the tarsal joints, where he says "les quatre premiers articles tarsaux sont de longueur égale, presque aussi longs que larges," a condition we do not know to exist in *Malacopsylla* or any other fleas, it becomes evident that his descriptions were made from simple visual estimations unaccompanied by the numerous more exact measurements which we now make. Falling back upon the extended general characterization which Weyenbergh gives, there can be no doubt but that the specimens now before me represent the true *grossiventris*.

Referring to the plates of Rothschild, there may be noticed at once a wide difference in the form of the movable finger of the male of *grossiventris* and that of *androcli*. In *androcli* this sclerite narrows very regularly to a somewhat acute tip. In *grossiventris* the apex is obliquely truncate. Turning to the paper by Wahlgren,^a this

^a Archiv für Zool., I, 1903, p. 191.

same condition may be found exactly represented for his *Meqopsylla inermis*. Trusting to the very erroneous description of *M. grossiventris* by the writer, he had every reason to suppose his species distinct, but it is undoubtedly identical.

SYNOPSIS OF SPECIES.

- A. Fore tibiæ armed with long, thick, stout teeth; pronotal ctenidium wanting; frontal tubercle present.
- B. Labial palpi reaching scarcely two-thirds of fore coxæ or less; tip of male movable finger obliquely truncate.....*grossiventris*
- BB. Labial palpi reaching nearly to apex of coxæ; tip of male movable finger evenly narrowed to a rounded tip.....*androcli*
- AA. Fore tibiæ armed with slender spines; with a pronotal ctenidium of six spines; no frontal tubercle; labial palpi reaching scarcely one-half of fore coxæ.
agenoris

Family LYCOPSYLLIDÆ, new family.

About the only disposition that can be made of this remarkable new form discovered by Rothschild is to found a new family for it. It is abundantly distinct, and presents many characters which it is believed will at least eventually prove well within the range of family value.

Genus LYCOPSYLLA Rothschild.

1904. *Lycopsylla* ROTHSCHILD, Novitat. Zool., XI, p. 602.

Family PULICIDÆ.

1893. *Pulicidæ* Bezzi, Rev. Ital. Sci. Nat. y Boll. Nat., XIII, p. 23.

Since the fuller elucidation of *Chætopsylla*, it becomes evident that *Vermipsylla* represents a group of not greater value than a subfamily. The genera *Anomiopsyllus* and *Dolichopsyllus* are in their way equally distinct, if not more so.

SYNOPSIS OF SUBFAMILIES.

- A. Antepygidial bristles wanting, at least in the female.....VERMIPSYLLINÆ
- AA. Antepygidial bristles present.
- B. Antepygidial bristles, one or three.
- C. Hind coxal epiphysis forming distally with the coxa a deep notch, subtended outwardly by a produced acute limb; female with one antepygidial bristle on each side.....ANOMIPSYLLINÆ
- CC. Hind coxal epiphysis narrowing into the coxa, forming a poorly defined notch or none; female with one or three antepygidial bristles...*Pulicidæ*
- BB. Antepygidial bristles, five on each side.....DOLICOPSYLLINÆ

Subfamily VERMIPSYLLINÆ.

1903. *Vermipsyllidæ* WAHLGREN, Archiv für Zool., I, p. 190.

1903. *Vermipsyllidæ* WAGNER, Rev. Russ. d'Ent., No. 5, p. 294.

1904. *Vermipsyllidæ* BAKER, Proc. U. S. Nat. Mus., XXVII, p. 376.

Extensive and carefully made detail drawings of all the forms referred to this group are very much needed,

SYNOPSIS OF GENERA.

- A. Labial palpi with less than ten pseudojoints *Chatopsylla* Kohaut
 AA. Labial palpi with more than ten pseudojoints..... *Vermipsylla* Schimkewitsch

Genus VERMIPSYLLA Schimkewitsch.

1903. *Vermipsylla* WAGNER, Revue Russe d'Entom., No. 5.

Genus CHÆTOPSYLLA Kohaut.

1903. *Chatopsylla* KOHAUT, Magyar. bolhai (May), p. 37.
 1903. *Oncopsylla* and *Vermipsylla* WAHLGREN, Archiv für Zool., I, July, pp. 186 and 190.

Subfamily PULICINÆ.

1904. *Pulicinae* part TIRABOSCHI, Archiv. de Parasit., VIII, pp. 242 and 243.

The generic groups separated in this paper are groups with a characteristic habitus, capable of a fuller definition, which, with fuller material, will be presented later. This separation is also substantiated in part by geographical distribution and host relations. The writer does not believe in the separation of flea genera on a single character, and that the arrangement of some of the weaker spines, as has been done by Wagner with some of his new genera. So far as the writer or any American student is concerned Wagner's genera may stand as he has made them, but should the attempt be made to carry out a similar system among the American fleas, using a single set of uncoordinated characters, it would necessitate the formation of legions of genera, and would also result in throwing together under single generic names species of otherwise very distant relationships. The characters which Wagner uses are of great taxonomic value in themselves, however, and should be carefully indicated in every species described, though unfortunately this has not always been done.

SYNOPSIS OF GENERA.

- A. Legs stout and thick set; female with one antepygidial bristle on either side.
 B. Head without ctenidia.
 C. Head above sloping obliquely forward, angled in front; segments of abdomen each with five to six rows of bristles *Goniopsyllus*, new genus
 (type, *kerquelensis*)
 CC. Head broadly rounded above and in front.
 D. Labial palpi four-jointed.
 E. Pronotum without ctenidial spines.
 F. Inner side of hind coxæ distally with a comb of minute teeth.
Pulex Linnæus
 (type, *irritans*)
 FF. Inner side of hind coxæ distally without a comb of minute teeth.
Rhopalopsyllus, new genus
 (type, *lutzi*)
 EE. Pronotum with ctenidial spines *Hoplopsyllus*, new genus
 (type, *anomalus*)
 DD. Labial palpi five-jointed *Parapsyllus* Enderlein
 (type, *longicornis*)

- BB. Head and prothorax with ctenidia.
 C. Head long and not deep, the genal area small and provided along its whole length with a ctenidium *Ctenocephalus* Kolenati
 (type, *canis*)
 CC. Head short and deep, the genal area very large and with an oblique ctenidium on its posterior portion only *Spilopsyllus*, new genus.
 (type, *leporis*)
 AA. Legs more slender; female with two to five antepygidial bristles on either side.
 B. Head without ctenidia; eyes usually well developed; last joint of hind tarsi with four or five spines on either side.
 C. Inner side of hind coxæ distally with a comb of minute teeth.
Odontopsyllus, new genus
 (type, *multispinosus*)
 CC. Inner side of hind coxæ without a comb of minute teeth.
 D. Last joint of hind tarsi with five pairs of lateral spines and a supernumerary pair at the middle *Dasyopsyllus*, new genus
 (type, *perpinatus*)
 DD. Last joint of hind tarsi with five pairs of lateral spines, all in line or only the first pair slightly dislocated *Ceratophyllus* Curtis
 (type, *gallinæ*)
 BB. Head with ctenidia; eyes usually rudimentary.
 C. Last article of hind tarsi with five pairs of normally placed lateral spines, and with two minute subapical ones on the disk.
Typhloceras Wagner
 (type, *poppæi*)
 CC. Last joint of hind tarsi with four pairs of well developed, normally placed lateral spines, the fifth pair reduced to hairs.
 D. Last article of hind tarsi with two subbasal and two subapical approximate supernumerary spines on the disk.
 E. Third pair of lateral spines normal *Paleopsylla* Wagner
 (type, *sibirica*)
 EE. Third pair of lateral spines reduced to hairs .. *Ctenophthalmus* Kolenati
 (type, *bisocdentatus*)
 DD. Last article of hind tarsi with only two approximate supernumerary spines on the disk and these subapical *Neopsylla* Wagner
 (type, *bidentatiformis*)

Genus PULEX Linnæus.

1893. *Pulex* BEZZI, Rev. Ital. Sci. Nat. y Boll. Nat., XIII, p. 137.
 1903. *Pulex* KOHAUT, Magyar. bolhai, p. 32.
 1903. *Pulex* ENDERLEIN, Deutsches Tief-see Exped., 1898-99, III, p. 259.
 1904. *Pulex* TRABOSCHI, Archiv. de Parasit., VIII, p. 245.

SYNOPSIS OF SPECIES.

- A. Teeth in coxal comb numerous and in an irregular row.
 B. Labial palpi one-half length of anterior coxæ *irritans*
 BB. Labial palpi three-fourths of anterior coxæ or more *dugeii*
 AA. Teeth in coxal comb six, and in a regular row *brasiliensis*

Genus RHOPALOPSYLLUS, new genus.

This genus will probably prove one of the greatest interest economically in the Siphonaptera. It is here that we find most of those American species of tropical rat fleas which may possibly be concerned

in the transference of bubonic plague and leprosy. The upper edge of the antennal groove has a row of usually many short and thick, but minute, spines or teeth.

SYNOPSIS OF SPECIES.

- A. Frontal notch present.
 B. Lower edge of genæ with a row of several hairs *corfidii*
 BB. Lower edge of genæ without a row of hairs *lutzi*
 AA. Frontal notch absent.
 B. Second joint of maxillary palpi as long as III and IV together *klagesi*
 BB. Second article of maxillary palpi equaling IV or shorter.
 C. Third joint of maxillary palpi once and a third the length of II; maxillary palpi much shorter than rostrum *concitus*
 CC. Third article of maxillary palpi distinctly shorter than II.
 D. Spines on outside of hind tibia numerous and arranged in about three longitudinal rows; two complete rows of bristles on all the abdominal tergites *bohlsi*
 DD. Spines on outside of hind tibia in a single row of about eleven members with a few scattering ones beside; second row of bristles on abdominal tergites always more or less incomplete.
 E. Harpe of male lanceolate; the upper claspers with long stout spines.
 F. Claspers in male with three stout spines and several smaller ones on the outer margin.
 G. Harpe of male with three bristles near tip; head with two rows of bristles before the eye *australis*
 GG. Harpe of male with a brush of about ten stout bristles below tip; head with but one row of bristles before the eye *cleophontis*
 FF. Claspers with a submarginal vertical row of about fourteen stout spines near outer edge, and others within the margin *simonsi*
 EE. Harpe of male spatulate, subrectangular; upper claspers with only small, weak spines *cocytii*

Genus HOPLOPSYLLUS, new genus.

This is a genus principally of rabbit fleas. Their general structure is quite characteristic.

SYNOPSIS OF SPECIES.

- A. Pronotal ctenidium with about nine spines *anomalous*
 AA. Pronotal ctenidium with fourteen to eighteen spines.
 B. Articles of hind tarsi with some apical bristles longer than their succeeding articles.
 C. Vestiture of spines and bristles rather heavy; a spine on hind distal angle of second article of hind tarsi as long as articles III and IV and three-fourths of V together; claspers short and stout; harpe shaggy with hairs *affinis*
 CC. Vestiture comparatively light; a spine on hind distal angle of second article of hind tarsi as long as articles III and IV, and scarcely one-fourth of V together; claspers long and slender; harpes with few hairs *lynx*
 BB. Articles of hind tarsi with all the bristles shorter than their succeeding articles *glacialis*

Genus CTENOCEPHALUS Kolenati.

1904. *Ctenocephalus* TIRABOSCHI, Archiv. de Parasit., VIII, p. 252.

CTENOCEPHALUS CANIS (Curtis) Baker.

Rothschild^a again asserts the absolute distinctness of *canis* and *felis*. After the reception of this paper the material in the collection here was again gone over, with the result that the conviction remains that *felis* is at most a variety, and that with the recognition of *felis* many other varieties will also have to be recognized. After Rothschild's first paper on the subject the preparation of hundreds of specimens from different parts of the world was begun, taken from dogs and cats, both domestic and wild, for the purpose of making an extensive study in variation, comparing every specimen down to the last hair, just as has also been arranged for in the case of certain species of *Ceratophyllus*. It is hoped to carry these very important studies to a conclusion soon, and at that time the writer will be ready to present various other varieties of *canis* too numerous to name.

Genus SPILOPSYLLUS, new genus.

The placing of *simplex* and *inæqualis* in *Ctenocephalus* was but a temporary expedient at best. Their separation is inevitable, since they are of totally different relationships.

SYNOPSIS OF SPECIES.

- A. Mandibles reaching three-fourths of anterior coxæ; head ctenidia in male with eight spines on either side.....*simplex*
 AA. Mandibles reaching one-fourth to one-half of anterior coxæ; head ctenidia in male with four to six spines on either side.....*inæqualis*

Genus PARAPSYLLUS Enderlein.

1903. *Parapsyllus* ENDERLEIN, Deutsches Tief-see Exped. 1898-99, III, p. 260. (Type, *Pulex longicornis* Enderlein.)

Genus ODONTOPSYLLUS, new genus.

This group of species, originally referred to *Ceratophyllus*, possesses the strikingly *Pulex*-like character of minute teeth on the inside of hind coxæ.

SYNOPSIS OF SPECIES.

- A. Teeth on inside of hind coxæ in several rows; eyes well developed.
 B. Pronotal ctenidium of about forty spines.....*multispinosus*
 BB. Pronotal ctenidium of about twenty-four spines.....*dentatus*
 AA. Teeth on inside of hind coxæ in one row; pronotal ctenidium of about fourteen spines.
 B. In front of eyes a single row of three bristles.....*charlottensis*.
 BB. In front of eyes a single bristle and two rows of four or six bristles each.
telegoni

^a Novitates Zoologicæ, XII, Jan., 1905.

Genus CERATOPHYLLUS Curtis.

1903. *Ceratophyllus* KOHAUT, Magyar. bolhai, p. 41.1904. *Ceratophyllus* TIRABOSCHI, Archiv. de Parasit., VIII, p. 260.

A complete revision of this genus—even now much needed—will be a matter of the greatest difficulty. Of many of the species both sexes are not yet known. Many of the American species recently described by Rothschild are not known from specimens in this country; the types have probably permanently left America. The preparation of this second table of the species—although it is a great improvement over the first—has been a very unsatisfactory piece of work. It was impossible to use those characters believed to be of most importance in the separation of species, since they were rarely described for each and every species. No one who has not tried it can appreciate the obstacles to be encountered in the preparation of a synopsis of a great genus of many species from the descriptions of several authors. Every author should at least mention every character used by every other author. The writer has suffered probably as much by his own remissness as by that of any other person, but this does not detract from the truth or vital taxonomical importance of the proposition.

Material of all American *Ceratophyllus* species is greatly desired by the writer, and it is hoped that American entomologists and mammalogists will neglect no opportunity for their collection. The older species must be better known and there unquestionably still remain numerous new ones to discover.

When we came down to the separation of species, by the “turn of a hair” it was realized that the time had come to undertake extensive variational studies. With that in view, certain species in very critical groups were collected in large series, and have been mounted to the number of hundreds of specimens. Important results are expected from their extended comparative study.

SYNOPSIS OF AMERICAN SPECIES.

(Excepting *grœnlandicus*.)

- A. Metatarsal article II with apical spines scarcely equaling III or shorter.
- B. Metatarsal article V with lateral spines all in line on margins, though the first pair may be more or less bent inward.
- C. Upper genal row of bristles extended nearly to genal margin and composed of five or six bristles.
- D. Labial palpi not reaching end of coxæ.....*abantis*
- DD. Labial palpi reaching end of coxæ or even of trochanters.
- E. Disk of vertex back of antennal groove with six stout bristles.....*asio*
- EE. Disk of vertex back of antennal groove with one to three bristles.
- F. Subpygidial group of bristles in female with one oblique row of four large bristles and with two smaller bristles above these; ventral group on eighth tergite of three large bristles and about fourteen smaller ones.....*lucifer*
- FF. Subpygidial group of bristles in female with three large bristles only; ventral group on eighth tergite with three or four large bristles.....*lucidus*

- DDD. Labial palpi reaching beyond the trochanters.
 E. Claspers in male with ventral margin concave and bearing two spines. *quirini*
- EE. Claspers in male with ventral margin nearly straight and bearing large, long teeth.
 F. Claspers with two teeth *rison*
 FF. Claspers with three teeth *cutmolpi*
- CC. Upper genal row of bristles represented only by:
 D. Two small ones above near the antennal groove.
 E. Two large bristles behind the antennal groove *canadensis*
 EE. Four bristles behind the antennal groove *euphorbi*
- DD. One large one near the genal margin, and one above near the antennal groove; abdominal tergites with three distinctly marked rows of usually numerous bristles *alaskensis*
- DDD. One slender bristle on genal margin *proximus*
- BB. Metatarsal article V with but four pairs of lateral spines on the margins, the normal basal pair strongly dislocated toward the median line and directed straight distad.
- C. Metatarsal article I equaling II, III, and IV together, rarely more or less.
 D. Labial palpi nearly equaling fore femora; upper genal row with three small bristles near the antennal groove, only *oculatus*
- DD. Labial palpi rarely slightly exceeding the trochanters.
 E. Frontal part of head with three rows of bristles; vertex with at least one distinct oblique row of bristles *pollionis*
 EE. Frontal part of head with the two usual rows of bristles—at least no more; vertex with no oblique rows of bristles.
- F. Hind femur with a well defined lateral row of more than three hairs.
 G. Mesotarsal article I distinctly longer than II or V *californicus*
 GG. Mesotarsal article I about equal to II and to V *ciliatus*
- FF. Hind femur without a lateral row of hairs on side, though one or two may occur there.
- G. Pronotal ctenidium with twenty spines or less.
 H. Abdominal sternites with but two bristles on each side; claspers of male with three stout black teeth on expanded middle portion of ventral margin *wagneri*
- HH. Abdominal sternites for the most part with always more than two bristles on either side; claspers of male not as above.
 I. Mesotarsal article V less than twice the length of IV, II longer than V, and I little longer than III *leucopus*
 II. Mesotarsal article V always about twice IV in length, and the other proportions different from above.
 J. Labial palpi abnormally slender *labiatus*
 JJ. Labial palpi normally stout.
 K. Claspers in male with ventral margin bearing four short black teeth *wickhami*
 KK. Claspers with five short teeth and one long bristle *agilis*
 KKK. Claspers with six short teeth and three bristles. *sexdentatus*
- GG. Pronotal ctenidium with 24–28 spines; the second genal row represented by a few bristles near the antennal groove.
 H. Metatarsal article II with only three pairs of bristles on dorsal side; hind femur without lateral bristles *pseudarctomys*
 HH. Metatarsal article II with four pairs of bristles on dorsal side; hind femur with one lateral bristle *keeni*

- AA. Metatarsal article II with an apical spine much exceeding segment III and often III and IV together.
- B. Vertex and front very unusually bristled, with several rows of supernumerary bristles *terribilis*
- BB. Vertex and front with no more than the normal number of bristles.
- C. Metatarsal article V with but four pairs of lateral spines on the margins, the normal basal pair strongly dislocated toward the median line and directed straight distad.
- D. Eye vestigial; metathoracic notum fused with epimerum, and sternum with episternum.
- E. Labial palpi extending beyond trochanters *divisus*
- EE. Labial palpi shorter than coxæ *terminus*
- DD. Eyes distinct; metathoracic notum and sternum not fused with other parts.
- E. Metatarsal article I about equaling II, III, and IV together; bristles of metatarsus abnormally lengthened; labial palpi extending beyond trochanters *telchinum*
- EE. Metatarsal article I equaling the three succeeding segments and three-fourths of V together; bristles of metatarsi not normally lengthened; metatarsal article I with seven groups of spines on dorsal margin and five on ventral; labial palpi shorter than the coxæ.
coloradensis
- CC. Metatarsal article V with the spines all inserted in line on the margins, the first pair sometimes slightly bent inward.
- D. Eyes vestigial; second genal row with five bristles *ignotus*
- DD. Eyes present; second genal row with one to three bristles.
- E. Labial palpi equaling coxæ; one bristle in the second genal row. *petiolatus*
- EE. Labial palpi always extending to the femur and often nearly its whole length.
- F. Hind tarsal article I equaling II, III, and IV together *bacchi*
- FF. Metatarsal article I about equaling II and III together or less.
- G. Abdominal tergites with three rows of bristles *hirsutus*
- GG. Abdominal tergites with two rows of bristles.
- H. Claspers of male with ventral margin bearing three stout teeth and two-bristles *peantis*
- HH. Claspers of male with only bristles on ventral margin.
- I. Claspers of male of a very short small, hemispherical type.
- J. Claspers with bristles scattered along entire ventral margin.
- K. Frontal notch very large, its lip projecting in the form of a tubercle *tuberculatus*
- KK. Frontal notch small, its lip not projecting in the form of a tubercle.
- L. Labial palpi reaching at most to one-half of the anterior femora.
- M. Gena below eye pointed posteriorly; on metatarsal article I with groups of spines 6-6; upper male claspers distally obliquely truncate away from the body *arizonensis*
- MM. Genæ below eye posteriorly subtruncate.
- N. Metatarsal article I with groups of spines 5-6; claspers of male distally obliquely truncate away from body *arctomys*
- NN. Metatarsal article I with groups of spines 5-5; claspers of male distally gradually narrowed to a point *idahoensis*

- JJ. Claspers of male with bristles in one small group of five near the upper end; metatarsal article I with three groups of spines on dorsal margin and five on ventral.....*bruneri*
- II. Claspers of male large and very long, of a sickle-shaped type; metatarsal article I with but four groups of spines on ventral margin.
- J. Length 3-3.5 mm., pale brown; metatarsal article I with groups of spines 4-4 in female, the whole article about equaling II and III together.....*acutus*
- JJ. Length 1.75-2.75 mm., dark brown; hind tarsal article I with groups of spines 4-5 in female; the whole article shorter than II and III together.....*montanus*

Genus CTENOPHTHALMUS Kolenati.

1893. *Typhlopsylla* part BEZZI, Rev. Ital. Sci. Nat. y Bull. Nat., XIII, p. 137.
1903. *Typhlopsylla* WAGNER, Horæ Soc. Ent. Ross., XXXVI, pp. 138, 140.
1903. *Typhlopsylla* part KOHAUT, Magyar. bolhai, p. 53.
1904. *Typhlopsylla* TIRABOSCHI, Archiv. de Parasit., VIII, p. 285.

SYNOPSIS OF AMERICAN SPECIES.

- A. Head ctenidia of two superposed spines on either side; size very large.
- B. Genæ lobed; prothoracic ctenidium of twelve spines.....*wenmanni*
- BB. Genæ not lobed; prothoracic ctenidium of twenty spines...*gigas* and *grandis*
- AA. Head ctenidia of three to five spines on either side; size small.
- B. Spines of head ctenidia in nearly longitudinal rows on lower margins of genæ.
- C. Head ctenidia of three spines each.....*pseudagyrtes*
- CC. Head ctenidia of four spines each.....*antiquorum*
- BB. Spines of head ctenidia in vertical rows on hind margins of genæ.
- C. Spines of head ctenidia very similar in shape; pronotal ctenidium of 20-22 spines.
- D. Head ctenidia each of four spines; head evenly rounded in front; front with a marginal row of six bristles on each side.....*intermedius*
- DD. Head ctenidia each of five spines; head angulate in front; front without marginal bristles.....*fraternus*
- CC. Spines of head ctenidia very dissimilar in shape; pronotal ctenidium of about twenty-eight spines.....*genalis*

Genus NEOPSYLLA Wagner.

1903. *Neopsylla* WAGNER, Horæ Soc. Ent. Ross., XXXVI, pp. 138, 140.
1904. *Neopsylla* TIRABOSCHI, Archiv. de Parasit., VIII, p. 292.

Genus PALÆOPSYLLA Wagner.

1903. *Palæopsylla* WAGNER, Horæ Soc. Ent. Ross., XXXVI, pp. 137, 140.
1904. *Palæopsylla* TIRABOSCHI, Archiv. de Parasit., VIII, p. 294.

Genus TYPHLOCERAS Wagner.

1903. *Typhloceras* WAGNER, Horæ Soc. Ent. Ross., XXXVI, p. 152.
1904. *Typhloceras* TIRABOSCHI, Archiv. de Parasit., VIII, p. 295.

Subfamily DOLICHOPSYLLINÆ.

Genus DOLICHOPSYLLA, new genus.

This new genus and new subfamily are erected for the reception of the very remarkable *Ceratophyllus stylosus*.

Family CTENOPSYLLIDÆ, new family.

1904. *Typhlopsyllina* part TIRABOSCHI, Archiv. de Parasit., VIII, p. 242, 275.

Attention had been previously called to the close relationship of *Ctenopsyllus* and *Stephanocircus* as indicated by the most essential characters. They form a group equivalent to the other families of fleas. A name for the group drawn from the wholly untenable "*Typhlopsylla*" could not be used in any event.

Genus CTENOPSYLLUS Kolenati.

1893. *Typhlopsylla* part BEZZI, Rev. Ital. Soc. Nat. y Bull. Nat., XIII, p. 137.

1903. *Ctenopsylla* WAGNER, Horæ Soc. Ent. Ross., XXXVI, p. 149.

1903. *Typhlopsylla* part and *Ctenopsylla* KOHAUT, Magyar. bolhai, pp. 53, 58.

1904. *Ctenopsyllus* TIRABOSCHI, Archiv. de Parasit., VIII, p. 276.

SYNOPSIS OF AMERICAN SPECIES.

- A. Head without ctenidia *alpinus*
 AA. Head with ctenidia.
 B. Head ctenidia of two spines each *hesperomyis*
 BB. Head ctenidia of four spines *musculi*
 BBB. Head ctenidia of five spines.
 C. Pronotal ctenidium of thirty to forty spines (female) or fifty to fifty-six spines (male); eighth tergite in female with ventral group of numerous bristles *brooksi*
 CC. Pronotal ctenidium in female of twenty-four spines.
 D. Pronotal ctenidium in male of twenty-eight spines; eighth tergite in female with ventral group of two bristles *hygini*
 DD. Pronotal ctenidium in male of thirty-four spines; eighth tergite in female with ventral group of four bristles *hyrtæi*

Genus STEPHANOCIRCUS Skuse.

1903. *Stephanocircus* RAINBOW, Records of Australian Museum, V, No. 1, p. 53.

Rothschild has worked out the anatomy of the females of several species of this genus most thoroughly. The males still remain undiscovered. The tangle in connection with the original types of the genus has been unraveled by Mr. Rainbow.

Family HYSTRICHOPSYLLIDÆ, new family.

1904. *Hystrichopsyllina* TIRABOSCHI, Archiv. de Parasit., VIII, pp. 242, 296.

Tiraboschi rightly appreciated the wide distinctness of the genus *Hystrichopsylla*, but it is here given the full standing of a family, which it deserves.

Genus HYSTRICHOPSYLLA Taschenberg.

1893. *Hystrichopsylla* Bezzi, Rev. Ital. Soc. Nat. y Boll. Nat., XIII, p. 137.

SYNOPSIS OF AMERICAN SPECIES.

- A. Pronotal ctenidium of about fifty spines; genal ctenidium of fourteen spines.
americana
- AA. Pronotal ctenidium of thirty-six spines; genal ctenidium of six spines. *dippii*

Family CERATOPSYLLIDÆ, new family.

1904. *Typhlopsyllinae* part TIRABOSCHI, Archiv. de Parasit., VIII, p. 242, 275.

This group is as eligible to family rank as any other in the order.

Genus CERATOPSYLLUS Kolenati.

1903. *Ceratopsyllus* KOHAUT, Magyar. bolhai, p. 59.1904. *Ceratopsyllus* TIRABOSCHI, Archiv. de Parasit., VIII, p. 276.

SYNOPSIS OF AMERICAN SPECIES.

- A. Cephalic processes long, curved, and acuminate; metatarsal article I as long as tibia and with fifteen pairs of spines on the margin; pronotal ctenidium of twenty spines *distinctus*
- AA. Cephalic processes short, blunt, and nearly straight.
- B. Metanotum with bristles and hairs only; none of these developed into ctenidial spines; mesonotum much longer than the metanotum; pronotal ctenidium of twenty-two spines; metatarsal article I with the lateral spines 7-5 *palposus*
- BB. Metanotum with the subapical row of bristles developed into a ctenidium.
- C. A ctenidium on segment I of abdomen only; segments II-IV with a single row of bristles each; pronotal ctenidium of 27-29 spines. *wolffsohni*
- CC. Ctenidia on segments I to IV of abdomen.
- D. Pronotal ctenidium of twenty-four spines. *fosteri*
- DD. Pronotal ctenidium of thirty-six spines. *insignis*
- CCC. Ctenidia on segments I-VII of abdomen; metatarsal article I with spines 7-8, and this segment as long as segments II, III, and IV together; mesonotum nearly twice the length of metanotum on the dorsal line *crobyi*, new species

ADDITIONS AND CORRECTIONS TO THE LIST OF SIPHONAPTERA OF THE WORLD GIVEN IN THE REVISION OF AMERICAN SIPHONAPTERA.

Family RHYNCHOPRIONIDÆ Baker.

Genus RHYNCHOPRION Oken.

RHYNCHOPRION CÆCATA (Enderlein) Baker.

1901. ENDERLEIN, Zool. Jahrb., p. 549 (*Sarcopsylla cæcata*).1901. ENDERLEIN, Deutsches Tief-see Exped., 1898-99, III, p. 263 (*Sarcopsylla cæcata*).1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 306 (*Sarcopsylla cæcata*).*Host.*—*Mus rattus*.*Habitat.*—Brazil.

RHYNCHOPRION PENETRANS (Linnæus) Oken.

1815. OKEN, Naturgesch. f. alle Stände, III, p. 402.
 1864. KARSTEN, Beitrag. zur Kenntniss des *Rhynchoprion penetrans*.
 1901. ENDERLEIN, Zool. Jahrb., p. 551 (*Sarcopsylla penetrans*).
 1901. ENDERLEIN, Deutsches Tief-see Exped., 1898-99, III, p. 263 (*Sarcopsylla penetrans*).
 1903. WAHLGREN, Archiv für Zool., I, p. 195 (*Sarcopsylla penetrans*).
 1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 307 (*Sarcopsylla penetrans*).

Habitat.—Tunis, German East Africa, Cameroon.

Genus ARGOPSYLLA Enderlein.**ARGOPSYLLA GALLINACEA (Westwood) Enderlein.**

1875. WESTWOOD, The Entom. Mo. Mag., XI, p. 246 (*Sarcopsyllus gallinaceus*).
 1901. ENDERLEIN, Zool. Jahrb. Abth. f. syst., XIV, p. 552 (*Sarcopsylla gallinacea*).
 1901. ENDERLEIN, Deutsches Tief-see Exped., 1898-99, III, p. 263.
 1903. TIRABOSCHI, Archiv. de Parasit., VII, p. 124-132 (*Sarcopsylla gallinacea*).
 1904. BAKER, Proc. U. S. Nat. Mus., XXVII, p. 375 (*Xestopsylla gallinacea*).
 1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 303 (*Sarcopsylla gallinacea*).

Habitat.—German East Africa.

ARGOPSYLLA RHYNCHOPSYLLA (Tiraboschi) Baker.

1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 309 (*Sarcopsylla rhynchopsylla*).

Host.—*Mus alexandrinus*.

Habitat.—Italy.

Genus ECHIDNOPHAGA Olliff.**ECHIDNOPHAGA AMBULANS Olliff.**

1886. OLLIFF, Proc. Linn. Soc. N. S. Wales (2), I, p. 172.
 1904. BAKER, Proc. U. S. Nat. Mus., XXVII, p. 439.

Family MALACOPSYLLIDÆ.**Genus MALACOPSYLLA Weyenbergh.****MALACOPSYLLA AGENORIS Rothschild.**

1898. BAKER, Journ. N. Y. Ent. Soc., VI, p. 53 (*Megapsylla grossiventris*, male—
 not Weyenbergh).
 1904. ROTHSCHILD, Novitat. Zool., XI, p. 606.

Hosts.—*Dasyppus minutus*, *Cataphractus minutus*.

Habitat.—Argentine and Patagonia.

MALACOPSYLLA ANDROCLI Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 604.

Host.—*Canis griseus*.

Habitat.—Santa Cruz, Brazil.

MALACOPSYLLA GROSSIVENTRIS Weyenbergh.

1879. WEYENBERGH, Bull. Acad. Nat. Cienc. Répub. Arg., III, pp. 188-193 (*Pulex grossiventris*).
 1881. WEYENBERGH, Periódico Zoológico, III, pp. 270, 271.
 1898. BAKER, Journ. N. Y. Ent. Soc., VI, p. 53 (*Megapsylla grossiventris*, female).
 1903. WAHLGREN, Archiv für Zool., I, p. 194 (*Megapsylla inermis*).
 1904. ROTHSCHILD, Novitat. Zool., XI, p. 604.

Family LYCOPSYLLIDÆ Baker.

Genus LYCOPSYLLA Rothschild.

LYCOPSYLLA NOVUS Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 602.

Host.—*Phascolomys mitchelli*.

Habitat.—New South Wales.

Family PULICIDÆ.

Subfamily VERMIPSYLLINÆ.

Genus VERMIPSYLLA Schimkewitsch.

VERMIPSYLLA ALACURT Schimkewitsch.

1903. WAGNER, Revue Russe d'Entom., No. 5, p. 296.

Genus CHÆTOPSYLLA Kohaut.

CHÆTOPSYLLA MIKADO Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 645.

Host.—*Mustela itatsi*.

Habitat.—Japan.

CHÆTOPSYLLA ROTHSCHILDI Kohaut.

1903. KOHAUT, Magyar. bolhai, p. 40.

1903. WAGNER, Revue Russe d'Entom., No. 5, p. 295 (*Vermipsylla rothschildi*).

Host.—*Putorius putorius*.

Habitat.—Hungary.

CHÆTOPSYLLA STRANDI (Wahlgren) Baker.

1903. WAHLGREN, Archiv für Zool., I, p. 190 (*Vermipsylla strandi*).

Host.—*Ursos arctos*.

Habitat.—Norway.

CHÆTOPSYLLA TRICHOSA Kohaut.

1903. KOHAUT, Magyar. bolhai, p. 39.

1903. WAGNER, Revue Russe d'Entom., No. 5, p. 296 (*Vermipsylla trichosa*).

Host.—*Meles tawus*.

Habitat.—Hungary.

CHÆTOPSYLLA TUBERCULATICEPS (Bezzi) Baker.1890. BEZZI, Bull. Soc. Ent. Ital., XXII, pp. 30-33 (*Pulex tuberculaticeps*).1903. WAGNER, Revue Russe d'Entom., No. 5, p. 296 (*Vermipsylla tuberculaticeps*).**CHÆTOPSYLLA URSI (Rothschild) Baker.**1902. ROTHSCILD, Entom. Record, XIV, No. 3 (*Pulex ursi*).1904. BAKER, Proc. U. S. Nat. Mus., XXVII, p. 468 (*Pulex ursi*).1903. WAGNER, Revue Russe d'Entom., No. 5, p. 296 (*Vermipsylla ursi*).*Host.*—*Ursus horribilis*.*Habitat.*—Alberta, Canada.**CHÆTOPSYLLA VULPES (Motschulsky) Baker.**1840. MOTSCHULSKY, Bull. Soc. Imp. Moscou, p. 171 (*Pulex vulpes*).1880. TASCHENBERG, Die Flöhe, p. 66 (*Pulex globiceps*).1896. MEINERT, Pulicidæ Danicæ, p. 4 (*Pulex vulpes*).1903. KOHAUT, Magyar. bolhai, p. 38 (*Chætopsylla globiceps*).1903. WAHLGREN, Archiv für Zool., I, p. 188 (*Oncopsylla vulpes*).1903. WAGNER, Revue Russ. d'Entom., No. 5, p. 295 (*Vermipsylla globiceps*).*Habitat.*—Sweden, Norway, Denmark, Greenland (?).**Subfamily ANOMIOPSYLLINÆ Baker.****Genus ANOMIOPSYLLUS Baker.****ANOMIOPSYLLUS CALIFORNICUS Baker.**

1904. BAKER, Invert. Pacifica, I, p. 39.

Host.—*Spilogale phenax*.*Habitat.*—Claremont, California.**Subfamily PULICINÆ.****Genus GONIOPSYLLUS Baker.****GONIOPSYLLUS KERQUELENSIS (Taschenberg) Baker.**1880. TASCHENBERG, Die Flöhe, p. 67 (*Pulex kerqueleensis*).**Genus PULEX Linnæus.****PULEX ÆQUISETOSUS Enderlein.**

1901. ENDERLEIN, Zool. Jahrb., p. 554.

Host.—*Cricetomys* sp.*Habitat.*—Mangu, Togo.**PULEX ALTERNANS Wahlgren.**

1903 (?). WAHLGREN, Results of Swed. Zool. Exped. to Egypt and the White Nile, 1901. Paper No. 16.

Host.—*Acomys cahirinus*.*Habitat.*—Egypt.

PULEX CHEOPIS Rothschild.

? TIRABOSCHI (*Pulex pallidus*).

1903. ROTHSCHILD, Ent. Mo. Mag., 2nd ser., XIV, p. 85.

1903. WAGNER, Revue Russe d'Entom., No. 5, p. 308 (*Pulex pallidus*).

Hosts.—*Mus gentilis*, *Acomys witherbyi*, *Gerbillus robustus*, *Arvicanthis testicularis*, *Dipodillus watersi*, *Dipus jaculus*, *Genetta dongolana*.

Habitat.—Near Shendi and Suez, Egypt.

PULEX CHEPHRENSIS Rothschild.

1903. ROTHSCHILD, Ent. Mo. Mag., 2d ser., XIV, p. 86.

Hosts.—*Dipus jaculus*, *Acomys cahirinus*.

Habitat.—Cairo, Egypt.

PULEX CLEOPATRÆ Rothschild.

1903. ROTHSCHILD, Ent. Mo. Mag., 2d ser., XIV, p. 84.

Hosts.—*Gerbillus pygargus*, *Gerbillus robustus*, *Lepus æthiopicus*, *Dipodillus watersi*, *Dipus jaculus*, *Erinaceus æthiopicus*, *Arvicanthis testicularis*.

Habitat.—Near Shendi, Egypt.

PULEX CONFORMIS Wagner.

1894. WAGNER, Horæ Soc. Ent. Ross., XXVIII, p. 440 (*Pulex pallidus* part).

1903. WAGNER, Revue Russe d'Ent., No. 5, p. 310.

Host.—?

Habitat.—?

PULEX CREUSÆ Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 608.

Hosts.—*Felis caracal*, "*Spreo bicolor*," *Procapra capensis*.

Habitat.—Cape Colony.

PULEX ERIDOS Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 611.

Host.—*Otomys branti*.

Habitat.—Cape Colony.

PULEX ERILLI Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 610.

Hosts.—*Zorilla striata*, *Xerus capensis*, *Luricatu tetradactyla*.

Habitat.—Cape Colony.

PULEX GERBILLI Wagner.

1894. WAGNER, Horæ Soc. Ent. Ross., XXVIII, p. 440 (*Pulex pallidus* part).

1903. WAGNER, Revue Russe d'Ent., No. 5, p. 309.

Host.—*Gerbillus* sp.

Habitat.—?

PULEX IRRITANS Linnæus.

1882. BRUHL, Zootom. aller Thierklassen, fasc. 26-27.

1896. MEINERT, Pulicidæ Danicæ, p. 3.

1903. KOHAUT, Magyar. bolhai, p. 33.

1903. WAHLGREN, Archiv für Zool., I, p. 185.

1903. ROTHSCHILD, Novitat. Zool., X, p. 314.

1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 246.

Hosts.—*Gallus domesticus*, *Cunis familiaris*.

Habitat.—Tenerife; Australia; Berber.

PULEX ISIDIS Rothschild.

1903. ROTHSCHILD, Novitat. Zool., X, p. 313.

Host.—*Procapra erlangeri*.

Habitat.—Near Harar.

PULEX LONGISPINUS Wagner.

1901. ENDERLEIN, Zool. Jahrb., p. 556.

PULEX MURINUS Tiraboschi.

1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 252.

Hosts.—*Mus decumanus*, *Mus rattus alexandrinus*.

Habitat.—Italy.

PULEX MYCERINI Rothschild.

1904. ROTHSCHILD, Entomologist, Jan., p. 1.

Hosts.—*Gerbillus tarabuli*, *Pachyuromys duprasi natronensis*.

Habitat.—Bir Victoria, Egypt.

PULEX NUBICUS Rothschild.

1903. ROTHSCHILD, Ent. Mo. Mag., 2d ser., XIV, p. 84.

Hosts.—*Arvicanthis testicularis*, *Gerbillus robustus*, *Herpestes albicauda*, *Genetta dongolana*.

Habitat.—Near Shendi, Egypt.

PULEX PALLIDUS Taschenberg.

1902. WITHERBY, Bird Hunting on the White Nile, p. 60 (*Pulex witherbyi*).

1903. ROTHSCHILD, Ent. Mo. Mag., 2d ser., XIV, p. 86 (*Pulex witherbyi*).

1903. ROTHSCHILD, Novitat. Zool., X, p. 542.

1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 249.

Hosts.—*Erinaceus albiventris*, *Erinaceus æthiopicus*, *Vulpes niloticus*, *Hyæna hyæna*.

Habitat.—Near Gebel Auli and at Shendi, Egypt.

PULEX PHILIPPINENSIS Herzog.

1904. HERZOG, Bull. 23, Bureau of Govt. Laboratories, p. 77, figs. 26-27.

Host.—Rats.

Habitat.—Manila, Philippine Islands.

PULEX PYRAMIDIS Rothschild.

1904. ROTHSCHILD, Entomologist, Jan., p. 3.

Host.—*Jaculus jaculus*.

Habitat.—Bir Victoria, Egypt.

PULEX RAMESIS Rothschild.

1904. ROTHSCHILD, Entomologist, Jan., p. 2.

Hosts.—*Gerbillus tarabuli*, *Pachyuromys duprasi natronensis*.

Habitat.—Bir Victoria, Egypt.

PULEX REGIS Rothschild.

1903. ROTHSCHILD, Novitat. Zool., X, p. 312.

Host.—*Meriones rex*.

Habitat.—South Arabia.

PULEX RIGGENBACHI Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 611.

Host.—*Hystrix cristata*.

Habitat.—Morocco and Cape Colony.

Genus RHOPALOPSYLLUS Baker.

RHOPALOPSYLLUS AUSTRALIS (Rothschild) Baker.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 613 (*Pulex australis*).

Hosts.—*Dicotyles labiatus*, *Tatusia novemcincta*, *Speothos venaticus*.

Habitat.—Brazil and Bolivia.

RHOPALOPSYLLUS BOHLSI (Wagner) Baker.

1901. WAGNER, Horæ Soc. Ent. Ross., XXXV, p. 21 (*Pulex bohlsi*).

RHOPALOPSYLLUS CLEOPHONTIS (Rothschild) Baker.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 614 (*Pulex cleopontis*).

Host.—*Muletia septemcincta*.

Habitat.—Argentina, Paraguay, and Minas Geraes, Brazil.

RHOPALOPSYLLUS COCYTI (Rothschild) Baker.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 617 (*Pulex cocyti*).

Host.—"Burrowing rat."

Habitat.—Chile.

RHOPALOPSYLLUS CONCITUS (Rothschild) Baker.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 615 (*Pulex concitus*).

Host.—*Kerodon boliviensis*.

Habitat.—Sucre, Bolivia.

RHOPALOPSYLLUS CORFIDII (Rothschild) Baker.

1904. ROTHSCHILD, *Novitat. Zool.*, XI, p. 619 (*Pulex corfidii*).

Host.—*Octodon degus*.

Habitat.—Valparaiso, Chile.

RHOPALOPSYLLUS KLAGESI (Rothschild) Baker.

1904. ROTHSCHILD, *Novitat. Zool.*, XI, p. 620 (*Pulex klagesi*).

Host.—“Spring rat.”

Habitat.—Venezuela.

RHOPALOPSYLLUS LUTZII Baker.

1903. BAKER, *Proc. U. S. Nat. Mus.*, XXVII, p. 380 (*Pulex lutzii*).

RHOPALOPSYLLUS SIMONSI (Rothschild) Baker.

1904. ROTHSCHILD, *Novitat. Zool.*, XI, p. 616 (*Pulex simonsi*).

Hosts.—*Neotodon simonsi*, *Akodon albivener*.

Habitat.—Bolivia.

Genus HOPLOPSYLLUS Baker.**HOPLOPSYLLUS AFFINIS Baker.**

1903. BAKER, *Proc. U. S. Nat. Mus.*, XXVII, p. 382 (*Pulex affinis*).

HOPLOPSYLLUS ANOMALUS Baker.

1903. BAKER, *Proc. U. S. Nat. Mus.*, XXVII, p. 381 (*Pulex anomalus*).

HOPLOPSYLLUS LYNX Baker.

1903. BAKER, *Proc. U. S. Nat. Mus.*, XXVII, p. 383 (*Pulex lynx*).

HOPLOPSYLLUS GLACIALIS (Taschenberg) Baker.

1880. TASCHENBERG, *Die Flöhe*, p. 76 (*Pulex glacialis*).

1903. WAHLGREN, *Archiv für Zool.*, I, p. 185 (*Pulex glacialis*).

Host.—*Lepus glacialis*.

Habitat.—Greenland.

Genus PARAPSYLLUS Enderlein.**PARAPSYLLUS LONGICORNIS Enderlein.**

1901. ENDERLEIN, *Zool. Jahrb. Abth. f. syst.*, XIV, p. 553 (*Pulex longicornis*).

1903. ENDERLEIN, *Deutsches Tief-see Exped.*, 1898-99, III, p. 261.

Host.—*Eudyptes chusocome* (Penguin).

Habitat.—St. Paul Island.

Genus CTENOCEPHALUS Kolenati.

CTENOCEPHALUS CANIS (Curtis) Baker.

1882. BRUHL, Zootom. aller Thierklassen, fasc. 26-27 (*Pulex canis*).
 1896. MEINERT, Pulicidae Danicae, p. 7 (*Pulex canis*).
 1903. KOHAUT, Magyar. bolhai, p. 34 (*Pulex canis*) and p. 35 (*Pulex felis*).
 1903. WAHLGREN, Archiv für Zool., I, p. 185 (*Pulex canis*).
 1903. ROTHSCHILD, Novitat. Zool., X, p. 315 (*Pulex felis*).
 1904. TIRABOSCHI, Archiv. de Parasit., VIII (*Ctenocephalus serraticeps*, p. 254, and *C. serraticeps* var. *marina*, p. 259).
 1905. ROTHSCHILD, Novitat. Zool., XII, p. 192 (*Pulex canis* and *Pulex felis*).

Hosts.—*Canis mesomelas*, *Mus decumanus*, *Mus rattus alexandrinus*.

Habitat.—Italy.

Genus SPILOPSYLLUS Baker.

SPILOPSYLLUS ERINACEI (Leach) Baker.

1832. LEACH, in Curtis Brit. Ent., IX, no. 417 (*Ceratophyllus erinacei*).
 1878. DALE, Hist. of Glanvilles Wooton, p. 291 (*Pulex glanis* part).
 1896. MEINERT, Pulicidae Danicae, p. 7 (*Pulex erinacei*).
 1903. KOHAUT, Magyar. bolhai, p. 36.
 1903. ROTHSCHILD, Ent. Mo. Mag., 2d ser., XIV, p. 145.

SPILOPSYLLUS INAEQUALIS Baker.

1895. BAKER, Canad. Ent., XXVII, p. 164 (*Pulex inaequalis*).

SPILOPSYLLUS LEPORIS (Leach) Baker.

1832. LEACH, in Curtis Brit. Ent., IX, no. 417 (*Ceratophyllus leporis*).
 1878. DALE, Hist. of Glanvilles Wooton, p. 291 (*Pulex cuniculi*).
 1880. TASCHENBERG, Die Flöhe, p. 82 (*Pulex goniocephalus*).
 1903. ROTHSCHILD, Ent. Mo. Mag., 2d ser., XLV, p. 145 (*Pulex cuniculi*).

SPILOPSYLLUS SIMPLEX Baker.

1895. BAKER, Canad. Ent., XXVII, p. 164 (*Pulex inaequalis* var. *simplex*).

Genus ODONTOPSYLLUS Baker.

ODONTOPSYLLUS MULTISPINOSUS Baker.

1898. BAKER, Journ. N. Y. Ent. Soc., VI, p. 54 (*Pulex multispinosus*).
 1903. BAKER, Proc. U. S. Nat. Mus., XXVII, pp. 389, 445 (*Ceratophyllus multispinosus*).

ODONTOPSYLLUS DENTATUS Baker.

1903. BAKER, Proc. U. S. Nat. Mus., XXVII, p. 390 (*Ceratophyllus dentatus*).

ODONTOPSYLLUS CHARLOTTENSIS Baker.

1898. BAKER, Journ. N. Y. Ent. Soc., VI, p. 56 (*Pulex charlottensis*).
 1905. ROTHSCHILD, Novitat. Zool., XII, p. 174 (*Ceratophyllus charlottensis*).

Hosts.—*Peromyscus leucopus*, *Peromyscus arcticus*, *Neotoma cinerea*, *Eutamias saturatus*.

Habitat.—British Columbia and Alberta, Canada.

ODONTOPSYLLUS TELEGONI (Rothschild) Baker.

1905. ROTHSCHILD, Novitat. Zool., XII, p. 172 (*Ceratophyllus telegoni*).

Hosts.—*Microtus drummondii*, *Evotomys gapperi*.

Habitat.—Western Canada.

Genus DASYPSYLLUS Baker.

DASYPSYLLUS PERPINNATUS Baker.

1903. BAKER, Proc. U. S. Nat. Mus., XXVII, p. 391 (*Ceratophyllus perpinnatus*).

Genus CERATOPHYLLUS Curtis.

CERATOPHYLLUS ABANTIS Rothschild.

1905. ROTHSCHILD, Novitat. Zool., XII, p. 164.

Hosts.—*Putorius longicaudatus*, *Microtus drummondii*.

Habitat.—British Columbia and Alberta, Canada.

CERATOPHYLLUS ACAMANTIS Rothschild.

1905. ROTHSCHILD, Novitat. Zool., XII, p. 156.

Hosts.—*Mephitis spissigrada*, *Arctomys flaviventer avarus*, *Lutreola energumenos*, *Canis latrans*.

Habitat.—British Columbia.

CERATOPHYLLUS ACUTUS Baker.

1904. BAKER, Invert. Pacifica, I, p. 40.

Host.—*Spermophilus* sp.

Habitat.—Stanford University, California.

CERATOPHYLLUS AGILIS Rothschild.

1905. ROTHSCHILD, Novitat. Zool., XII, p. 167.

Hosts.—*Neotome cinerea*, *Ochotoma princeps*, *Putorius longicaudatus*, *Sciurus richardsoni baileyi*.

Habitat.—British Columbia and Alberta, Canada.

CERATOPHYLLUS AGRIPPINÆ Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 634.

Hosts.—*Otomys branti*, *Otomys unisulcatus*.

Habitat.—Cape Colony.

CERATOPHYLLUS AHALÆ Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 631.

Host.—"Small jungle squirrel."

Habitat.—Sidapur, India.

CERATOPHYLLUS ALLADINIS Rothschild.1904. ROTHSCHILD, *Novitat. Zool.*, XI, p. 632.*Host.*—"Small jungle squirrel."*Habitat.*—Sidapur, India.**CERATOPHYLLUS ANGULATUS** Wahlgren.1903. WAHLGREN, *Archiv für Zool.*, I, p. 184.*Host.*—*Lestris parasitica*.*Habitat.*—Norway.**CERATOPHYLLUS BACCHI** Rothschild.1905. ROTHSCHILD, *Novitat. Zool.*, XII, p. 159.*Host.*—*Spermophilus 13-lineatus*.*Habitat.*—Alberta, Canada.**CERATOPHYLLUS CALIFORNICUS** Baker, var.**ENDYMIONIS** (Rothschild) Baker.1904. ROTHSCHILD, *Novitat. Zool.*, XL, p. 634 (*Ceratophyllus endymionis*).*Host.*—*Marmosa elegans*.*Habitat.*—Valparaiso, Chile.**CERATOPHYLLUS COLUMBÆ** Walker.1903. WAGNER, *Horae Soc. Ent. Ross.*, XXXVI, p. 292.**CERATOPHYLLUS CONSIMILIS** Wagner.1904. TIRABOSCHI, *Archiv. de Parasit.*, VIII, p. 268.**CERATOPHYLLUS DALEI** Rothschild.1903. ROTHSCHILD, *Entomologist*, Dec., p. 297.*Host.*—"Wood pigeon."*Habitat.*—Glanvilles Wooton, Dorsetshire, England.**CERATOPHYLLUS DORIPPÆ** Rothschild.1904. ROTHSCHILD, *Novitat. Zool.*, XI, p. 636.*Host.*—*Herpestes badius*.*Habitat.*—Cape Colony.**CERATOPHYLLUS EUMOLPI** Rothschild.1905. ROTHSCHILD, *Novitat. Zool.*, XII, p. 161.*Hosts.*—*Tamias borealis*, *Eutamias quadrivittatus affinis*.*Habitat.*—British Columbia and Alberta, Canada.

CERATOPHYLLUS EUPHORBI Rothschild.

1905. ROTHSCHILD, Novitat. Zool., XII, p. 165.

Host.—*Peromyscus canadensis*.

Habitat.—British Columbia.

CERATOPHYLLUS FASCIATUS Bosc.

1878. DALE, Hist. of Glanvilles Wooton, p. 291 (*Pulex furoris*).

1896. MEINERT, Pulicidæ Danicæ, p. 5.

1903. KOHAUT, Magyar. bolhai, p. 42.

1903. ROTHSCHILD, Ent. Mo. Mag., 2d ser., XIV, p. 145.

1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 262.

Habitat.—Sydney.

CERATOPHYLLUS FRINGILLÆ (Walker).

1856. WALKER, Dipt. Britt., III, p. 4 (*Pulex fringillæ*).

1903. ROTHSCHILD, Entom. Record, XV, No. 12, p. 308.

CERATOPHYLLUS GALLINÆ Schrank.

1878. DALE, Hist. of Glanvilles Wooton, p. 291 (*Ceratopsyllus monedula*, *Ceratopsyllus turdi* part, *Ceratopsyllus merula* part, *Ceratopsyllus cinerea* part, *Ceratopsyllus spini*, *Ceratopsyllus ænus*).

1896. MEINERT, Pulicidæ Danicæ, p. 5.

1903. KOHAUT, Magyar. bolhai, p. 45.

1903. WAGNER, Horæ Soc. Ent. Ross., XXXVI, p. 292.

1903. ROTHSCHILD, Ent. Mo. Mag., 2d ser., XIV, pp. 145-146.

1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 273.

CERATOPHYLLUS GALLINULÆ (Dale).

1878. DALE, Hist. of Glanvilles Wooton, pp. 291, 292 (*Ceratopsyllus gallinulæ*, *Ceratopsyllus turdi* part, *Ceratopsyllus merula* part, *Ceratopsyllus garruli*, *Ceratopsyllus pyrrhulæ*, *Ceratopsyllus citrinellæ*, *Ceratopsyllus pratensis*, *Ceratopsyllus atricapillæ*, *Ceratopsyllus cinerea* part, *Ceratopsyllus caudati*).

1901. ROTHSCHILD, Ent. Record, XIII, p. 284 (*Ceratophyllus newsteadi*).

1903. WAGNER, Horæ Soc. Ent. Ross., XXXVI, p. 291 (*Ceratophyllus newsteadi*).

1903. ROTHSCHILD, Ent. Mo. Mag., 2d ser., XIV, pp. 145-146.

CERATOPHYLLUS GRŒNLANDICUS Wahlgren.

1903. WAHLGREN, Archiv für Zool., I, p. 183.

Host.—*Myodes torquatus*.

Habitat.—Greenland.

CERATOPHYLLUS HENLEYI Rothschild.

1904. ROTHSCHILD, Entomologist, Jan., p. 3.

Hosts.—*Gerbillus tarabuli*, *Pachyuromys duprasi natronensis*.

Habitat.—Bir Victoria, Egypt.

CERATOPHYLLUS HILLI Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 622.

Hosts.—*Bettongia penicillata*, *Dasyurus viverrinus*, *Perameles nasuta*.

Habitat.—West Australia and New South Wales.

CERATOPHYLLUS HIRUNDINIS Curtis.

1903. WAGNER, Horæ Soc. Ent. Ross., XXXVI, p. 292.

CERATOPHYLLUS ITALICUS Tiraboschi.

1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 266.

Hosts.—*Mus decumanus*, *Mus rattus alexandrina*, *Mus musculus*, *Mus silvaticus*.

Habitat.—Italy.

CERATOPHYLLUS LAGOMYS Wagner.

1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 269.

CERATOPHYLLUS LUCIFER Rothschild.

1905. ROTHSCHILD, Novitat. Zool., XII, p. 170.

Host.—*Microtus drummondi*.

Habitat.—Alberta, Canada.

CERATOPHYLLUS MELIS (Leach) Curtis.

1896. MEINERT, Pulicidæ Danicæ, p. 6.

1903. KOHAUT, Magyar. bolhai, p. 44.

CERATOPHYLLUS MUSTELÆ Dale.

1878. DALE, Hist. of Glanvilles Wootton, p. 291 (*Pulex mustelæ*).

1898. WAGNER, Horæ Soc. Ent. Ross., XXXI, p. 565.

1903. ROTHSCHILD, Ent. Mo. Mag., 2d ser., XIV, p. 145 (*Pulex mustelæ*).

1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 268.

CERATOPHYLLUS NOVÆGUINEÆ Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 629.

Host.—*Perameles raffrayanus*.

Habitat.—New Guinea.

CERATOPHYLLUS NUMÆ Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 637.

Host.—*Otomys branti*.

Habitat.—Cape Colony.

CERATOPHYLLUS OCHI Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 628.

Host.—"An opossum."

Habitat.—Victoria, Australia.

CERATOPHYLLUS OCTAVII Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 638.

Host.—*Graphocularis biurus*.

Habitat.—Cape Colony.

CERATOPHYLLUS OLIGOCHÆTUS Wagner.

1903. WAGNER, Horæ Soc. Ent. Ross., XXXVI, pp. 290, 292.

Host.—"Vogel."

Habitat.—Vege sack, Germany.

CERATOPHYLLUS PENCILLIGER (Grube) Wagner.

1903. WAHLGREN, Archiv für Zool., I, p. 182.

1904. TIRABOSCHI, Archiv. de Parasit., p. 270.

Hosts.—*Myodes lemmus*, *Putorius sibiricus*.

Habitat.—Norway and Siberia.

CERATOPHYLLUS PINNATUS Wagner.

1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 271.

CERATOPHYLLUS PÆANTIS Rothschild.

1905. ROTHSCHILD, Novitat. Zool., XII, p. 155.

Hosts.—*Tamias* spp., *Spermophilus columbianus*, *Putorius longicaudatus*, *Sciurus aberti*.

Habitat.—Arizona and Alberta, Canada.

CERATOPHYLLUS POLLIONIS Rothschild.

1905. ROTHSCHILD, Novitat. Zool., XII, p. 171.

Hosts.—*Microtus drummondii*, *Ecotomys saturatus*.

Habitat.—Alberta, Canada.

CERATOPHYLLUS PSEUDARCTOMYS Baker, var. ACASTI (Rothschild)
Baker.

1905. ROTHSCHILD, Novitat. Zool., XII, p. 168 (*Ceratophyllus acasti*).

Host.—*Sciuropterus sabrinus*.

Habitat.—British Columbia.

CERATOPHYLLUS QUIRINI Rothschild.

1905. ROTHSCHILD, Novitat. Zool., XII, p. 163.

Hosts.—*Ecotomys gapperi*, *Ecotomys saturatus*.

Habitat.—Alberta, Canada.

CERATOPHYLLUS RECTANGULATUS Wahlgren.

1903. WAHLGREN, Archiv für Zool., I, p. 182.

Host.—*Myodes lemmus*.*Habitat.*—Norway.**CERATOPHYLLUS RUSTICUS** Wagner.

1903. WAGNER, Horæ Soc. Ent. Ross., XXXVI, p. 288 and 292.

Host.—“Vogel.”*Habitat.*—Vege sack, Germany.**CERATOPHYLLUS SCIURORUM** (Schrank) Curtis.1878. DALE, Hist. of Glanvilles Wooton, pp. 291 and 293 (*Pulex gliris* part).

1896. MEINERT, Pulicidæ Danicæ, p. 6.

1903. KOHAUT, Magyar. bolhai, p. 43.

1903. ROTHSCHILD, Ent. Mo. Mag., 2d ser., XIV, p. 145.

CERATOPHYLLUS SEXDENTATUS Baker.

1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 272.

CERATOPHYLLUS SILANTIEWI Wagner.

1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 274.

CERATOPHYLLUS SPINOSUS Wagner.1894. WAGNER, Horæ Soc. Ent. Ross., XXVIII, p. 440 (*Ceratophyllus arion*).

1903. WAGNER, Horæ Soc. Ent. Ross., XXXVI, p. 287 and 292.

Host.—“Vogel.”*Habitat.*—Vege sack, Germany.**CERATOPHYLLUS STYX** Rothschild.

1903. WAGNER, Horæ Soc. Ent. Ross., XXXVI, p. 292.

CERATOPHYLLUS TELCHINUM Rothschild.

1905. ROTHSCHILD, Novitat. Zool., XII, p. 153.

Hosts.—*Eutamias gapperi*, *Sorex richardsoni*.*Habitat.*—British Columbia.**CERATOPHYLLUS TERINUS** Rothschild.

1905. ROTHSCHILD, Novitat. Zool., XII, p. 158.

Host.—*Spermophilus columbianus*.*Habitat.*—British Columbia.**CERATOPHYLLUS TERRIBILIS** Rothschild.

1903. ROTHSCHILD, Novitat. Zool., X, p. 317.

Host.—*Lagomys princeps*.*Habitat.*—Alberta, Canada.

CERATOPHYLLUS THOMASI Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 625.

Host.—*Acrobates pygmaea*.

Habitat.—Australia.

CERATOPHYLLUS TRISTIS Rothschild.

1900. ROTHSCHILD, Ent. Record, XII, p. 36 (*Typhlopsylla tristis*).

1904. BAKER, Proc. U. S. Nat. Mus., XXVII, p. 451 (*Ctenophthalmus tristis*).

1904. ROTHSCHILD, Novitat. Zool., XI, p. 625.

CERATOPHYLLUS VAGABUNDUS (Boheman) Wahlgren.

1865. BOHEMAN, Ofvers. of K. Vet. Akad. Forh., p. 576 (*Pulex vagabunda*).

1903. WAHLGREN, Archiv für Zool., I, p. 184 (*Ceratophyllus digitalis*).

1903. WAHLGREN, Entom. Tidskr., July, p. 219.

Host.—?

Habitat.—Spitzbergen.

CERATOPHYLLUS WICKHAMI Baker, var.
ÆGER (Rothschild) Baker.

1905. ROTHSCHILD, Novitat. Zool., XII, p. 166 (*Ceratophyllus æger*):

Hosts.—*Peromyscus arcticus*, *Evotomys saturatus*.

CERATOPHYLLUS WICKHAMI Baker, var.
NEPOS (Rothschild) Baker.

1905. ROTHSCHILD, Novitat. Zool., XII, p. 168 (*Ceratophyllus nepos*).

Host.—*Spilogale latifrons*.

Habitat.—British Columbia.

CERATOPHYLLUS WOODWARDI Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 623.

Host.—?

Habitat.—West Australia.

CERATOPHYLLUS ZETHI Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 626.

Host.—*Bettongia cuniculus*.

Habitat.—Gippsland, Victoria.

Genus TYPHLOCERAS Wagner.

TYPHLOCERAS POPPEI Wagner.

1903. WAGNER, Hoffe Soc. Ent. Ross., XXXVI, p. 154.

1903. ROTHSCHILD, Ent. Record, XV, p. 196.

1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 295.

Host.—*Mus sylvaticus*.

Habitat.—Vege sack in Germany; Tharandt in Saxony; England.

Genus PALÆOPSYLLA Wagner.

PALÆOPSYLLA DASyncNEMUS Rothschild.

1897. ROTHSCHILD, The Ent. Record, IX, No. 7, p. 159 (*Typhlopsylla dasyncnemus*).
 1903. WAGNER, Horæ Soc. Ent. Ross., XXXVI, pp. 140, 142.

PALÆOPSYLLA GRACILIS (Taschenberg) Wagner.

1880. TASCHEBERG, Die Flöhe, p. 96 (*Typhlopsylla gracilis*).
 1903. WAGNER, Horæ Soc. Ent. Ross., XXXVI, pp. 140, 142.

PALÆOPSYLLA ROSENBERGI (Rothschild) Baker.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 639 (*Typhloceras rosenbergi*).

Hosts.—*Metachirus opposum*, *Didelphys azaræ*.

Habitat.—Ecuador.

PALÆOPSYLLA SIBIRICA Wagner.

1901. WAGNER, Horæ Soc. Ent. Ross., XXXV, p. 26 (*Typhlopsylla sibirica*).
 1903. WAGNER, Horæ Soc. Ent. Ross., XXXVI, p. 140.

Genus CTENOPHTHALMUS Kolenati.

CTENOPHTHALMUS AGYRTES (Heller) Baker.

1903. WAGNER, Horæ Soc. Ent. Ross., XXXVI, pp. 141, 148 (*Typhlopsylla agyrtes*).
 1903. WAHLGREN, Archiv für Zool., I, p. 189 (*Typhlopsylla agyrtes*).
 1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 288 (*Typhlopsylla agyrtes*).

CTENOPHTHALMUS ANTIQUORUM Rothschild.

1904. ROTHSCHILD, Novitates Zool., XI, p. 643.

Host.—*Didelphys aurita*.

Habitat.—Tigneti Zech, Brazil.

CTENOPHTHALMUS ASSIMILIS (Taschenberg) Baker.

1896. MEINERT, Pulicidæ Danicæ, p. 11 (*Typhlopsylla assimilis*).
 1903. WAGNER, Horæ Soc. Ent. Ross., XXXVI, p. 141 (*Typhlopsylla assimilis*).
 1903. KOHAUT, Magyar. bolhai, p. 54 (*Typhlopsylla assimilis*).
 1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 286 (*Typhlopsylla assimilis*).

CTENOPHTHALMUS BISODDENTATUS Kolenati.

1903. KOHAUT, Magyar. bolhai, p. 56.

CTENOPHTHALMUS CAUCASICA Taschenberg.

1903. WAGNER, Horæ Soc. Ent. Ross., XXXVI, p. 141 (*Typhlopsylla caucasica*).

CTENOPHTHALMUS GRANDIS (Rothschild) Baker.

1902. ROTHSCHILD, Ent. Record, XIV, No. 3 (*Typhlopsylla grandis*).
 1904. BAKER, Proc. U. S. Nat. Mus., XXVII, p. 468.

Host.—*Tamias striatus*.

Habitat.—Branchtown, Ontario.

CTENOPHTHALMUS MONTICOLA (Kohaut) Baker.

1904. KOHAUT, Ann. Mus. Nat. Hung., p. 86, (*Typhlopsylla monticola*).

Host.—*Spalax monticola*.

Habitat.—Bosnia.

CTENOPHTHALMUS ORIENTALIS (Wagner) Baker.

1903. WAGNER, Horæ Soc. Ent. Ross., XXXVI, p. 142 (*Typhlopsylla orientalis*).

CTENOPHTHALMUS PROXIMA (Wagner) Baker.

1903. WAGNER, Horæ Soc. Ent. Ross., XXXVI, pp. 141, 147 (*Typhlopsylla proxima*).

1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 292 (*Typhlopsylla proxima*).

Hosts.—*Crocidura aranea*, *Mus sylvaticus*.

Habitat.—Caucasus.

CTENOPHTHALMUS PSEUDAGYRTES Baker.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 641.

Hosts.—*Scalops aquaticus*, *Microtus drunondii*, *Microtus saturatus*.

Habitat.—Alberta, Canada, and North Carolina.

CTENOPHTHALMUS TYPHLUS (Motschulsky) Baker.

1903. KOHAUT, Magyar. bolhai, p. 55.

Host.—*Spalax hungaricus*.

CTENOPHTHALMUS UNCINATA (Wagner) Baker.

1903. WAGNER, Horæ Soc. Ent. Ross., XXXVI, p. 142 (*Typhlopsylla uncinata*).

1903. WAHLGREN, Archiv für Zool., I, p. 188 (*Typhlopsylla uncinata*).

Host.—*Modes lemnius*.

Habitat.—Norway.

CTENOPHTHALMUS WENMANNI Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 642.

Hosts.—*Peromyscus leucopus*, *Neotoma cinerea*.

Habitat.—British Columbia.

Genus NEOPSYLLA Wagner.**NEOPSYLLA ALTAICA Wagner.**

1901. WAGNER, Horæ Soc. Ent. Ross., XXXV, p. 27 (*Typhlopsylla altaica*).

1903. WAGNER, Horæ Soc. Ent. Ross., XXXVI, p. 141.

NEOPSYLLA BIDENTATIFORMIS Wagner.

1898. WAGNER, Horæ Soc. Ent. Ross., XXXI, p. 292 (*Typhlopsylla setosa*).

1903. WAGNER, Horæ Soc. Ent. Ross., XXXVI, pp. 141, 143, 146.

1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 292.

NEOPSYLLA PENTACANTHUS (Rothschild).

1897. ROTHSCHILD, The Ent. Record, IX, No. 3 (*Typhlopsylla pentacanthus*).
 1903. WAGNER, HORÉ Soc. Ent. Ross., XXXVI, pp. 141, 146.
 1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 293.

Subfamily DOLICHOPSYLLINÆ Baker.

Genus DOLICHOPSYLLUS Baker.

DOLICHOPSYLLUS STYLOSUS Baker.

1903. BAKER, Proc. U. S. Nat. Mus., XXVII, p. 418 (*Ceratophyllus stylosus*).

Family CTENOPSYLLIDÆ Baker.

Genus CTENOPSYLLUS Kolenati.

CTENOPSYLLUS AGANIPPES Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 647.

Host.—*Mus* sp.

Habitat.—Cape Colony.

CTENOPSYLLUS ALPINUS Baker.

1903. WAGNER, HORÉ Soc. Ent. Ross., XXXVI, p. 151 (*Ctenopsylla alpina*).
 1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 285 (*Ctenopsylla alpina*).

CTENOPSYLLUS BIDENTATUS (Kolenati) Wagner.

1903. WAGNER, HORÉ Soc. Ent. Ross., XXXVI, p. 151 (*Ctenopsylla bidentata*).

CTENOPSYLLUS BROOKSI Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 649.

Hosts.—*Putorius richardsoni*, *Putorius longicaudatus*, *Mustela americana*.

Habitat.—British Columbia and Alberta, Canada.

CTENOPSYLLUS GRANTI Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 646.

Host.—“*Macro proboscideus*.”

Habitat.—Cape Colony.

CTENOPSYLLUS HYGINI Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 650.

Host.—*Putorius richardsoni*.

Habitat.—Alberta, Canada.

CTENOPSYLLUS HYRTACI Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 652.

Hosts.—*Lutreola energumenos*, *Sorex obscurus*.

Habitat.—British Columbia.

CTENOPSYLLUS MUSCULI (Duges) Wagner.

1896. BAKER, *Canad. Ent.*, XXVIII, p. 85 (*Typhlopsylla mexicana*).
 1896. MEINERT, *Pulicidæ Danicæ*, p. 10.
 1903. WAGNER, *Horæ Soc. Ent. Ross.*, XXXVI, pp. 150, 152.
 1903. KOHAUT, *Magyar. bolhai*, p. 58.
 1904. BAKER, *Proc. U. S. Nat. Mus.*, XXVII, p. 430 (*Ctenopsyllus mexicanus*).
 1904. TIRABOSCHI, *Archiv. de Parasit.*, VIII, p. 277.

Habitat.—Mexico and the United States.

CTENOPSYLLUS PECTINICEPS Wagner.

1903. WAGNER, *Horæ Soc. Ent. Ross.*, XXXVI, p. 150.
 1904. TIRABOSCHI, *Archiv. de Parasit.*, VIII, p. 283.

CTENOPSYLLUS SIBIRICUS Wagner.

1903. WAGNER, *Horæ Soc. Ent. Ross.*, XXXVI, p. 151 (*Ctenopsylla sibirica*).

CTENOPSYLLUS SILVATICUS (Meinert) Baker.

1903. WAGNER, *Horæ Soc. Ent. Ross.*, XXXVI, p. 151 (*Ctenopsylla silvatica*).

CTENOPSYLLUS SORECIS (Dale) Baker.

1878. DALE, *Hist. of Glanvilles Wooton*, p. 291 (*Ceratophyllus sorecis*).
 1880. TASCHENBERG, *Die Flöhe*, p. 96 (*Typhlopsylla gracilis*).
 1903. KOHAUT, *Magyar. bolhai*, p. 56 (*Typhlopsylla gracilis*).
 1903. ROTHSCHILD, *Ent. Mo. Mag.*, 2d ser., XIV, p. 145.
 1904. BAKER, *Proc. U. S. Nat. Mus.*, XXVII, p. 452 (*Ctenopsyllus gracilis*).

CTENOPSYLLUS SPECTABILIS (Rothschild) Baker.

1903. WAGNER, *Horæ Soc. Ent. Ross.*, XXXVI, p. 151.
 1904. TIRABOSCHI, *Archiv. de Parasit.*, VIII, p. 282.

CTENOPSYLLUS TASCHENBERGI Wagner.

1903. WAGNER, *Horæ Soc. Ent. Ross.*, XXXVI, pp. 150, 151.
 1904. TIRABOSCHI, *Archiv. de Parasit.*, VIII, p. 284.

Genus STEPHANOCIRCUS Skuse.**STEPHANOCIRCUS DASYURI Skuse.**

1903. RAINBOW, *Record Austrl. Mus.*, V, p. 53.
 1903. ROTHSCHILD, *Novitat. Zool.*, X, p. 319.
 1905. ROTHSCHILD, *Ent. Mo. Mag.*, XVI, p. 61.

Hosts.—*Bettongia penicillata*, *Mus velutinus*, *Perameles gunni*.

Habitat.—West Australia and Tasmania.

STEPHANOCIRCUS MINERVA Rothschild.

1903. ROTHSCHILD, *Novitat. Zool.*, X, p. 319.

Host.—*Didelphys azaræ*.

Habitat.—Sapucay, Paraguay.

STEPHANOCIRCUS SIMPSONI Rothschild.

1905. ROTHSCHILD, Ent. Mo. Mag., XVI, p. 61.

Hosts.—*Mus velutinus*, *Dasyurus maculatus*.*Habitat.*—Tasmania.**STEPHANOCIRCUS THOMASI** Rothschild.

1903. ROTHSCHILD, Novitat. Zool., X, p. 318.

Host.—*Mus ferculinus*.*Habitat.*—Northwest Australia.

Family HYSTRICHOPSYLLIDÆ Baker.

Genus HYSTRICHOPSYLLA Taschenberg.

HYSTRICHOPSYLLA DIPPÆI Rothschild.

1902. ROTHSCHILD, Ent. Record, XIV, No. 3.

1904. BAKER, Proc. U. S. Nat. Mus., XXVII, p. 468.

Hosts.—*Putorius longicaudatus*, *Lutreola energumenos*.*Habitat.*—British Columbia and Alberta, Canada.**HYSTRICHOPSYLLA NARBELI** Galli-Valerio.

1900. GALLI-VALERIO, Archiv. de Parasit., III, pp. 96-100.

1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 301.

Host.—*Microtus nivalis*.*Habitat.*—Italy and Switzerland.**HYSTRICHOPSYLLA TALPÆ** (Curtis) Rothschild.1903. WAHLGREN, Archiv für Zool., I, p. 188 (*Hystrichopsylla obtusiceps*).

1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 299.

Habitat.—Sweden.**HYSTRICHOPSYLLA TRIPECTINATA** Tiraboschi.

1902. TIRABOSCHI, Boll. della Soc. Zool. Ital.

1903. TIRABOSCHI, Archiv für Hygiene, XLVI, p. 257.

1904. TIRABOSCHI, Archiv. de Parasit., VIII, p. 297.

Host.—*Mus musculus*.*Habitat.*—Rome.

Family CERATOPSYLLIDÆ Baker.

Genus CERATOPSYLLUS Kolenati.

CERATOPSYLLUS ÆGYPTIUS Rothschild.1903. ROTHSCHILD, Ent. Mo. Mag., 2d ser., XIV, p. 83 (*Ceratopsylla*).*Host.*—*Taphozous perforatus*.*Habitat.*—Near Cairo, Egypt.

CERATOPSYLLUS CAMINÆ Rothschild.

1903. ROTHSCHILD, Novitat. Zool., X, p. 323 (*Ceratopsylla*).

Host.—“A bat.”

Habitat.—West Australia.

CERATOPSYLLUS CAMINÆ Rothschild var. REDUCTUS (Rothschild) Baker.

1903. ROTHSCHILD, Novitat. Zool., X, p. 323 (*Ceratopsylla reductus*).

Host.—*Vespertilio macropus*.

Habitat.—Melbourne, Australia.

CERATOPSYLLUS CONSIMILIS Wahlgren.

1903?. WAHLGREN, Results of Swedish Zool. Exped. to Egypt and the White Nile, 1901.

Host.—*Rhinopoma microphyllum*.

Habitat.—Egypt.

CERATOPSYLLUS CROSBYI Baker.

1905. BAKER, see p. 137.

Host.—Little brown bat.

Habitat.—Rockport, Missouri.

CERATOPSYLLUS DICTENUS Kolenati.

1903. KOHAUT, Magyar. bolhai, p. 65.

CERATOPSYLLUS DISTINCTUS Rothschild.

1903. ROTHSCHILD, Novitat. Zool., X, p. 325 (*Ceratopsylla*).

Host.—?

Habitat.—Villa Rica, Paraguay.

CERATOPSYLLUS ELONGATUS Curtis.

1903. KOHAUT, Magyar. bolhai, p. 60.

CERATOPSYLLUS FOSTERI Rothschild.

1903. ROTHSCHILD, Novitat. Zool., X, p. 324 (*Ceratopsylla*).

Hosts.—*Molossus bonariensis*, *Nyctinomus laticaudatus*.

Habitat.—Sapucay, Paraguay.

CERATOPSYLLUS HEXACTENUS Kolenati.

1903. KOHAUT, Magyar. bolhai, p. 63.

CERATOPSYLLUS INSIGNIS Rothschild.

1903. ROTHSCHILD, Novitat. Zool., X, p. 319 (*Ceratopsylla*).

Host.—*Myotis lucifugus*.

Habitat.—Ontario, Canada.

CERATOPSYLLUS JUBATUS Wagner.

1903. KOHAUT, Magyar. bolhai, p. 61.

Habitat.—Hungary.

CERATOPSYLLUS MARTIALIS Rothschild.

1903. ROTHSCHILD, Novitat. Zool., X, p. 322 (*Ceratopsylla*).*Host.*—*Nyctinomus acetabulosus*.*Habitat.*—Island of Reunion.

CERATOPSYLLUS PALPOSUS Rothschild.

1904. ROTHSCHILD, Novitat. Zool., XI, p. 652 (*Ceratopsylla*).*Host.*—“Brown bat.”*Habitat.*—British Columbia.

CERATOPSYLLUS PENTACTENUS Kolenati.

1903. KOHAUT, Magyar. bolhai, p. 64.

CERATOPSYLLUS SIGNATUS Wahlgren.

1903. WAHLGREN, Archiv für Zool., I, p. 189 (*Ceratopsylla signata*).*Host.*—*Nyctinomus plicatus*.*Habitat.*—Java.

CERATOPSYLLUS UNIPECTINATUS Wagner.

1903. KOHAUT, Magyar. bolhai, p. 66.

Host.—*Rhinolophus ferrum-equinum*.*Habitat.*—Hungary.

CERATOPSYLLUS WAGNERI Kohaut.

1903. KOHAUT, Magyar. bolhai, p. 62.

Host.—*Myotis myotis*.*Habitat.*—Hungary.

CERATOPSYLLUS WOLFFSOHNI Rothschild.

1903. ROTHSCHILD, Novitat. Zool., X, p. 321 (*Ceratopsylla*).*Hosts.*—*Myotis nigricans*, *Myotis albescens*.*Habitat.*—Sapucay, Paraguay, and Valparaiso, Chile.

SUPPLEMENTAL HOST INDEX.

Class AVES.

<i>Eudypetes clusocome</i>	<i>Parapsyllus longicornis</i> Enderlein.
<i>Gallus domesticus</i>	<i>Pulex irritans</i> Linnæus.

Class MAMMALIA.

Order MARSUPALIA.

Family DASYURIDÆ.

<i>Dasyurus maculatus</i>	<i>Stephanocircus simpsoni</i> Rothschild.
<i>Dasyurus viverinus</i>	<i>Ceratophyllus hilli</i> Rothschild.

Family MURIDÆ.

Acomys cahirinus	<i>Pulex alternans</i> Wahlgren. <i>Pulex chephrensis</i> Rothschild.
Acomys witherbyi	<i>Pulex cheopis</i> Rothschild.
Arvicanthis testicularis	<i>Pulex cheopis</i> Rothschild. <i>Pulex cleopatæ</i> Rothschild. <i>Pulex nubicus</i> Rothschild.
Crietomys sp.	<i>Pulex aquisetosus</i> Enderlein.
Dipodillus watersi	<i>Pulex cheopis</i> Rothschild. <i>Pulex cleopatæ</i> Rothschild.
Evotomys gapperi	<i>Ceratophyllus quirini</i> Rothschild. <i>Ceratophyllus telchinum</i> Rothschild. <i>Odontopsyllus telegoni</i> (Rothschild) Baker.
Evotomys saturatus	<i>Ceratophyllus wickhami</i> Baker, var. <i>ager</i> (Rothschild) Baker. <i>Ceratophyllus pollionis</i> Rothschild. <i>Ceratophyllus quirini</i> Rothschild. <i>Odontopsyllus charlottensis</i> Baker.
Gerbillus pygargus	<i>Pulex cleopatæ</i> Rothschild.
Gerbillus robustus	<i>Pulex cheopis</i> Rothschild. <i>Pulex nubicus</i> Rothschild.
Gerbillus sp	<i>Pulex gerbilli</i> Wagner.
Gerbillus tarabuli	<i>Ceratophyllus henleyi</i> Rothschild. <i>Pulex mycerini</i> Rothschild. <i>Pulex ramesis</i> Rothschild.
Lemmus ('Myodes') lemmus	<i>Ceratophyllus pencilliger</i> (Grube) Wagner. <i>Ceratophyllus rectangulatus</i> Wahlgren. <i>Ctenophthalmus uncinata</i> (Wagner) Baker.
Lemmus ('Myodes') torquatus	<i>Ceratophyllus grælandicus</i> Wahlgren.
Meriones rex	<i>Pulex regis</i> Rothschild.
Microtus drummondii	<i>Ceratophyllus abantis</i> Rothschild. <i>Ceratophyllus lucifer</i> Rothschild. <i>Ceratophyllus pollionis</i> Rothschild. <i>Ctenophthalmus pseudagyrtes</i> Baker. <i>Odontopsyllus telegoni</i> (Rothschild) Wagner.
Microtus nivalis	<i>Hystriechopsylla narbeli</i> Galli-Valerio.
Microtus saturatus	<i>Ctenophthalmus pseudagyrtes</i> Baker.
Mus ferulinus	<i>Stephanocircus thomasi</i> Rothschild.
Mus gentilis	<i>Pulex cheopis</i> Rothschild.
Mus musculus	<i>Ceratophyllus italicus</i> Tiraboschi. <i>Hystriechopsylla tripectinata</i> Tiraboschi.
Mus norvegicus ('decumanus')	<i>Ceratophyllus italicus</i> Tiraboschi. <i>Pulex murinus</i> Tiraboschi.
Mus rattus	<i>Rhynchoprion cucata</i> (Enderlein) Baker.
Mus rattus alexandrinus	<i>Argopsylla rhynchopsylla</i> (Tiraboschi) Baker. <i>Ceratophyllus italicus</i> Tiraboschi. <i>Pulex murinus</i> Tiraboschi.
Mus sylvaticus	<i>Ceratophyllus italicus</i> Tiraboschi. <i>Ctenophthalmus proxima</i> (Wagner) Baker. <i>Typhlocerus poppei</i> Wagner.
Mus sp.	<i>Ctenopsyllus aganippes</i> Rothschild.
Mus velutinus	<i>Stephanocircus dasyuri</i> Skuse. <i>Stephanocircus simpsoni</i> Rothschild.

<i>Neotoma cinerea</i>	<i>Ceratophyllus agilis</i> Rothschild. <i>Ctenophthalmus wernmani</i> Rothschild. <i>Odontopsyllus charlottensis</i> Baker.
<i>Otomys branti</i>	<i>Ceratophyllus agrippinæ</i> Rothschild. <i>Pulex eridos</i> Rothschild.
<i>Otomys unisulcatus</i>	<i>Ceratophyllus agrippinæ</i> Rothschild.
<i>Pachyuromys duprasi natronensis</i>	<i>Ceratophyllus heuleyi</i> Rothschild. <i>Pulex ramesis</i> Rothschild.
<i>Peromyscus arcticus</i>	<i>Ceratophyllus wickhami</i> Baker, var. <i>xeger</i> Rothschild) Baker. <i>Odontopsyllus charlottensis</i> Baker.
<i>Peromyscus canadensis</i>	<i>Ceratophyllus euphorbi</i> Rothschild.
<i>Peromyscus leucopus</i>	<i>Ctenophthalmus wernmani</i> Rothschild. <i>Odontopsyllus charlottensis</i> Baker.

Family OCTODONTIDÆ.

<i>Akodon albivener</i>	<i>Rhopalopsyllus simonsi</i> (Rothschild) Baker.
<i>Kerodon boliviensis</i>	<i>Rhopalopsyllus concitus</i> (Rothschild) Baker.
<i>Neoctodon simonsi</i>	<i>Rhopalopsyllus simonsi</i> (Rothschild) Baker.
<i>Ochotona</i> ('Lagomys') <i>princeps</i>	<i>Ceratophyllus agilis</i> Rothschild. <i>Ceratophyllus terribilis</i> Rothschild.
<i>Octodon degus</i>	<i>Rhopalopsyllus confidii</i> (Rothschild) Baker.

Family SCIURIDÆ.

<i>Arctomys flaviventer avarus</i>	<i>Ceratophyllus acamantis</i> Rothschild.
<i>Citellus</i> ('Spermophilus') <i>columbianus</i>	<i>Ceratophyllus pœantis</i> Rothschild. <i>Ceratophyllus terinus</i> Rothschild.
<i>Citellus</i> ('Spermophilus') <i>13-lineatus</i>	<i>Ceratophyllus bacchi</i> Rothschild.
<i>Citellus</i> ('Spermophilus') sp.	<i>Ceratophyllus acutus</i> Baker.
<i>Eutamias quadrivittatus affinis</i>	<i>Ceratophyllus cumolpi</i> Rothschild.
<i>Sciuropterus sabinus</i>	<i>Ceratophyllus pseudarctomys</i> Baker, var. <i>acasti</i> (Rothschild) Baker.
<i>Sciurus aberti</i>	<i>Ceratophyllus pœantis</i> Rothschild.
<i>Sciurus richardsoni baileyi</i>	<i>Ceratophyllus agilis</i> Rothschild.
<i>Tamias borealis</i>	<i>Ceratophyllus cumolpi</i> Rothschild.
<i>Tamias</i> sp.	<i>Ceratophyllus pœantis</i> Rothschild.
<i>Tamias striatus</i>	<i>Ctenophthalmus grandis</i> (Rothschild) Baker.
<i>Xerus capensis</i>	<i>Pulex erilli</i> Rothschild.

Family SPALACIDÆ.

<i>Spalax hungaricus</i>	<i>Ctenophthalmus typhlus</i> (Motschulsky) Baker.
<i>Spalax monticola</i>	<i>Ctenophthalmus monticola</i> (Kobaut) Baker.

Order INSECTIVORA.

Family ERINACEIDÆ:

<i>Erinaceus æthiopicus</i>	<i>Pulex cleopatra</i> Rothschild. <i>Pulex pallidus</i> Taschenberg.
<i>Erinaceus albiventris</i>	<i>Pulex pallidus</i> Taschenberg.

Family SORECIDÆ.

<i>Crocidura aranea</i>	<i>Ctenophthalmus proxima</i> (Wagner) Baker.
<i>Sorex obscurus</i>	<i>Ctenopsyllus hygini</i> Rothschild.
<i>Sorex richardsoni</i>	<i>Ceratophyllus telchinum</i> Rothschild.

Family TALPIDÆ.

Scalops aquaticus *Ctenophthalmus pseudagyrtes* Baker.

Order CHIROPTERA.

Family NOCTILIONIDÆ.

Molossus bonariensis *Ceratopsyllus fosteri* Rothschild.
Nyctinomus acetabulosus *Ceratopsyllus martialis* Rothschild.
Nyctinomus laticaudatus *Ceratopsyllus fosteri* Rothschild.
Nyctinomus plicatus *Ceratopsyllus signatus* Wahlgren.
Rhinopoma microphyllum *Ceratopsyllus consimilis* Wahlgren.
Taphozous perforatus *Ceratopsyllus ægyptius* Rothschild.

Family RHINOLOPHIDÆ.

Rhinolophus ferrum-equinum *Ceratopsyllus unipectinatus* Wagner.

Family VESPERTILIONIDÆ.

Myotis albescens *Ceratopsyllus wolffsohni* Rothschild.
Myotis lucifugus *Ceratopsyllus insignis* Rothschild.
Myotis myotis *Ceratopsyllus wagneri* Kohaut.
Myotis ('*Vespertilio*') *nigricans* *Ceratopsyllus wolffsohni* Rothschild.
Vespertilio ('*Myotis*') *macropus* *Ceratopsyllus caninx* Rothschild var. *reductus*
 (Rothschild) Baker.

Order UNGULATA.

Family TAYASSUIDÆ.

Dicotyles labiatus *Rhopalopsyllus australis* (Rothschild) Baker.

Order FERÆ.

Family CANIDÆ.

Canis griseus *Malacopsylla androeci* Rothschild.
Canis latrans *Ceratophyllus acamantis* Rothschild.
Canis mesomelas *Ctenocephalus canis* (Curtis) Baker.
Speothos venaticus *Rhopalopsyllus australis* (Rothschild) Baker.
Vulpes niloticus *Pulex pallidus* Taschenberg.
Vulpes vulpes *Chaetopsylla vulpes* (Motschulsky) Baker.

Family FELIDÆ.

Felis caracal *Pulex creuxæ* Rothschild.

Family HYÆNIDÆ.

Hyæna hyæna *Pulex pallidus* Taschenberg.

Family MUSTELIDÆ.

Lutreola ('*Putorius*') *energumenos* *Hystrihopsylla dippiei* Rothschild.
 *Ceratophyllus acamantis* Rothschild.
 *Ctenopsyllus hygini* Rothschild.
Meles taxus *Chaetopsylla trichosa* Kohaut.
Mephitis spissigrada *Ceratophyllus acamantis* Rothschild.
Mustela americana *Ctenopsyllus brooksii* Rothschild.
Mustela itatsi *Chaetopsylla mikado* Rothschild.

<i>Putorius longicaudatus</i>	<i>Ceratophyllus abantis</i> Rothschild.
	<i>Ceratophyllus agilis</i> Rothschild.
	<i>Ceratophyllus pectantis</i> Rothschild.
	<i>Ctenopsyllus brooksi</i> Rothschild.
	<i>Hystriopsylla dippei</i> Rothschild.
<i>Putorius putorius</i>	<i>Chatopsylla rothschildi</i> Kohaut.
<i>Putorius richardsoni</i>	<i>Ctenopsyllus brooksi</i> Rothschild.
	<i>Ctenopsyllus hygini</i> Rothschild.
<i>Putorius sibiricus</i>	<i>Ceratophyllus pencilliger</i> (Grube) Wagner.
<i>Spilogale latifrons</i>	<i>Ceratophyllus wickhami</i> Baker var. <i>nepos</i> (Rothschild) Baker.
<i>Spilogale phenax</i>	<i>Anomiopsyllus californicus</i> Baker.
<i>Zorilla striata</i>	<i>Pulex erilli</i> Rothschild.

Family URSIDÆ.

<i>Ursus arctos</i>	<i>Chatopsylla strandi</i> (Wahlgren) Baker.
	<i>Chatopsylla tuberculiceps</i> (Bezzi) Baker.
<i>Ursus horribilis</i>	<i>Chatopsylla ursi</i> (Rothschild) Baker.

Family VIVERRIDÆ.

<i>Genetta dongolana</i>	<i>Pulex cheopis</i> Rothschild.
	<i>Pulex nubicus</i> Rothschild.
<i>Herpestes albicauda</i>	<i>Pulex nubicus</i> Rothschild.
<i>Herpestes badius</i>	<i>Ceratophyllus dorippæ</i> Rothschild.

NOT IN ABOVE LIST.

<i>Graphocularis biurus</i>	<i>Ceratophyllus octavii</i> Rothschild.
<i>Lestris parasitica</i>	<i>Ceratophyllus angulatus</i> Wahlgren.
<i>Suricata tetradactyla</i>	<i>Pulex erilli</i> Rothschild.
"Macro proboscideus"	<i>Ctenopsyllus granti</i> Rothschild.
"Spreo bicolor"	<i>Pulex creuse</i> Rothschild.

ADDITIONAL BIBLIOGRAPHY.

In the desire to make this bibliography very exact and very complete, the writer has made very strenuous efforts to keep pace with all the literature, though not with entire success. The individual investigator, working alone, must ever wage an uphill fight for the literature of his subject. An urgent appeal is extended herewith to all coworkers in the Siphonaptera to kindly forward all corrections, additions, and criticisms possible. Full credit will be gladly given. Many of our bibliographical references lack exact page, volume, or even year.

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1903. ROTHSCHILD, Ent. Mo. Mag., 2d ser., XIV, p. 146 (*Ceratopsyllus*).

Host.—"Skylark."

Habitat.—England.

CERATOPHYLLUS TROCHILI Dale.

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Host.—"Willow-wren."

Habitat.—England.

CERATOPHYLLUS VISCIVORA Dale.

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Host.—"Stone-thrush."

Habitat.—England.

INDEX.

The following index prepared by Mr. E. S. G. Titus and Mr. F. D. Couden, of the Bureau of Entomology of the U. S. Department of Agriculture, contains references to the present paper and to one previously published by Mr. Baker (Proceedings of the U. S. National Museum, XXVII, 1904, pp. 365-469, No. 1361), the pagination referring to the latter paper being in italics.

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<i>scieurorum</i> var. <i>dryas</i> = <i>dryas</i>	442	<i>Typhlopsylla</i> = ANOMIOPSYLLUS	425, 452
<i>segnis</i>	467	= CERATOPHYLLUS	152, 416, 443
<i>serraticeps</i> = <i>canis</i>	145, 385, 438	= CERATOPSYLLUS	371,
<i>serraticeps</i> var. <i>marina</i> = <i>canis</i>	145	454, 455, 456, 457	
<i>setosa</i>	451, 459	= CTENOPHTHALMUS	135,
<i>setosa</i> = bidentatiformis	154	153, 154, 423, 448, 449, 450, 451	
<i>sexdentatus</i>	133, 151, 387, 403, 446, 459	= CTENOPSYLLUS	136, 156, 452, 453
<i>sibirica</i>	129, 153, 451, 458	= NEOPSYLLA	154, 155
<i>sibiricus</i>	156, 453, 462	= PALÆOPSYLLA	153
<i>signatus</i>	159, 163	<i>Typhlopsyllinæ</i> = CTENOPSYLLIDÆ	136
<i>silantiewi</i>	151, 446, 459	= CERATOPSYLLIDÆ	137
<i>silvaticus</i>	156, 453	typhlus	154, 451, 458
<i>simonsi</i>	130, 144, 162	<i>uncinata</i>	154, 161, 451, 462
<i>simplex</i>	131, 145, 384, 385, 439, 458	<i>unidentatus</i>	462
<i>simplex</i> , <i>inaequalis</i> var. = <i>simplex</i>	145, 439	<i>unipectinatus</i>	159, 163, 457, 461
<i>simpsoni</i>	157, 159, 161	<i>uralensis</i>	448
<i>simulans</i> , <i>irritans</i> var.	457	<i>ursi</i>	140, 164, 468
<i>simulans</i> = <i>irritans</i>	436	<i>vagabundus</i>	152, 468
SIPHONAPTERA	120, 372	<i>variabilis</i>	457, 461
<i>sorecis</i>	156	VERMIPSYLLA	127, 128, 139, 376, 434, 463
<i>spectabilis</i>	156, 453, 458	<i>Vermipsylla</i> = CHETOPSYLLA	128, 139, 140
SPILOPSYLLUS	129, 131, 145	VERMIPSYLLIDÆ	373, 376, 434
<i>spini</i> = gallinae	148	<i>Vermipsyllidæ</i> = VERMIPSYLLINÆ	127
<i>spinosus</i>	151	VERMIPSYLLINÆ	127-128, 139-140
STEPHANOCIRCUS	136,	<i>respertilionis</i> Bouche	468
156-157, 377, 430-431, 453-454, 463		<i>respertilionis</i> Duges	468
<i>strandii</i>	139, 164	<i>viscivora</i>	166
<i>striatus</i> = <i>hyænae</i>	436	<i>vison</i>	133, 388, 408, 448, 462
<i>sturni</i>	447, 457	<i>vulgaris</i> = <i>irritans</i>	436
<i>stylosus</i>	135, 155, 388, 418, 447, 459	<i>vulpes</i>	140, 163, 438, 462
<i>styx</i>	151, 447, 457	<i>wagneri</i> (CERATOPHYLLUS)	133, 387, 405, 448, 459
<i>subarmatus</i>	447, 458	<i>wagneri</i> (CERATOPSYLLUS)	159, 163
<i>subaureus</i> = <i>elongatus</i>	455	<i>walkeri</i>	468
<i>Suctoria</i> = SIPHONAPTERA	372	<i>wenmanni</i>	135, 154, 162
<i>talpa</i>	157, 432, 454, 458, 459, 460, 462, 468	<i>wickhami</i>	133, 387, 403, 448, 459, 460
<i>talpa</i> = <i>bisectodentatus</i>	432, 449	<i>wickhami</i> var. <i>ager</i>	152, 161, 162
<i>taschenbergi</i>	156, 453, 458	<i>wickhami</i> var. <i>nepos</i>	152, 164
<i>telchinum</i>	134, 151, 161, 162	<i>witherbyi</i> = <i>pallidus</i>	142
<i>telegoni</i>	131, 146, 161	<i>wolfsolmi</i>	137, 159, 163
<i>terinus</i>	134, 151, 162	<i>woodwardi</i>	152
<i>terrestris</i>	468	XESTOPSYLLA	373, 374, 434, 463
<i>terribilis</i>	134, 151, 162	<i>Xestopsylla</i> = ARGOPSYLLA	125, 138
<i>tesquorum</i>	447, 459	<i>zethi</i>	152, 160

A NEW SUBSPECIES OF GROUND DOVE FROM MONA
ISLAND, PORTO RICO.

By J. H. RILEY,
Aid, Division of Birds.

Mr. B. S. Bowdish, while collecting for the United States National Museum on Mona Island, Porto Rico, sent in three specimens (two adult males and one adult female) of a ground dove that appear to represent an undescribed form. It may be known as:

COLUMBIGALLINA PASSERINA EXIGUA new subspecies.

Type.—Adult male, Cat. No. 177211, U.S.N.M., Mona Island, Porto Rico, August 10, 1901; B. S. Bowdish. Forehead, lores, sides of face, throat, and a narrow line extending back over the eye light vinaceous; crown, occiput, and cervix cinereous, each feather slightly edged with plumbeous, giving the region a scaly appearance; back, rump, and scapulars smoke gray; upper tail-coverts slightly darker than the back; feathers of jugulum blackish centrally, edged with vinaceous, giving the region a scaly appearance; breast vinaceous; flanks mouse gray; belly whitish; under tail-coverts brownish gray, each feather edged with whitish; tail slate color at base, broadly banded with black and slightly margined at the tip with mouse gray, the outer feather margined with white at the tip; primaries and secondaries rufous, the primaries margined on the outer web and tipped rather broadly with blackish, the rufous decreasing on the secondaries inwardly until it becomes only a basal spot on the inner web; tertials color of the back; primary coverts rufous, broadly tipped with black; greater and lesser coverts mouse gray; median coverts vinaceous; some of the greater and median coverts with steel blue spots on the outer web; lining of wing and a patch on sides rufous. Wing, 77; tail, 50.7; exposed culmen, 10.5; tarsus, 14; middle toe, 13.5 mm.

Female.—Similar to female of *C. p. bahamensis*, but smaller. Wing, 75.5; tail, 53; exposed culmen, 10.5; tarsus, 14.5; middle toe, 13.5 mm.

Remarks.—This form of ground dove needs comparison with no West Indian form known to me, except *C. p. bahamensis* and *C. p.*

perpallida. It differs from the former in its smaller size and much paler coloration both above and below and from the latter in its paler coloration above and wholly black bill. *C. p. exigua* is probably the smallest and palest known form of ground dove of the *passerina* group. Ten adult males of *C. p. bahamensis* average: Wing, 81; tail, 56.9; exposed culmen, 11; tarsus 15.1; middle toe 13.6 mm. Two adult males of *C. p. exigua* average: Wing, 77.7; tail, 50.7; exposed culmen, 10.7; tarsus, 14.5; middle toe, 13.5 mm. Two adult males of *C. p. perpallida* average: Wing, 81.7; tail, 55.7; culmen, 11; tarsus, 15.2; middle toe, 13.7 mm.

NEW GENERA OF SOUTH AMERICAN MOTHS.

By HARRISON G. DYAR,
Custodian of Lepidoptera.

The collections of the United States National Museum have been lately enriched by the South American moths presented by Mr. William Schaus, probably the best collection of South American Macroheterocera that has been formed. A large number of the species are undescribed, particularly from Mr. Schaus's latest captures in Guiana. The following papers by Mr. Schaus and Mr. Warren characterize a part of them; it is expected that other descriptions will follow. A few new genera, referred to in Mr. Schaus's paper, have been described, and appear herewith. I have also made synoptic tables of genera for several families, which have been inserted in their proper places in Mr. Schaus's article. Sir George F. Hampson has kindly verified the new genera in the Syntomidæ and Lithosiidæ.

Family SYNTOMIDÆ.

Genus SAURITINIA, new genus.

Palpi upturned to vertex of head; proboscis well developed; antennæ bipectinate, the branches long in the male with bristles at extremity; tibiæ with the spurs small. Fore wing with vein 3 from before angle of cell; 4, 5 from angle; 7, 8, 9 stalked, 10 from cell before angle, joined to the stalk to form a long accessory cell; 11 from the cell. Hind wings with the cell moderate; veins 2, 4 from angle, 3 from 2 near margin; 5 obsolescent from lower third of discocellulars; 6, 7 from upper angle.

Type.—*Sauritinia dubiosa* Schaus.^a

Genus METACROCEA, new genus.

Palpi upturned to vertex of head; proboscis well developed; antennæ bipectinate with short branches in the male with bristles at extremity; tibiæ with the spurs moderate; abdomen with the second segment constricted. Fore wings with vein 3 from near angle of cell, 4, 5 from angle, 6 from shortly below upper angle, 7, 8, 9, 10 stalked, 11 from the end of the cell. Hind wings with the cell long; 2 from long before the angle of the cell, 3, 4 stalked; 5 strong, from well above angle of cell; 6, 7 very shortly stalked.

Type.—*Metacrocea postflava* Schaus.^b

^a Proc. U. S. Nat. Mus., XXIX, 1905, p. 188.

^b Idem, XXIX, 1905, p. 193.

Genus APOCEREA, new genus.

Proboscis well developed; palpi smooth, upturned, and reaching vertex of head, the third joint nearly erect; antennæ moderately bipectinated in the male with bristles on the pectinations; tibiae with the apical spurs smaller than the median ones. Fore wings with vein 2 from long before the angle of the cell; 3 from shortly before the angle; 4, 5 from a point; 6 from well below upper angle of cell; 7, 8, 9, 10, 11 stalked; hind wings with the cell long; vein 2 from long before the angle; 3, 4, 5 separate and all close to the angle of the cell; 6, 7 separate, from the upper angle.

Type.—*Apocerea sobria* Schaus.^a

Genus HOMONEURONIA, new genus.

Proboscis well developed; palpi upturned above vertex; antennæ of male bipectinated, the shaft swollen centrally; thorax smooth; abdomen constricted basally; legs smooth, slender, the spurs small. Fore wings with vein 3 from long before angle of cell, 4 absent, 5 above the angle of the cell, 6 at apex of cell; 7, 8, 9, 10 stalked, 11 from the cell. Hind wings with the cell very long, the inner area normal; veins 2 and 3 from a point near angle of cell, curved together to touch at the margin; 4 and 5 from angle of cell, 6 and 7 from apex of cell.

Type.—*Homoneuronia modesta* Schaus.^b

Family LITHOSIIDÆ.

Genus PARÁPALOSIA, new genus.

Antennæ simple in the female; palpi short, porrect, hardly exceeding the front; hind tibiae with four long spurs. Fore wings with vein 2 beyond the middle of the cell, 3 from before the angle; 4, 5 very shortly stalked; 6 from below the angle of cell; accessory cell present, 7, 8, 9 stalked from its apex, 7 arising a little before 9; 10 from the upper side of accessory cell, 11 also from the accessory cell, joining 12 at costa. Hind wings with vein 2 from near middle of cell, 3 from before the angle; 4, 5 stalked; 6, 7 stalked; 8 from before middle of cell.

Type.—*Parapalosia cinderella* Schaus.^c

Genus ARHABDOSIA, new genus.

Antennæ simple with bristles; tongue developed; palpi very short but well scaled below; hind tibiae with four spurs, moderate. Fore wings with vein 2 from beyond middle of cell, 3 shortly before the angle, 4 from the angle, 5 from above angle, 6 from below upper angle, 7, 8, 9 stalked, 7 arising beyond 9, 10 from the cell, 11 free but curved close to 12. Hind wings with vein 2 before angle of cell, 3, 4 coincident; 4, 5 stalked; 6, 7 coincident, 8 beyond middle of cell.

Type.—*Arhabdosia subvarda* Schaus.^d

^a Proc. U. S. Nat. Mus., XXIX, 1905, p. 193.

^b Idem, XXIX, 1905, p. 188.

^c Idem, XXIX, 1905, p. 197.

^d Idem, XXIX, 1905, p. 201.

Genus ASCAPTESYLE, new genus.

Antennæ of female simple, proboscis developed, palpi porrect, exceeding the front, hind tibiæ with four spurs moderate. Fore wings with vein 2 beyond middle of cell, 3 from before angle, 4, 5 stalked, 6 below upper angle of cell; 7, 8, 9 stalked, 7 arising beyond 9, 10 from the cell, 11 curved and approximated to 12. Hind wings with vein 2 beyond middle of cell, 3 and 4 coincident, 5 from a point with 4, 6, and 7 coincident, 8 from the middle of the cell.

Type.—*Ascapesyle submarginata* Schaus.^a

Genus PARATALARA, new genus.

Antennæ simple, proboscis developed, palpi oblique, exceeding the front, hind tibiæ with four long spurs. Fore wings with vein 2 from near middle of cell, 3 from well before angle; 4, 5 stalked; 6 to 10 stalked; 9 absent; 11 free. Hind wings with vein 2 near angle of cell; 3, 4 coincident, 5 from above angle of discocellulars, 6 and 7 stalked, 8 from near end of cell.

Type.—*Paratalara inversa* Schaus.^b

Genus EPITALARA, new genus.

Antennæ simple in the female; proboscis developed; palpi slender, upturned, not reaching vertex, hind tibiæ with four long spurs. Fore wings with vein 2 from near middle of cell; 3 and 4 stalked; 5 from the lower angle; 6 from the upper angle; 7, 8, 9 stalked, 7 arising beyond 9; 10 from the cell; 11 free, oblique. Hind wings with vein 2 from near angle of cell; 3, 4, and 5 coincident; 6 and 7 stalked; 8 beyond the middle of the cell.

Type.—*Epitalara reversa* Schaus.^c

Genus EUZEUGAPTERYX, new genus.

Antennæ with bristles and cilia, proboscis obsolete, palpi slender, hardly exceeding the front, hind tibiæ with four long spurs. Fore wings with vein 2 arising from near base of cell from a large elliptical fovea; 3, 4 from a point at angle of cell; 5 from just above the angle; 6 below upper angle; 7 and 8 stalked; 9 absent; 10, 11 stalked. Hind wings with the inner area large, a broad incision in the margin opposite the cell; veins 5 and 6 absent; 8 strongly curved. In the male the costa is somewhat distorted at base, with a tuft of hairs; there is a long thick ridge below subcostal vein to end of cell; the fovea at base of cell is filled with rough scales and the cellular area is denuded. On the hind wings there is a band of rough scales between vein 7 and the margin.

Type.—*Euzeugapteryx speciosa* Schaus.^c

^a Proc. U. S. Nat. Mus., XXIX, 1905, p. 201.

^b Idem, XXIX, 1905, p. 203.

Idem, XXIX, 1905, p. 205.

Family DALCERIDÆ.

Genus PARACRAGA, new genus.

Antennæ short, bipectinate, without scale tuft; palpi slender, reaching the middle of front. Fore wings with veins 2 to 5 well spaced, 6 arising above the end of the discal vein, 7 and 8 coincident, 9 and 10 coincident, 7 and 9 stalked, 11 from the cell near the end. Hind wings elongate oval, veins 2 to 5 well spaced, 6 and 7 separate, parallel, 8 running close to subcostal to end of cell.

Type.—*Paracraga innocens* Schaus.^a

Genus MINONOA, new genus.

Antennæ short, bipectinate; palpi short, tongue absent. Fore wings with veins 2, 3, 4, 5 well spaced, 6 arising above the discal vein, 7 and 8 coincident, 9 and 10 coincident, 11 from the cell near the end. Hind wings with veins 3 and 4 approximate at origin, 6 arising above the discal vein, separate from and parallel to 7, 8 anastomosed with the subcostal for nearly the outer two-thirds of the cell.

Type.—*Minonoa perbella* Schaus.^b

Genus MINACRAGA, new genus.

Antennæ short, bipectinate, with a scale tuft at tip; palpi oblique to middle of front; fore wings with a prominent angle at tornus with a fringe of long spatulate scales. Fore wings with veins 2 and 3 well spaced, 4 and 5 from a point at lower angle of cell, 6 from above the discal vein, 7 and 8 long stalked; 9, 10, 11 stalked. Hind wings with vein 4 from lower angle of cell, 5 well above it, 6 and 7 remote and parallel, 8 running close to subcostal to near end of cell.

Type.—*Minacraga disconitens* Schaus.^a

Genus ANACRAGA, new genus.

Antennæ short, bipectinate, palpi slender, to middle of front. Fore wings with veins 2 to 5 well separated, 6 from near upper angle of cell, a large accessory cell; 7 and 8 shortly stalked from its apex, 9 and 10 nearly coincident, likewise from its tip, 11 from the top of the accessory cell, close to the costa and in line with the base of the subcostal vein. Hind wings elongate trigonate, veins 2 to 5 well spaced, 6 and 7 separate and parallel, 8 joined to the subcostal on outer half of cell, separate from it and angled at base.

Type.—*Dalcera citrina* Schaus.^c

Genus ACRAGOPSIS, new genus.

Antennæ short, bipectinate; palpi slender and upturned to middle of front. Fore wings with veins 2 to 5 well separated, the upper part

^a Proc. U. S. Nat. Mus., XXIX, 1905, p. 331.

^b Idem, XXIX, 1905, p. 332.

^c Journ. N. Y. Ent. Soc., IV, 1896, p. 57.

of the cell retracted toward base, vein 6 from the upper angle of cell, 7 to 10 stalked from the same point, 9 and 10 coincident; a small convex accessory cell from near the base to end of discal cell with vein 11 arising from its anterior part. Hind wings with veins 2 to 5 evenly spaced, 6 and 7 separate and parallel, 8 joined to the subcostal on outer half of cell, free and angled at base.

Type.—*Acragopsis flavetta* Schaus.^a

Family MEGALOPYGIDÆ.

Genus ANARCHYLUS, new genus.

Male antennæ bipectinate, more than half as long as the fore wings; proboscis and palpi absent; hind legs with small terminal spurs; fore wings with veins 2, 3, 4, 5 well spaced, 7 to 10 stalked, 11 from the cell; hind wings with 3, 4 from a point or shortly stalked, 5 from near angle of cell, 6 and 7 separate, slightly divergent, 8 anastomosing with the subcostal to near end of cell.

Type.—*Archylus mexicana* Schaus.^b

Genus GOIS, new genus.

Male antennæ short, bipectinate; fore wings trigonate, the costa straight, the apex acute but rounded; veins 4 and 5 rather long stalked, 7 to 10 stalked, 11 from near the end of the cell; hind wings oval, elongate, veins 3 and 4 stalked, 5 from close to the angle of the cell, 6 and 7 separate and parallel, 8 joined to the subcostal to two-thirds the length of the cell.

Type.—*Gois nigrescens* Schaus.^c

Family COSSIDÆ.

Genus HEMIPECTEN, new genus.

Antennæ in both sexes broadly unipectinate, one row of pectinations being reduced to short serrations, while the other is strongly developed. Head small; palpi short. Wings usually rather broad. Fore wings with veins 8, 9 stalked; accessory cell present, vein 11 arising from it. Hind wings with vein 8 free from the cell.

Type.—*Hemipecten eparilis* Schaus.^d

Genus MIACORA, new genus.

Antennæ simple, flattened in the male. Head moderate; palpi upturned to the middle of the front; hind tibiæ with four distinct spurs. Fore wings with veins 7 and 8 stalked; accessory cell present,

^a Proc. U. S. Nat. Mus., XXIX, 1905, p. 332.

^b Proc. Zool. Soc. Lond., 1892, p. 288.

^c Proc. U. S. Nat. Mus., XXIX, 1905, p. 338.

^d Idem, XXIX, 1905, p. 340.

vein 11 arising from the discal cell. Hind wings with vein 8 joined to the subcostal by an oblique bar at the end of cell, the bar partly obsolete above.

Type.—*Cossus tropicalis* Schaus.^a

Genus RAVIGIA, new genus.

Antennæ of male shortly bipectinate to the tip. Head moderate; palpi slender, just exceeding the front. Fore wings with veins 7, 8, 9 stalked; accessory cell present, with vein 11 arising from it. Hind wings with vein 8 joined to the subcostal by an erect bar at the end of the cell, veins 6 and 7 separate at origin and subparallel at base; frenulum well developed.

Type.—*Givira polybioides* Schaus.^b

Genus ACOSSUS, new genus.

Antennæ of male bipectinate to tip; palpi upturned to near middle of frons. Sexes similar, the wings broad. Hind wings with veins 6 and 7 from a point or stalked, vein 8 joined to the subcostal by an oblique bar near end of cell. Fore wings with veins 7, 8, 9 stalked; accessory cell present, vein 11 from the discal cell.

Type.—*Cossus undosus* Lintner.^c

Genus LENTAGENA, new genus.

Antennæ of male shortly bipectinate; palpi minute. Wings narrow. Fore wings with veins 7 and 8 stalked; no accessory cell. Hind wings with vein 8 free.

Type.—*Eugivira nudaria* Schaus.^d

Genus TRIGENA, new genus.

Antennæ of male broadly bipectinate; palpi minute. Wings rather narrow. Fore wings with veins 8 and 9 stalked; no accessory cell. Hind wings with vein 8 free.

Type.—*Cassus parilis* Schaus.^e

Family PSYCHIDÆ.

Genus BIOPSYCHE, new genus.

Differs from *Thanatopsyche* Butler in the presence of the branch of vein 1 on fore wings, which is much as in *Thyridopteryx*. Wings elongate, narrow; fore wings with veins 4, 5 stalked.

Type.—*Thanatopsyche apicalis* Hampson.^f

^a Trans. Am. Ent. Soc., XXX, 1904, p. 142.

^b Journ. N. Y. Ent. Soc., IX, 1901, p. 48.

^c Rep. N. Y. State Mus., XXX, 1878, p. 243.

^d Journ. N. Y. Ent. Soc., IX, 1901, p. 75.

^e Proc. Zool. Soc. Lond., 1892, p. 327.

^f Ann. Mag. Nat. Hist. (7), XIV, 1904, p. 180.

DESCRIPTIONS OF NEW SOUTH AMERICAN MOTHS.

By WILLIAM SCHAUS,
Of Twickenham, England.

The following 479 species are described from my collection, which I have deposited in the United States National Museum. They comprise species from the families Saturniidae, Citheroniidae, Syntomidae, Lithosiidae, Nolidae, Arctiidae, Notodontidae, Melalophidae, Eupterotidae, Lasiocampidae, Lacosomidae, Dalceridae, Aedidae, Megalopygidae, Cosmidae, and Psychidae. Those of other families will appear later. I am indebted to my friend Sir George F. Hampson for kindly examining the species of Syntomidae, Lithosiidae, Nolidae, and Arctiidae.

Family SATURNIIDÆ.

Genus ROTHSCILDIA Grote.

ROTHSCILDIA AROMA, new species.

Body brownish red, the abdomen irrorated with lilacine. Collar white. A white transverse basal band on abdomen; anal hairs white; a lateral white band spotted with red-brown; ventral white marks. Wings bright reddish brown; the transparent spots subtriangular, outlined with white and black, extending on to postmedial line; the lines broad, white, medially edged with black. Primaries: costa irrorated with grey; the lilacine and grey irrorations beyond postmedial barely extending above vein 5. This species is most nearly allied to *Rothschildia lebeaui* Guérin, but the primaries are more falcate and more brilliantly colored.

Expanse.—Male, 123 mm.

Habitat.—Honduras.

Type.—Cat. No. 8471, U.S.N.M.

ROTHSCILDIA ROXANA, new species.

Body and wings dark reddish brown; collar edged with white; a basal white band on abdomen; anal hairs white; a lateral white band spotted with brown; the ventral lines almost obsolete; transparent spots triangular, incurved on basal side, extending on to postmedial

line. Primaries: the postmedial line is straighter above vein 5 than in *Rothschildia hesperus* Linnæus, and is not followed above that vein by the lilacine irrorations; the apex is not so falcate as in *hesperus* male, and the irrorations beyond the postmedial are not distinctly dentate as in *hesperus*, and *avrota* Cramer. This is evidently a distinct northern race of *hesperus* Linnæus.

Expanse.—Male, 140 mm.; female, 153 mm.

Habitat.—Orizaba, Mexico.

Type.—Cat. No. 8472, U.S.N.M.

Genus DYSDÆMONIA Hübner.

DYSDÆMONIA LEMOULTI, new species.

Male.—The margins more deeply crenulate than in *tamerlan*. Male, color greyish brown tinged with green when freshly caught. Primaries: the lines fine, darker; the two oblique lines from costa near base to inner margin and below vein 2 very much as in *tamerlan*; the two outer lines more wavy than in *tamerlan* or *boreas*, and not thickened or shaded as in the former species; a small transparent spot at end of cell, followed by an irregular large velvety brown space; a large triangular spot on costa before apex, and a series of submarginal large dark velvety brown spots. Secondaries: the median line not reaching costa; the outer line irregular and angled above vein 3; a large dark submarginal spot below vein 2, and some dark marginal shadings.

Expanse.—142 mm.

Habitat.—St. Jean, French Guiana.

This species is quite distinct when compared with series of *tamerlan* and *boreas*, both of which I have from the Guianas and southern Brazil.

Type.—Cat. No. 8473, U.S.N.M.

Family CITHERONIIDÆ.

Genus EACLES Hübner.

EACLES GUIANENSIS, new species.

Male.—Head and collar yellow. Thorax dull violaceous. Abdomen: two basal segments yellow, otherwise dull violaceous above, yellow below; traces of a yellow subdorsal line. Legs violaceous. Wings yellow. Primaries almost completely suffused with dark violaceous, except on costa toward apex and on inner margin on either side of outer line; the yellow portion irrorated with violaceous; two yellow spots at base; the inner and outer lines very broad; the outer margin defined by the absence of striæ; a hyaline spot at end of cell, broadly circled with unstriated violaceous. Secondaries: a basal violaceous irregular band, widening on inner margin and not extend-

ing above cell; the outer line broad, interrupted by the discal spot, which is similar to the spot on primaries; the outer margin irrorated with violaceous, especially toward inner margin; marginal violaceous spots between the veins. Underneath yellow; the discal spots large; the outer line much narrower, partly shaded with lilacine. Primaries: a violaceous median spot below costa; a violaceous space on outer margin. Secondaries: marginal violaceous spots between the veins.

Expanse.—106 mm.

Habitat.—Omai, British Guiana; St. Jean, French Guiana.

This species somewhat resembles *Eacles magnifica* Walker, but the lines and spots differ. In the Guianas *Eacles magnifica* differs from the more southern and typical form in having the primaries in the male very acute and falcate.

Type.—Cat. No. 8476, U.S.N.M.

EACLES BARNESI, new species.

Male.—Head and collar ochreous. Palpi and legs outwardly violaceous brown. Thorax ochreous with large violaceous red spots. Abdomen yellow below, chiefly violaceous red above, with a subdorsal interrupted yellow line. Wings ochreous irrorated with black striæ. Primaries: the basal portion violaceous red, limited by an indistinct irregular lilacine line, and with two ochreous spots at base; two violaceous red spots at end of cell, containing each a minute white spot; a violaceous red band from apex to inner margin at two-thirds from base, slightly lunular toward apex; outer margin dark grey shaded with paler grey, except just below apex, and a wider space on inner margin which is ochreous. Secondaries: no black irrorations on basal half; an inner irregular violaceous red line, not reaching costal margin; a median, interrupted, lunular violaceous red band contiguous to a round similarly colored discal spot, which contains a small white spot; some violaceous red marginal shades between the veins and at anal angle. Underneath yellow with only a very few black striæ. Primaries: a small violaceous discal spot; the outer line narrower; the outer margin with more pale grey scales. Secondaries: the median line and discal spot as above.

Female.—The dorsal dark shades on abdomen much reduced. Wings without the dark shades at base and on outer margin; irrorations violaceous; a single discal spot on primaries; a distinct wavy basal line on both wings.

Expanse.—Male, 108 mm.; female, 150 mm.

Habitat.—Omai, British Guiana; St. Jean, French Guiana.

Named after Mr. J. Barnes, my companion during my journey through the Guianas.

This species comes nearest to *Eacles penelope* Cramer, which has, however, the discal spots large, white, circled with blackish, and on

the secondaries the median line is straighter and beyond the discal spot. Underneath the two species are quite different.

Type.—Cat. No. 8474, U.S.N.M.

EACLES ACUTA, new species.

Male.—Head, collar, and body below yellow. Thorax dark brownish red, with some yellow lines posteriorly. Abdomen above violaceous red. Primaries brownish red; a transverse dark wavy line just before middle of wing; a round vitreous spot at end of cell, broadly edged with dark grey; a small spot below the costal margin, with a minute grey center; a fine violaceous line from apex to inner margin at four-fifths from base, preceded by a yellow space, broadest on costa, and not extending below vein 3; a narrow yellow shade beyond the line below vein 3; the outer margin otherwise dark violaceous grey. Secondaries yellow; the inner margin and cell brownish red; a grey discal spot circled with reddish and containing a vitreous point; an outer lunular brownish red line; the outer margin broadly brownish red, but not extending to the outer line. Underneath yellow. Primaries: some dark striæ; costal margin violaceous from base to beyond middle; spots and outer line as above; outer margin violaceous grey, leaving a yellow space above inner margin. Secondaries: the base suffused with lilacine and roseate; the line paler; the outer margin more narrowly violaceous. The primaries have the apex very acute.

Expanse.—90 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. No. 8475, U.S.N.M.

Genus **ADELOCEPHALA** Herrich-Schaeffer.

ADELOCEPHALA PURPURASCENS, new species.

Head, thorax, and abdomen above reddish brown. Collar, patagia, and abdomen underneath lilacine. Primaries rich brown; a white discal point on a blackish oblique shade; a broad basal line, not reaching costa, lilacine; a fine dark outer line from apex to middle of inner margin outwardly shaded with lilacine; outer margin lilacine on apical half. Secondaries dark brown; a faint lilacine shade at apex. Underneath dark lilacine grey, the primaries shaded with reddish brown; a brown shade on secondaries from apex.

Expanse.—Male, 74 mm.; female, 113 mm.

Habitat.—St. Jean, French Guiana; Omai, British Guiana; Rio Janeiro, Brazil.

Type.—Cat. No. 8477, U.S.N.M.

ADELOCEPHALA PLATEADA, new species.

Male.—Body reddish brown, shaded with lilacine on patagia, and on abdomen laterally and ventrally. Primaries: the base and outer

margin lilacine; the space between the lines reddish brown with a few dark striæ; the basal space limited by a wavy violaceous line; the outer line violaceous, lunular from costa before apex to inner margin at two-thirds from base; a minute silver spot at end of cell; a large oval silver spot between veins 2 and 3, and a small spot above vein 3; the spots finely edged with dark brown. Secondaries reddish brown, darkest along inner margin; an indistinct darker outer shade. Underneath: primaries reddish brown, shaded with lilacine on outer margin toward apex; a blackish line at end of cell. Secondaries lilacine, darkest on costal margin.

Expanse.—63 mm.

Habitat.—Omai, British Guiana.

This species is allied to *Adelocephala tristygma* Boisduval, but the lines are very different.

Type.—Cat. No. 8478, U.S.N.M.

ADELOCEPHALA ODA, new species.

Head white. Collar, thorax, and base of abdomen dorsally reddish brown; abdomen above otherwise dark lilacine; underneath white; fore legs partly brown. Primaries narrow, rounded from vein 5 to middle of inner margin. Secondaries elongated, angled slightly at vein 5. Primaries: basal half dark brown; a large reddish brown discal spot; outer half lighter brown, thinly irrorated with black, the outer margin shaded with lilacine, especially toward inner angle; fringe reddish brown. Secondaries brown; the outer margin narrowly dark lilacine below vein 5; fringe white; a white spot at base. Underneath primaries light reddish brown; the outer margin lilacine. Secondaries white, the outer margin shaded with lilacine.

Expanse.—41 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8479, U.S.N.M.

ADELOCEPHALA PELOTA, new species.

Head yellow, shaded with violaceous. Thorax yellow; tegulae and patagia dark lilacine. Abdomen reddish brown above, white underneath. Primaries: base broadly dark lilacine; outer margin broadly dark lilacine at inner angle, narrowly so at apex, shaded with paler lilacine; intermediate space yellow with some dark striæ, and a large dark lilacine space about end of cell, containing a white streak on discocellular. Secondaries reddish brown. Underneath the primaries have the coloring less pronounced and the secondaries are whitish.

Expanse.—45 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8780, U.S.N.M.

Family SYNTOMIDÆ.

Genus SPHECOSOMA Butler.

SPHECOSOMA ABDOMINALIS, new species.

Palpi yellow, third joint ochreous. Legs yellow and ochreous; mid and fore tarsi streaked with black. Antennæ dark brown. Head yellow; a brown spot on vertex. Collar black in front, yellow behind. Thorax yellow, spotted with black. Patagia ochreous, edged with black. Abdomen: first two segments yellow, the first with a black subdorsal spot containing a few lilacine scales, and a transverse black streak on either side; other segments brownish ochreous; underneath yellow. Wings hyaline, the veins black, the fringe black. Primaries: an ochreous streak on costal margin; median vein ochreous between veins 2 and 4; a white spot at base of costa; some yellow and a dark streak at base of inner margin.

Expanse.—27 mm.*Habitat.*—Caura Valley, Venezuela.*Type.*—Cat. No. 8481, U.S.N.M.

Genus BOMBILIODES Hampson.

BOMBILIODES CINCTA, new species.

Legs, head, collar, and thorax black; fore coxæ white; some white hairs on frons close to eyes; pale blue spots on vertex and collar. Abdomen above with first segment yellow, last three segments dark red, otherwise black with a dorsal and a lateral row of bluish green spots; underneath ochreous, the ventral valve white. Wings hyaline, the veins black; the margins broadly black; a hyaline streak at base of costal margin, and one above submedian close to vein 2; a black spot at end of cell on primaries from vein 4 to costa.

Expanse.—35 mm.*Habitat.*—St. Jean, Maroni River, French Guiana.*Type.*—Cat. No. 8482, U.S.N.M.

Genus GYMNELIA Walker.

GYMNELIA TARSIPUNCTA, new species.

Antennæ black, the terminal fifth white. Legs black, spotted with white at joints. Body black; some dark roseate on shoulders; first segment of abdomen dark roseate above. Wings hyaline, the veins black; the outer margin and costa narrowly black. Primaries: a little more than the basal third black; the apex broadly black; the discocellular broadly black. Secondaries: the basal half and entire inner margin black.

Expanse.—41 mm.*Habitat.*—Santa Catharina, S. E. Brazil.*Type.*—Cat. No. 8483, U.S.N.M.

Genus LOXOPHLEBIA Butler.

LOXOPHLEBIA GEMINATA, new species.

Body black; white spots at base of legs; fore coxæ white; ventral valve ochreous; two dark red spots on collar. Wings hyaline; veins and margins black, more broadly at apices; discocellular on primaries broadly black.

Expanse.—18 mm.

Habitat.—60 miles up the Maroni River, French Guiana.

Type.—Cat. No. 8484, U.S.N.M.

Genus MESOTHEN Hampson.

MESOTHEN CÆRULEICORPUS, new species.

Body blue above. Tibiæ roseate, tarsi black. Wings hyaline, the veins black; the outer margins narrowly black, more broadly so at apices.

Expanse.—30 mm.

Habitat.—La Paz, Bolivia.

Type.—Cat. No. 8485, U.S.N.M.

MESOTHEN NANUM, new species.

Body black; a red spot on shoulders. Wings hyaline; the veins and margins black; the apices broadly black. Primaries: the inner angle more broadly black; a large black spot at end of cell.

Expanse.—17 mm.

Habitat.—Albina, on the Surinam side of Maroni River.

Type.—Cat. No. 8486, U.S.N.M.

Genus CHROSTOSOMA Hübner.

CHROSTOSOMA PELLUCIDA, new species.

Antennæ black. Legs black, streaked with yellow. Body ochreous orange; the palpi and last two segments of abdomen black. Wings hyaline, the veins black; the apices broadly black. Primaries: some ochreous orange at base.

Expanse.—25 mm.

Habitat.—Carabaya, Peru.

Type.—Cat. No. 8487, U.S.N.M.

Genus LEUCOTMENSIS Butler.

LEUCOTMENSIS ALBIGUTTA, new species.

Antennæ and body black; some red at base of fore tibiæ; some white and blue on fore coxæ; vertex blue; white and blue spots on collar and shoulders; two opalescent white spots on thorax; a subdor-

sal and lateral green stripe on abdomen; abdomen underneath violet. Wings hyaline, the veins black; the margins broadly black. Primaries: a large black spot at end of cell.

Expanse.—33 mm.

Habitat.—Geldersland, Surinam River, Dutch Guiana.

Type.—Cat. No. 8488, U.S.N.M.

LEUCOTMENSIS THORACICA, new species.

Antennæ black, tipped with white. Head and abdomen black; vertex blue; a subdorsal row of green spots, and a lateral broad green stripe on abdomen. Collar and thorax ochreous yellow; some ochreous on thorax underneath. Wings hyaline, the veins black; the margins broadly black. Primaries: a large black spot at end of cell, which is also irrorated with black scales.

Expanse.—30 mm.

Habitat.—Captured on a small island 100 miles up the Maroni River.

Type.—Cat. No. 8489, U.S.N.M.

Genus **COSMOSOMA** Hübner.

COSMOSOMA THORACICUM, new species.

Collar and thorax ochreous orange. Body otherwise black; frons spotted with blue; two blue dorsal spots on first segment of abdomen, lateral blue spots on other segments. Wings hyaline. Primaries: base ochreous orange; margins black, the apex broadly so; space between veins 2 and 3 to inner angle, also between 3 and 4 close to cell black; veins and discocellular black. Secondaries: the margins broadly black.

Expanse.—24 mm.

Habitat.—100 miles up the Maroni River, French Guiana.

Type.—Cat. No. 8490, U.S.N.M.

Genus **PÆCILOSOMA** Hübner.

PÆCILOSOMA VESPOIDES, new species.

Antennæ black. Body orange yellow. Legs streaked with black; palpi tipped with black; a black spot on vertex; a large black spot on thorax anteriorly; patagia tipped with black. Abdomen banded with black. Wings hyaline; the veins and fringe black; the apices narrowly black. Primaries: an ochreous streak on costal margin to near apex; a short streak at base of inner margin.

Expanse.—24 mm.

Habitat.—Carabaya, Peru.

Type.—Cat. No. 8491, U.S.N.M.

Genus ICHORIA Butler.

ICHORIA CHROSTOMIDES, new species.

Antennæ and body black; a red spot on shoulders; a red streak on patagia; fore coxæ white; tibiæ streaked with white. Wings smoky hyaline; the veins black. Primaries: the inner margin broadly black; the apex narrowly black. Secondaries irrorated with black except on inner margin, and more thickly on outer half below median vein.

Expanse.—20 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8492, U.S.N.M.

Genus PSEUDOMYA Hübner.

PSEUDOMYA NIGROZONUM, new species.

Body dark blue black. Fore coxæ whitish. Abdomen ventrally whitish, the segments posteriorly black. Wings smoky hyaline; a broad black median fascia on primaries, extending on to apical half of secondaries. The inner margin of primaries black.

Expanse.—19 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8493, U.S.N.M.

Genus SAURITA Herrich-Schaeffer.

SAURITA PERSPICUA, new species.

Body black; a red spot on shoulders and one on patagia; fore coxæ irrorated with grey. Primaries smoky hyaline, the veins and fringe black; a black shade at base and along the inner margin. Secondaries slightly whiter, irrorated with black below cell and chiefly toward outer margin.

Expanse.—Female, 27 mm.

Habitat.—Trinidad, British West Indies.

Type.—Cat. No. 8494, U.S.N.M.

SAURITA TRICOLOR, new species.

Antennæ black with a grey spot toward end. Head black. Collar and thorax orange with some black shading. Abdomen orange, the last four segments black above, brown underneath. Legs: femora and tarsi yellow; tibiæ black. Primaries black; the median space ochreous yellow. Secondaries ochreous yellow, the margin black, very broadly so at apex.

Expanse.—23 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8495, U.S.N.M.

Genus SAURITINIA Dyar.

SAURITINIA DUBIOSA, new species.

Antennæ, palpi, and head black. Legs black. Collar, thorax, and first segment of abdomen orange red; abdomen otherwise black. Wings semihyaline smoky brown-black, the veins darker. Primaries: the costal and inner margins black; a darker streak in and beyond cell between veins 5 and 6.

Expanse.—21 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8496, U.S.N.M.

Genus MACROCNEME Hübner.

MACROCNEME MARONIENSIS, new species.

Body and legs black; base of femora white; fore coxæ white; ventral valve fringed with white; two ventral rows of white spots; fore tibiae dark blue; some blue on frons and on vertex; some white behind eyes; a white point outwardly on collar; a blue and white point on shoulders; a few blue scales on thorax. Wings black; the primaries slightly paler toward apex.

Expanse.—24 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8497, U.S.N.M.

Genus PHAIO Neumoegen.

PHAIO CÆRULEONIGRA, new species.

Head and thorax blue black. Abdomen dark green-blue. Legs spotted with white at joints; white points on fore coxæ; a white point laterally on frons; a white point behind vertex. Wings dark blue changing to grey-black in certain lights.

Expanse.—36 mm.

Habitat.—Carabaya, Peru.

Type.—Cat. No. 8498, U.S.N.M.

Genus HOMONEURONIA Dyar.

HOMONEURONIA MODESTA, new species.

Antennæ black. Body and legs dark blue; thorax below spotted with white; fore coxæ white; trochanters spotted with white; second segment of abdomen laterally and ventrally white, the white extending ventrally on to first and third segments. Wings hyaline, the veins and margins black. The secondaries more opalescent white, the margin at apex more broadly black.

Expanse.—27 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8499, U.S.N.M.

Genus CHRYSOSTOLA Herrich-Schaeffer.

CHRYSOSTOLA DISCOPLAGA, new species.

Antennæ, palpi, head, collar, and thorax anteriorly black; a lilacine spot on vertex; collar broadly lilacine in front; thorax posteriorly and patagia ochreous, the latter streaked with black. Abdomen ochreous, the last two segments black. Underneath yellow, the tarsi partly black. Wings hyaline. Primaries: basal half of costa, median vein, vein 2, base of vein 3 and inner margin ochreous yellow; a black streak on subcostal near base; a black spot at end of cell; outer half of costa, apex, and fringe black. Secondaries: the veins yellow; the apex and inner margin black, the latter fringed with ochreous.

Expanse.—24 mm.

Habitat.—Caura Valley, Venezuela.

Type.—Cat. No. 8500, U.S.N.M.

Genus PSEUDACLYTIA Butler.

PSEUDACLYTIA MINOR, new species.

Body black, the abdomen above velvety black; some ochreous brown behind head; fore coxæ white. Primaries: black, the veins velvety black. Secondaries: semihyaline white, the veins, inner margin broadly, apex and outer margin narrowly, black.

Expanse.—22 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8501, U.S.N.M.

PSEUDACLYTIA UNIMACULA, new species.

Body black above, underneath brownish, with apparently grey streaks on abdomen. Wings black. Primaries: with a broad yellow fascia from costa beyond cell to vein 2, close to outer margin.

Expanse.—34 mm.

Habitat.—Cayenne, French Guiana.

Type.—Cat. No. 8502, U.S.N.M.

Genus CYANOPEPLA Clemens.

CYANOPEPLA PERSPICUA, new species.

Head black, red behind; some white scales laterally on frons. Collar, thorax, and abdomen dark blue above; a whitish subdorsal line. Patagia brown, streaked with white and fringed with blue. Body underneath white. Legs blue and white, tarsi brown. Primaries black; cell partly hyaline, also below cell and vein 2, and above vein 2; a hyaline fascia beyond cell from subcostal to near outer margin above vein 3; a lilacine streak above submedian and contiguous to

hyaline space, and also on fringe of inner margin. Secondaries hyaline, the veins and margins dark blue, the fringe black.

Expanse.—35 mm.

Habitat.—La Paz, Bolivia.

Type.—Cat. No. 8503, U.S.N.M.

Genus TRICHODESMA Hampson.

TRICHODESMA AURIMACULA, new species.

Body black above; frons white; segments of abdomen fringed with white; underneath white, the legs partly grey; collar anteriorly orange, and a similar streak on shoulders; patagia dorsally fringed with buff. Primaries black; the veins and costa at base streaked with yellow; an oblique yellow fascia at end of cell from subcostal to vein 2. Secondaries black; a white streak from base below cell, extending into and slightly beyond cell.

Expanse.—30 mm.

Habitat.—Caura Valley, Venezuela.

Type.—Cat. No. 8504, U.S.N.M.

Genus ANTAXIA Hampson.

ANTAXIA MERIDIONALIS, new species.

Palpi brown, darkest behind, and mottled with reddish hairs. Head, collar, thorax, base of abdomen, and anal hairs sulphur yellow; patagia dorsally edged with red and grey. Abdomen crimson above, white underneath. Primaries sulphur yellow; costa finely light brown; markings violaceous brown; a large irregular antemedial space constricted on subcostal, containing a yellow spot below cell, and very limited on inner margin toward base; an irregular space at anal angle, almost reaching the antemedial space; a postmedial space above vein 5, widening on costa to apex; a point near end of cell, and two beyond it; postmedial points above veins 2, 3, and 4; a subterminal row of points; the veins tinged with red where crossing the violaceous portions. Secondaries white; the inner margin broadly pale roseate.

Expanse.—43 mm.

Habitat.—Carabaya, S. E. Peru.

Type.—Cat. No. 8505, U.S.N.M.

Genus PTYCHOTRICHOS Schaus.

PTYCHOTRICHOS ELONGATA, new species.

Head, collar, and thorax brown; a greenish buff stripe from antennæ across collar and shoulder; an ochreous streak on patagia. Abdomen orange, the segments banded with black posteriorly; the last segment

black; the anus white; a broad brown dorsal band on first four segments; an interrupted black line on other segments; underneath white. Primaries light grey; the costa, apex broadly and inner margin dark-brown grey; the veins buff brown; some buff-brown lines on inner margin; a large round dark brown-grey spot in and below cell medially; a large irregular dark brown-grey spot at and beyond end of cell; both spots outlined with whitish grey; a similar line from subcostal to vein 3, separating the light portion from dark apical portion; a dentate subterminal buff-brown line above vein 5; elongated dark streaks between the veins; below vein 5 these spots are edged with buff. Secondaries hyaline; the veins black; the margins clouded with black.

Expanse.—43 mm.

Habitat.—Rio Janeiro, Brazil.

Type.—Cat. No. 8506, U.S.N.M.

Genus HELUIRA Butler.

HELUIRA DOLENS, new species.

Body black; patagia and abdomen shaded with dark blue; fore coxæ and base of abdomen ventrally creamy buff; a fringe of orange hairs behind head. Primaries dull black; an antemedial and a medial velvety black shade on costa; a similar shade along submedian vein; a sub-apical shade, and a subterminal similar shade from veins 2 to 5. Secondaries hyaline, the margins broadly black.

Expanse.—27 mm.

Habitat.—Caura Valley, Venezuela.

Type.—Cat. No. 8507, U.S.N.M.

HELUIRA UMBRIMACULA, new species.

Body black; an orange and red fringe behind head; a yellow spot posteriorly on thorax; fore coxæ white; a large ventral white spot on abdomen. Primaries olivaceous buff; the veins black; a broad post-medial black shade from costa to near inner angle; apex broadly blackish, with terminal dark olivaceous buff spots; an orange spot at base of costa. Secondaries: the basal half white; the veins and outer half black. Underneath the primaries are black with whitish shades in and below cell; four postmedial whitish spots.

Expanse.—31 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8508, U.S.N.M.

Genus EUCEREON Hübner.

EUCEREON CARABAYANA, new species.

Antennæ and palpi black; frons dark blue; collar, thorax, and back of head grey, irrorated with brown; abdomen greyish on basal half.

terminally black. Primaries grey, thinly irrorated with brown; markings blackish brown; a shade at base; an antemedial fascia; a broad shade from end of cell to costa; a postmedial line curved around cell, thickest on inner margin; a broad subterminal shade, interrupted between veins 4 and 5; a marginal shade below vein 2, one between veins 4 and 5, and at apex. Secondaries white; the costa and apex blackish brown.

Expanse.—35 mm.

Habitat.—Carabaya, Peru.

Type.—Cat. No. 8509, U.S.N.M.

EUCEREON FLAVICINCTA, new species.

Palpi dark grey, tipped with light grey. Head dark grey, buff at sides. Collar pale grey, with diffuse dark spots. Thorax pale grey, with dark streaks subdorsally, and on patagia inwardly. Abdomen black, the segment before last bright yellow. Primaries whitish, the veins and markings blackish brown; a basal shade; an antemedial dentate line below cell; a streak in cell on either side of an annular spot; discoellular curved, greyish brown, preceded and followed by a dark shade; postmedial curved beyond cell and between 5 and 3, then incurved to middle of inner margin; subterminal thickened on costa between 5 and 6, and between 2 and 3; marginal streaks thickening into spots above submedian, veins 4, 6, and 7; fringe white, spotted with black above vein 3. Secondaries grey, the apex and outer margin broadly black to near anal angle; a black shade at end of cell.

Expanse.—30 mm.

Habitat.—Carabaya, Peru.

Type.—Cat. No. 8510, U.S.N.M.

EUCEREON MERULOIDES, new species.

Head, thorax, and primaries dark leaden grey; the veins velvety black; a black postmedial shade; base of fringe black. Abdomen black. Secondaries blue black; a semihyaline space at base, below and beyond cell.

Expanse.—39 mm.

Habitat.—Carabaya, Peru.

Type.—Cat. No. 8511, U.S.N.M.

EUCEREON LEMOULTI, new species.

Body black; some orange behind head; collar and thorax shaded with leaden. Primaries leaden; the veins black; the basal half of inner margin broadly black. Secondaries black, darkest on outer margin; a semihyaline shade in, below, and beyond cell.

Expanse.—29 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8512, U.S.N.M.

Genus METACROCEA Dyar.

METACROCEA POSTFLAVA, new species.

Head, thorax, and base of abdomen black; abdomen otherwise orange above, brown underneath. Primaries black-brown, the veins darker; a darker shade at base and medially on inner margin; an antemedial darker spot on costa; traces of a darker subterminal shade. Secondaries black; a hyaline streak in, below, and beyond cell.

Expanse.—29 mm.

Habitat.—Rio Janeiro, Brazil.

Type.—Cat. No. 8513, U.S.N.M.

Genus APOCEREA Dyar.

APOCEREA SOBRIA, new species.

Head and thorax dark grey; some yellow behind head. Abdomen black above; the last three segments banded with yellow, interrupted subdorsally; anal hairs yellow. Primaries light grey, the veins and markings dark grey; an antemedial curved line; a postmedial line incurved below cell, dentate on inner margin, followed by shades and streaks between the veins; terminal streaks between the veins. Secondaries smoky grey-black, the base slightly whitish.

Expanse.—26 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8514, U.S.N.M.

Genus CORREBIA Herrich-Schaeffer.

CORREBIA OBSCURA, new species.

Body black; an orange streak from antennae across collar and shoulders; palpi yellow at base, circled with yellow near tips; trochanters whitish; base of femora white and yellow; legs otherwise black; tarsi circled with yellow. Primaries black; a postmedial fascia from costa to inner margin, yellowish buff, becoming brown below cell. Secondaries semihyaline black, the veins, costa, and outer margin darker.

Expanse.—20 mm.

Habitat.—Maroni River, French Guiana.

Type.—Cat. No. 8515, U.S.N.M.

Genus PROPYRIA Hampson.

PROPYRIA ATROXANTHA, new species.

Fore wing with vein 6 stalked with 7 and 9, vein 8 absent, otherwise agreeing with *Propyria*. Body black, orbits, patagia, a central stripe on thorax, and subdorsal band on first two segments of abdomen, orange yellow. Wings orange yellow, the apical third of pri-

maries black with a narrow black edge along inner margin; secondaries with an outer black border roundedly incised between veins 2 and 3 and before anal angle, produced nearly half way up the inner margin and abruptly terminated. It is less than one-fourth of the wing in width.

Expanse.—22 mm.

Habitat.—Cuesta de Misantla, Vera Cruz, Mexico.

Type.—Cat. No. 8516, U.S.N.M.

Genus EPECTAPTERA Hampson.

EPECTAPTERA DISCALIS, new species.

Head, thorax, and hairs on base of abdomen black; abdomen otherwise dark, metallic blue above, black underneath. Primaries dark blackish brown, with a few scattered buff scales; a quadrate whitish patch in middle of cell; a postmedial blackish shade. Secondaries orange red, the margins all broadly black.

Expanse.—31 mm.

Habitat.—Carabaya, Peru.

Type.—Cat. No. 8517, U.S.N.M.

EPECTAPTERA UMBRESCENS, new species.

Antennæ black. Palpi white at base, otherwise black. Head, collar, and thorax dark brown. Abdomen black above, irrorated with ochreous, underneath irrorated with light gray. Legs brown; fore coxæ creamy buff. Primaries dark brown, almost black on inner margin; a vague, darker spot at end of cell. Secondaries brown, irrorated with yellow, especially in cell; outer margin broadly blackish.

Expanse.—30 mm.

Habitat.—Carabaya, Peru.

Type.—Cat. No. 8518, U.S.N.M.

Family NOLIDÆ.

Genus CELAMA Walker.

CELAMA ALBIRUFA, new species.

Body white. Legs grey, the tarsi circled with white. Primaries brown grey; a white streak from base through cell to apex; median vein and vein 4 distinctly white; a whitish space at base of inner margin; an antemedial row of brown points angled below cell; a brown spot in cell close to subcostal; a postmedial row of black points on veins from costa to vein 2; veins terminally shaded with white; some dark terminal points; fringe brown. Secondaries white, the apex clouded with brown.

Expanse.—8 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8558, U.S.N.M.

Genus NOLA Leach.

NOLA MESOGRAPHA, new species.

Head and thorax white. Abdomen pale brown, tibiae grey and white, tarsi dark grey brown circled with white. Primaries white, shaded with brown on outer margin; a large dark brown spot on costa close to base; a large brown space on middle of costa through cell, basally and outwardly shaded with darker brown scales, the basally placed scales extending as a fine line to inner margin; a subterminal irregular grey shade, angled at apex; a terminal brown line; fringe grey. Secondaries dirty white, the outer margin broadly dark grey; underneath the discocellular black.

Expanse.—16 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8559, U.S.N.M.

Genus ROESELIA Hübner.

ROESELIA NIVEICOSTA, new species.

Head and thorax grey, irrorated with light brown. Abdomen greyish brown. Primaries brown; the inner margin and space above median and vein 5 irrorated with white; the outer two-thirds of costa white with only a few grey irrorations; outer margin darker brown. Secondaries white; a fine terminal pale brown line; a few grey irrorations at apex.

Expanse.—20 mm.

Habitat.—Castro, Parana, Brazil.

Type.—Cat. No. 8560, U.S.N.M.

ROESELIA DIVISOIDES, new species.

Head and thorax white thinly irrorated with black. Abdomen grey. Tarsi blackish brown circled with white. Primaries grey, thinly irrorated with brown; an antemedial dark-brown line, followed by a brown spot in cell, a whitish spot at end of cell, and a dark-brown streak above it on costa; a postmedial dark-brown line, deeply curved beyond cell, then inwardly oblique to near middle of inner margin; the outer margin below vein 6 shaded with brown; a subterminal brown shade, oblique from costa; terminal dark streaks on veins 2 to 5. Secondaries grey, darkest on outer margin.

Expanse.—17 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8561, U.S.N.M.

ROESELIA POLYDONTA, new species.

Head and thorax white; patagia inwardly edged with black. Abdomen grey, banded with white. Primaries grey irrorated with light

brown; the costa brownish, the lines black; a medial straight line, brown in cell, black below it, incurved below submedian; an inwardly curved line from subcostal at end of cell to vein 3, then upwardly curved to median, then outwardly oblique to submedian near postmedial, and very deeply indentate on submedian; a deeply dentate line beyond cell, followed by the postmedial, which is evenly curved from costa to vein 2, then slightly incurved to inner margin; an irregular subterminal line; a terminal line; some brown shadings on outer margin; fringe white spotted with brown. Secondaries dirty white; the veins dark; outer margin and a postmedial line dark grey.

Expanse.—19 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8562, U.S.N.M.

Family LITHOSIIDÆ.

Genus AGYLLA Walker.

AGYLLA DELICIA, new species.

Head and thorax dark grey. Abdomen whitish; anal tufts yellowish buff. Primaries white; the inner margin to cell smoky grey. Secondaries yellowish buff; the inner margin and a subterminal space white; the outer margin grey, darkest toward costa. Underneath the primaries are grey, the secondaries white; the basal half of costa on both wings yellowish buff.

Expanse.—23 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8519, U.S.N.M.

AGYLLA AURANTICARIA, new species.

Body grey above, whitish buff underneath. Primaries white, faintly grey on inner margin. Secondaries white; a large patch of androconia on basal half of cell; a greyish shade on vein 2 at outer margin. Underneath the primaries have a streak of hairs below cell, widening to a broad tuft between veins 2 and 4.

Expanse.—26 mm.

Habitat.—St. Jean, French Guiana.

Comes next to *Agylla polysemata* Schaus.

Type.—Cat. No. 8520, U.S.N.M.

AGYLLA SUBVOLUTA, new species.

Body above dark grey; frons tinged with brown. Primaries white; the inner margin below submedian dark grey, above it paler grey; the costa finely pale buff; a dark-grey line on fringe. Secondaries white; the apex broadly, the outer margin narrowly, smoky grey. Underneath, primaries dark grey; secondaries as above, the apical grey shadings somewhat darker.

Expanse.—30 mm.

Habitat.—Maroni River, French and Dutch Guiana.

Type.—Cat. No. 8521, U.S.N.M.

Comes next to *A. dognini* Hampson.

AGYLLA SANCTÆ-JOHANNIS, new species.

Body grey above, darkest terminally on abdomen. Primaries white; the inner margin below submedian greyish. Secondaries white, thickly irrorated with grey, more heavily on outer margin.

Expanse.—Female, 19 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8522, U.S.N.M.

Genus **ARDONEA** Walker.

ARDONEA JUDAPHILA, new species.

Head dark brown. Collar and thorax orange red. Abdomen violaceous black. Primaries grey brown; the costal and inner margins broadly shaded with dark violaceous; some similar streaks between veins on outer margin; an orange-red space at base. Secondaries fuscous grey.

Expanse.—21 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8523, U.S.N.M.

Genus **PARAPALOSIA** Dyar.

PARAPALOSIA CINDERELLA, new species.

Head and thorax greyish buff. Abdomen grey, much darker terminally. Primaries light grey; a very broad darker grey transverse shade from near base to end of cell. Secondaries whitish at base, the outer portion suffused with grey.

Expanse.—19 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8524, U.S.N.M.

Genus **PRONOLA** Hampson.

PRONOLA FRATERNA, new species.

Head and thorax bright yellow. Abdomen violaceous black; some yellow ventrally at base. Legs yellow. Primaries dark violaceous black; the base, costal margin, apex broadly, and outer margin to vein 3 bright yellow. Secondaries: the costal half greyish buff, otherwise dark brown.

Expanse.—16 mm.

Habitat.—Maroni River, French Guiana.

Type.—Cat. No. 8525, U.S.N.M.

Genus *DIPÆNA* Walker.*DIPÆNA INCONTENTA*, new species.

Head black, shot with blue and violet. Thorax dark violaceous brown. Abdomen dark blue-black; terminal two segments dorsally and laterally red; anal hairs red. Primaries dark reddish brown, shot with violaceous, especially on inner margin. Secondaries grey-black; the outer margin broadly dark blue.

Expanse.—23 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8526, U.S.N.M.

Genus *EUDOLICHE* Möschler.*EUDOLICHE LONGA*, new species.

Head and thorax white. Abdomen buff-white. Primaries white; a brown shade near base below median; a medial brown shade in cell; a brown shade below median, extending to postmedial shade; the latter obsolete on costa and inner margin; a brown spot at apex, one at inner angle, and one on middle of outer margin; fringe white. Secondaries white.

Expanse.—22 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8527, U.S.N.M.

Genus *THYONE* Walker.*THYONE MURICOLOR*, new species.

Head and thorax dark leaden grey. Abdomen greyish black. Primaries leaden grey, changing to light violaceous. Secondaries grey-black.

Expanse.—18 mm.

Habitat.—Cayenne, French Guiana.

Type.—Cat. No. 8528, U.S.N.M.

THYONE PERBELLA, new species.

Head yellow. Collar and thorax orange. Abdomen ochreous yellow. Primaries: Base yellow, changing to orange, then red, and finally brown, followed by a broad medial pale yellow fascia, which is slightly oblique from costa to inner margin; a black spot at base of costa; the median fascia followed by a brown shade, gradually fading to ochreous yellow; the veins on outer portion dark brown. Secondaries pinkish yellow.

Expanse.—16 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8529, U.S.N.M.

Genus HYPERMÆPHA Hampson.

HYPERMÆPHA MARONIENSIS, new species.

Head and thorax greenish buff. Abdomen and secondaries roseate. Primaries pale greenish buff; a brown streak from base below cell to outer margin (sometimes almost obsolete), where it is joined by a brown terminal line from apex; a dark brown spot beyond cell. Underneath red.

Expanse.—12 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8530, U.S.N.M.

Genus ODOZANA Walker.

ODOZANA UNICA, new species.

Head and thorax dark fuscous grey. Abdomen red above. Body underneath dark fuscous grey. Primaries fuscous grey, darker at base and along inner margin. Secondaries red; the costa, apex, and outer margin fuscous grey, very broadly so at apex, narrowing to a point at anal angle.

Expanse.—17 mm.

Habitat.—Cordoba, Mexico.

Type.—Cat. No. 8531, U.S.N.M.

Genus PREPIELLA Hampson.

PREPIELLA CONVERGENS, new species.

Head buff. Abdomen pale roseate. Body creamy buff underneath. Primaries pale buff; the basal half streaked with black; a black line from middle of inner margin curving up around end of cell and returning to inner angle, inclosing a pale yellow space, on which is a red spot at end of cell, and some red irrorations above and below submedian; black streaks beyond this line not reaching apex and outer margin; a black terminal line. Secondaries yellow; the apex black.

Expanse.—18 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8532, U.S.N.M.

Genus CALLISTHENIA Hampson.

CALLISTHENIA ANGUSTA, new species.

Head dark grey; a pale buff line close to eyes. Thorax black; the patagia tipped with red. Abdomen red above, yellowish underneath. Primaries black; yellowish buff streaks on basal half of cell, below it, above submedian, and on inner margin; a broad postmedial yellow fascia, narrowing at inner margin, and inclosing a red spot at end of cell; yellowish buff streaks on outer margin and costa between the

veins. Secondaries orange red; the apex broadly black, narrowing to vein 3.

Expanse.—13 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8533, U.S.N.M.

Genus *ILLICE* Walker.

ILLICE ABALA, new species.

Head and thorax grey-black. Collar yellowish. Abdomen roseate. Primaries grey-black; a roseate yellow spot at base of inner margin; a broad yellowish fascia across end of cell, from costa to inner margin. Secondaries yellowish red; the apex broadly grey-black, narrowing to vein 3 in the male, continuous to anal angle in the female.

Expanse.—14 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8534, U.S.N.M.

ILLICE SUBRUBRA, new species.

Head and thorax dark leaden grey. Collar and abdomen red. Primaries leaden grey; the costa finely pale buff. Secondaries red; the apex broadly leaden grey. Underneath the same.

Expanse.—16 mm.

Habitat.—Cayenne, French Guiana.

Type.—Cat. No. 8535, U.S.N.M.

ILLICE PYGMÆA, new species.

Head and thorax black-grey. Collar and patagia creamy buff. Abdomen red. Primaries black-grey; basal half of inner margin creamy buff; a similar postmedial fascia slightly constricted at end of cell. Secondaries yellowish, tinged with roseate on costal margin; apical half of outer margin black-grey.

Expanse.—10 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8536, U.S.N.M.

ILLICE RUBRICOLLIS, new species.

Head and thorax blackish grey. Collar and abdomen crimson. Primaries dark fuscous grey. Secondaries blackish; a red streak on inner margin.

Expanse.—16 mm.

Habitat.—Cayenne, French Guiana.

Type.—Cat. No. 8537, U.S.N.M.

Genus METALOBOSIA Hampson.

METALOBOSIA INVARDA, new species.

Head and thorax black. Abdomen above dull red, black underneath and on last segment above. Primaries violaceous brown, iridescent. Secondaries black; below cell to inner margin and anal angle roseate.

Expanse.—19 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8538, U.S.N.M.

Genus ARHABDOSIA Dyar.

ARHABDOSIA SUBVARDA, new species.

Head, thorax, and primaries dark brown. Abdomen red; the last segment and tufts black. Secondaries black; the inner area from just within cell red.

Expanse.—19 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8539, U.S.N.M.

Genus ASCAPTESYLE Dyar.

ASCAPTESYLE SUBMARGINATA, new species.

Head, thorax, and primaries greyish brown. Abdomen dark brown. Secondaries crimson; the apex, a terminal line, and fringe black.

Expanse.—20 mm.

Habitat.—Trinidad, British West Indies.

Type.—Cat. No. 8540, U.S.N.M.

Genus NODOZANA Hampson.

NODOZANA BELLICULA, new species.

Head and thorax dark grey. Abdomen roseate above; underneath buff banded with black. Primaries pinkish buff; a broad black median fascia, containing a pale buff spot in cell and one above it, followed by a red spot at end of cell; an oblique black line from costa at three-fourths from base to a black spot at inner angle, followed by black streaks on veins, interrupted on veins 5 and 6. Secondaries pinkish yellow, the apex black.

Expanse.—12 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8541, U.S.N.M.

Genus LYCOMORPHODES Hampson.

LYCOMORPHODES EPATRA, new species.

Frons, collar, and thorax shining coal black; vertex ochreous. Abdomen dull black. Primaries shining coal black; an ochreous streak at base below costa. Secondaries dull black.

Expanse.—18 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8542, U.S.N.M.

Genus TALARA Walker.

TALARA ORNATA, new species.

Head and collar light greyish brown. Thorax blackish. Abdomen roseate, the last segment black. Primaries: basal half and apex creamy buff, thinly irrorated with brown; outer half more thickly irrorated with brown, forming a broad diffuse postmedial shade; subterminal blackish shades, a dark brown spot at end of cell. Secondaries: the base and inner margin roseate, otherwise black. Underneath the primaries are black, the inner margin yellowish.

Expanse.—16 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8543, U.S.N.M.

TALARA SUBCOCCINEA, new species.

Head and thorax light roseate brown. Abdomen and secondaries roseate ochreous; anal hairs black. Primaries pale buff, shaded with roseate except on costal and inner margins, and thinly irrorated with brown; a fine oblique darker shade from below cell to inner margin; fringe shaded with black-brown. Underneath the primaries are roseate, the costa, apex, and outer margin shaded with brown.

Expanse.—18 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8544, U.S.N.M.

TALARA DECEPTA, new species.

Frons, thorax, and abdomen black; vertex yellow. Primaries black, tinged with deep blue; a postmedial whitish fascia interrupted below cell by a dark streak; a pale buff spot close above inner angle, and extending on to fringe. Secondaries light brown at base, suffusing to black on outer margin.

Expanse.—19 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8545, U.S.N.M.

TALARA UNIMODA, new species.

Head and thorax dark grey. Abdomen roseate. Primaries dark grey. Secondaries roseate; apex very broadly black, tapering to a point at anal angle.

Expanse.—13 mm.

Habitat.—Cayenne, French Guiana.

Type.—Cat. No. 8546, U.S.N.M.

TALARA DIVERSA, new species.

Head and thorax dark grey. Abdomen roseate; anal hairs dark brown. Primaries whitish; a dark brown shade at base of costa, extending to submedian; a broad brown medial shade from costa to below cell, followed by a dark grey postmedial shade on which is a black point at end of cell; a large blackish spot at inner angle, extending to vein 3; apex shaded with brown; some light brown irrorations on inner margin. Secondaries red; apex and outer margin broadly black, narrowing to a point at anal angle.

Expanse.—14 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8547, U.S.N.M.

TALARA RUGIPENNIS, new species.

Head and thorax black grey. Abdomen roseate. Primaries drab grey, irrorated with apparently raised black and white scales. Secondaries dull black.

Expanse.—14 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8548, U.S.N.M.

Genus **PARATALARA** Dyar.**PARATALARA INVERSA**, new species.

Head and thorax white. Abdomen and secondaries grey. Primaries: the base, costal margin broadly, apex, and outer margin to vein 2 white; antemedial space below cell to inner margin dark grey, followed by a broad brown shade, extending faintly onto white costa; a whitish postmedial line, followed by a dark grey shade reaching outer margin at inner angle.

Expanse.—14 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8549, U.S.N.M.

Genus CLEMENSIA Packard.

CLEMENSIA BRUNNEOMEDIA, new species.

Head and thorax brown. Abdomen dark grey; anal hairs buff. Primaries: basal third creamy buff, shaded with gray, chiefly on base of costa, followed by a brown space extending on costa to apex, limited at end of cell by a grey streak, constricted between cell and submedian; terminal portion whitish, irrorated with grey; an interrupted terminal brown line. Secondaries white; the outer margin tinged with grey below vein 2.

Expanse.—19 mm.

Habitat.—Costa Rica.

Type.—Cat. No. 8550, U.S.N.M.

CLEMENSIA SUBLEIS, new species.

Head and thorax dirty white. Abdomen grey. Primaries dirty white, the median space irrorated with light brown; a black spot at base of costa and one below median; an antemedial black spot on costa, and one above submedian; a postmedial interrupted blackish shade; a subterminal black spot on costa, a smaller one below vein 6, and a shade above inner margin. Secondaries pale grey; a dark medial spot on costa.

Expanse.—14 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8551, U.S.N.M.

CLEMENSIA DISTINCTA, new species.

Body dark mouse grey. Primaries dark mouse grey; a darker basal, antemedial and postmedial shade; a subterminal whitish line at costa, and below vein 2 to inner margin; a black spot at apex; a dark grey spot at vein 5 extending on to fringe; fringe terminally whitish above and below vein 5 to inner angle. Secondaries lighter grey.

Expanse.—18 mm.

Habitat.—Trinidad, British West Indies.

Type.—Cat. No. 8552, U.S.N.M.

CLEMENSIA INLEIS, new species.

Head and thorax buff. Abdomen grey. Primaries buff, thinly irrorated with light brown; a postmedial row of small brown spots; a small brown spot at apex, and one on costa before apex. Secondaries buff-white.

Expanse.—18 mm.

Habitat.—Castro, Parana, Brazil.

Type.—Cat. No. 8553, U.S.N.M.

CLEMENSIA ABNORMIS, new species.

Head and collar white. Thorax yellow. Abdomen whitish grey; dark grey terminally. Primaries bright yellow; the costal margin, apex broadly, and outer margin whitish; some brown irrorations on yellow space near white outer margin. Secondaries white, shaded with buff below cell; a subterminal grey shade on costa, becoming marginal and broad below vein 5 to anal angle.

Expanse.—16 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8554, U.S.N.M.

Genus EPITALARA Dyar.

EPITALARA REVERSA, new species.

Head white. Thorax and abdomen grey. Primaries white from base to middle of costa and inner angle; beyond shaded with brown, leaving only apex white; a black point at end of cell; traces of a fine dark postmedial line; fringe white mottled with brown; a terminal dark brown line. Secondaries grey.

Expanse.—13 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8555, U.S.N.M.

Genus DIARHABDOSIA Hampson.

DIARHABDOSIA STRIGIPENNIS, new species.

Head and thorax creamy white. Abdomen yellowish at base, terminally roseate. Primaries white; a black spot at base of costa; an antemedial and a medial black line from costa, meeting below cell, and enclosing some black clusters of scales in cell; a postmedial black line from costa, curving around to apex, enclosing a white spot streaked with black; a blackish spot at middle of outer margin; an irregular cluster of black scales at inner angle. Secondaries yellowish; the apex black. Underneath yellow tinged with red; basal half of costa on primaries black, with a large black medial spot from costa to below cell; black at apex and inner angle.

Expanse.—13 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8556, U.S.N.M.

Genus EUZEUGAPTERYX Dyar.

EUZEUGAPTERYX SPECIOSA, new species.

Head light brown. Thorax light grey. Abdomen blackish grey. Primaries grey thickly irrorated with brown; a broad blackish brown

streak below costa for two-thirds from base. Secondaries dark grey; the costal margin whitish; fringe at apex blackish.

Expanse.—15 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8557, U.S.N.M.

Family ARCTIIDÆ.

Genus ROBINSONIA Grote.

ROBINSONIA ROCKSTONIA, new species.

Palpi, head, and collar dark brown spotted with white; some ochreous below and at sides of head. Legs white inwardly, brown outwardly. Thorax ochreous; patagia white, edged with dark greyish brown. Abdomen with a dorsal ochreous stripe, with a dark brown stripe on either side of it, laterally and ventrally white. Primaries brown; a broad subcostal ochreous streak; below cell and beyond it, below vein 6, white, leaving the margins narrowly brown, also veins 2, 3, and 4; subapical white spots above and below vein 7; smaller marginal white spots above and below vein 5. Secondaries white, a fuscous streak on veins 2 and 1; a dark streak on basal half of costal margin. Underneath similar, without any ochreous.

Expanse.—40 mm.

Habitat.—Rockstone, British Guiana.

Allied to *R. lefaivrei* Schaus.

Type.—Cat. No. 8563, U.S.N.M.

ROBINSONIA EVANIDA, new species.

Head and thorax white; back of head ochreous. Abdomen ochreous above; subdorsal white points; white ventrally. Primaries white; the costal margin pale greyish brown. In the male the outer and inner margin and a stripe across end of cell to outer margin between veins 2 and 3, faintly greyish. Secondaries white.

This is probably a subspecies of *R. formula* Grote. Had I not taken the specimens myself, I should have thought they had lost their markings in the cyanide bottle. The male was taken in May, the female in July, at Santiago de Cuba.

Expanse.—34 mm.

Robinsonia formula was not found at the east end of the island, but was common at Matanzas. *Robinsonia devitzi* Gundlach was also taken at Matanzas; it is an older name for *R. grotci* Schaus, and I have specimens from Mexico, Trinidad, Cuba, French Guiana, and Rio de Janeiro, Brazil.

Type.—Cat. No. 8564, U.S.N.M.

Genus IDALUS Walker.

IDALUS RUBENS, new species.

Antennæ of male pectinated. Palpi crimson behind, buff in front; a dark point near tip. Head creamy white with crimson lines; tegulae creamy white edged with crimson, and crimson annular spots. Thorax greyish brown; a crimson dorsal streak; patagia crimson, with a brown dorsal streak, and a lateral whitish streak; a silvery white spot at tips. Abdomen crimson above, whitish ventrally; fore coxæ crimson. Legs greyish spotted with brown. Primaries yellowish white; the veins crimson, widening on outer margin; costal margin thickly mottled with dark grey; crimson basal spots on costa, below cell, and below submedian; a broad dark grey antemedial shade interrupted by the veins; a crimson streak on outer half of cell with irregular grey spots above and below it; an outer irregular row of long dark grey patches between the veins, mottled with buff transverse streaks near the veins; the inner margin medially crimson; terminal dark grey spots between the veins. Secondaries crimson; a whitish space in, beyond, and above cell. The secondaries as in *I. hippia* Stoll. The patch of androconia on fore wings is very slight and does not reach vein 2.

Expanse.—30 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8565, U.S.N.M.

IDALUS LAURENTIA, new species.

Palpi whitish, a black line behind and across tip. Head, collar, and thorax pale yellow; a blackish curved line anteriorly on patagia. Abdomen ochreous above, whitish underneath. Legs yellowish, spotted with black; fore coxæ black, fringed with white. Primaries pale yellow; the spots annular, black; an elongated spot on base of costal margin; a small round spot below cell at base; an antemedial row of irregular elongated spots, the one in cell surmounted by two small spots; medial black streaks on costal margin; a round spot in cell and a smaller one between veins 2 and 3; very small spots above and below vein 4; a long spot above 5, and a shorter spot above 6; an outer row of round spots, the spot between 5 and 6 being nearer the marginal spot; marginal triangular spots; the spots on apical fourth of costa very narrow; fringe just above anal angle to submedian black; a black streak on inner margin. Secondaries white; a yellow shade on margin at vein 6.

Expanse.—34 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Allied to *I. panduma* Druce.

Type.—Cat. No. 8566, U.S.N.M.

IDALUS NEJA, new species.

Body ochreous yellow. Palpi and legs grey; a light brown streak on patagia. Primaries pale yellow; a brown spot at base between median and submedian; large antemedial spots, from below costa to submedian, below this a small spot, all coalescing, greyish brown; the balance of spots still paler; two in cell, one at upper angle, the other close to vein 3; a row of spots between veins close to cell, a post-medial row of larger spots, the one between vein 2 coalescing with a grey patch at angle; the spot between 5 and 6 rather elongated; a submarginal row of round spots between the veins, and smaller marginal spots on the veins. Secondaries white; the inner margin pale yellow.

Expanse.—36 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8567, U.S.N.M.

IDALUS FLAVOPLAGA, new species.

Antennæ serrate and fasciculate. Secondaries with vein 3 before lower angle of cell; 6 and 7 coincident, shortly stalked with 8. Palpi grey. Head yellow; a black spot on frons, one between antennæ and two behind. Collar yellow; two blackish grey spots. Thorax dark grey; patagia yellow, edged dorsally with black. Abdomen yellow, the last two segments grey; anal hairs white. Legs grey; fore coxæ yellow spotted with black. Primaries dark greyish brown; the veins buff; a yellow streak on inner margin widening outwardly; a large yellow spot postmedially from costa to vein 3; basally the spot is oblique, outwardly slightly angled between 5 and 6; a buff streak from base between median and submedian veins; fringe dark grey. Secondaries yellowish, tinged with ochreous on inner margin.

Expanse.—28 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8568, U.S.N.M.

IDALUS ALBICOXÆ, new species.

Palpi black; a crimson lateral streak on basal half. Head and collar yellow. Thorax lilacine grey; yellowish in front; crimson streaks on patagia. Abdomen crimson above; a subdorsal white basal spot; underneath white. Coxæ white. Primaries: from base to just beyond cell lilacine grey irrorated with darker scales and outwardly shaded with red; basal third of costa white; outer portion of wing yellow, incurving slightly between vein 3 and inner angle; above vein 3 a curved row of small clusters of black scales between the veins. Secondaries whitish; a crimson streak near inner margin. Veins 3 and 5 very shortly stalked.

Expanse.—30 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8569, U.S.N.M.

IDALUS CATENATA, new species.

Palpi roseate tipped with yellow. Fore coxæ and fringe around eyes roseate. Head and collar yellow. Thorax grey, the patagia fringed with roseate. Abdomen brownish yellow; a subdorsal roseate tuft at base. Primaries pale yellow; between cell, vein 2, and submedian a grey space extending into cell at base and medially, and on to inner margin beyond base, and on outer third; this grey space is partly edged and streaked with crimson; two small spots at end of cell and one between 3 and 4 and between 6 and 7; an outer row of large grey spots divided by crimson streaks on veins; a marginal row of round grey spots between the veins. Secondaries whitish yellow; some roseate hairs at base of inner margin.

Expanse.—40 mm.

Habitat.—Castro, Parana, Brazil.

This species is allied to *I. lophocampoides* Felder, but differs in many respects.

Type.—Cat. No. 8570, U.S.N.M.

Genus PRUMALA Schaus.

PRUMALA HIEROGLYPHICA, new species.

Head and thorax yellow, spotted with red, palpi spotted with brown; frons brown; tegulæ edged with brown. Abdomen roseate above, buff laterally, light brown underneath. Primaries yellowish irrorated with red; a streak from base above submedian, outer half of inner margin, and outer margin dark brown; median space on extreme costa dark grey, apically extreme costal margin brown; a dark grey streak on discocellular; veins on yellow portion all crimson; an interrupted antemedial brown irregular line; two brown lines crossed on submedian between veins 2 and 3; a brown medial streak from costa to discocellular; a fine postmedial line from veins 3 to 6, followed by two brown annuli on veins 5 and 6; an outer line from costa angled above 5, then wavy to vein 3; the angle is connected to outer margin by a dark brown shade; a fine submarginal line. Secondaries roseate.

Expanse.—Female, 36 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Allied to *P. optima* Butler.

Type.—Cat. No. 8571, U.S.N.M.

Genus PREMOLIS Hampson.

PREMOLIS AMARYLLIS, new species.

Head and thorax greenish yellow; some fine transverse reddish lines. Abdomen pale ochreous. Primaries greenish yellow; costal margin, and a broad band from costa before apex to inner angle brown; traces of fine reddish interrupted lines; basal, antemedial, medial, postmedial, submarginal and marginal. Secondaries roseate.

Expanse.—29 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8572, U.S.N.M.

Genus ZATREPHES Hübner.

ZATREPHES ARENOSA, new species.

Palpi crimson fringed with white. Head and collar white irrorated with red. Thorax and prolegs grey irrorated with red; fore coxae white. Abdomen crimson above, white underneath. Primaries lilacine grey, irrorated with red; two darker grey oblique lines; the antemedial from subcostal to inner margin, the postmedial from vein 7 to inner margin, followed by a white semihyaline band between 4 and 7, widest between veins 4 and 5; extreme costal margin white irrorated with red. Secondaries crimson; the costal margin and fringe white. The female paler.

Expanse.—Male, 29 mm.; female, 39 mm.

Habitat.—Maroni River, French Guiana.

Allied to *Z. nitida* Cramer.

Type.—Cat. No. 8573, U.S.N.M.

ZATREPHES MODESTA, new species.

Head and thorax light brown thinly irrorated with red. Abdomen pale buff; a subdorsal brown line, widest at base and on terminal segments. Primaries yellowish buff, thinly irrorated with red between the lines; costal margin darker, the extreme margin white; three olivaceous grey lines from subcostal to submedian vein, antemedial, medial, and postmedial; inner and outer margins narrowly reddish, preceded by a faint semihyaline spot above and below vein 4; fringe dark reddish brown above vein 2; below it and on inner margin olivaceous grey. Secondaries yellowish white; fringe toward anal angle dark reddish.

Expanse.—27 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Allied to *Z. trilineata* Hampson; the outer margin of primaries slightly incurved at vein 4.

Type.—Cat. No. 8574, U.S.N.M.

ZATREPHES OSSEA, new species.

Palpi whitish; a crimson streak behind. Head and thorax greyish white thinly irrorated with red; a brown spot on vertex; a subdorsal dark line. Abdomen roseate above, whitish underneath. Primaries bone white; a few red irrorations on basal half; outer portion with coalescing brownish striæ; costal margin finely brown; fringe and outer margin narrowly dark brown; an antemedial and a postmedial brown line; closer together on inner margin than on costal margin; veins on outer margin brown. Secondaries white; the inner margin broadly roseate; fringe brown.

Expanse.—35 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8575, U.S.N.M.

Genus EUPSEUDOSOMA Grote.

EUPSEUDOSOMA ABERRANS, new species.

Palpi white; second segment terminally and upper part black. Head and thorax white; a brown bar on frons; some yellow on vertex. Abdomen white; crimson above, except on first and two terminal segments; a dorsal row of white spots. Wings white; outer half of extreme costa on primaries fuscous; a fuscous streak below cell, between veins 2 and 3, and below submedian.

Expanse.—43 mm.

Habitat.—Coatepec, Mexico.

This species differs from *E. involuta* Sepp in the position of the fuscous lines on primaries.

Type.—Cat. No. 8576, U.S.N.M.

Genus NEAXIA Hampson.

NEAXIA GNOSIA, new species.

Head and thorax yellow; a crimson line behind palpi; a red line across frons; red spots on thorax; patagia fringed and with a crimson line. Abdomen roseate above, white underneath. Primaries yellow; a large dark grey space from middle of cell to inner margin, where it is widest, edged with crimson and crossed by a crimson streak below cell; a crimson spot near base of costa and at base below median vein; a pale grey spot in cell and a row of four spots beyond cell, followed by a series of postmedial darker grey spots, coalescing between veins 5 and 8; a marginal row of very pale spots. All the spots edged more or less with reddish. Secondaries roseate; the costal margin white; fringe yellow.

Expanse.—31 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. No. 8577, U.S.N.M.

NEAXIA BELLA, new species.

Palpi yellowish tipped and spotted with dark brown. Head ochreous; a brown line in front of antennæ. Collar and thorax yellow, two dark brown spots posteriorly on the latter; large blackish brown spots on patagia edged with red. Abdomen crimson above, anal segment yellow; underneath white. Legs yellow, spotted with blackish grey. Primaries bright yellow; spots blackish grey; antemedial elongated spots, extending below cell to outer margin, interrupted on inner margin by a yellow spot; submedian partly streaked with red; a red streak below cell and vein 2; a round spot at end of cell; a streak above it; four small spots beyond cell; a postmedial row of spots, very large above vein 4, the spot above vein 5 and above vein 7 close to margin, with some crimson streaks on veins above and below them; a marginal row of small spots. Secondaries: costal margin white; inner margin and a streak through cell to outer margin roseate; otherwise black.

Expanse.—27 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8578, U.S.N.M.

Genus ERIOSTEPTA Hampson.

ERIOSTEPTA BACCHANS, new species.

Head, thorax, and fore coxæ rosy vermilion; palpi fringed with dark grey; yellow streak on patagia. Abdomen roseate above, whitish underneath. Primaries rosy vermilion; the costal edge and a streak below on basal half dark grey; a grey spot in cell, another at end of cell, and one between veins 3 and 4 at cell; basal and antemedial yellow spots; yellow streaks between the veins interrupted by postmedial grey spots edged with red, those below vein 5 parallel with margin; three spots above 5 oblique from costa to outer margin; terminal grey streaks on veins; fringe dark grey. Secondaries roseate; the fringe and anal angle broadly yellowish white; a hyaline streak from base below cell.

Expanse.—30 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8579, U.S.N.M.

Genus AMAXIA Walker.

AMAXIA CONSISTENS, new species.

Palpi buff, streaked behind with black. Head, collar, and shoulders bright yellow; a dark spot edged with crimson posteriorly on head. Thorax dark violaceous brown. Abdomen black and brown above; anal segment yellow, preceded by a crimson line; underneath white.

Primaries bright yellow; a dark violaceous brown space occupying entire inner margin and extending to base of costa and to subcostal vein medially, edged with crimson; median vein crimson on dark portion of wing; a crimson streak below cell; outer half of submedian and a small spot on middle of inner margin crimson; a roseate spot at base of inner margin; spots on yellow portion grey, edged with black; a small spot at end of cell; a black streak above it; fine small spots beyond cell; a postmedial row of larger spots, increasing in size toward costa and coalescing with a costal streak at apex; red streaks on veins 6 to 8 separating the spots; small marginal spots. Secondaries blackish; costal margin white; inner and outer margin narrowly roseate; a roseate spot at end of cell; a roseate streak below cell.

Expanse.—28 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8580, U.S.N.M.

Genus *EVIUS* Walker.

EVIUS ALBISCRIPTA, new species.

Palpi crimson behind, white and brown in front. Frons white and brown. Vertex silvery white; an inverted V red line posteriorly. Collar light brown with silvery white spots edged with crimson. Thorax fawn brown; a silvery white streak on patagia inwardly edged with crimson. Abdomen dorsally grey; a red tuft subdorsally at base; last segment brown, the two before it crimson; anal hairs and ventrally white. Primaries lilacine brown; a very large semihyaline pale yellowish space beyond cell from vein 3 to subcostal; a black mark on this space at vein 6; a silvery white streak in cell; a similar streak below vein 2, edged above with crimson, below with black; marginal silvery white streaks and spots above vein 3 to apex; some crimson at ends of veins, and yellow spots on fringe. Costa grey, with a crimson streak from base to apex; a red spot at base of inner margin; a yellowish and red spot near base below cell. Secondaries crimson, the inner margin white.

Expanse.—29 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8581, U.S.N.M.

Genus *PAREVIA* Hampson.

PAREVIA METHÆMIA, new species.

Head yellow, frons pale brown. Collar and thorax brown. Abdomen crimson above, pale yellow below. Primaries lilacine brown; a large yellow spot medially on costal margin extending to median vein; two smaller yellow spots on costa before apex; a yellow space on outer

margin from above vein 4 to inner angle, widest toward apex. Secondaries roseate.

Expanse.—17 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8582, U.S.N.M.

Genus AUTOMOLIS Hübner.

AUTOMOLIS ALETERIA, new species.

Palpi pale greyish brown. Head, collar, and thorax white; a yellow spot on vertex; collar edged posteriorly with yellow; thorax shaded with roseate. Abdomen crimson above; subdorsal white spots; last segment white; ventrally white; wings white. Primaries somewhat opalescent; outer two-thirds of extreme costa brown, darkest on medial third; a short black streak at end of cell and close beyond, above, and below vein 3; a longer streak below vein 2; short streaks medially above and below submedian; a faint small greyish submarginal spot between veins 5 and 6. Secondaries white; the inner margin broadly roseate.

Expanse.—35 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8583, U.S.N.M.

AUTOMOLIS OCHREATA, new species.

Antennæ of male serrate and fasciculate. Palpi and frons grey. Vertex ochreous. Collar white, spotted with black anteriorly. Thorax ochreous; a white patch in front and behind spotted with black. Abdomen ochreous above; anal hairs white. Primaries ochreous; base above submedian white with three oblique black spots; a black spot on inner margin on the medial white area; a broad black outer band, edged with white and cut by white veins; a white streak toward end of cell and another below vein 2. Secondaries reddish orange; the costal margin broadly pale yellow. The patch of androconia on primaries underneath extends below cell above vein 2. On the hind wings veins 2 and 3 are shortly stalked; vein 5 nearer to 6 than 3.

Expanse.—Male, 27 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8584, U.S.N.M.

AUTOMOLIS ASTEROIDES, new species.

Head and thorax pale greyish brown; tegulae and patagia edged with white. Abdomen red above, white below; the last three segments above, and a subdorsal line, brown; a large whitish subdorsal basal spot. Primaries: the costal margin greyish white; apical and marginal space broadly above vein 3 semihyaline, crossed by dark veins; otherwise lilacine grey with darker mottlings; brown shades in

cell and on inner margin; two whitish points medially above submedian vein. Secondaries lilacine grey; the costal margin broadly whitish on basal half; a dark streak from base, below cell to outer margin, and a similar streak near inner margin.

Expanse.—28 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8585, U.S.N.M.

AUTOMOLIS PULVEROSA, new species.

Head and thorax grey. Palpi circled and tipped with white. White lines on head and collar. Collar and patagia dorsally fringed with white; patagia with a lateral pale yellow streak. Abdomen ochreous above, white underneath; a white line across next to last segment, white anal hairs. Primaries greyish brown; a greyish white shade along discocellular, and obliquely from middle of vein 2 to vein 4, and along it to margin; basal half of costa, base of median, basal half of submedian, base of vein 4, veins 5 and 6, spotted and streaked with white; ends of veins below 6, and fringe, white. Secondaries whitish yellow; costal margin white with a large brown patch of androconia; veins 3 and 5 from lower angle of cell; 6 and 7 coincident.

Expanse.—29 mm.

Habitat.—Geldersland, Surinam River, Dutch Guiana.

Type.—Cat. No. 8586, U.S.N.M.

AUTOMOLIS CARINOSA, new species.

Palpi pale grey streaked behind with black. Frons brown. Vertex and collar white, the latter irrorated dorsally with red. Thorax ochreous brown, the patagia tipped with red. Abdomen crimson above; subdorsal points, anus, and venter white. Primaries: the base obliquely from costa dark brownish grey cut by white veins; a crimson streak on inner margin; a white triangular medial space on which in and below cell is a large pale yellow spot; a broad dark brown grey fascia across end of cell, widening on margins, outwardly divided by white veins; the outer space pale yellow. Secondaries whitish broadly tinged with roseate above anal angle. The secondaries have costa evenly rounded; veins 6 and 8 stalked; 6 and 7 coincident.

Expanse.—35 mm.

Habitat.—Rio Janeiro, Brazil.

Type.—Cat. No. 8587, U.S.N.M.

AUTOMOLIS IRRUPTA, new species.

Palpi greyish brown in front, crimson behind. Head, collar, and thorax ochreous buff, spotted with red; patagia fringed and streaked with red; two white spots edged with brown posteriorly on thorax. Abdomen crimson above; the anal segments yellow; underneath

white. Primaries yellow; the costal margin dark lilacine; the veins edged with crimson, not reaching outer margin but meeting in curves; some greyish brown at base below median and submedian veins; the medial and outer space below cell and vein 2 divided by red lines into elongated yellow spots; discocellular crimson, surrounded by a grey space, inwardly limited by a dark line from subcostal vein to inner margin near the angle; an outer row of oval pale grey spots shaded toward base and outer margin with darker grey; a terminal red line and grey spots at ends of veins. Secondaries crimson; the costal margin whitish. Belongs to Section III A. b. a. of Hampson's Catalogue Lepidoptera Phalaenæ.

Expanse.—37 mm.

Habitat.—Rockstone, British Guiana.

Type.—Cat. No. 8588, U.S.N.M.

AUTOMOLIS FORMONA, new species.

Head and thorax yellowish brown; two black points posteriorly on the latter. Abdomen crimson above, dirty white underneath; anal hairs whitish. Primaries brownish yellow; the veins paler, reddish brown; dark specks and striae on costal margin; a blackish line from base of median vein to inner angle, where it is thicker, and expands towards vein 2; a crimson spot at base of inner margin; spots greyish partly edged with black; antemedial spots in and below cell; an irregular spot at end of cell; three spots beyond end of cell; postmedial spots outwardly dentate, larger and darker, divided only by the veins, and the spots between 5 and 6 extend to the submarginal spot; these are smaller, slightly lunular; terminal spots between the veins, alternately large and small. Secondaries crimson; the costal margin broadly whitish.

Expanse.—39 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Belongs to Section III A. a. b.

Type.—Cat. No. 8589, U.S.N.M.

AUTOMOLIS SULFUREA, new species.

Palpi, frons, legs, and pectus black; frons and coxæ shot with dark blue. Head and thorax pale sulphur yellow. Abdomen orange; a black and blue dorsal patch on last four segments. Primaries pale sulphur yellow; a brown spot at apex. Secondaries orange yellow; a black marginal spot from vein 2 to anal angle. Underneath the same.

Expanse.—40 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Belongs to the same section as *A. superba* Druce, and is closely allied to it.

Type.—Cat. No. 8590, U.S.N.M.

AUTOMOLIS CHRYSOPERA, new species.

Palpi yellow, whitish and grey in front. Head and thorax yellow streaked with crimson. Abdomen crimson above, white below; some dark subdorsal shades towards anus. Primaries dark grey, the veins partly streaked with crimson; apical third of costa, apex, and outer margin to vein 2 bright yellow separated from the dark portion by an irregular crimson line; terminal red spots on veins; a submarginal red spot from veins 6 to 8; antemedial yellow streaks edged with crimson on costa, in cell, on submedian, and below cell; a medial crimson spot above submedian and on inner margin. Secondaries black; the base roseate. Underneath the basal third of wings is roseate otherwise black, except the yellow space on primaries, which is as above.

Expanse.—24 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8591, U.S.N.M.

AUTOMOLIS NEIRA, new species.

Head and thorax black; front dark blue; an orange streak on tegulae and patagia. Pectus and legs dark brown; coxæ blue. Abdomen black; terminal blue dorsal spots; two rows of lateral blue spots. Primaries black; an orange streak from submedian near base to vein 5 and below it, but not reaching the outer margin; an oblique orange streak from subcostal at vein 7 to outer margin below vein 6. Secondaries black; an orange subcostal streak; in the male a thinly scaled space below the cell. Underneath the subcostal yellow streak on secondaries much more conspicuous.

Expanse.—Male, 36 mm.; female, 42 mm.

Habitat.—Rio Janeiro, Brazil.

Allied to *A. packardi* Butler.

Type.—Cat. No. 8592, U.S.N.M.

AUTOMOLIS ZONANA, new species.

Head black; some blue on frons. Collar and thorax black; a broad yellow band posteriorly on collar and on shoulders. Abdomen black; two basal segments dorsally and laterally orange; four terminal segments bluish black; underneath orange ventral spots. Primaries velvety black, markings sulphur yellow, an antemedial fascia, wider on inner margin than on costa; an irregularly curved fascia from costa beyond cell to outer margin below veins 5 and 6; a broad space on outer half of vein 2. Secondaries: basal half yellow tinged with orange; outer half black.

Expanse.—38 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Belongs to Section III, B. b. a'.

Type.—Cat. No. 8593, U.S.N.M.

AUTOMOLIS MOMA, new species.

Head and thorax black. Collar sulphur yellow. Abdomen black above, broadly dark orange before anal segment, also underneath to base. Primaries black; a very broad sulphur yellow space beyond base; an outer sulphur yellow broad fascia from costa to outer margin from vein 4 to below vein 3. Secondaries brownish yellow, outer margin broadly black.

Expanse.—Female, 40 mm.

Habitat.—Omai, British Guiana.

Antennæ serrate and fasciculate; secondaries without marginal fold; veins 6, 7, 8 stalked, 7 and 8 very shortly.

Type.—Cat. No. 8594, U.S.N.M.

AUTOMOLIS APICATA, new species.

Palpi and frons brown; vertex orange with a brown spot. Collar and thorax yellowish white, a broad brown dorsal streak. Abdomen brown black above; terminally, laterally, and ventrally orange. Pectus and legs brown; fore coxæ orange. Wings yellowish white; apex broadly brown, narrowing to a point just below 3; a brown streak along inner margin; a short brown streak above submedian. Secondaries: inner margin yellower with some black hairs.

Expanse.—Male, 31 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Belongs to the same group as *A. moma* Schaus.

Type.—Cat. No. 8595, U.S.N.M.

AUTOMOLIS CROCOPERA, new species.

Body black. Head and last two segments of abdomen orange; some dark blue shades on abdomen dorsally. Primaries very dark green, the veins black. Secondaries: the disc semihyaline white; the margins bluish black.

Expanse.—46 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. No. 8596, U.S.N.M.

AUTOMOLIS ALBIPLAGA, new species.

Pectus, legs, thorax and palpi dark grey. Head and base of fore coxæ orange. Abdomen dull blue black. Primaries dark greyish brown, the veins paler; a large round white spot beyond cell. Secondaries black; a diffuse whitish spot below cell.

Expanse.—31 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Secondaries with vein 8 from cell, 6 and 7 stalked.

Type.—Cat. No. 8597, U.S.N.M.

AUTOMOLIS POLYSTRIA, new species.

Body ochreous. Primaries ochreous, shaded with pale lilacine brown on costal margin, between veins 2 and 3, and at base of inner margin; discocellular shaded with black on either side; short black streaks at end of cell; longer streaks above cell; a black streak above vein 2 from cell to outer margin; short intervein outer streaks from costa to vein 3; short terminal black streaks above and below vein 5; also above and below submedian; a medial streak on inner margin. Secondaries yellowish.

Expanse.—32 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8598, U.S.N.M.

AUTOMOLIS BONORA, new species.

Orange yellow; four terminal segments of abdomen black, spotted with blue. Abdomen ventrally white, with transverse black lines; legs whitish, streaked with brown; fore coxæ whitish, edged with black; pectus with blue spots close to legs. Palpi black, fringed with white; lower portion of frons blue. Primaries: the apex narrowly edged with dark brown to vein 5. Secondaries: some black scales at end of vein 2 and at anal angle.

Expanse.—31 mm.

Habitat.—Cayenne, French Guiana.

Allied to *A. orbona* Schaus.

Type.—Cat. No. 8599, U.S.N.M.

AUTOMOLIS ILIODES, new species.

Palpi brown, spotted with buff at base. Head pale buff. Collar and thorax pale buff, irrorated with roseate, the tegulae and patagia edged with dark brown. Abdomen roseate above, buff underneath. Primaries buff, thinly irrorated with roseate; the veins streaked with roseate on buff portion; inner and outer margins from below vein 6 dark brown; a roseate streak at base of inner margin, followed by a small buff spot; three antemedial brown spots on costa with white points; a brown mark below the outer two from subcostal to brown inner margin, containing a white streak in cell; a brown spot at end of cell, bifurcating on costal margin; two large brown annuli, one medial, the other at end and lower portion of cell to vein 2; an oval brown annular spot from vein 4 to near vein 7, and a small brown annulus on costa above, followed by an oblique brown line to vein 5; a brown streak at apex. Secondaries white, tinged with roseate on inner margin.

Expanse.—39 mm.

Habitat.—Omai, British Guiana.

Allied to *A. ilus* Cramer.

Type.—Cat. No. 8600, U.S.N.M.

Genus HYPIDALIA Hampson.

HYPIDALIA SANGUIRENA, new species.

Head and thorax ochreous, two black spots on collar; patagia edged with red. Abdomen reddish; a dorsal row of black spots. Primaries ochreous; the veins vinous red; also a triangular line in cell resting on discocellular; an antemedial line, incurved towards base of inner margin; a geminate postmedial line, divided by a greyish line, incurved to antemedial line on inner margin; a subterminal wavy line; a streak below cell and vein 2; all the lines vinous red. Secondaries reddish.

Expanse.—47 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8601, U.S.N.M.

Genus MELESE Walker.

MELESE CASTRENA, new species.

Head and thorax light brown. Abdomen roseate above, pale brown underneath. Primaries light brown; a black point in cell; a black and red spot below median near base; a buff space on inner margin from nearer base to middle, containing crimson annuli; some red scales near cell between veins 2 and 3; a blackish spot on end of cell; a semihyaline spot below vein 6 and one above it, both edged with black; a roseate buff spot above on costal margin; the outer margin greyer. Secondaries pale roseate.

Expanse.—26 mm.

Habitat.—Castro, Parana, Brazil.

Very much like *M. asana* Druce, but the male antennæ are minutely serrate, with cilia.

Type.—Cat. No. 8602, U.S.N.M.

MELESE CHIRIQUENSIS, new species.

Palpi crimson, fringed with dark brown. Head and thorax brown. Abdomen crimson above, white underneath. Primaries brown, irrorated with dark brown scales; a white antemedial point on submedian; a small roseate spot below median nearer base; an irregular hyaline spot beyond cell from vein 5 to subcostal, broadest on vein 5; white and roseate spots on apical third of costa; fringe spotted with white. Secondaries: the base and inner margin roseate; otherwise blackish grey; a roseate postmedial spot on costa.

Expanse.—Male, 26 mm.

Habitat.—Chiriqui, Panama.

Allied to *M. babosa* Dognin, which has the hyaline spot extending below vein 5, and no roseate on secondaries, and is also of a greyer color. Of *M. babosa* I have 2 males and a female.

Type.—Cat. No. 8603, U.S.N.M.

Genus GLAUCOSTOLA Hampson.

GLAUCOSTOLA FLAVIDA, new species.

Head, legs, thorax, and primaries grey-brown; some yellow behind head; a dark yellow streak at base of inner margin; a darker oblique shade at end of cell. Abdomen and secondaries dark yellow. Underneath the primaries are tinged with yellow.

Expanse.—37 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8604, U.S.N.M.

GLAUCOSTOLA METAXANTHA, new species.

Palpi and legs dark brown grey. Head orange; a black spot on vertex. Collar orange; subdorsal and lateral blackish spots. Thorax blackish; the patagia inwardly edged with yellow. Abdomen orange; a black band across last segment. Primaries dark brown; pale streaks on costa, in cell, above inner margin, and above and below vein 2; an oblique white band beyond cell from subcostal to vein 3 near outer margin; an acute elongated white spot at base below cell. Secondaries: base and inner area yellow; outer portion from middle of costa and from beyond anal angle black.

Expanse.—34 mm.

Habitat.—Tuis, Costa Rica.

Type.—Cat. No. 8605, U.S.N.M.

GLAUCOSTOLA BINOTATA, new species.

Palpi, head, and collar dark grey; some yellow behind head, and posteriorly on tegulae. Abdomen yellow above; a subdorsal and a lateral black band; the last segment black, leaving anal hairs yellow. Primaries grey; a large whitish spot beyond cell from veins 4 to 6; a diffuse whitish spot below cell near base; the veins on outer half streaked with black. Secondaries yellow at base; the outer half black; underneath the primaries are darker than above.

Expanse.—26 mm.

Habitat.—Rockstone, Essequibo River, British Guiana.

Type.—Cat. No. 8606, U.S.N.M.

Genus HYPERTHÆMA Hampson.

HYPERTHÆMA RUBERRIMA, new species.

Body crimson. Abdomen with two lateral rows of black spots. Legs crimson; tibiae and tarsi black, the latter with broad white annuli; a black spot on tegulae. Primaries crimson; a black point at base of subcostal vein; a large round white antemedial spot below cell, and another beyond cell between veins 4 and 6, both circled with

black; fringe black. Secondaries white, the margins, except base of inner margin black. In the female, only the base of wing is white.

Expanse.—Male, 38 mm.; female, 37 mm.

Habitat.—Maroni River, French Guiana.

The male antennæ are serrate and ciliate; vein 10 is from angle of cell.

Type.—Cat. No. 8607, U.S.N.M.

HYPERTHÆMA COCCINATA, new species.

Body crimson. Palpi tipped with black; a black point on tegulæ; two lateral rows of black spots on abdomen. Legs crimson; tibiæ and tarsi brown. Primaries crimson; a black point at base; a round white antemedial spot below cell, and one beyond cell from veins 5 to 6 both circled with black; fringe brown. Secondaries: the base and a spot beyond cell white; otherwise black, thinly scaled; some red scales at base of inner margin.

Expanse.—Male, 31 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Antennæ pectinated; vein 10 is slightly stalked with 8.

Type.—Cat. No. 8608, U.S.N.M.

Genus PACHYDOTA Hampson.

PACHYDOTA DUCASA, new species.

Head and thorax dark brown; the vertex white. Abdomen yellow on first and last three segments; other segments black with lateral yellow spots; underneath dark brown. Legs brown; femora yellow. Primaries violaceous brown, with dark transverse fasciæ; the antemedial, medial, and postmedial fasciæ straight to inner margin, the last followed by an incurved fascia from costa to outer margin below vein 3, where it is joined by the subterminal; a shorter shade at apex. Secondaries white, the veins and margins suffused with violaceous brown.

Expanse.—57 mm.

Habitat.—Aroa, Venezuela.

Type.—Cat. No. 8609, U.S.N.M.

Genus DIALEUCIAS Hampson.

DIALEUCIAS VIOLASCENS, new species.

Head, thorax, and primaries violaceous brown. Abdomen and secondaries black-grey. Abdomen underneath yellowish buff. Primaries, a medial and a postmedial darker shade.

Expanse.—Female, 31 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8610, U.S.N.M.

Genus BARITIUS Walker.

BARITIUS HÆMORRHOIDES, new species.

Body black; three terminal segments of abdomen and anal hairs scarlet. Legs and coxæ black. Primaries leaden black; the veins black; a black basal space above submedian; a broad oblique black shade above end of cell from costa to above vein 3; a narrow shade from end of cell to inner margin. Secondaries white, the veins and outer margin black.

Expanse.—45 mm.

Habitat.—Cayenne, French Guiana.

Type.—Cat. No. 8611, U.S.N.M.

Genus ELYSIUS Walker.

ELYSIUS PHANTASMA, new species.

Palpi, frons, and legs dark greyish brown. Vertex, collar, and thorax lilacine fawn; large blackish spots on collar. Abdomen ochreous. Primaries lilacine fawn, palest at base and on costa; a pale shade at end of cell. Secondaries similar, somewhat thinly scaled, white at base; inner margin ochreous yellow.

Expanse.—34 mm.

Habitat.—Maroni River, French Guiana.

Type.—Cat. No. 8612, U.S.N.M.

Genus HALISIDOTA Hübner.

HALISIDOTA RACEMA, new species.

Palpi light brown, fringed with buff. Head and thorax light brown, streaked with buff. Abdomen ochreous above, luteous underneath. Primaries yellowish buff, with fine brown lunular marks between the veins, those on the outer half of wing more distinct; a large lilacine-brown space at end of cell, and a similar shade from it to apex; another narrower shade from submedian, near base, to outer margin between veins 2 and 3. Secondaries whitish; a marginal brown spot at apex; a submarginal brown spot between 5 and 6; a dark shade on and below vein 2; inner margin tinged with ochreous.

Expanse.—45 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8613, U.S.N.M.

HALISIDOTA MARONIENSIS, new species.

Antennæ long and deeply pectinated. Pale yellowish buff, the markings light brown. Primaries: ten spots on costa, the commencement of fine wavy lines, which are broken by the veins; a dark point at end of cell, and one on subterminal between veins 5 and 6; terminal dark

points between the veins. Distinguished from *H. texta* Herrich-Schaeffer by the longer pectinations of antennæ.

Expanse.—30 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8614, U.S.N.M.

HALISIDOTA APICEPUNCTATA, new species.

Primaries: Pale yellowish, darkest on costal margin and middle of inner margin; a few clusters of gray scales scattered over the wing; a dark yellow spot at origin of veins 3 to 5, circled with black; three oblique black spots from above vein 5 to apex. Secondaries: a broad subterminal brownish shade from vein 3 to anal angle.

Expanse.—37 mm.

Habitat.—Carabaya, Peru.

Type.—Cat. No. 8615, U.S.N.M.

Genus NERITOS Walker.

NERITOS CARMEN, new species.

Palpi crimson streaked with brown and yellow. Head and collar yellow edged with crimson. Thorax dark grey; a subdorsal crimson spot. Abdomen roseate above, buff underneath. Primaries dark violaceous gray; an antemedial yellow transverse band edged with crimson; a triangular yellow space on costa beyond to vein 3 also edged with crimson; an irregular yellow space on outer margin inwardly edged with crimson; the crimson borders meeting on costal margin. Secondaries pale roseate, thickly irrorated with black on outer half; the fringe from vein 2 to anal angle black.

Expanse.—28 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8616, U.S.N.M.

NERITOS COCCINEA, new species.

Palpi buff; a crimson line behind. Head yellow; a red line in front and behind. Collar pale yellow, red in front. Thorax red, narrowly yellow at collar. Abdomen red above, buff underneath. Primaries red; a wavy yellow antemedial band from below costa to inner margin; a broad yellow fascia from middle of costa to vein 3, constricted at its middle, edged with black, which extends along costa to base; a narrow yellow space on outer margin from apex to vein 6, and a wider space below vein 5 narrowing to vein 2; a black line borders the red space along outer margin. Secondaries black; inner margin and base narrowly yellow. Underneath, dark brown replaces the red, except under lobed costa of secondaries.

Expanse.—24 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8617, U.S.N.M.

NERITOS GAUDIALIS, new species.

Palpi crimson fringed with brown. Head ochreous; a red line behind. Collar and thorax brown. Abdomen reddish ochreous above, buff underneath; tibiæ and tarsi red. Primaries greyish brown; a yellow spot occupying second third of costa to vein 2, its margin wavy, edged with crimson which extends as a subcostal line to base, and along costa around apex and outer margin, incurved at vein 4 to inner angle, edging a terminal yellow space. Secondaries reddish ochreous. Underneath primaries pale yellow, costal margin crimson, a broad submarginal crimson band, reaching margin at inner angle and above vein 4; a black spot at angle; a large apical black spot. Secondaries with the costal margin broadly crimson.

Expanse.—30 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8618, U.S.N.M.

NERITOS TREMULA, new species.

Palpi roseate fringed with pale brown. Head and thorax light brown; crimson streaks on head, collar posteriorly, and on patagia. Abdomen roseate above, yellowish white underneath; a white subdorsal basal spot. Primaries roseate brown, mottled with brown striae and interrupted lines; a medial space on costa to cell posteriorly, finely edged with crimson, this space pale yellow on costal margin, semihyaline white in cell; a small pale yellow spot at apex; an irregular white space on outer margin from below vein 5 to near inner angle, containing a brown spot between veins 3 and 4. Secondaries roseate.

Male without fovea; veins 10 and 11 stalked.

Expanse.—32 mm.

Habitat.—Cayenne, French Guiana.

Type.—Cat. No. 8619, U.S.N.M.

NERITOS MACULOSA, new species.

Head and thorax dark grey; back of head yellow. Abdomen yellow. Primaries whitish grey with dark grey streaks; short streaks at base; a streak at end of, and below fovea; a streak on middle of inner margin; long streaks on costa beyond the basal fourth; two at end of cell; broad long streaks between the veins; leaving the outer margin broadly pale, with dark streaks on the veins. Secondaries yellowish, darker on inner margin; the disk irrorated with black. The secondaries are short and broad.

Expanse.—30 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8620, U.S.N.M.

NERITOS CHRYSOZONA, new species.

Palpi blackish, yellow in front. Head yellow; a black spot on frons and on vertex. Collar yellow, spotted with black. Thorax and abdomen black above; abdomen ventrally grey. Primaries brown black; the veins paler; a broad yellow band from middle of costal margin to inner margin before angle. Secondaries black, a broad yellow streak from base to near outer margin on vein 2.

Expanse.—25 mm.

Habitat.—Maroni River, French Guiana.

Type.—Cat. No. 8621, U.S.N.M.

NERITOS PROPHÆA, new species.

Palpi and head mottled light and dark brown; some crimson on head behind. Thorax dark violaceous brown. Abdomen above red; the last three segments brown. Primaries brown, darkest at base. Secondaries brown, irrorated thinly with blue black; inner margin broadly orange red.

Expanse.—27 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8622, U.S.N.M.

NERITOS SANGUIDORSIA, new species.

Head and thorax crimson. Abdomen blue-black above. Wings black; a crimson spot at base of primaries. Underneath lilacine brown.

Expanse.—19 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8623, U.S.N.M.

Genus **AEMILIA** Kirby.**AEMILIA MELANCHRA**, new species.

Body dark brown; a whitish spot on vertex, and a similar subdorsal spot on abdomen at base. Primaries dark brown, irrorated with still darker striae; a large space at end of cell, the outer margin broadly from vein 7, and inner margin narrowly violaceous black. Secondaries dirty white, the margins shaded with brown. Underneath: primaries brown; some white at base; a black shade at end of cell. Secondaries whiter than above; the costal margin broadly brown, the outer margin narrowly so.

Expanse.—38 mm.

Habitat.—Carabaya, Peru.

Type.—Cat. No. 8624, U.S.N.M.

Genus *HYPOMOLIS* Hampson.*HYPOMOLIS MINCA*, new species.

Veins 7 and 8 of fore wings coincident; otherwise falls in *Hypomolis*. Black, the body and hind wings with a dark blue reflection. Fore wings grey black.

Expanse.—30 mm.

Habitat.—Oaxaca, Mexico.

Type.—Cat. No. 8625, U.S.N.M.

Genus *TESSELLOTA* Hampson.*TESSELLOTA APOSTATA*, new species.

Veins 8 and 9 of fore wings coincident; proboscis aborted but visible, once coiled—in these characters differing generically from *Tesselota*; a new genus may be proposed later. Black; two spots on back of head, collar, last abdominal segment and slight lateral spots on the two preceding segments orange yellow. Legs and the lengthily bipectinated antennae black. Fore wings semidiaphanous black, thinly scaled, brownish tinted; hind wings black, nearly opaque.

Expanse.—29 mm.

Habitat.—Castro, Parana, Brazil.

Type.—Cat. No. 8626, U.S.N.M.

Genus *PARANERITA* Hampson.*PARANERITA CARMINATA*, new species.

Body crimson above; yellowish white underneath; a subdorsal yellow spot at base of abdomen. Primaries crimson; a yellow streak at base of inner margin; an oblique, narrow yellow band from middle of costa to outer margin at vein 2; above this the fringe is yellow. Secondaries roseate.

Expanse.—26 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8627, U.S.N.M.

PARANERITA COMPLICATA, new species.

Palpi red, dark grey in front. Frons buff and brown. Vertex red with a yellow spot. Collar red with two yellow spots. Thorax lilacine grey; a red streak on patagia. Abdomen crimson above, yellowish underneath; anal hairs yellow. Primaries dark grey; three yellow spots at base broadly edged with crimson; a similar small spot medially on inner margin; a large semihyaline spot medially from costal margin, extending to vein 3, irregular, edged with crimson, and containing a crimson point at origin of vein 6; a postmedial row of

dull roseate spots, the largest between veins 6 and 7; irregular marginal yellow blotches, edged with crimson, one at veins 6 to 7, the other from vein 5 to near angle, containing crimson spots at ends of veins 3, 4, and 6. Secondaries roseate, the fringe yellow.

Expanse.—26 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8628, U.S.N.M.

Genus HYPONERITA Hampson.

HYPONERITA INTERNA, new species.

Head and thorax dark grey; palpi white at base; a small red streak at tips of patagia. Abdomen roseate above, white underneath. Primaries dark lilacine grey; a broad pale yellow fascia from costa to outer margin to vein 2 and above vein 4, where it continues narrowly to apex; a reddish line edges the grey portion and the apical spot; below cell to base and middle of inner margin a large darker yellow spot, irrorated with red. Secondaries semihyaline pale yellow, the margins irregularly roseate.

Expanse.—Female, 32 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8629, U.S.N.M.

HYPONERITA LUCENS, new species.

Palpi red, spotted with brown. Head and thorax lilacine brown. Abdomen ochreous above, white underneath; a subdorsal white basal spot. Primaries lilacine brown; a broad space from costa to outer margin at veins 2 to 4, pale yellow on costal margin, opalescent semihyaline below subcostal; some black scales at end of fovea and from outer end of fovea to inner margin. Secondaries yellowish white, semihyaline; some lilacine brown on costal margin; some blackish hairs on inner margin.

Expanse.—28 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8630, U.S.N.M.

HYPONERITA FURVA, new species.

Body brown above, yellowish underneath; some crimson behind palpi at base. Primaries dark brown; a pale yellow, narrow space on outer margin from just above vein 4, to near angle, widest anteriorly. Secondaries dark brown; the costal margin broadly yellow, the inner margin narrowly so.

Expanse.—25 mm.

Habitat.—Geldersland, Surinam River, Dutch Guiana.

Type.—Cat. No. 8631, U.S.N.M.

HYPONERITA CARINARIA, new species.

Body violaceous red above, yellow underneath; a yellow spot on vertex; a yellow transverse line at base of abdomen. Primaries violaceous red; an antemedial yellow spot on costa reaching median, finely edged with crimson; a similar smaller postmedial spot not extending below the subcostal; the outer margin below vein 7 yellow-edged by a crimson line forming three outward curves close to margin from vein 7 to vein 4, where it forms an inward angle just below 5 and is wavyly perpendicular to inner angle. Secondaries yellow. In the female the secondaries are roseate; the inner margin broadly tinged with yellow.

Expanse.—Male, 27 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8632, U.S.N.M.

HYPONERITA DECLIVIS, new species.

Palpi yellowish; a fine crimson streak behind. Frons, collar, and thorax lilacine brown. Vertex yellow with some crimson scales anteriorly and posteriorly. Abdomen lilacine brown above, yellow underneath; some crimson subdorsally at base. Primaries lilacine brown, an elongated yellow spot on costa from near base to middle, extending to median; a smaller postmedial spot, and a still smaller spot near apex; the outer margin below vein 7 yellow, widening just below vein 5; all the yellow markings finely edged with red. Secondaries yellow. In the female the secondaries are yellow on costal margin and at base, otherwise blackish brown; there is also a small crimson spot medially on submedian vein.

Expanse.—24 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8633, U.S.N.M.

HYPONERITA INCERTA, new species.

Palpi roseate fringed with grey. Body violaceous brown above, yellow underneath; some crimson at base of abdomen, also laterally and on last segment. Primaries violaceous brown; markings yellow, finely edged with crimson; a large costal spot from near base to middle not reaching the median vein; the postmedial spot smaller and the spot before apex very small; the outer half of costa salmon color; the outer margin below vein 7 yellow, widest just above vein 4; antemedial and postmedial upright crimson lines above the inner margin. Secondaries roseate.

What I consider the female of this species has the secondaries black; no red above inner margin of primaries, and only a red subdorsal spot at base of abdomen.

Expanse.—Male, 26 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8634, U.S.N.M.

Family NOTODONTIDÆ.

Genus CALLEDEMA Butler.

CALLEDEMA ARGENTA, new species.

Palpi brown, whitish in front. Head brown with whitish tufts at base of antennæ. Collar olivaceous brown; thorax with whitish and violaceous hairs. Abdomen brown above, fawn colour below; legs streaked with violaceous brown. Primaries violaceous brown, the veins on median space paler; an indistinct, wavy, pale, basal line; an antemedial olivaceous line across cell, not reaching inner margin, broadly bordered with silvery white which is finely toothed towards base, and outwardly prolonged along vein 6 to submarginal line; a broad silvery yellow streak from end of cell to submarginal line, enclosing there a small brown spot; a geminate wavy darker outer line, not visible on silvery streak; a submarginal white line, inwardly curved below costa, outwardly curved from vein 5 to inner angle, and edged outwardly above vein 4 by yellow, which broadens near costa to apex, and is interrupted by a dark line; oblique yellowish lines from this space to outer margin at veins 2, 3, and 4; veins on outer margin whitish. Secondaries violaceous brown. Underneath paler violaceous brown, the outer margin of primaries broadly whitish mottled with brown, and with marginal black lunules; two black points at apex; secondaries whitish at apex, fringe whitish.

Expanse.—43 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8635, U.S.N.M.

CALLEDEMA AREMA, new species.

Head and thorax reddish brown; patagia violaceous-grey. Abdomen brown with fawn color hairs at base. Primaries violaceous brown; the costa tinged with reddish; the inner margin lilacine brown; veins 2, 3 and 4 speckled with grey and black; a silvery yellow antemedial spot below cell, crossed by a dark line, and followed by some raised dark brown scales; a white transverse line in cell; a dark brown spot at end of cell, followed by a silvery white line between veins 4 and 5 and containing a brown spot, where it joins the submarginal yellowish band, which is curved from costa and apex to vein 4, inwardly edged by a white line which continues to inner angle; a pale brown line on the submarginal band, partly followed by a dark brown line from just above vein 6 to vein 4; fine oblique marginal lines below

vein 4 and vein 3. Secondaries violaceous brown, some white at base.

Expanse.—29 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8636, U.S.N.M.

CALLEDEMA SURA, new species.

Palpi brown, white in front. Head brown; tegulae fawn color; thorax grey brown. Abdomen light brown above, whitish below. Primaries brown; the costa tinged with reddish fawn; the inner margin tinged with lilacine fawn; the cell and a shade beyond, dark brown; a broad whitish space near base, not reaching either margin, crossed by a greenish yellow line; a whitish transverse streak in cell; a silvery white line along vein 5 from just beyond cell to a large submarginal white band which extends from costa at apex to vein 4, this space being crossed by a grey and yellowish line; a whitish submarginal line below vein 4 to inner angled, followed by two oblique white lines below veins 4 and 3. Secondaries whitish, thickly irrorated with violaceous brown scales.

Expanse.—26 mm.

Habitat.—Castro, Parana, Brazil.

Type.—Cat. No. 8637, U.S.N.M.

Genus PRONERICE Schaus.

PRONERICE (?) CYMANTIS, new species.

Head and collar reddish brown. Thorax lilacine brown. Abdomen black above, luteous underneath. Primaries brown, shaded with black, irrorated with grey scales, except on outer margin; a black point in cell; discocellular velvety black; a postmedial row of black points on veins, preceded and followed by light brown shades on veins; terminal black spots between the veins; fringe black, spotted with brown at ends of veins. Secondaries dark brown, almost black on outer margin.

Expanse.—38 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

This species agrees with *Pronerice*, but has pectinated instead of fasciculate antennae.

Type.—Cat. No. 8638, U.S.N.M.

Genus DYASIA, new genus.

Antennae of male fasciculate. Palpi short, hairy, third joint minute, concealed. Wings short and broad. Primaries: vein 5 from upper angle of cell; 6 from middle of areole; 7 and 8 from end of areole; 10 from before end; 3 and 4 close together from lower angle of cell. Secondaries: 3 and 4 from a point; 6 and 7 stalked; vein 8 anastomosing with 7 beyond base, and diverging at middle of cell.

DYASIA VIVIANA, new species.

Body light brown. Primaries; basal third whitish, limited by a black line slightly curved; some light brown irrorations on this space, and a subbasal row of black points; median space brown and buff; a creamy space at end of cell containing a kidney shaped brown line; a deeply angular steel grey line, containing buff and brown V-shaped spots, and followed by a brown dentate interrupted line and creamy spots on veins; outer margin lilacine; a submarginal row of velvety brown spots, largest subapically; a marginal brown line, slightly wavy. Secondaries white; a terminal brown line; some dark hairs along inner margin.

Expanse.—27 mm.

Habitat.—Maroni River, French Guiana.

In some specimens the entire wing beyond basal third is dark lilacine grey.

Type.—Cat. No. 8639, U.S.N.M.

Genus NYSTALEA Guenée.

NYSTALEA PORGANA, new species.

Body brown above slightly tinged with reddish; underneath pale buff. Primaries brown, the veins speckled with dark brown and grey, and some similar irrorations in cell; veins 4, 5, and 6 shaded above and below with very dark brown; indistinct geminate basal, median, and outer lines; submarginal fine oblique lines below veins 2, 3, and 4; a double row of marginal velvety brown points above and below veins; a large olivaceous brown spot on costa close to apex, partly edged with white and buff, and containing a black streak. Secondaries light brown at base; outer margin broadly dark brown; fringe buff at base, terminally white.

Expanse.—63 mm.

Habitat.—St. Laurent, French Guiana; also British Guiana.

This species comes nearest to *N. balea* Cramer.

Type.—Cat. No. 8640, U.S.N.M.

NYSTALEA SEQUORA, new species.

Body grey above; the palpi, head, and tegulae shaded with brown; abdomen with pale buff lateral tufts. Primaries grey; a black spot at base of median, followed by a fine geminate black line, hardly visible on inner margin; some very fine and indistinct medial lines; a black streak on costa, and one crossing base of vein 2, preceded and followed by finer black lines; a transverse darker grey spot at end of cell, partly edged with velvety black; three postmedial transverse lines preceded by some dark lunules and spots below vein 4, and followed by a black line between veins 4 and 8, and dark brown spots

below veins 3 and 2; an irregular outer row of dark steel grey spots between veins 3 and 8; an irregular submarginal, fine, velvety black line, followed by dark steel grey marginal spots; fringe dark with buff spots at tips of veins. Secondaries brownish white at base, becoming dark brown on outer margin; fringe whitish.

Expanse.—54 mm.

Habitat.—Rockstone, British Guiana.

Type.—Cat. No. 8641, U.S.N.M.

NYSTALEA MARONA, new species.

Body dark brownish grey; a blackish subdorsal spot at base of abdomen. Primaries light brown irrorated with darker brown, black, and grey, so that all the markings are very indistinct; blackish streaks at base below costa and on inner margin; faint brownish geminate transverse, basal, medial, and postmedial lines; a fine velvety geminate line at end of cell, united above; the postmedial line black between the veins; a thick outer lunular black line, widest at vein 5; a fine submarginal black velvety line, partly shaded with grey outwardly and followed by marginal blackish shades, chiefly above vein 4; fringe blackish spotted with light brown. Secondaries pale at base, the outer margin broadly dark brown; the fringe whitish.

Expanse.—51 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8642, U.S.N.M.

Genus HEORTA Walker.

HEORTA CAREMA, new species.

Palpi brown. Frons buff. Vertex and collar reddish brown mottled with lilacine. Abdomen dark brown, grey above, luteous underneath. Primaries: costal margin olive brown spotted with dark brown, cell and a little below it buff; three dark points in cell; basal half of inner margin green; a basal white streak below cell; a geminate velvety brown line crossing cell before and to just below vein 2, where it is joined by a similar postmedial line from vein 7; the triangular space formed by these lines mottled brown, lilacine, green, and white, with two dark brown spots on vein 6; an irregular black subterminal shade, outwardly mottled with white; some marginal white shadings below vein 5. Secondaries dark brown.

Expanse.—27 mm.

Habitat.—Cayenne, French Guiana.

Type.—Cat. No. 8643, U.S.N.M.

Genus BARDAXIMA Walker.

The type of this genus is *lucilinea* Walker. *Longara* Stoll refers to some other species which I have not yet identified.

Genus ELYMIOTIS Walker.

I now have both sexes of *E. purpurascens* Butler, which must be separated from *E. attenuata* Walker.

Genus CTIANOPHA Schaus.

CTIANOPHA ARGENTILINEA, new species.

Palpi mottled grey and pale green. Head and thorax dark fawn color, some white and red scales on vertex. Abdomen light reddish brown above. Body below pale fawn color. Primaries dark fawn color, irrorated with brown; the costal margin, outer half of cell, and an antemedial spot above submedian tinged with green; traces of fine basal, antemedial, postmedial, and outer dark lines; a streak on median from before vein 2 to discocellular, also discocellular silver white; a submarginal row of black spots from vein 3 to apex; marginal transverse brown lines between the veins. Secondaries pale at base, dark reddish brown on outer margin; a black spot divided by a white line above anal angle; some dark fawn-color scales at angle.

Expanse.—32 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8644, U.S.N.M.

CTIANOPHA SERENA, new species.

Palpi grey. Head and collar white, the vertex and tegulae irrorated with reddish brown. Thorax mottled grey and brown. Abdomen light reddish brown above, the terminal segments fawn color. Primaries lilacine grey; the costal margin, a large spot at end of cell, and an antemedial spot above inner margin greenish; the discocellular finely brown, narrowly edged with white outwardly, with yellow inwardly; lines very indistinct, consisting of dark irrorations; small submarginal black spots from vein 3 to apex, preceded above veins 3 and 4 by a reddish brown spot. Secondaries similar to *C. argentilinea* Schaus.

Expanse.—32 mm.

Habitat.—Rockstone, British Guiana.

Type.—Cat. No. 8645, U.S.N.M.

Genus PROELYMIOTIS Schaus.

PROELYMIOTIS JOANNA, new species.

Palpi grey. Head, collar, and thorax dorsally reddish brown, laterally grey. Abdomen dark grey, a reddish subdorsal spot at base, and laterally white hairs. Primaries grey, shaded with pale buff in and beyond cell; the inner and outer margins broadly pale brown; a dark medial spot on costa, preceded by a dark point; faint traces of geminate

basal and medial lines; the postmedial line fine, geminate, dark brown, filled in with light brown; a large grey spot at apex; a large grey marginal space between veins 2 and 4; a minute grey spot at inner angle; a submarginal black line on the brown portions. Secondaries pale at base, shading to dark violaceous brown on outer margin; fringe yellowish.

Expanse.—47 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8646, U.S.N.M.

Genus PSEUDANTIORA Kirby.

PSEUDANTIORA RUFESCENS, new species.

Head and collar reddish brown. Thorax light grey^o. Abdomen dark grey above, fawn color below. Primaries: the apical half of costa and outer margin light grey, otherwise light reddish brown, the inner margin shaded with grey; a whitish line from cell along and below vein 5 separates the two colors. A black point at end of cell; a dark median spot below cell; indistinct traces of reddish brown basal, medial, postmedial, and outer lines, the latter preceded on costa by a large reddish brown spot; a whitish submarginal wavy line; a reddish brown marginal spot above vein 3. Secondaries brown, the fringe whitish. Underneath reddish brown with broad whitish margins.

Expanse.—48 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8647, U.S.N.M.

Genus MARTHULA Walker.

MARTHULA GRISESCENS, new species.

Head and palpi reddish brown. Thorax and tegulae dark velvety brown; patagia pale grey. Abdomen blackish grey above, becoming paler on last segments; underneath grey, the last two segments dark brown. Primaries lilacine grey, irrorated with black and shaded with brown on costal half of wing; a basal pale line on costa, not entering cell, shaded with dark brown, followed closely by a geminate brown line from subcostal to submedian; an antemedial V-shaped line in and below cell, surmounted by some pale reddish brown spots on costa, and followed by a pale line outwardly, edged with brown from just below subcostal to inner margin; a large indistinct brown spot at end of cell, preceded by a black point on subcostal; a velvety blackish space medially on inner margin; the postmedial pale line inwardly edged with dark brown from subcostal to inner margin, surmounted on costa by some light reddish brown spots; a pale submarginal line from vein 8 to inner margin; two marginal rows of black lunular

spots between the veins. Secondaries white; the tips of veins and outer margin narrowly brown; fringe whitish.

Expanse.—40 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8648, U.S.N.M.

MARTHULA CASTRENSIS, new species.

Palpi and head ochreous brown; a black line behind head; collar and thorax dark reddish brown; tegulae lilacine brown. Abdomen dark brown above, luteous underneath; the anal tuft dark violaceous brown. Primaries brown, slightly reddish on costa, shaded with lilacine below cell; black spots on basal half of costal margin; some black irrorations in and below cell; a round black spot anteriorly in cell before end; a large spot vaguely outlined with black at end of cell; three lilacine lines partly bordered by black irrorations from cell, one before vein 2, one at vein 2, starting in cell, and the third from base of vein 3; an outer lilacine line inwardly shaded with ochreous brown from costa near apex to just beyond middle of inner margin; beyond this line the outer margin is partly tinged with lilacine and slightly irrorated with black; a submarginal and a marginal row of black spots between the veins. Secondaries white, a terminal light golden brown shade.

Expanse.—31 mm.

Habitat.—Castro, Parana, Brazil.

This type specimen was figured^a as *M. quadrata* Walker, but is quite distinct from that species.

Type.—Cat. No. 8649, U.S.N.M.

MARTHULA HIRSUTA, new species.

Palpi, head, and thorax reddish brown. Collar and patagia lilacine brown. Abdomen dark reddish brown above, whitish underneath, with long tufts below and laterally on anal segments of violaceous black hairs. Primaries lilacine brown; a broad reddish brown shade from middle of costa to outer margin above vein 3; a blackish brown shade separates it from the lilacine portion below; the lines oblique, pale, inwardly shaded with brown; the basal line from median to submedian veins, the antemedial line from just above median to inner margin, the postmedial from costa, curved around cell, very indistinct above vein 3, and followed by a finer line parallel to it; the outer line from costa; a submarginal row of black points between the veins. Secondaries smoky white; the veins brown; the costal and outer margins shaded with brown; the inner margin broadly blackish.

Expanse.—34 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8650, U.S.N.M.

^a Trans. Ent. Soc., 1901, pl. xi, fig. 2.

MARTHULA MINNA, new species.

Palpi, head, and collar bright orange red. Thorax and abdomen above dark brownish grey; abdomen below cream white, the last two segments dark grey. Primaries: the costal half of the wing bright reddish brown; the inner margin dark brownish grey; a lilacine grey space between cell and submedian vein; lines fawn color; the antemedial line outwardly curved, very indistinct on costa, followed by a round black spot in cell; two round black spots at end of cell, one above the other; the postmedial line curved beyond cell, the submarginal from vein 5 to inner margin; from vein 5 to costa a dark shade; a marginal row of black spots between the veins. Secondaries blackish brown; the fringe tipped with white.

Expanse.—24 mm.

Habitat.—St. Laurent, French Guiana.

This is the smallest species of the genus as yet known.

Type.—Cat. No. 8651, U.S.N.M.

Genus ANTIOPHA Schaus.

ANTIOPHA ALBOLINEA, new species.

Palpi dark brown fringed with fawn color. Head and thorax mottled lilacine brown and fawn color; patagia with a black streak. Abdomen light brown with basal and lateral fawn color tufts. Primaries: costal and inner margins broadly light lilacine brown, the intermediate space dark brown mottled with olivaceous and lilacine brown with dark longitudinal lines; traces of an antemedial pale line; a row of submarginal and marginal black spots, the latter somewhat connected by blackish scales; a whitish line from middle of cell to half the length of vein 6, posteriorly thickened at vein 5. Secondaries brownish, somewhat thinly scaled. Underneath the primaries are brownish, the secondaries yellowish white.

Expanse.—47 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8652, U.S.N.M.

Genus ERAGISA Walker.

ERAGISA BOGRA, new species.

Palpi dark brown fringed with fawn color. Head and thorax reddish brown; dark steel shades on tegulae and patagia. Abdomen dark grey brown; some luteous tufts at base; underneath luteous. Primaries dark brown with paler brown transverse lines on costa and outer margin; a broad basal blackish band; a dark brown shade beneath median vein; three fine postmedial black lines, interrupted and indistinct; a round black spot above vein 3 and another below it; a pale

brown space cut by black lines at end of cell; a marginal row of black spots between the veins; fringe dark streaked with lighter brown at ends of veins. Secondaries blackish brown; some paler hairs at base; a white and black spot at anal angle; fringe yellow except at angles. Underneath dull greyish black; the outer margins pale fawn color; the secondaries with long pale fawn color scales.

Expanse.—40 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8653, U.S.N.M.

Genus CRINODES Herrich-Schaeffer.

Hübner^a figures two species as *besckei*; fig. 1, the male is the same as *dissimilis* Grote; fig. 2, the female is the species I described as *striolata*. *Besckei* Hübner, male, is figured as "*C. ritsemæ* Butler."^b *Crinodes abscondes* Druce (not Walker), figured on the same plate, fig. 5, is the true *C. ritsemæ* Butler.

Genus PORESTA Schaus.

PORESTA SERICEA, new species.

Palpi, head and tuft dark grey. Collar and thorax reddish brown, the patagia lilacine brown. Abdomen reddish brown above with pale transverse lines on segments posteriorly; laterally and underneath grey. Primaries silky lilacine brown; the costal margin dark brown, broadly at base, narrowly towards apex; a pale lilacine streak irrorated with reddish brown from base along submedian vein to outer angle; the inner margin below this dark grey; from below apex to middle of submedian vein, a reddish brown line outwardly shaded with dark brown, inwardly with pale buff; a somewhat triangular black line occupying the entire end of cell; a marginal row of small black lunular spots partly shaded with white; a terminal reddish brown line; fringe dark brown. Secondaries dark blackish brown, somewhat luteous at base, fringe whitish.

Expanse.—43 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Allied to *P. thermesia* Felder and *P. flocciferus* Möschler. I have specimens of the latter species agreeing perfectly with the description, but as Möschler's diagnosis of the genus *Strophocerus* is evidently wrong, I do not use his generic term for the genus.

Type.—Cat. No. 8654, U.S.N.M.

PORESTA OLIVESCENS, new species.

Palpi dark brown. Head and thorax mottled white and green. Abdomen brown above, terminally grey, underneath luteous. Pri-

^aSamml. Ex. Schmett., II.

^bBiologica Cent.-Am., II, pl. xcii, fig. 4.

maries: costa brown with a green streak from base to apex; a snow white space from before end of cell to submarginal line. This space is irrorated with brown and green scales along the costal margin, but posteriorly it is pure white, edged by a fine black line, which runs straight to above middle of vein 3, is there rounded and curves obliquely to submarginal line at vein 6; beyond and below this white mark the wing is dark green; the base below cell and inner margin rather broadly pale grey, irrorated with darker grey scales; traces of an antemedial black irregular line; the submarginal line fine, black, outwardly lunular; a similar terminal line; fringe dark green, grey at inner angle. Secondaries reddish brown at base, becoming violaceous brown on outer half; fringe brown, tipped with white. Underneath the primaries dark brown; a pale subcostal streak and another on inner margin; the outer margin and apex pale green, with submarginal black points between the veins and paired black spots at end of veins.

Expanse.—35 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Allied to *P. mumetes* Cramer, which should be placed in this genus.

Type.—Cat. No. 8655, U.S.N.M.

Genus LEPASTA Möschler.

LEPASTA MAONICA, new species.

Palpi, head and patagia lilacine brown. Tegulae and thorax dark velvety brown. Abdomen violaceous brown above, paler below. Primaries reddish brown; the veins streaked with black, edged above and below with dark lilacine; the outer margin lilacine irrorated with grey and brown and crossed by a velvety black line slightly dentate between the veins; a dark shade precedes the paler outer margin, curving from costa to inner margin near base; five white points on costa from middle to apex; a short white streak above inner margin on its outer half; an indistinct oblique dark antemedial and postmedial shade on costa; some yellowish green scaling on outer margin below vein 3. Secondaries dark brown, the fringe mottled with yellow.

Expanse.—39 mm.

Habitat.—St. Jean, Maroni River, French Guiana; Rockstone, Essequibo River, British Guiana.

Allied to *L. mixta* Möschler (*calophasioides* Kaye), but much darker altogether.

Type.—Cat. No. 8656, U.S.N.M.

LEPASTA MALTHA, new species.

Palpi reddish brown, mottled in front with white. Head, tuft and thorax mottled with white, grey, and olivaceous; the patagia outwardly dark brown. Abdomen light brown above, luteous under-

neath; anal segment mottled with grey. Primaries: the costal margin dark olivaceous brown, broadly from base to middle, then finely to apex, interrupted by yellow streaks; a snow white spot on costa at base; an irregular dark olivaceous brown space from cell near base, widening at end of cell, where it is preceded by a white spot in cell, and followed by another snow white spot between 4 and 5, not extending beyond a transverse postmedial yellowish line; posteriorly the dark space is slightly toothed below cell, then oblique to vein 2 and postmedial line where the latter has a dark spot on either side; the dark shade extends below vein 3 to outer margin; inner margin greyish white, irrorated thinly with pale brown; a dark triangular spot just before middle of inner margin; a whitish triangular space irrorated with brown before postmedial line below costa; the outer space pale olivaceous brown shaded with lilacine grey; a submarginal dentate black line; faint traces of a similar marginal line. Secondaries reddish brown, darkest on outer margin.

Expanse.—33 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8657, U.S.N.M.

LEPASTA VIRIDIS, new species.

Palpi brown, fringed and tipped with lilacine. Head and thorax moss green. Abdomen light brown; anal tuft green. Primaries bright moss green; a broad dark grey streak on costal margin near base; four white points on costa beyond middle; a dark grey shade from costa near apex, where it is very narrow, curving to just below vein 2, where it is very broad, and is joined between 2 and 3 by a dark green and grey spot extending from middle of cell; a whitish shade at cell and vein 3; some white spots after the grey postmedial shade, chiefly toward costa; the outer margin below vein 7 dark grey, spotted with green; fringe mottled brown and green. Secondaries violaceous brown, pale at base and on costa, dark on outer margin.

Expanse.—33 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8658, U.S.N.M.

Genus TACHUDA Schaus.

TACHUDA ANGUSTIPENNIS, new species.

Male.—Head and collar buff, mottled with brown. Thorax and abdomen above dark steel grey, the latter luteous underneath and with lateral pale tufts at base. Primaries mottled grey and moss green, with a dark brownish shade from cell to apex, and sometimes along the inner margin; subbasal and median geminate blackish lines; a postmedial geminate brownish line, closely followed by another geminate line, all these lines sometimes almost obsolete; a black streak at end

of cell and a small white spot on discocellular posteriorly; submarginal dark steel grey blotches above vein 6, between 5 and 4 and above submedian; a marginal row of dark spots; a white spot at apex. Secondaries dirty white; the outer margin broadly black-brown; the fringe luteous. Distinguished from allied species by the narrow fore wings and whitish hind wings in the male.

Expanse.—32 mm.

Habitat.—Maroni River, French Guiana.

Type.—Cat. No. 8659, U.S.N.M.

TACHUDA DISCRETA, new species.

Head and collar varying from buff to dark brown. Thorax and abdomen dark greyish brown. Primaries greyish brown, thinly irrorated with black; traces of geminate subbasal and medial lines on margins, sometimes continuous; a geminate dark transverse streak at end of cell spotted with white anteriorly and posteriorly; a postmedial row of black points on veins followed by a dark brown line; this is followed by two dark brown shades from costa to inner angle, sometimes obsolete below vein 3; submarginal black spots sometimes coalescent, and preceded by a vague lilacine shade; marginal black points, partly shaded with buff, especially at apex; in two females there is a large greyish space in middle of inner margin. Secondaries dark brown in both sexes, the fringe pale.

Expanse.—Male, 33 mm.; female, 42 mm.

Habitat.—The Guianas, Brazil, Trinidad, British West Indies.

Allied to *Tachuda albosigma* Druce, but easily distinguished by the postmedial markings.

Type.—Cat. No. 8660, U.S.N.M.

Genus EUMASCHANE, new genus.

Antennæ pectinated to tips. Palpi with second joint very long, and dilated terminally; third joint minute. Primaries: costal margin straight; apex acute; outer margin slightly incurved from apex to vein 4, then very oblique and deeply lobed on inner margin; veins 2, 3, 4 well apart; 5 from above middle of discocellular; 6 from upper angle of cell; accessory cell long; 7, 8, 10 from its end. Secondaries: veins 2, 3, 4 well apart; 5 present; 6 and 7 stalked; 8 diverging from 7 at middle of cell.

EUMASCHANE LAURA, new species.

Palpi buff, dark brown above. Frons white. Vertex, collar, and thorax fawn brown; the patagia outwardly edged with white. Abdomen light brown above, white underneath. Primaries silvery lilacine grey; a few black irrorations on costa and inner margin; some black striæ on outer margin; a whitish oval line, inclosing outer half of cell

on which is an angled whitish line toward base of oval, and a curved whitish line within discocellular; a medial whitish line from below this oval to submedian; a postmedial whitish line, curved beyond cell and slightly wavy to end of submedian. Secondaries pale buff on basal half; outer half brown.

Expanse.—26 mm.

Habitat.—St. Laurent, French Guiana.

Type.—Cat. No. 8661, U.S.N.M.

Genus DASYLOPHIA Packard.

DASYLOPHIA ABNORMIS, new species

Palpi dark brown fringed with black. Head, collar, and a streak on patagia reddish; thorax otherwise and abdomen dull violaceous brown; a reddish brown subdorsal spot containing white scales at base of abdomen. Primaries brown; a dark red-brown shade from base, curved anteriorly toward costa, then incurved in cell, terminating at end of cell, posteriorly limited by median vein, below which the color is brown slightly irrorated with dark red, and limited by a medial curved line from cell to inner margin; a bright reddish streak on inner margin to middle of wing; a round black spot at upper angle of cell, preceded by a smaller dot; a lilacine shade from end of cell to outer margin between 2 and 3, shaded above with a diffuse blackish streak; oblique lilacine shade from costa on outer half; traces of a dentate black postmedial line below vein 3; some marginal dark brown spots. Secondaries dark brown; a reddish streak above anal angle cut by a whitish spot.

Expanse.—32 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. No. 8662, U.S.N.M.

Genus FARIGIA Schaus.

FARIGIA MAGNIPLAGA, new species.

Body brown mottled with whitish hairs. Primaries brown, thickly irrorated with bright green at base, and on costal margin; a large velvety brown space on outer half of inner margin extending to subcostal at end of cell, followed by a whitish shade at inner angle, a geminate dark medial line on costa; a geminate dark brown finely wavy postmedial line, curved around cell, divided by green scales; a velvety dark brown marginal line interrupted by veins; fringe black brown with whitish streaks at ends of veins. Secondaries dark brown.

Expanse.—37 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8663, U.S.N.M.

FARIGIA FRAGILIS, new species.

Head and thorax moss green mottled with lilacine. Abdomen lilacine irrorated with moss green, and a similar subdorsal tuft at base. Primaries: the costal margin and a shade below cell moss green; cell and inner margin lilacine; outer margin broadly white; a dark olive green postmedial line curved beyond cell; a submarginal interrupted moss green shade; terminal black points between the veins, black points on fringe at tips of veins. Secondaries whitish; lilacine irrorations on outer margin; some pale green hairs on inner margin.

Expanse.—27 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8664, U.S.N.M.

Genus HIPPIA Möschler.

HIPPIA SALANDERA, new species.

Head and thorax dark brown mottled with some whitish tipped scales; the palpi and tegulae darker than other parts. Abdomen dark violaceous brown mottled with paler scales. Primaries dark velvety brown; a creamy yellow streak from middle of cell to above vein 6, near outer margin, interrupted by a brown line at vein 5; above this line the subcostal space is thickly irrorated with lilacine and pale brown scales with a round black point before apex; the basal third between cell and submedian thickly irrorated with lilacine grey scales; the outer half from inner margin to vein 3 paler; very indistinct traces of darker postmedial and submarginal lines; a dark lunular marginal line. Secondaries dark brown.

Expanse.—37 mm.

Habitat.—Omai, British Guiana.

This species resembles somewhat *H. matheis* Schaus, the male of which differs from typical *Hippia* in having a raised tuft of scales on basal half of antennae. *Hippia* was created by Möschler for *mumetes* Cramer, but evidently Möschler identified some other species as *mumetes*, which undoubtedly belongs to *Lepasta* Schaus. Möschler's description of *mumetes* answers better to *H. pulchra* Butler or an allied unnamed species.

Type.—Cat. No. 8665, U.S.N.M.

Genus ARHACIA Herrich-Schaeffer.

ARHACIA ELONGATA, new species.

Palpi lilacine grey, dark brown in front; frons below dark reddish brown. Head otherwise and collar pale grey. Thorax dark reddish brown. Abdomen blackish brown above, luteous underneath. Primaries convex on outer half, the outer margin very oblique; lilacine

buff heavily shaded with dark grey on basal half below subcostal, black points before and beyond discocellular; a greyish shade to outer margin about vein 4; apical third of costa brownish; fine black lines in cell, and above submedian; an outer fine, irregular, dentate dark line; a geminate black terminal line. Secondaries grey-black.

Expanse.—86 mm.

Habitat.—Carabaya, S. E. Peru.

Type.—Cat. No. 8666, U.S.N.M.

Genus CERURA Schrank.

CERURA GONEMA, new species.

Palpi reddish brown. Head white. Collar white anteriorly, broadly black posteriorly; thorax silvery white spotted with black. Abdomen dark brown above, white below; white bands on last two segments. Primaries silvery white, the markings black; a basal line bifurcated on costa; two wavy antemedial lines the second coalescing with a black spot in cell; a medial line interrupted below costa and above inner margin, forming a thick black spot before end of cell; a spot at base of veins 2 and 3 connecting this discal spot with a postmedial line, lunular, partly geminate and widely bifurcating on costa; a line on discocellular; marginal oblique lines reaching terminal dark spots at ends of veins, except at vein 5; fringe white between the veins. Secondaries grey; fringe white spotted with black.

Expanse.—32 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8667, U.S.N.M.

CERURA LANCEA, new species.

Head white. Collar black anteriorly, grey posteriorly. Thorax white with two rows of black spots. Abdomen black above, mottled with white on last two segments; underneath white. Primaries white, not silvery, the lines brown. A black spot at base of costa, one on median and another on submedian vein, followed by a row of spots interrupted in cell; an antemedial black triangular spot on costa and a brown annular spot on inner margin containing a darker spot, a medial line, interrupted by veins; three postmedial lunular lines; all the lines ending in thicker blackish spots on costa; submarginal triangular spots between the veins except between 2 and 3; terminal lanceolate dashes between the veins, reaching the submarginal spots between 4 and 5 and 5 and 6; fringe white. Secondaries white; the inner margin, anal angle, and apex slightly smoky black; a terminal dark line.

Expanse.—40 mm.

Habitat.—Cayenne, French Guiana.

Type.—Cat. No. 8668, U.S.N.M.

Genus PEROARA, new genus.

Palpi hairy, third joint minute. Antennæ fasciculate. Primaries: outer margin obliquely rounded; veins 3 and 4 apart; 5 from above middle of discocellular; 6 from near end of accessory cell; 7 and 8 stalked; 10 from end of accessory cell. Secondaries: 3 and 4 from lower angle of cell; 6 and 7 stalked; 8 close to 7 to end of cell.

PEROARA SYLVESTRIS, new species.

Palpi dark brown. Head and thorax mottled brown and fawn color; the patagia with silvery white hairs. Abdomen golden brown, the basal segment dark velvety brown. Primaries grey, irrorated with brown; the basal third darkest; a whitish space at end of cell cut by a brown line; a postmedial white line, inwardly edged by a brown line and followed by brownish scales; a large dark patch on costa before apex; a broad subterminal white shade, inwardly shaded with brown below vein 4; a marginal brown shade; a brown terminal line, interrupted by veins and inwardly edged with white; fringe grey. Secondaries smoky brown, palest on basal half; fringe tipped with whitish.

Expanse.—Male, 33 mm.; female, 44 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8669, U.S.N.M.

Genus GOPHA Walker.

GOPHA NIVEIGUTTA, new species

Palpi blackish, irrorated with white scales. Head and collar mottled reddish brown and fawn color. Thorax dark brown. Patagia and abdomen blackish. Primaries blackish, mottled with dark moss green, in cell, below cell and vein 2, and at apex; two rows of submarginal dark moss green spots, interrupted by a deep black shade beyond cell to below apex; the outer row of green spots inwardly with small velvety black spots; some white irrorations on veins; a silvery white spot close beyond cell, toothed towards apex; fringe black with fine buff streaks at end of veins. Secondaries black brown; fringe as on primaries.

Expanse.—36 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Allied to, but much darker than *Gopha albipuncta* Schaus.

Type.—Cat. No. 8670, U.S.N.M.

Genus MALUPA, new genus.

Palpi porrect, third joint short. Antennæ fasciculate. Legs hairy. Primaries long and narrow. Costal margin convex before apex; outer margin very oblique; veins 3 and 4 from lower angle of cell;

5 from middle of discocellular; a long accessory cell; vein 6 from near its end; 7, 8, and 10 from end of it; vein 11 from cell. Secondaries triangular, the angles well rounded, the outer margin straight; veins 3 and 4 from lower angle of cell; 6 and 7 on long stalk; 8 diverging from 7 just beyond middle of cell.

MALUPA ELONGATA, new species.

Palpi, head, collar, and patagia light fawn brown. Coxæ brown. Thorax and abdomen dorsally dark brown, the latter with paler transverse shades. Primaries light olivaceous brown; the outer half of costal margin, the outer margin below vein 4, and the inner margin bright reddish brown. A velvety brown streak below median vein from base to middle of cell, below which is a pale fawn shade; a pale fawn streak on outer portion of median and extending on to vein 4, shaded below with dark brown; a reddish brown shade at end of cell; a pale fawn streak along vein 6 to apex at vein 7; a marginal fawn line from end of vein 6 to inner margin before angle. Secondaries whitish; a dark brown shade along inner margin and at anal angle; veins light brown; a terminal light brown shade.

Expanse.—48 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. No. 8671, U.S.N.M.

Genus **SALLUCA** Schaus.

SALLUCA PSITTICA, new species.

Palpi light brown. Fore legs, head, collar, thorax, and a subdorsal basal tuft on abdomen bright pea green. Abdomen light brown. Primaries bright pea green, the lines dark green mottled with black on costa; geminate basal line not reaching inner margin, heavily marked on costal margin; antemedial geminate line thick on costa and in cell, then wavy and slighter to inner margin; postmedial line, geminate on costa, triplicate, lunular, dentate below it, the middle line faintest; these lines followed by a broad dark green shade, outwardly incurved below vein 7, and again below vein 3, outwardly edged with pale pea green; outer margin darker green with an interrupted wavy very dark green marginal line, fringed with paler green spots. Secondaries pale brown, the outer half shaded with grey.

Expanse.—44 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Allied to *herbida* Möschler.

Type.—Cat. No. 8672. U.S.N.M.

Genus *DICENTRIA* Herrich-Schaeffer.*DICENTRIA VALLIMA*, new species.

Head and thorax brown, mottled with olivaceous and reddish brown. Abdomen violaceous brown. Primaries light brown, the veins on outer half streaked with black and grey; the costal margin shaded with green and fawn color, with darker spots at origin of lines; a greenish streak below cell and on inner margin; the submedian shaded with lilacine; a dark streak on discocellular preceded by a green and lilacine patch; traces of two lunular dark postmedial lines below vein 5; the outer margin broadly shaded with darker brown; a submarginal velvety brown streak between 2 and 3 and between 7 and 8; the spot between 2 and 3 followed by a white dash; marginal black points between the veins; fringe light brown, spotted with dark brown at tips of veins. Secondaries: the base and disk semihyaline violaceous brown, the margins dark; fringe terminally whitish.

Expanse.—Male, 36 mm.; female, 42 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8673, U.S.N.M.

DICENTRIA STRIDULA, new species.

Head and thorax mottled different shades of brown, with a black shade on vertex and collar. Abdomen blackish brown above, shaded with light reddish brown on anal segments; underneath luteous, with a dark ventral line. Primaries brownish-fawn, shaded with lilacine above inner margin, in cell, and partly between 3 and 4; a dark brown streak from base of costa across cell, extending between veins 2 and 3 to outer margin; a similar streak from discocellular, which is itself dark brown to outer margin; a shorter streak above vein 6; a greenish grey spot at end of cell; traces of an antemedial, partly geminate, dark dentate line, divided by a faint lilacine shade; traces of a similar postmedial line; a short velvety brown dash between veins 7 and 8; dark streaks at end of vein, extending on to fringe; a dentate white submarginal spot between 2 and 3. Secondaries smoky brown, the margins darker.

Expanse.—37 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8674, U.S.N.M.

DICENTRIA PALMITA, new species.

Head, thorax, and anal segments light brown; the abdomen otherwise darker brown dorsally, whitish ventrally, with a basal darker brown spot. Primaries: basal third of costa and cell blackish brown, followed by a white space in cell; a lilacine streak on costa; the discocellular pale brown, preceded by an oval dark reddish brown spot, and

followed by an outwardly dentate blackish shade; postmedial space from vein 3 to costa and apex pale lilacine brown; the inner and outer margin darker violaceous brown, except a reddish brown shade below cell; two rows of submarginal dark streaks on veins; dark spots at end of veins and on apical third of costa. Secondaries white; the inner margin with violaceous and light-brown hairs; a darker shade at anal angle; the ends of veins dusted with brown.

Expanse.—40 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. No. 8675, U.S.N.M.

DICENTRIA DRUCEI, new species.

Male.—Head olivaceous brown. Thorax buff-brown with darker striae. Abdomen olivaceous brown, darkest subdorsally. Primaries pale buff; costa shaded with brown; a dark olivaceous streak below cell from base to vein 2; a blackish streak on submedian, which is edged above with grey; traces of antemedial and postmedial geminate lines below cell and vein 2; a black streak on discocellular, surrounded by a brownish shade; a white marginal spot above vein 2, preceded by a dark grey shade; fine geminate greyish streaks between the veins beyond cell; terminal small brown spots between the veins. Secondaries buff-white; a dark shade along inner margin, becoming darker at anal angle, crossed by a terminal brown line.

Expanse.—47 mm.

Habitat.—Jalapa, Mexico.

This species is the "*laciniosa*" of the *Biologia Centrali-Americana* (not Hy. Edwards).

Type.—Cat. No. 8676, U.S.N.M.

Genus NOTOPLUSIA Schaus.

NOTOPLUSIA EUGENIA, new species.

Head and thorax brownish buff; collar and patagia striated with dark violaceous brown and lilacine grey. Abdomen dark grey above; underneath and anal tufts buff brown. Primaries, base, from one-fourth of costa to middle of inner margin dark brown, on which are some velvety streaks; space beyond to postmedial and above vein 2 buff irrorated with lilacine on costal margin, with brown below it; at end of cell a clearer white space, on which is an oval brown line; postmedial consisting of a fine dark brown line, very indistinct, followed by brown and grey shades, and some dark velvety streaks between the veins; a subterminal whitish line, broadening basally between veins 4 and 6; an interrupted lunular marginal line. Secondaries dark grey.

Expanse.—27 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8677, U.S.N.M.

NOTOPLUSIA SABRENA, new species.

Head and collar light reddish brown. Thorax buff, mottled with grey and brown. Abdomen grey. Primaries buff, thickly irrorated with dark brown, forming a dark, broad antemedial shade on costa, and a subterminal spot on costa; a distinct dark point at end of cell; traces of geminate antemedial and postmedial interrupted lines; rather large dark marginal spots between the veins. Secondaries dark grey, paler at base.

Expanse.—34 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8678, U.S.N.M.

Genus **HETEROCAMPA** Doubleday.**HETEROCAMPA LAMA**, new species.

Head, collar laterally and patagia greenish, collar medially and thorax, also subdorsal tuft on abdomen, dark reddish brown. Abdomen dark greyish brown, the last segment light reddish brown. Primaries: the inner and outer margin slightly excavated before angle; the costal margin, apex above vein 6, and space between veins 3 and 4, moss green, otherwise violaceous brown; black geminate basal streak on costa; a single antemedial black line across wing, but very indistinct; a more distinct medial lunular black line from middle of cell to inner margin; a black streak below vein 2 from medial line to the very indistinct postmedial line, which is again followed by a fine geminate black line; a small yellow spot at end of cell; a white crescent mark on inner margin at postmedial line; faint brown marginal spots between the veins. Secondaries whitish, the costal and inner margins broadly brown; three darker lines on costal near apex.

Expanse.—36 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8679, U.S.N.M.

HETEROCAMPA GRAVIS, new species.

Palpi and head fawn color. Collar, thorax, and base of abdomen violaceous brown; patagia moss green. Primaries dull moss green on basal half, irrorated thinly with black below cell and on inner margin where there is a reddish brown streak; a darker antemedial line forming three outward curves; two fine black medial lines, lunular, and diverging on costa; a faint reddish brown shade at end of cell; a broad dark brown shade from cell between veins 2 and 3 to inner angle, with a pale green shade above and below it; a broad lilacine white shade irrorated with moss green on apical third of costal margin; outer margin lilacine brown, the veins streaked with black; a terminal dark brown line. Secondaries whitish; the costal margin

shaded with brown; the apex grey; two short dark lines dividing the two colors; inner and outer margin slightly clouded with brown.

Expanse.—30 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8680, U.S.N.M.

HETEROCAMPA INFANDA, new species.

Palpi and head light reddish brown; collar, thorax, and a subdorsal basal tuft on abdomen dark green. Abdomen violaceous brown above, whitish underneath. Primaries: basal third black, mottled with green above and below submedian vein; this space outwardly indented on median, and followed in cell by pale green, then whitish irrorated with pale reddish brown, on which the fine discocellular line is barely visible: a blackish oblique streak at base of vein 2; a fine pale, reddish brown geminate, postmedial line partly irrorated with black below vein 3; small submarginal blackish spots above veins 4, 5, and 6, and below vein 2, followed by greyish shades; the costa dark brown between postmedial and submarginal lines; a vague lilacine space between 2 and 4 before postmedial; outer margin and fringe pale green with darker green shades on fringe at tip of veins. Secondaries whitish, the outer margin thinly irrorated with black; luteous and reddish hairs on inner margin, followed by a blackish space at anal angle; fringe basally light reddish brown.

Expanse.—39 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8681, U.S.N.M.

HETEROCAMPA HABILIS, new species.

Palpi light brown, laterally black, vertex and patagia greenish; collar and thorax violaceous brown. Abdomen light brown, the anal segment black; a subdorsal reddish brown and green spot. Primaries pale moss green; a broad black basal shade, mottled with green on costa, with reddish brown on inner margin; cell beyond blackish; a dark brown discocellular line, shaded with paler brown on either side; a black blotch at base of veins 2 and 3; a very fine postmedial brownish line, and an irregular row of submarginal brownish spots, the spot between 3 and 4 closer to margin and preceded by a pale green shade. Secondaries white; the costal margin pale brown, crossed by two darker lines before apex; a terminal dark line; the inner margin with pale brown hairs.

Expanse.—31 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8682, U.S.N.M.

HETEROCAMPA BACTREA, new species.

Palpi black fringed with golden fawn color. Head and thorax mottled green and brown. Abdomen dull brown, with a subdorsal reddish brown tuft at base. Primaries: basal third dark violaceous brown and black-grey mottled with green, and limited by an irregular geminate antemedial black line, followed in cell by a black and grey spot; discocellular reddish, outlined with buff; a black spot below cell between veins 2 and 3, crossed by a blackish medial line interrupted in cell; a postmedial geminate, wavy, lunulate, reddish brown line shaded with black on costa, between 4 and 5, and below vein 2; paired marginal black spots connected by grey lines; three pairs oblique from apex to vein 5, and three pairs from below vein 5 at outer margin and parallel to it; fringe light reddish brown with black spots at end of veins. Secondaries reddish brown; a postmedial dark line; the outer margin broadly irrorated with black, most heavily at apex and anal angle. Underneath creamy white; subcostal reddish brown shadings on primaries.

Expanse.—33 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8683, U.S.N.M.

HETEROCAMPA ECHINA, new species.

Palpi and frons light brown. Collar laterally and patagia dark moss green; collar medially and thorax dark reddish brown, with similar subdorsal tufts on the abdomen. Primaries reddish brown; the costa broadly dark moss green, with similar shadings on outer margin and basally between veins 3 and 4; some dark irrorations in and below cell; a reddish brown shade at base of inner margin, and another beyond cell between veins 4 and 6; a fine lunular antemedial black line, and a similar postmedial line, both rather indistinct, the latter followed by white spots on veins; an irregular marginal reddish brown shade, darkest and most conspicuous below vein 3; minute pale dots at ends of veins, preceded by dark streaks and followed by dark spots on the fringe. Secondaries dark brown somewhat thinly scaled; a darker shade at apex crossed by a reddish brown paler line. Underneath: primaries light brownish yellow, the costa darker; a submarginal darker line. Secondaries creamy, with some brown shading at apex.

Expanse.—37 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8684, U.S.N.M.

HETEROCAMPA DELIRA, new species.

Palpi brown. Head moss green. Thorax violaceous brown; collar anteriorly, patagia posteriorly mottled with moss green. Abdomen

dull brown above with a basal subdorsal tuft of curly violaceous scales. Primaries moss green; antemedial and postmedial roseate wavy lines edged with brown; the discocellular moss green, edged on either side with roseate; an irregular row of marginal roseate spots shaded with brown and edged with black inwardly; a terminal dark line; fringe brown and grey. Secondaries greyish brown; the costa paler crossed at apex by two darker lines, the outer one shaded with grey; a terminal moss green line at apex; fringe greyish.

Expanse.—31 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8685, U.S.N.M.

HETEROCAMPA FOLIATA, new species.

Palpi black, tipped and fringed with fawn color. Thorax moss green and violaceous brown. Abdomen greyish brown. Primaries dull moss green; some black scales on basal half of inner margin; a fine dentate, antemedial, black line; a dark brown line on discocellular; a small dark grey shade basally between veins 2 and 3; a fine dentate black postmedial line beyond which the veins are finely black; submarginal brown dashes between the veins; a marginal darker line; dark spots on fringe at ends of veins. Secondaries smoky white; the costal margin dull moss green, crossed by two black lines near apex; a terminal dark line; the inner margin with light brown hairs. Underneath: primaries smoky grey. Secondaries whitish; a terminal dark line on primaries.

Expanse.—31 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8686, U.S.N.M.

HETEROCAMPA CARIOSA, new species.

Body dark brown with transverse paler lines on abdomen posteriorly. Primaries: light brown, palest on outer coster half and at base below median vein; an oblique blackish shade from costa antemedially to middle of inner margin; a similar postmedial shade from veins 2-5; a fine reddish brown line on discocellular with a brown point above it and one below it; some small dark spots on costa, and dark streaks on inner margin; a geminate postmedial brown line, curved beyond cell, shaded with black and grey between veins 2 and 4; an interrupted pale terminal line. Secondaries dark brown; a black and buff spot at anal angle. Underneath: primaries dark brown, secondaries lighter brown.

Expanse.—30 mm.

Habitat.—Rockstone, British Guiana.

Type.—Cat. No. 8687, U.S.N.M.

HETEROCAMPA MARGINALIS, new species.

Head and thorax dark moss green. Abdomen dull brown. Primaries: light violaceous brown; a dark green shade on costa near base, extending into cell; submedian light green; space between veins 2 and 3 light green; a dark brown slightly curved line from costa near apex to vein 3 near outer margin, broadly shaded with white inwardly; the space between this and cell pale green; the outer margin beyond it irrorated with black towards apex; marginal green blotches between the veins; a terminal dark line; a small black spot at inner angle; indistinct traces of an antemedial and a postmedial dentate, fine dark brown line. Secondaries dull blackish brown.

Expanse.—36 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8688, U.S.N.M.

HETEROCAMPA ÆMULA, new species.

Palpi, head, and anterior half of thorax rich brown; posterior half of thorax grey. Abdomen dull black brown; a subdorsal grey and brown tuft at base; reddish brown on second segment; anal segments dark grey; two black spots on last segment; underneath creamy white. Tarsi brown with white rings. Primaries dark brown; the inner margin pale grey, the grey extending above submedian vein in places; a greyish brown spot at base of costa; traces of dark geminate basal, antemedial, medial, and triplicate postmedial lines; a round grey spot at end of cell, inwardly surmounted by a smaller spot; a row of white spots between second and third postmedial line, preceded by a grey spot between veins 3 and 4; a marginal grey spot between 3 and 4; an irregular broad grey shade from vein 5 to apex; a terminal grey lunular line, leaving brown intervenal spots which extend on to fringe. Secondaries dark brown; a black spot surmounted by white at anal angle; fringe whitish, shaded with brown.

Expanse.—41 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Allied to *H. læca* Schaus.

Type.—Cat. No. 8689, U.S.N.M.

HETEROCAMPA NOTABILIS, new species.

Palpi grey, laterally black towards base. Head grey, vertex mottled with pale brown. Collar and thorax light brown, the patagia edged with grey; a dark-brown subdorsal spot at base of abdomen, which is greyish brown. Primaries grey; a darker grey line below subcostal; a brown shade from outer margin between veins 4 and 7, widening to inner margin near base and inner angle; a black point at end of cell; some postmedial white points on veins followed and pre-

ceded by black points; fringe fawn color spotted with brown. Secondaries violaceous brown, darkest on outer margin, thinly scaled towards base; luteous hairs at base, and on inner margin; fringe luteous.

Expanse.—45 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8690, U.S.N.M.

HETEROCAMPA OTIOSA, new species.

Body dark grey above, white underneath, the patagia lighter grey. Primaries brownish grey; a clearer grey space at base; a whitish space on outer margin, widest at veins 2 and 3, irrorated with reddish brown, especially towards costa; traces of a brown, geminate, basal line; a fine brown antemedial line, wavy and preceded by a fine dark-grey line; postmedial line fine, geminate; a distinct blackish marginal line, lunular below vein 3; fringe grey, with dark spots at ends of veins. Secondaries white; a terminal dark-brown line; some luteous hairs on inner margin.

Expanse.—40 mm.

Habitat.—Cayenne, French Guiana.

Type.—Cat. No. 8691, U.S.N.M.

HETEROCAMPA PATRICIA, new species.

Body dark grey above, whitish grey underneath. Primaries light grey; a velvety black streak from base of costa to submedian vein near antemedial line, which is wavy and chiefly noticeable below cell; at the end of the cell a somewhat lunular white spot bordered by a fine brown line and followed by a whitish shade; a velvety black line from veins 8 to 2 inwardly curved towards cell, wavy from vein 2 to inner angle, followed by a broad brown shade irrorated with black, leaving a greyish shade on outer margin crossed by a smoky line; a terminal blackish line; fringe grey tipped with white. Secondaries white; a terminal dark line; some dark irrorations on outer portion of veins and at anal angle.

Expanse.—40 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8692, U.S.N.M.

HETEROCAMPA CALUNA, new species.

Head, thorax, and anal hairs moss green. Abdomen dark grey. Primaries yellowish green; a black streak at base below cell; oblique darker antemedial and medial lines, rather indistinct; a dark line on discocellular followed by a dark-grey patch between veins 4 and 5; a similar patch between veins 2 and 3; black clusters of scales beyond these grey patches, forming part of a subterminal black line, inter-

rupted between 3 and 4, and outwardly edged by a finely wavy pale line; a lunular whitish marginal line; black scales on fringe at tips of veins. Secondaries whitish, dusted with grey; the inner margins yellowish.

Expanse.—Male, 30 mm.

Habitat.—Castro, Parana, Brazil.

Allied to *herbida* Walker.

Type.—Cat. No. 8693, U.S.N.M.

HETEROCAMPA POULSONI, new species.

Head mottled green and brown; collar and thorax buff mottled with light brown; a dark reddish brown shade on middle of collar. Abdomen brown, shaded with dark grey laterally. Primaries from near base of costa to postmedial on inner margin buff irrorated with brown; terminal area of inner margin dark reddish brown; a similar streak below cell from veins 2 to 4; outer margin from 2 to 4 light brown crossed by a darker brown line; otherwise dark green, mottled with blackish grey; a reddish brown streak on discocellular; the veins shaded with reddish brown; the outer margin slightly excavated between veins 2 and 3, more so between 2 and submedian. Secondaries whitish; the costa greenish brown; the inner margin light brown.

Expanse.—40 mm.

Habitat.—Omai, British Guiana.

I am indebted to Mr. H. H. Poulson, of Omai, for this interesting new species.

Type.—Cat. No. 8694, U.S.N.M.

HETEROCAMPA SUBALBIDA, new species.

Head pale brownish buff. Thorax greyish buff. Abdomen dark grey above. Primaries brownish green, no doubt brighter green in fresh specimens; the basal third grey, limited by a dark-grey geminate line; a postmedial fine dark-grey line; the outer margin shaded with grey; a small whitish spot on inner margin beyond postmedial. Secondaries whitish; the costal margin broadly greenish; the inner margin broadly dark grey; a postmedial dark line chiefly noticeable on costal and inner margins; fringe greenish; a terminal dark-green line. Underneath white.

Expanse.—37 mm.

Habitat.—Castro, Parana, Brazil.

Type.—Cat. No. 8695, U.S.N.M.

Genus **MALOCAMPA** Schaus.

MALOCAMPA PARAMARIBENA, new species.

Body buff brown; palpi laterally and scales around eyes dark velvety brown; a similar shade anteriorly on collar. Primaries: basal half

black, with basal and antemedial pale brownish bands; the inner margin below the dark space with a brownish streak; outer half pale buff-brown; a large black spot below costa between veins 6 and 8, followed by a smaller dark spot at apex; a small black spot between veins 3 and 4; a fine wavy black marginal line; black spots on fringe. Secondaries dirty white; the costal and inner margins light brown, the latter with a darker streak; three black points on fringe near anal angle.

Expanse.—40 mm.

Habitat.—Paramaribo, Dutch Guiana.

Type.—Cat. No. 8696, U.S.N.M.

MALOCAMPA PIRATICA, new species

Palpi black, fringed with pale buff. Head, patagia and anal segments grey. Vertex, collar, thorax, and abdomen above dark brown; abdomen below luteous. Primaries grey, shaded with pale brown, except on margins; a black spot at base of costa; an outwardly curved geminate, antemedial black line, coalescing into a large black spot on costal margin, thickly shaded with dark brown on inner margin; a dark brown and black space from this line below vein 2 to inner angle; a white point at end of cell, and a fine brown streak on costa above it; a faint geminate postmedial wavy dark grey line starting from a black spot on costa, which is followed by two black costal points; a smoky shade between 4 and 5, and a small dark spot below vein 2; fringe buff spotted with black. Secondaries dark blackish brown, fringe luteous.

Expanse.—43 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Very similar in markings to *M. bolivari* Schaus, but quite different in color.

Type.—Cat. No. 8697, U.S.N.M.

MALOCAMPA MARONIENSIS, new species.

Head, thorax, and anal segments slate grey. Abdomen brown above, greyish fawn below. Primaries slate grey, markings dark brown; a basal line not reaching inner margin; an antemedial spot on costa, followed closely by a fine wavy line preceded by dark points on median and submedian veins; a large black spot at end of cell, slightly constricted anteriorly; a median band angled at vein 4; a postmedial spot on costa followed by three black points and geminate points on vein 4, and veins below it; terminal dark spots on fringe. Secondaries smoky brown, the veins and margins darker; a black spot divided by a whitish line at anal angle.

Expanse.—43 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8698, U.S.N.M.

MALOCAMPA AMANTHIS, new species.

Antennæ pectinated in both sexes. Palpi light brown, fringed with grey. Head and thorax grey, mottled with black and brown hairs. Abdomen yellow with dorsal transverse grey bands; anal segments grey; underneath luteous. Primaries: basal half grey with geminate basal, antemedial and medial black lines; outer half ochreous except outer margin, which is narrowly grey; a fine dark line on discocellular; beyond cell four transverse lunular lines, the second and third partly geminate; oblique blackish lines between veins on grey outer margin; paired dark points on fringe at end of veins. Secondaries yellow; the outer margin grey-brown. The female has the markings less distinct and the primaries entirely grey.

Expanse.—Male, 50 mm.; female, 63 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Allied to *M. eepantherioides* Schaus.

Type.—Cat. No. 8699, U.S.N.M.

MALOCAMPA GASTRIVA, new species.

Antennæ deeply serrate above, rasped underneath. Body grey, mottled with brown. Primaries grey, irrorated with darker scales; the outer margin broadly shaded with brown; faint traces of basal and antemedial lines; a fine geminate black medial line, thicker below cell, and outwardly dentate close above submedian vein; a pale brown lunular mark at end of cell finely and distinctly outlined with black; a curved geminate, fine black postmedial line; a dark shade on costa before apex, and black submarginal streaks on veins 6 and 7; an irregular black marginal line. Secondaries grey, thinly irrorated with brown; the veins and a terminal line dark brown; a blackish patch at anal angle crossed by a pale line. Underneath: primaries brown; the costa and fringe white, with dark spots. Secondaries white, clouded with brown at apex.

Expanse.—45 mm.

Habitat.—Paramaribo, Dutch Guiana.

Type.—Cat. No. 8700, U.S.N.M.

MALOCAMPA EUGENIA, new species.

Palpi dark velvety brown, fringed with buff. Head, collar, and thorax brown; patagia greenish grey. Body dark brown above, lighter brown underneath. Primaries greenish grey with a silken sheen; a curved oblique black line from base of costa to inner margin, outwardly shaded with white below cell; three fine and indistinct darker antemedial lines; a reniform spot at end of cell finely outlined with black; a fine brown dentate shade curved beyond cell and followed by a geminate fine black line; an irregular row of brown submarginal spots partly followed by a whitish dentate line; a marginal

black line straight from costa to vein 4, lunular below vein 4; some darker terminal irrorations; fringe light brown with dark points at veins 2, 3, and 4. Secondaries dark brown, the fringe buff; a blackish point at anal angle.

Expanse.—Female, 57 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8701, U.S.N.M.

MALOCAMPA SOREX, new species.

Palpi dark brown laterally, fringed with buff. Head, thorax and anal segments dark greenish grey irrorated with brown. Abdomen dark brown-grey above. Primaries dark greenish grey, irrorated with brown and black; a fine, indistinct, wavy, darker line at base; a fine antemedial shade from costa at one third from base to middle of submedian vein, where it is joined by a similar shade from costa beyond cell; a median shade from costa to end of cell; at end of cell two superposed black points; an outer geminate row of dark points on veins separated by whitish points; a fine dark submarginal shade above vein 3; terminal black points between the veins; fringe light brown with darker irrorations. Secondaries dark brown; buff hairs on inner margin; a buff spot at anal angle; fringe yellow. Underneath the secondaries and fringe are buff; a dark medial line; the outer margin dark, narrowing at anal angle.

Expanse.—37 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8702, U.S.N.M.

MALOCAMPA TÆTRICA, new species.

Palpi light brown; a lateral black streak. Head and collar moss green; thorax dark reddish brown; the patagia lilacine brown. Abdomen violaceous brown above; luteous hairs at base; anal segments moss green. Primaries slightly lobed at inner angle, moss green; a velvety dark point at base of submedian; base above submedian pale violaceous brown, extending somewhat in cell; faint traces of a fine geminate black antemedial line; a fine dentate brownish shade curved around cell to middle of inner margin, followed by two rows of black points on veins; a pale violaceous brown shade beyond cell from veins 2 to 5, a terminal row of dark points between the veins; fringe pale violaceous brown. Secondaries dark brown, paler at base and on inner margin; a terminal blackish line; fringe pale fawn color, black at anal angle; a black and white spot above anal angle. Underneath dark brown; a buff space from middle of cell to anal angle and inner margin.

Expanse.—36 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8703, U.S.N.M.

MALOCAMPA GEMONIA, new species.

Body grey, irrorated with brown. Antennæ light golden brown. Primaries silvery grey, thinly irrorated with greyish brown; traces of a brownish geminate basal line; an antemedial and a medial line, wavy and indistinct; a dark streak at end of cell, beyond which from vein 2 to costa there is a brown space limited by the outer line which is dark brown, lunular, slightly incurved below vein 2; an irregular dark brown, interrupted, marginal line, preceded from vein 5 to vein 8 by a brownish shade; a fine terminal dark line above vein 4. Secondaries at base whitish, otherwise brownish grey, thinly scaled; the veins and a terminal line darker.

Expanse.—37 mm.

Habitat.—Geldersland, Surinam River, Dutch Guiana.

Type.—Cat. No. 8704, U.S.N.M.

MALOCAMPA SPURCA, new species.

Head, collar, and abdomen dark brownish grey, thorax light grey. Primaries dirty white, thinly irrorated with brown; a large blackish brown triangular space on costa at one-third from base to near apex, and to just above submedian vein at middle of inner margin; a fine dark postmedial line, punctiform on veins; a fine dark marginal line; dark terminal points between the veins and on fringe at tips of veins. Secondaries dirty white, more thickly irrorated with brown; a darker medial line, followed by a whiter shade. Underneath dirty white, the primaries irrorated with brown; a large smoky black medial space on cell and costa.

Expanse.—30 mm.

Habitat.—Paramaribo, Dutch Guiana.

Type.—Cat. No. 8705, U.S.N.M.

MALOCAMPA BROMA, new species.

Head, collar, and thorax dark reddish brown irrorated with lilacine; patagia lilacine white. Abdomen dark grey. Primaries, base and costal margin grey-brown; a white line at base not reaching margins; an antemedial and five postmedial yellow streaks on costa, the last two very minute; median space whitish, irrorated in cell with brown, on inner margin with grey and lilacine; a yellow antemedial spot below cell; a white streak at end of cell through irrorations; a geminate fine lunular postmedial line, slightly incurved, followed by a dark brown space above vein 4 to costa and apex; a yellow spot between 3 and 4, and lilacine irrorations below vein 3; a submarginal dentate blackish line from vein 5 to costa; a dark irregular marginal line inwardly edged with whitish. Secondaries whitish thickly irrorated with lilacine brown, darkest along margins.

Expanse.—32 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8706, U.S.N.M.

MALOCAMPA MAYERI, new species.

Body grey mottled with blackish grey; a dark brown shade posteriorly on collar. Primaries brownish grey, darker on costa, in cell, and on outer margin; whitish irrorations at base and on inner margin; a blackish, geminate, lunular antemedial line; geminate black medial lines on costa; a postmedial geminate black lunular line, somewhat inwardly oblique from costa; dark velvety brown submarginal spots above vein 4; marginal black spots between the veins preceded by a lilacine shade. Secondaries lilacine brown, the veins and margins blackish brown. Underneath the primaries are dark lilacine grey, the inner margin and a postmedial costal spot whitish; the secondaries white, the basal half of costa and outer margin on apical half dark lilacine grey.

Expanse.—31 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8707, U.S.N.M.

Genus **RHUDA** Walker.

RHUDA DISSONA, new species.

Palpi black, fringed with grey and brown. Head and collar olive brown. Thorax duller brown; patagia black with white scales and a lateral roseate shade. Abdomen grey brown above; the anal segments darker; underneath yellowish. Primaries: on costa at one-third from base to near apex a blackish space, posteriorly broadly bordered with white from costa to end of cell, along vein 3, and up to vein 5, above which it is edged by a fine lunular white line; this white border is posteriorly shaded with roseate and followed by a dark olive green shade, starting from costal margin at base to inner angle; a white line from base to middle of submedian, below which the inner margin is grey; outer half of inner margin olive brown; a marginal wavy olive brown line preceded by some dark irrorations on roseate and white portion; the ends of veins yellowish, with yellow points at tips interrupting a dark marginal line; traces of a geminate postmedial dark wavy line below vein 3. Secondaries dirty white; the costal margin broadly brown, the base and inner margin broadly light brown; a dark spot at anal angle. Underneath: primaries with the black costal space as above followed below cell and on outer margin by whitish; costa at base and inner margin yellowish; a black streak below cell to a black marginal patch below vein 2; a marginal dark line, and angled dark lines at ends of veins. Secondaries white; the costal margin shaded with black; the base and inner area with yellowish.

Expanse.—57 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Easily distinguished by the pale outer margin of secondaries.

Type.—Cat. No. 8708, U.S.N.M.

RHUDA GEOMETRICA, new species.

Head and thorax grayish olive brown; a whitish lateral streak on patagia. Abdomen brownish grey above, yellow underneath. Primaries: a large dark olive green space on costal margin at one-third from base, oblique to vein 3, straight along \pm for half its length, then oblique to costal margin near apex; the costa on outer half of this space shaded with grey, with some black spots on extreme costal margin; a broad whitish shade behind this space; from base of costa a dark green shade, becoming dark brownish beyond basal third and occupying all the space below cell and vein 2, except the basal third of inner margin which is grey, anteriorly bordered by a white line; a black outer spot on vein 2, outwardly shaded with white and preceded by a fine geminate wavy black line from vein 3 to inner margin; black marginal streaks connecting the veins, very faint above vein 4; the outer margin brown below vein 4; only the fringe brown above it. Secondaries yellow; the outer half of costal margin and the outer margin broadly black; fringe yellow. Underneath the primaries are blackish brown; the veins yellowish; the inner margin broadly yellow; a yellow oblique shade from basal third of costa across cell, extending slightly between veins 2 and 4.

Expanse.—62 mm.

Habitat.—Rio Janeiro, Brazil.

Type.—Cat. No. 8709, U.S.N.M.

RHUDA MINOR, new species.

Head and thorax mottled brown and grey; a black spot anteriorly on patagia. Abdomen brown above, yellowish underneath. Primaries: a dark olive green costal space as in *geometrica* Schaus, edged by a white line slightly dentate basally on costa and only reaching vein 6 outwardly; some grey shades on costa on outer half of this space and three black dentate lines between veins 6 and 10; the white line posteriorly followed by a broad roseate shade; an olive green shade from base of costa below cell and vein 2 to outer margin; a white line below it from base to just beyond middle of submedian; below this a bluish grey streak below submedian; a postmedial geminate dark wavy line from vein 4 to inner margin, followed below vein 2 by a black spot, outwardly bordered with whitish; a wavy marginal irregular dark line; terminal brown shades chiefly below vein 4; pale streaks on tips of veins. A velvety black point in cell. Secondaries: the costal and outer margins broadly dark brown with the veins

blackish; the discal area and inner margin yellowish, streaked with brown. Underneath: primaries blackish; the outer margin broadly whitish with dark shades above vein 4; the inner margin narrowly white; a whitish shade from costa basally across cell and between veins 2 and 4 at their origin. Secondaries whitish, the costal margin broadly black; a submarginal irregular blackish shade on outer margin.

Expanse.—43 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8710, U.S.N.M.

Genus TALMECA, new genus.

Antennæ pectinated to near apex. Palpi slight, second joint long, third short. Legs long, not very hairy. Wings long and narrow; anal tuft. Primaries: veins 3 and 4 near together; 5 from just above middle of discocellular; 6 from about middle of areole; 7 and 8 stalked; 10 from end of areole. Secondaries: veins 3 and 4 stalked or from lower angle of cell, 6 and 7 stalked; 8 close to 7 to near end of cell.

Type.—*T. perplexa* Schaus.

TALMECA PERPLEXA, new species.

Head and thorax lilacine brown. Abdomen light brown. Primaries lilacine buff; a darker shade from base through cell and along vein 4; a buff shade on median and submedian veins; a dark point in cell; an outer row of black points on veins, preceded by black points between the veins; veins blackish on outer margin; a terminal row of black points between the veins. Secondaries lilacine brown, whitish at base and on inner margin; fringe white.

Expanse.—30 mm.

Habitat.—Maroni River, French Guiana; Trinidad, British West Indies.

In this species veins 3 and 4 are from lower angle of cell, or stalked.

Type.—Cat. No. 8711, U.S.N.M.

TALMECA BIPLAGA, new species.

Palpi laterally black fringed with fawn color. Head and thorax lilacine brown. Abdomen light brown above, luteous underneath. Primaries lilacine brown; a large black spot at origin of veins 2 and 3, and another, submarginal, between 4 and 5; traces of fine geminate antemedial, medial, and postmedial lines; blackish marginal streaks between veins 3 and 4, 5 and 6, and 6 and 7; terminal black points between the veins. Secondaries dirty white, the outer margin dark greyish brown; fringe whitish.

Expanse.—28 mm.

Habitat.—Cayenne, French Guiana.

Veins 3 and 4 on secondaries from lower angle of cell.

Type.—Cat. No. 8712, U.S.N.M.

TALMECA INVISA, new species.

Palpi laterally black fringed with buff. Head and thorax lilacine brown, also the anal tuft. Abdomen grey-brown above, dirty white underneath. Primaries lilacine brown, irrorated with darker scales, forming a brownish streak below subcostal vein, one at base of median, and an oblique shade from end of cell and middle of vein 5 to middle of inner margin; antemedial and postmedial geminate black points on veins; a black point in cell; the veins on outer margin shaded with black; terminal black points between the veins. Secondaries: base and fringe whitish; a smoky shade on outer margin.

Expanse.—27 mm.

Habitat.—Geldersland, Dutch Guiana.

Veins 3 and 4 on secondaries from lower angle of cell.

Type.—Cat. No. 8713, U.S.N.M.

TALMECA SCIRPEA, new species.

Palpi black, fringed with fawn. Head and thorax pale moss green. Abdomen pale brown above. Primaries white; a pale moss green shade from base, through cell to outer margin between veins 4 and 5; the inner margin broadly pale moss green, and also a short streak between veins 7 and 8; an antemedial and a postmedial lunular line, blackish on costa, the former blackish and green below costal margin, the latter geminate, lunular, pale green, followed by two rows of black points on the veins; short dark streaks at ends of veins extending on to fringe. Secondaries light smoky lilacine brown.

Expanse.—26 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

In this species veins 7 and 8 on primaries are not stalked, veins 3 and 4 on secondaries from a point.

Type.—Cat. No. 8714, U.S.N.M.

TALMECA PULCHRA, new species.

Palpi dark brown with paler fringe. Head and collar moss green. Thorax lilacine brown. Abdomen blackish brown; anal segments and subdorsal basal tuft reddish brown; underneath brownish yellow. Primaries: the costal margin lilacine, with darker oblique lines; two antemedial and three postmedial, the last two separated by a white shade; a dark violaceous streak above median; end of cell pale green with a black point; a white streak on median vein to vein 2; a moss green shade below it and vein 2 to outer margin; inner margin lilacine; fringe on inner margin moss green; vein 4 dark violaceous, the other veins mottled violaceous and white, partly edged with lilacine; two outer rows of dark points on veins; moss green streaks between the veins; black terminal points between the veins. Secondaries black brown, the fringe luteous.

Expanse.—30 mm.

Habitat.—Bolivia.

Neuration as in *T. scirpea* Schaus.

Type.—Cat. No. 8715, U.S.N.M.

TALMECA CONSOCIATA, new species.

Palpi lilacine with a dark lateral streak. Vertex, collar, and subdorsal basal spot on abdomen pale green. Thorax lilacine. Abdomen dark grey above, luteous underneath. Primaries lilacine; apical third of costa, a spot at end of cell, a streak below median vein and vein 2, and inner margin narrowly, pale green; a whitish spot, with lilacine streak, at end of cell; two antemedial black points on submedian; an outer geminate row of black points on veins separated by whitish spots; marginal lilacine brown shades; terminal intervenal black points inwardly edged with white; fringe lilacine. Secondaries dull lilacine brown, fringe tipped with white.

Expanse.—27 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Neuration as in *T. scirpea* Schaus.

Type.—Cat. No. 8716, U.S.N.M.

Genus BORIZA Schaus.

BORIZA POVERA, new species.

Head, collar, and thorax fawn color; patagia lilacine brown. Abdomen dark grey brown. Primaries pale pinkish brown; a black point at base; a faint black medial line angled in cell; a postmedial fine black line from costa near apex to near middle of inner margin; a faint black shade from below costa beyond middle, joining this line at vein 5; a reddish brown streak on discocellular; terminal black points between the veins. Secondaries blackish.

Expanse.—32 mm.

Habitat.—Rockstone, British Guiana.

Type.—Cat. No. 8717, U.S.N.M.

Genus BLERA Walker.

BLERA NITIDA, new species.

Palpi dark brown. Head and thorax silvery white, thinly irrorated with brown. Abdomen dark brown; blackish transverse shades posteriorly on segments; anal segments grey. Primaries silvery white; a few scattered brown scales; lines black; a basal line inwardly oblique below subcostal; an antemedial line, incurved on median, outcurved above submedian, and again below it, preceded on costa by a brown spot; geminate medial spots on costa, followed by two more spots; below the last a line starts from vein 8, inwardly dentate at vein 5,

and at vein 3, then wavy to inner margin; this line is followed by a fine brownish shade, and again by a heavier shade from costa to vein 5; these lines all start from brown spots on costa; a marginal black line, disconnected, oblique and lunular below vein 4; terminal dark points at ends of veins; fringe white mottled with brown. Secondaries smoky white, the veins on basal half luteous; on outer half veins and outer margin brown; brown hairs on inner margin; fringe white.

Expanse.—Male, 31 mm.; female, 34 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8718, U.S.N.M.

BLERA LAUTA, new species.

Head and thorax grey mottled with brown. Abdomen dorsally grey; a large dark lateral space extending on to dorsum; underneath white with dark brown anal hairs. Primaries light brown; outer margin white, irrorated with dark grey, widest between veins 4 and 5, and 2 and 3; inner margin pure white almost to angle, the white extending somewhat above the submedian medially; some white spots on costa before apex; the veins irrorated with black and white; traces of antemedial and postmedial black lines on brown portion of wing; a dark grey marginal line, partly lunular. Secondaries white; a terminal dark shade; ends of veins dark; fringe white.

Expanse.—31 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. No. 8719, U.S.N.M.

Genus **CHADISRA** Walker.

CHADISRA MULTIFIDA, new species.

Palpi dark brown fringed with reddish brown. Head and thorax mottled dark and lighter brown. Abdomen dark brown; a subdorsal velvety basal tuft. Primaries: basal portion, including one third of costa and two thirds of inner margin, dark brown, crossed by a lunular darker velvety line, geminate on costa; some light brown and fawn scales at base; a dark brown spot in cell, with a fawn streak on either side; these are somewhat lunular in shape; costal margin on outer two-thirds whitish, irrorated, and spotted with dark brown; a velvety black postmedial line from vein 8, forming two outward curves to vein 3, then inwardly curved to inner margin, edged with white below vein 3, and above it shaded with brown, followed between 4 and 5 by a velvety black streak, and a dark blotch from vein 3 to below vein 2; submarginal velvety black streaks on a dark brown shade above vein 5, followed by a dentate whitish line; outer margin brown; a buff shade from veins 2-5, widest between veins 3 and 4; a marginal wavy black line, beyond which the veins are black; a pale line at base of fringe, which is brown, mottled with buff above vein 4.

Secondaries: white; some brown at apex and at anal angle; a fine brown terminal line; fringe white mottled with brown.

Expanse.—30 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8720, U.S.N.M.

CHADISRA (?) CUCULLIOIDES, new species.

Head and collar reddish brown with a few lilacine hairs. Thorax and abdomen above dark grey, thinly irrorated with white. Primaries greyish brown, the costal margin and veins irrorated with white; a pale shade at base below cell; postmedial dark spots between the veins, the spot between veins 2 and 3 velvety and the most conspicuous; submarginal brown streaks between the veins, indistinct; terminal brown shades inwardly lunular. Secondaries whitish, the veins and outer margin dark brown; a blackish spot at anal angle, divided by a white line.

Expanse.—49 mm.

Habitat.—St. Jean, French Guiana.

I am doubtful about the true position of this species, as it is described from a female with simple antennæ.

Type.—Cat. No. 8721, U.S.N.M.

Genus MERAGISA Schaus.

MERAGISA ARIDA, new species.

Head and thorax dark grey. Abdomen greyish above, whitish underneath. Primaries grey with darker irrorations; a broad dark brown transverse shade near base, crossed by two blackish lines; an outer, and a marginal row of white spots between the veins, outwardly edged with ochreous and black scales; fringe white mottled with grey scales. Secondaries whitish, the inner and outer margins clouded with smoky grey; some luteous hairs at base and on inner margin.

Expanse.—45 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8722, U.S.N.M.

MERAGISA ARENOSA, new species.

Palpi dark brown fringed with whitish fawn. Head grey. Thorax dark brown streak with fawn. Abdomen dark grey, paler at base and terminally; underneath creamy white. Primaries dirty white, irrorated with grey and light brown, especially on costa and medial portion; a basal brown shade from below median vein at base, outwardly oblique to inner margin; some dark brown lines at end of cell, separated by pale reddish brown, and contiguous to a large brown costal spot before apex; brownish marginal spots between the veins. Sec-

ondaries brown, rather thinly scaled; some yellowish white at base and along inner margin; fringe whitish.

Expanse.—33 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8723, U.S.N.M.

MERAGISA SUBMARGINATA, new species.

Head and thorax greenish grey, with dark mottlings. Abdomen above ochreous at base, then greyish black; the anal segments fawn mottled with dark scales; underneath ochreous. Primaries greenish grey irrorated with dark brown; base of inner margin broadly clearer grey; a basal dark geminate line very indistinct below costa; the antemedial geminate, oblique from costa to median below which it starts again from nearer base and is lunular, oblique, to middle of inner margin; the postmedial lunular geminate, followed by grey shades, the lunule between veins 3 and 4 closer to outer margin; terminal grey patches, inwardly edged with dark velvety brown; terminal geminate points at veins; fringe ochreous mottled with dark scales. Secondaries black, the inner margin and fringe ochreous. Underneath black; the primaries with the margin yellowish buff; the secondaries with the cell and inner area broadly, the costa and outer margin narrowly, also the fringe yellowish buff.

Expanse.—54 mm.

Habitat.—Carabaya, Peru.

Type.—Cat. No. 8724, U.S.N.M.

Genus **PHASTIA** Walker.

PHASTIA OCHREATA, new species.

Head and collar bright yellow, also an anterior space on thorax, which is otherwise dark lilacine. Abdomen dark grey above, whitish underneath; the terminal segments reddish brown; anal tuft yellowish. Primaries above median and vein 4 bright ochreous, below them violaceous brown, with a lilacine grey shade above the submedian; base of cell, extreme costal margin, and veins 5 and 6 violaceous brown. Secondaries smoky grey, darkest on inner margin; the ends of veins and a terminal shade light reddish brown. The female has the secondaries light reddish brown shaded with grey at base and on inner margin. On the primaries the posterior half of wing is duller and the lilacine shade above submedian is absent.

Expanse.—Male, 32 mm.; female, 36 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8725, U.S.N.M.

PHASTIA UMBRATA, new species.

Head and thorax reddish brown streaked with white. Abdomen greyish buff. Primaries light brown shaded with grey at base, above submedian and on outer margin above each vein; a round reddish brown spot above submedian near base; the costal margin shaded with grey and lilacine, traces of darker brown basal, antemedial, medial and postmedial lines; a faint submarginal whitish shade. Secondaries whitish thickly irrorated with lilacine brown. Underneath greyish white.

Expanse.—30 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8726, U.S.N.M.

Genus MASCHANE Walker.

MASCHANE FRONDEA, new species.

Palpi ochreous brown. Head violaceous irrorated with lilacine. Collar bright yellow. Thorax lilacine brown. Abdomen ochreous brown, paler underneath. Primaries light brown, shaded with ochreous on outer margin; the base and medial space shaded with dull violaceous; some lilacine irrorations on costal and inner margins; a black point at end of cell; the costal margin very arched, with a medial, broad, velvety brown streak across it. Secondaries light reddish brown, palest at base.

Expanse.—34 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Another specimen is almost entirely dark violaceous, the outer margin light brown, with darker brown marginal shade.

Type.—Cat. No. 8727, U.S.N.M.

Genus RIFARGIA Walker.

RIFARGIA LEMOULTI, new species.

Palpi dark brown with two pale streaks. Head buff and brown. Collar dark brown edged with buff. Thorax dark brown. Patagia creamy buff, edged with dark brown dorsally. Abdomen dark brown; some grey subdorsal scales on last segments; underneath brownish cream color. Primaries dark grey; at base a large buff space streaked with reddish brown occupying a little over one-third of wing on costal margin and in cell; below cell it narrows to inner margin; a fine dark brown line outwardly edged with pale grey limits this space from costa to submedian and then continues wavy to inner margin; a kidney shape spot at end of cell outlined by a fine brown line; a geminate dark grey, lunular, postmedial line curved around end of cell; an outer geminate and broken brown line divided by a pale reddish

brown shade; this line below vein 3 seems to start from the post-medial line; apex light reddish brown, with some dark velvety streaks; some dark grey submarginal spots preceded in the female by a pale grey shade above vein 4; an irregular fine dark marginal line; outer margin crenulate, the fringe reddish brown. Secondaries dark brown, paler in the female; fringe reddish brown; a black spot at anal angle.

Expanse.—Male, 63 mm.; female, 76 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8728, U.S.N.M.

RIFARGIA MISTURA, new species.

Palpi reddish brown; two lateral pale streaks. Head, collar, and thorax dark brown; a large gray spot posteriorly on thorax. Abdomen reddish brown; anal segments grey above. Primaries grey irrorated with brown; the basal third of costal margin, extending below cell, dark brown, limited by a geminate brown line which extends from costa to inner margin; a small darker grey spot in cell, followed by an oval spot merely outlined, finely, by blackish brown; a dark grey shade above this spot on costa, curving around cell to middle of inner margin; an outer geminate, lunular, dark brown line, divided by light brown shades, from vein 8 to inner margin, incurved below vein 3, followed by a dark grey shade between veins 3 and 4, and paler grey shades above vein 4; outer margin darker grey; some brown at apex; a velvety brown streak between veins 7 and 8; a marginal black irregular line; dark terminal lunules; fringe brown, spotted with buff at ends of veins. Secondaries dark brown; fringe paler; some black streaks at anal angle. Underneath the secondaries with long reddish brown hairs, and a submarginal black band.

Expanse.—Male, 67 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8729, U.S.N.M.

RIFARGIA NOTABILIS, new species.

Palpi, head, and collar ochreous brown. Thorax moss grey. Abdomen dark grey above, luteous underneath; anal hairs ochreous brown. Primaries ochreous brown; the costal margin moss grey to near apex, with darker spots; a similar oblique band from base of cell to inner margin, followed by a fine dark brown line; an irregular black line at end of cell; from cell to submarginal line and from vein 4 to costal margin dark grey, crossed by two wavy darker lines; a postmedial reddish brown line below vein 4; the submarginal line fine, velvety black, wavy from vein 8 to vein 4; below vein 4 lunular and marginal; fringe grey with darker spots. Secondaries whitish; the costal margin narrowly, the inner margin broadly smoky black; a dark streak at anal angle.

Expanse.—44 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8730, U.S.N.M.

RIFARGIA CONDITA, new species.

Palpi grey, laterally brown. Head reddish brown and grey. Collar and thorax anteriorly brown, posteriorly grey. Abdomen darker grey above, white below. Primaries: the basal third white irrorated with black, crossed by a black wavy line, geminate on costa, and limited by a straight black line, geminate below cell to inner margin; rest of wing light brown becoming darker toward apex; at end of cell a kidney-shape spot outlined with black; traces of geminate medial lines on costa and inner margin; a wavy geminate, brown, postmedial line followed by a row of large black spots between the veins from 3-8; a black marginal line straight from apex to vein 3, interrupted and irregular below vein 3; fringe light brown with darker spots at ends of veins. Secondaries white, also the fringe; a broad black band on outer margin.

Expanse.—35 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8731, U.S.N.M.

RIFARGIA DEMISSA, new species.

Palpi and head buff brown; a dark brown streak on palpi. Thorax lichen grey; some dark brown hairs on thorax anteriorly. Abdomen dark brown-grey; anal segments light grey; some luteous tufts at base; underneath buff. Primaries lichen grey, irrorated with reddish brown and black scales; a basal dark brown line terminating in a brown spot above submedian; a dark brown, waved, dentate, geminate, antemedial line; two oblique brown lines at end of cell, crossed by an indistinct medial brown shade, geminate on costa; a postmedial brown lunular line, followed by two black spots above and below vein 2, and three spots above vein 5, which are oblique toward apex; a fine reddish brown submarginal shade; a marginal black lunular line interrupted by pale streaks on veins; fringe grey and brown with darker spots. Secondaries greyish black, some pale hairs on inner margin. Underneath black, the fringe luteous; a yellowish space on inner margin.

Expanse.—41 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8732, U.S.N.M.

RIFARGIA EXTRANEA, new species.

Female.—Head, collar, and thorax brown mottled with grey. Abdomen above dull grey-brown, underneath white, shaded with brown at base and on anal segments. Primaries grey, irrorated with dark

brown, leaving only the basal third of costal margin and the outer margin really greyish; the inner margin darkest to postmedial line; traces of a dark basal line; three black antemedial wavy lines; a lunular greyish brown streak at end of cell; a postmedial, geminate, dark brown line from costa to vein 3, divided by a grey shade; from below end of cell the line is only partly geminate; the postmedial is followed by a brown shade on which is a series of dark velvety streaks between the veins above 3, and most heavily marked toward costa; submarginal brown irrorations; a marginal black line, wavy below vein 3; fringe whitish mottled with dark grey. Secondaries whitish; the costal and outer margins broadly black; the inner margin shaded with dark brown; fringe white. Underneath primaries, black; some white markings on costa near apex. Secondaries as above, but the inner margin white.

Expanse.—38 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

What I believe to be the male of this species has the primaries lighter grey, and the antemedial and postmedial lines shaded on inner margin with yellow and white; some yellow at end of cell, and at base below median vein.

Type.—Cat. No. 8733, U.S.N.M.

RIFARGIA MERITA, new species.

I described ^a as the female of *Rifargia picta* a species which turns out to be quite distinct. As I now have males and females of both forms, showing that the markings of the sexes agree, it will require a name. The specimen I described as a female is really a male, the antennæ being fasciculate; the female antennæ are simple. I propose the name *merita*.

Type.—Cat. No. 8734, U.S.N.M.

RIFARGIA MORTIS, new species.

Male.—Head, thorax, and abdomen above blackish grey. Body underneath luteous. Primaries dark blackish grey; some moss green irrorations on costa medially; a velvety black streak on discocellular; traces of an antemedial darker line; traces of a darker postmedial line, with minute whitish spots on veins, not always visible; a buff shade from vein 6 to apex; a vague submarginal darker shade; a dark velvety point on outer margin above submedian vein. Secondaries dirty white; the costal margin narrowly brown; some terminal brown irrorations. The female is paler; the costal margin shaded with buff; the antemedial line pale reddish brown; a long velvety dark streak below vein 3; a postmedial pale reddish brown shade, followed by short dark velvety streaks between the veins; marginal small spots,

^aTrans. Am. Ent. Soc., XXX, 1904, p. 147.

light reddish brown, outwardly shaded with darker brown. Secondaries smoky grey; whitish at base; an outer whitish line.

Expanse.—Male, 33 mm.; female, 35 mm.

Habitat.—Tucuman, Argentine Republic; Cayenne, French Guiana.

This species is allied to *R. xylinoides* Walker.

Type.—Cat. No. 8735, U.S.N.M.

RIFARGIA OCCULTA, new species.

Palpi and head dark reddish brown. Collar and thorax dark violaceous brown; the patagia mottled with grey and light brown scales. Abdomen blackish brown above, buff underneath. Primaries blackish brown, the veins irrorated with black and grey; some small buff spots on outer half of costa; a round spot at end of cell finely outlined with white, and containing some light brown scales; above it some fine whitish lines; a fine, lunular, postmedial black line, faintly geminate; a pale buff spot at apex crossed by a dark streak; a faint buff narrow marginal shade; terminal black lunules, shaded on either side with buff; fringe brown; buff streaks at ends of veins. Secondaries blackish brown; fringe luteous. Underneath lighter brown; the outer margins buff; disc of secondaries shaded with buff.

Expanse.—Male, 54 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8736, U.S.N.M.

RIFARGIA ONEROSA, new species.

Head and thorax violaceous brown, the latter with luteous tufts posteriorly; abdomen dull reddish brown; the anal segments blackish grey. Primaries dull violaceous black; the base mottled moss green and grey, limited by a curved pale line; the medial space on costa and inner margin mottled with moss green; an antemedial and a postmedial lunular dark brown line shaded with reddish brown; a similar spot at end of cell, on which is a dark brown circle; the postmedial followed by a row of small dark brownish shades; a light reddish brown streak above vein 4, and one below vein 2; three brown spots on costa medially, followed by three buff spots toward apex; a large buff spot at apex, irrorated with reddish brown; a pale marginal shade between veins 4 and 6; a wavy velvety terminal line, touching inwardly light brown spots; fringe dark with light brown spots at ends of veins. Secondaries violaceous brown; the fringe luteous; a darker spot at anal angle. Underneath: primaries dark brown; the outer and inner margins grey; a buff spot at apex. Secondaries yellowish; a dull brown submarginal band.

Expanse.—45 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8737, U.S.N.M.

RIFARGIA DISCREPANS, new species.

Female.—Palpi brown, fringed with buff. Head and thorax greyish brown. Abdomen blackish grey above; a subdorsal brown tuft on third segment; underneath dark buff. Primaries dark mouse grey; a vague circular brown space between median and submedian veins on basal third, crossed by a dark brown lunular line, partly geminate; the postmedial line, velvety brown, dentate, deeply so inwardly between veins 4 and 5, interrupted between veins 2 and 3, preceded and followed by a dark velvety brown line below vein 2; the costa mottled with light grey between the lines; the postmedial followed above vein 4 by reddish brown shades, crossed by a nearly straight dark line close to the postmedial; a dark submarginal streak above and one below vein 5; a velvety brown lunular mark between 7 and 8; a faint marginal grey shade, and short white streaks on veins; the veins on outer margin dark brown; a terminal dark lunular line edged with light brown. Secondaries: base light brown, otherwise very dark brown; the fringe luteous; a dark brown streak and white spot at and above anal angle. Underneath dull dark brown; a broad buff space on inner margin from base to anal angle.

Expanse.—47 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8738, U.S.N.M.

RIFARGIA TULIRA, new species.

Male.—Head and thorax brown, mottled with buff. Abdomen violaceous brown above; dirty yellow underneath. Primaries buff brown; basal half thickly irrorated with darker brown, on which the geminate basal and antemedial lunular lines are only distinct on costa; a medial geminate lunular black line divided by reddish brown, nearly straight from costal to inner margin; a large irregular spot at end of cell, outlined with buff and containing some black lines, followed by a dark brown dash on veins 4 and 6; a similar dash on vein 2; these dashes followed by the postmedial, which is black, finely wavy, shaded inwardly with buff; the veins postmedially irrorated with black and grey; darker brown shadings on outer margin; a terminal black line, thickened between the veins. Secondaries dark brown; a dark point at anal angle; fringe pale buff. Underneath dull dark brown; on secondaries some dirty yellow shades below cell and on inner margin; a faint medial brown shade. The female is greyer in tone.

Expanse.—Male, 45 mm.; female, 49 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8739, U.S.N.M.

RIFARGIA INDECORA, new species.

Head reddish fawn color; collar darker. Thorax grey. Abdomen dark grey above, whitish underneath. Primaries grey, irrorated with darker grey on basal half; a reddish fawn spot at base between median and submedian veins; some brown irrorations on costa medially and in cell; a black streak on discocellular, followed by a large diffuse black spot, followed by a blackish brown shade to apex; traces of a black wavy postmedial line; an indistinct marginal brown line; fringe grey spotted with brown at ends of veins. Secondaries dull blackish grey.

Expanse.—32 mm.

Habitat.—Geldersland, Surinam River, Dutch Guiana.

Type.—Cat. No. 8740, U.S.N.M.

RIFARGIA LITURA, new species.

Head and thorax dark reddish brown; the patagia mottled with dark buff. Abdomen dull brown above, yellow underneath; some luteous tufts at base laterally. Primaries light brown irrorated with dark brown; a black basal line, followed below cell by a broad blackish shade; a lunular, irregular black antemedial line; traces of a wavy medial line; an oblique blackish shade in cell and between base of veins 2 and 3; a velvety dark linear streak at end of cell; the postmedial consisting of black lunular marks between the veins, followed by a dark spot between 3 and 4, and above vein 6 to the submarginal line, also by black and grey spots on the veins; the submarginal appearing paler owing to the absence of irrorations; round black marginal spots between the veins; terminal black paired spots at veins; fringe spotted with black between the veins. Secondaries violaceous brown, darkest on outer margin; a black and white spot at anal angle; fringe luteous, except at angles. Underneath dull blackish brown; the outer margins narrowly buff; the secondaries with luteous hairs below cell and along inner margin.

Expanse.—51 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8741, U.S.N.M.

Genus LOBEZA Herrich-Schæffer.

LOBEZA MINOR, new species.

Head and thorax dark grey. Abdomen golden ochreous above; laterally grey; ventrally whitish. Primaries grayish white, irrorated with brown, very thickly at base and submarginally; the basal third of costa to middle of inner margin darkest, crossed and limited by a darker wavy line; an irregular postmedial line to middle of inner margin, leaving a triangular medial space the palest; a broad submarginal dark space separated from the postmedial line by a grey shade;

outer margin dark grey, the veins whitish. Secondaries dark smoky grey. The female is slightly paler than the male.

Expanse.—Male, 35 mm.; female, 43 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8742, U.S.N.M.

Genus LUSURA Walker.

LUSURA FLORABILIS, new species.

Palpi dark brown; a white point above. Head lilacine brown. Thorax dark steel grey, thinly streaked with grey hairs. Abdomen dark violaceous above, creamy white below. Primaries: steel black, finely irrorated with grey; some dark brown in cell, at base of inner margin; an antemedial and a postmedial row of dark velvety brown spots, the latter followed by some brown shadings, and two rows of dull dark brown spots; some white irrorations on costa medially, and three whitish points toward apex; a dark brown spot at end of cell; the outer margin shaded with brown and crossed by a row of dark velvety lunules, outwardly shaded with buff. Secondaries smoky brown.

Expanse.—45 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

The female differs in having the antemedial and postmedial spots dull brown.

Type.—Cat. No. 8743, U.S.N.M.

Genus NESEBRA, new genus.

Antennæ shortly pectinated to beyond middle in both sexes. Palpi down curved; third joint minute. Primaries long and rather narrow, outer margin rounded; veins 2, 3, and 4 equally distant; 5 from middle of discocellular; 6 from below upper angle of cell; 7 to 10 stalked; 10 beyond 7. Secondaries: veins 3 and 4 apart; 5 weak; 6 and 7 on short stalk; 8 diverging from 7 at middle of cell.

NESEBRA NOREMA, new species.

Palpi reddish brown. Head and thorax violaceous brown. Abdomen dull dark brown above, buff underneath. Primaries brown; a dark velvety brown oblique streak from base below median to inner margin, followed by a white spot below cell, lighter brown in and above cell, all limited by a geminate curved brown line, closely followed by a blackish line; space to outer line brown, in one specimen dark velvety brown, with a large irregular paler spot in cell and a greyish shade on costa above it; outer line brown, evenly curved from costa to vein 3, followed to that vein by a whitish shade, then a brown shade, widest on costa; outer margin mottled with grey and lilacine; a submarginal row

of brownish spots; a marginal row of blackish streaks. Secondaries brown. The female is greyer, with the lines all indistinct, brown; a curved row of blackish spots beyond cell from below costa to vein 2.

Expanse.—Male, 35 mm.; female, 46 mm.

Habitat.—Maroni River, French Guiana.

Type.—Cat. No. 8744, U.S.N.M.

Genus DYLOMIA Felder.

DYLOMIA OCHREATA, new species.

Palpi and head reddish brown. Collar and thorax ochreous, the latter with a reddish brown spot posteriorly. Abdomen dark ochreous above, whitish yellow underneath. Primaries ochreous; costa finely reddish brown to above end of cell, then ochreous and again reddish brown apically; an irregular darker antemedial shade; a reddish brown point at end of cell; a lilacine shade on inner margin before antemedial line; a marginal darker ochreous line, followed by a lilacine shade and a terminal darker lilacine line; white points on veins at marginal line, the largest at vein 7. Secondaries: base light yellow, becoming ochreous on outer margin.

Expanse.—29 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8745, U.S.N.M.

DYLOMIA DELICATA, new species.

Head brownish lilacine. Thorax violaceous. Abdomen brown above, luteous underneath. Primaries lilacine; the costa ochreous brown on basal half, paler on outer half; an ochreous brown shade in middle of cell; basal third below cell, violaceous, followed by a reddish brown shade; outer half of inner margin narrowly ochreous brown; a dark point at end of cell; a buff streak below vein 7; below vein 6, a submarginal ochreous brown shade; fringe dark buff. Secondaries dirty white; the outer half irrorated with lilacine brown scales.

Expanse.—20 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8746, U.S.N.M.

DYLOMIA CONSOBRINA, new species.

Head violaceous. Collar ochreous. Thorax buff, a violaceous spot posteriorly. Abdomen ochreous brown above, luteous underneath. Primaries pale yellowish buff; costal margin finely ochreous; a violaceous spot at middle of costa; a wavy, dark yellow antemedial shade; a similar point at end of cell; a dark reddish brown marginal line, preceded by a brownish shade with white points on veins, and followed by a dark violaceous shade irrorated with lilacine scales; fringe

brown and buff. Secondaries pale yellowish buff, the outer margin shaded with pale reddish brown.

Expanse.—25 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8747, U.S.N.M.

DYLOMIA FRAGILIS, new species.

Head violaceous. Palpi, collar, and thorax ochreous; patagia buff. Abdomen ochreous brown above, paler underneath. Primaries pale yellow; the costal and outer margins broadly violaceous and lilacine; a dark brown point at end of cell; a brown shade below end of cell, angled below vein 2, then inwardly oblique to inner margin, outwardly edged by a darker brown line, and a white point on submedian, followed on inner margin by a grey and brown shade, limited outwardly by a short white line; a submarginal ochreous brown shade from vein 4 to inner margin, edged on either side by a dark brown line, outer margin at inner angle thickly irrorated with lilacine. Secondaries dirty white, shaded with pale reddish brown on outer and inner margins.

Expanse.—30 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8748, U.S.N.M.

DYLOMIA PULVEREA, new species.

Palpi and head pale reddish brown; vertex white. Collar dark reddish brown. Thorax lilacine grey. Abdomen reddish brown above, luteous underneath. Primaries brown, thickly irrorated with lilacine, except on outer half of inner margin, and the outer margin, where there is only a cluster of lilacine scales above the submedian and vein 2; an oblique white line from apex to submedian at one-third from base, inwardly shaded with clear brown; a perpendicular line from this line at vein 2 to inner margin; a black point at end of cell; beyond cell to oblique line the veins are brown; a black point below apex, and white marginal points above and below vein 6. Secondaries reddish brown, paler at base.

Expanse.—28 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8749, U.S.N.M.

DYLOMIA GERMANA, new species.

Palpi, head, and collar reddish brown, vertex white. Thorax lilacine brown. Abdomen reddish brown above, luteous underneath. Primaries lilacine brown, finely irrorated with lilacine on margins; an oblique pale line, inwardly shaded with dark brown from a black spot below apex to middle of submedian vein, then forming an outward

curve to inner margin; a similar line from subcostal near base to below vein 2 near the outer line, there angled, and inwardly oblique to submedian at one-third from base; this line has sometimes a black spot on subcostal and at median veins; a black point at end of cell; a small, pale, curved antemedial line below submedian vein. Secondaries reddish brown, paler at base:

Expanse.—31 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Closely allied to *D. pulverea* Schaus, but in a long series of each the lines always present the difference described.

Type.—Cat. No. 8750, U.S.N.M.

Genus ODONTOSIA Hübner.

ODONTOSIA (?) VIRIDIFUSCA, new species.

This species agrees with *Odontosia* in venation, but the outer margin is hardly crenulate. Head olivaceous. Thorax reddish brown. Abdomen grey. Primaries moss green; the inner margin broadly violaceous brown; similar spots on costa, the commencement of lines; the antemedial and postmedial lines fairly distinct, the latter with white points on veins; cell greyish; dentate grey shades beyond cell and before postmedial; geminate black marginal spots below vein 7; those between veins 2 and 3 edging a white spot; the outer margin between veins 3 and 7 tinged with reddish brown. Secondaries blackish brown; some black and white scales above anal angle.

Expanse.—35 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. 8751, U.S.N.M.

Genus ANITA Schaus.

ANITA NORELLA, new species.

Palpi grey with a lateral dark velvety streak. Head, collar, and thorax reddish brown; the patagia grey. Abdomen dark brown above, greyish underneath. Primaries: a velvety black transverse line just before middle; from base to this line the costal margin and veins are grey, below the subcostal the space to inner margin is mottled brown and buff; a geminate basal dark grey line; two antemedial lines, the first broad, dark grey, the second finer, dark brown; a wavy black line just beyond cell; intermediate space dark grey on costa; brown below cell; a grey shade between base of veins 2 and 3; a large dark brown spot in cell; this black line is followed by white points on veins and a narrow brown shade, beyond which is a broad greyish white shade on which is a row of large black spots separated by the veins; outer margin brown; the veins black crossed by a fine whitish

line, beyond which are terminal black spots on veins; fringe brown. Secondaries dark brown.

Expanse.—Male, 37 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8752, U.S.N.M.

ANITA SYRTA, new species.

Palpi light grey tipped with brown. Head, collar, and thorax ochreous brown; patagia creamy white edged with lilacine. Abdomen brown, slightly paler underneath. Primaries brown, lines blackish; a wavy basal line; costal margin broadly white from basal to antemedial line; antemedial line wavy, becoming reddish brown on inner margin; a thick black mark in cell; a reddish brown streak at end of cell; postmedial line lunular, becoming brown below vein 3, followed by white points and black streaks on veins 3 to 7; costal margin medially darker brown, then mottled with white to apex; submarginal black spots on a white shade; a marginal brown line; terminal black spots on veins. Secondaries dark brown.

Expanse.—34 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8753, U.S.N.M.

ANITA GALIBENSIS, new species.

Palpi dark velvety brown, deeply fringed with buff and brown. Head and collar mottled dark and ochreous brown; a violaceous space posteriorly on thorax; a pale streak on patagia. Abdomen dark brown above; a subdorsal darker tuft on third segment; underneath dark buff. Primaries: basal third dark velvety brown, with a lighter brown shade at base of costa and below cell, and limited by a wavy slightly curved pale line; immediately after this a small velvety brown spot in cell; above median vein and vein 4 the wing is light grey, below it brown; an annular dark grey spot at end of cell; a dentate black line, curved around cell, followed by a finer reddish brown dentate line; a deeply dentate submarginal black line; a marginal wavy dark brown line. Secondaries dark brown.

Expanse.—Male, 44 mm.; female, 50 mm.

Habitat.—Maroni River, French Guiana; Essequibo River, British Guiana.

Type.—Cat. No. 8754, U.S.N.M.

ANITA LASSA, new species.

Palpi and patagia light brown. Head and collar velvety black. Abdomen blackish brown above, light brown underneath. Primaries light brown shaded with dark steel grey on costa before apex, above inner angle, and on basal third between median and submedian veins;

a darker brown shade at base of costa; and oblique antemedial, broad, dark steel grey shade from costa across cell; a small velvety black spot in cell, one below cell, and one on submedian vein; an outer geminate row of black points on veins, followed by dark streaks between the veins; marginal dark grey elongated spots between the veins, edged with black which extends on to fringe. Secondaries dark brown.

Expanse.—50 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8755, U.S.N.M.

Genus NAVARCOSTES, new genus.

Antennæ pectinated in both sexes to beyond the middle. Palpi thick, reaching beyond frons; the third joint short, a tuft of hair on either side of frons. Legs with thin tufts of hairs; tarsi smooth. Abdomen extending beyond hind wings. Primaries long and narrow; veins 3 and 4 well apart; vein 5 from near upper angle of cell; vein 6 from middle of areole; 7, 8, 10 from end of areole. Secondaries somewhat triangular; veins 3 and 4 from lower angle of cell; 5 very weak or absent; 6 and 7 on short stalk.

NAVARCOSTES LIMNATIS, new species.

Palpi, head, and collar reddish brown. Thorax lilacine; a blackish spot posteriorly; a large white spot on shoulders. Abdomen dark greyish brown above; luteous underneath and at anus. Primaries grey, thinly irrorated with brown; a geminate black basal line from costa to submedian, followed by a large whitish spot below cell; a black point in cell; another at end of cell; three antemedial brown lines; a medial and three postmedial black marks on inner margin; traces of two brownish postmedial lines, followed by a series of small brown intervenal spots; an interrupted wavy black outer line; submarginal brown spots and streaks below costa; marginal black spots between the veins; a buff space at apex. Secondaries greyish brown. Underneath whitish; a medial wavy dark line, basal anterior half of primaries blackish; outer and marginal blackish spots on primaries.

Expanse.—Male, 43 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8756, U.S.N.M.

Genus PAMCOLOMA, new genus.

Antennæ fasciculate. Palpi hairy, extending above frons; third joint minute; legs hairy. Primaries: outer margin obliquely rounded; vein 5 from near upper angle; 6 from middle of areole; 7, 8, 10 from end of areole; 2 and 3 near together from lower angle. Secondaries: the costal margin convex at base; outer margin rounded; 2 and 3 from

lower angle of cell; discocellular weak; vein 5 absent; 6 and 7 from upper angle; vein 8 diverging from 7 before middle of cell. Wings very hairy underneath.

Type.—*Pamcoloma marita* Schaus.

PAMCOLOMA MARITA, new species.

Head and thorax dark reddish brown, mottled with grey. Abdomen dark brown above; anal segments greyish; luteous underneath; lateral luteous tufts at base. Primaries light grey irrorated with brown; the costal margin broadly to postmedial, the inner margin broadly from antemedial to outer margin, also apex much darker; the lines dark brown, inversely lunular; antemedial and postmedial geminate; an oblique streak from base of costa to submedian; a dark spot in cell; dark outer spots below vein 3 and above vein 5, preceded near costa by a creamy white shade; oblique dark marginal streaks; fringe grey, spotted with black. Secondaries very dark violaceous brown, slightly paler toward base and on inner margin; fringe brown tipped with white and with darker spots. Underneath: primaries blackish brown; apical half of costa and fringe buff with dark spots. Secondaries grey; the base with yellow hairs; a broad black outer margin; fringe whitish.

Expanse.—37 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8757, U.S.N.M.

PAMCOLOMA REFERVENS, new species.

Male.—Palpi, head, thorax, and anal segments grey, streaked with brown. Abdomen brownish grey above, whitish underneath. Primaries grey, thinly irrorated with light brown; lines brown; a geminate basal line from costa, which is brown at base; three antemedial lines, interrupted and irregular, only two reaching inner margin; two medial lines on costa and inner margin; two parallel black streaks at end of cell; the postmedial geminate, lunular, interrupted by veins; an outer row of blackish spots; an irregular brown submarginal shade; marginal, black, lunular spots between the veins; fringe buff with blackish spots. Secondaries very dark brown; the fringe brown tipped with white. Underneath similar to *P. marita* Schaus.

The female has the lines darker, the medial space shaded with brown; a distinct whitish shade beyond the postmedial line. The base of secondaries underneath is whiter without any yellow hairs.

Expanse.—Male, 37 mm.; female, 39 mm.

Habitat.—Maroni River, French Guiana; Surinam River, Dutch Guiana.

Type.—Cat. No. 8758, U.S.N.M.

Genus *KASERIA*, new genus.

Antennæ pectinated on basal two-thirds. Palpi short, hairy, and thin, third joint minute. Primaries: outer margin rounded; veins 2 and 3 well apart; vein 5 from above middle of discocellular; 6 from middle of areole; 7, 8, 10 from end of areole. Secondaries: veins 3 and 4 apart from lower angle of cell; 5 absent; 6 and 7 from upper angle; 8 close to 7 to beyond middle of cell.

KASERIA PALLIDA, new species.

Head, thorax, and anal segment light grey, thinly irrorated with brown. Abdomen light reddish brown above, white underneath; a darker subdorsal basal tuft. Primaries silvery, with a few light brown irrorations; lines light brown; traces of a basal line at costa; a fine medial line indented below cell and on submedian, preceded from costa to just below median vein by another line; from cell to post-medial thickly irrorated with brown, also on costa above this shade, where there are also four dark brown spots; the postmedial lunular, partly geminate; some brownish marginal spots, preceded by some brown irrorations from above vein 4 to above vein 7. Secondaries light brown, thinly scaled.

Expanse.—32 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8759, U.S.N.M.

Genus *GINALDIA*, new genus.

Antennæ fasciculate. Palpi thick, hairy; third joint minute. Legs hairy. Primaries: outer margin oblique; veins 3 and 4 apart; 5 from upper angle; 6 from middle of areole; 7, 8, 10 from end of areole. Secondaries short and broad; costal and outer margins rounded; veins 3 and 4 near together from lower angle of cell; 5 absent; 6 and 7 very shortly stalked; 8 diverging from 7 at middle of cell.

GINALDIA DAVIDSONI, new species.

Palpi black, fringed with grey. Head and collar light reddish brown, mottled with grey. Thorax light grey, streaked with violaceous. Abdomen grey brown above, white underneath; anal segments light grey. Primaries white, thinly irrorated with black and brown; black marginal streaks on veins; a postmedial row of geminate black spots on veins, faintly connected by grey irrorations; a large black spot at end of cell; a black basal streak below median vein; an oblique black geminate antemedial line from costa to below cell; a submarginal brown shade from near apex to vein 4; paired black terminal spots at veins; fringe spotted with dark brown. Secondaries white; a terminal brown line; some dark hairs at anal angle; fringe white.

Expanse.—35 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8760, U.S.N.M.

Genus HEMICERAS Guenée.

HEMICERAS INDIGNA, new species.

Head and thorax light lilacine brown. Abdomen dark lilacine brown above, buff underneath. Primaries light brown, the veins dark brown, all irrorated with lilacine grey scales; the lines fine, olivaceous brown; the antemedial straight, the postmedial at one-fifth from apex, straight to middle of inner margin; a dark spot at end of cell; a similar spot above it toward base; a darker marginal shade. Secondaries buff at base and on inner margin; outer half of veins and outer margin dark violaceous brown; fringe light brown, tipped with buff.

Expanse.—40 mm.

Habitat.—Cayenne, French Guiana.

The inner margin of primaries is slightly sinuous and toothed before base. This species comes nearest to *H. transducta* Walker.

Type.—Cat. No. 8761, U.S.N.M.

HEMICERAS UNDILINEA, new species.

Palpi fawn color; a lateral reddish brown streak. Head and thorax mottled lilacine and light reddish brown. Abdomen brown above, whitish buff underneath. Primaries moss grey; the postmedial line, a submarginal shade, a large space at inner angle, and a basal space above the submedian reddish brown; the lines very lunular wavy; the basal and antemedial lines dark brown; the postmedial at three-fourths from base of costa, slightly curved below vein 7 to just beyond middle of inner margin, a broad oblique dark spot at end of cell. Secondaries dark brown. Underneath light brown, the costal margin of secondaries broadly whitish.

Expanse.—35 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

The inner margin of primaries straight.

Type.—Cat. No. 8762, U.S.N.M.

HEMICERAS JEJUNA, new species.

Palpi light reddish brown, fringed and tipped with buff. Vertex white. Collar and thorax mottled lilacine and white. Abdomen brown above, whitish underneath. Primaries whitish, thickly irrorated with light brown, leaving only the lines white; the basal and antemedial lines slightly oblique, the latter followed by a greyish shade and a black point on median and submedian veins; the postmedial from costa at three-fourths from base, slightly incurved below

vein 3; the veins beyond this line irrorated with black; a greyish submarginal shade; a darker grey spot at end of cell, the inner margin slightly sinuous. Secondaries greyish brown, slightly whitish at base.

Expanse.—Female, 38 mm.

Habitat.—Trinidad, British West Indies.

Allied to *H. indistans* Guenée.

Type.—Cat. No. 8763, U.S.N.M.

HEMICERAS SATELLES, new species.

Frons reddish brown; white spot at base of antennæ. Vertex and thorax brown, irrorated with lilacine. Collar reddish brown, fringed with lilacine. Abdomen dark brown above, buff underneath. Primaries dark olivaceous brown; the lines lilacine; the basal and antemedial lines inwardly edged with reddish brown; the basal line straight, the antemedial line slightly oblique; a slightly darker line at end of cell; postmedial from costa at four-fifths from base to just beyond middle of inner margin, followed by a lilacine shade extending to inner angle; a darker submarginal shade at veins 3 and 4. Secondaries very dark brown, the veins and opaque spot still darker.

Expanse.—Male, 36 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

The inner margin of primaries nearly straight.

Type.—Cat. No. 8764, U.S.N.M.

HEMICERAS BEATA, new species.

Frons brown; a white line posteriorly, and small white tufts at base of antennæ. Vertex and thorax lilacine mottled with brown. Collar reddish brown. Abdomen dull brown above. Primaries brown, irrorated with lilacine, especially on costal margin, beyond antemedial, and at inner angle; lines whitish, the basal and postmedial inwardly, the antemedial outwardly shaded with darker brown; the basal and antemedial lines slightly angled below subcostal vein; the postmedial at three-fourths from base on costa very slightly curved to inner margin beyond middle; a dark spot at end of cell; a submarginal brown space between veins 3 and 4; inner margin very slightly sinuous. Secondaries brown; the opaque spot darker. The female is more thickly irrorated with lilacine.

Expanse.—33 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8765, U.S.N.M.

HEMICERAS GORTYNOIDES, new species.

Head and collar anteriorly reddish brown; whitish hairs at base of antennæ; collar posteriorly and thorax light brown; patagia lilacine. Abdomen dark brown above, light brown ventrally, buff laterally.

Primaries dark reddish brown, in a fresh female violaceous; the inner margin straight, shaded with lilacine; basal line white, interrupted, not reaching submedian; a large white spot in cell crossed by a wavy reddish brown line, a smaller white spot above it on costa; an antemedial dark streak on inner margin; a dark spot at end of cell; on costa at four-fifths from base a white spot; below it a grey line to inner margin at two-thirds from base. Secondaries whitish with blackish grey hairs; the veins dark brown; the outer margin and opaque spot blackish brown.

Expanse.—38 mm.

Habitat.—Omai, British Guiana; St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8766, U.S.N.M.

HEMICERAS CRASSA, new species.

Palpi lilacine. Head reddish brown; some white hairs at base of antennæ; thorax violaceous brown; patagia lilacine. Abdomen dull blackish brown above, ventrally lilacine, laterally buff. Primaries very dark reddish brown; inner margin straight, narrowly shaded with grey; a dark point at its center; a large darker spot at end of cell; some grey scales on costa just before its middle; postmedial line at four-fifths from base, dark grey, edged with black; no other lines visible; a few greyish scales on costa at postmedial line. The secondaries as in *H. gortynoides* Schaus.

Expanse.—37 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8767, U.S.N.M.

HEMICERAS COMMENTICA, new species.

Palpi and frons light reddish brown; some white at base of antennæ. Vertex, collar, and thorax lilacine streaked with light reddish brown. Abdomen buff, becoming dark grey dorsally on last segments. Primaries grey, irrorated with light brown, the outer margin brown; a darker grey spot at end of cell; a basal and an antemedial fine-wavy darker line, very indistinct; the postmedial from costa at two-thirds from base, oblique to just above vein 6, where it is angled and finely wavy to inner margin at two-thirds from base; the brown marginal shade is inwardly bordered above vein 3 by a fine darker brown shade. Secondaries buff at base; outer margin dark grey-brown.

Expanse.—Male, 39 mm.; female, 41 mm.

Habitat.—Maroni River, French Guiana.

This species is very similar to *H. angulinea* Schaus, the type of which is a female with simple antennæ. In *H. commentica* the female antennæ are pectinated but more shortly than in the male.

Type.—Cat. No. 8768, U.S.N.M.

HEMICERAS LONGIPENNIS, new species.

Palpi ochreous brown fringed with buff; head darker, some grey scales at base of antennæ. Collar ochreous brown, thorax darker; patagia yellowish buff. Abdomen dark golden yellow above, underneath tinged with light brown. Primaries long and narrow, slightly bulged below apex, then very oblique; the inner margin straight from base to outer line buff, very thinly irrorated with brown; costal margin tinged with golden yellow, the extreme margin brown; a dark brown spot at base of cell; a thick brown and lilacine streak at end of cell, preceded below subcostal by a smaller dark spot; a fine antemedial violaceous line, curved below subcostal; between the lines, the inner margin finely golden ochreous, and a grey shade above it; the outer line whitish outwardly edged with violaceous, starting from a black spot at apex; slightly curved to vein 3, then oblique to near middle of inner margin; beyond this line the wing is ochreous brown; paler toward apex; submarginal dark shades on veins 4 to 7. Secondaries pure white; the opaque spot dark brown.

Expanse.—44 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. No. 8769, U.S.N.M.

HEMICERAS FLAVA, new species.

Palpi, head and tufts at base of antennæ light reddish brown. Collar pale yellow, posteriorly and thorax reddish brown; patagia shaded with lilacine. Abdomen dull greyish brown above, buff underneath. Primaries with the outer margin, anal angle and inner margin rounded as in *H. rivicosta* Guenée, bright yellow, shaded with reddish brown on inner margin and beyond the outer line; lilacine irrorations between cell and submedian; a straight inner line, from median to submedian, dark brown, outwardly shaded with white; the outer line from a dark shade at apex to submedian near inner line, dark brown inwardly edged with white; below the submedian the two lines are reddish brown and close together; a small reddish brown shade at end of cell, preceded on subcostal by a black point. Secondaries whitish; the inner margin, opaque spot, and outer margin narrowly, light reddish brown.

Expanse.—47 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. No. 8770, U.S.N.M.

HEMICERAS MARONITA, new species.

Head brown. White tufts at base of antennæ. Collar light violaceous brown. Thorax greyish buff. Abdomen light reddish brown above, whitish underneath. Primaries buff, thinly irrorated with brown; lines fine, reddish brown, edged with dark grey toward medial

space; inner line inwardly oblique from costa; outer line from apex to near middle of inner margin; fringe reddish brown; the inner margin straight. Secondaries whitish; the veins, inner margin, outer margin narrowly, and opaque spot light reddish brown.

Expanse.—40 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

This species is allied to *H. leucospila* Walker.

Type.—Cat. No. 8771, U.S.N.M.

HEMICERAS STUPIDA, new species.

Head and thorax lilacine brown irrorated with white; white hairs at base of antennæ; a dark grey shade posteriorly on collar. Abdomen dark brown above, mottled with grey on anal segment, whitish underneath. Primaries light brown, the veins irrorated with black and buff; the costal and inner margins irrorated with buff; the antemedial line fine, dark brown, straight from subcostal to submedian vein; the outer line dark brown, thick, from apex to middle of inner margin; a fine dark brown streak at end of cell; submarginal dark grey shades parallel to the outer line; the inner margin faintly sinuous. Secondaries whitish at base, thinly scaled; veins outwardly dark brown; outer half clouded with brown; opaque spot dark brown.

Expanse.—35 mm.

Habitat.—Paramaribo, Dutch Guiana.

Type.—Cat. No. 8772, U.S.N.M.

HEMICERAS CAYENNENSIS, new species.

Head, collar, and thorax lilacine brown; a white line behind frons. Abdomen dull reddish brown above, buff underneath. Primaries lilacine brown, the veins darker; the inner line straight from costal to inner margin, dark brown; a narrow dark shade at end of cell; outer line from costa close to apex to just beyond middle of inner margin; this line reddish brown, outwardly edged with buff; irregular darker submarginal shades; the inner margin slightly sinuous. Secondaries whitish; the veins, opaque spot, and outer margin narrowly, dark brown; inner margin shaded with pale violaceous brown.

Expanse.—43 mm.

Habitat.—Cayenne, French Guiana.

This species is allied to *H. bilinea* Schaus.

Type.—Cat. No. 8773, U.S.N.M.

HEMICERAS FLAVESCENS, new species.

Palpi, frons, collar, and thorax reddish brown; vertex white; collar posteriorly violaceous; patagia bright yellow tipped with violaceous. Abdomen yellow above, paler underneath. Primaries: costal margin to near apex, and basal third of wing bright yellow; a grey spot on

base of submedian; some violaceous irrorations beyond it from subcostal vein to inner margin; an antemedial black and grey point on median, and another on submedian vein, connected by a fine violaceous shade, beyond which is a lilacine space to postmedial, irrorated with brown; a dark grey spot at end of cell, preceded by a dark point on subcostal; the postmedial consisting of black and grey spots on veins, connected below vein 2 by a wavy dark line; beyond cell, and entire outer margin above vein 2 shaded with lilacine brown; from vein 5 to apex irrorated with black and grey; the inner margin produced medially; a deep sinus before inner angle, edged with dark brown. Secondaries whitish; the margins shaded with pale ochreous brown.

Expanse.—40 mm.

Habitat.—St. Laurent, French Guiana.

This species is nearest *H. pallidula* Guenée.

Type.—Cat. No. 8774, U.S.N.M.

HEMICERAS LAURENTINA, new species.

Head and thorax reddish brown; some white and black on vertex; patagia shaded with lilacine; some white scales posteriorly on thorax. Abdomen light brownish. Primaries: base and outer margin brown; a broad space before outer line, shaded with lilacine brown; antemedial black and grey points on subcostal, median and submedian veins; a black point on subcostal before end of cell; a fine greyish streak at end of cell; apex black; from below it a straight line to sinus, geminate, dark reddish brown divided by a paler shade; the inner margin with deep lobe, finely edged with black and a few grey scales. Secondaries whitish; the inner and outer margin faintly shaded with pale reddish brown; the opaque spot dark brown.

Expanse.—39 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8775, U.S.N.M.

HEMICERAS MANORA, new species.

Head and palpi dark reddish brown, vertex white. Collar and thorax dark violaceous brown. Abdomen lighter brown above. Primaries dark brown, tinged with violaceous except beyond the outer line, which is dark violaceous from costa close to apex to near middle of inner margin; an indistinct curved, fine, reddish brown antemedial line; three dark spots at end of cell in a curved row; the inner margin straight. The secondaries smoky grey at base; outer margin and veins brown; the opaque spot darker brown.

Expanse.—36 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8776, U.S.N.M.

HEMICERAS METALLESCENS, new species.

Palpi and head reddish brown; vertex white. Collar buff, edged anteriorly with ochreous, posteriorly with dark violaceous. Thorax light brown; patagia buff. Abdomen light brown above. Primaries golden brown, iridescent; costal margin for two thirds from base yellowish buff; the extreme costa brown; cell and a space beyond from veins 2 to 6 lilacine white; a brown streak on discocellular; submarginal geminate black spots on veins 6 and 7; an outwardly oblique dark brown inner line from median to submedian vein; a postmedial ochreous brown spot on submedian, edged on either side with violaceous; the inner margin lobed, with a slight sinus before inner angle. Secondaries whitish; the veins and inner margin light brown; a terminal brown shade; the opaque spot golden brown.

Expanse.—39 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. No. 8777, U.S.N.M.

HEMICERAS CONSPIRATA, new species.

Palpi buff; a brown lateral streak. Head lilacine brown; a white streak between the antennæ. Thorax violaceous brown. Abdomen dull brown above, white below. Primaries violaceous brown; the outer margin narrowly olivaceous brown, widely so between veins 3 and 4; the costa finely white; a wavy antemedial line, reddish brown, indistinct, with a small black and grey spot on median and submedian veins, and one spot between these veins; a narrow dark shade at end of cell; outer minute dark spots on veins, partly shaded with grey scales from costa near apex to sinus, from vein 2 to inner margin connected by a grey line; the inner margin deeply lobed, with sinus before inner angle. Secondaries whitish; the veins slightly brown; a marginal narrow brown shade; a brown streak along inner margin; opaque spot brown.

Expanse.—Male, 44 mm.

Habitat.—Omai, British Guiana; the Guianas, Venezuela, Southern Brazil.

Allied to *H. levana* Druce. Some specimens are more of a reddish brown than the type.

Type.—Cat. No. 8778, U.S.N.M.

HEMICERAS MICANS, new species.

Head brown; a white spot on vertex; white and brown tufts at base of antennæ. Collar streaked buff and light reddish brown. Thorax pale violaceous. Abdomen light reddish brown above. Primaries: base and outer margin light silky brown; intermediate space dull lilacine brown; costa finely brown; antemedial and postmedial minute

dark points on veins; a dark streak at end of cell; the postmedial spots starting from costa near apex; a slight submarginal darker shade; the inner margin lobed; a slight sinus before angle. Secondaries whitish, thinly irrorated with light reddish brown; the opaque spot violaceous brown.

Epanse.—45 mm.

Habitat.—Orizaba, Mexico.

Type.—Cat. No. 8779, U.S.N.M.

HEMICERAS NEBULOSA, new species.

Palpi buff; a lateral brown streak. Head and collar anteriorly brown; vertex white; collar posteriorly, and thorax lilacine, thinly streaked with brown. Abdomen blackish above; transverse pale lines posteriorly on segments. Primaries buff, irrorated with brown; light grey shades at base, and along inner margin; a grey streak at end of cell, from which a dark grey shade starts and widens on outer margin from submedian to near apex; a basal dark point below cell; antemedial dark points on median, below it and on submedian; an outer row of black points on veins, followed by an outwardly lunular dark brown line; the inner margin straight. Secondaries brown; the outer margin and opaque spot very dark; fringe whitish.

Epanse.—35 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8780, U.S.N.M.

HEMICERAS NIGRIPLAGA, new species.

Palpi brown fringed with buff. Frons brown; a white streak in front of antennæ. Collar and thorax reddish brown, the collar fringed with violaceous. Abdomen greyish brown above. Primaries brown; an irregular fine dark brown line spotted with black on veins and below cell, the costal spot largest; a large black spot at end of cell, surmounted by a smaller black spot; a dentate black line from below costa near apex to vein 5, followed by dark brown and black spots; on veins 3 and 4 a black point; from vein 2 to inner margin at sinus a dentate dark brown line; sinus finely black; inner margin lobed. Secondaries whitish, thinly scaled with brown and grey hairs; veins and margins shaded with brown; opaque spot dark brown. The female has the secondaries dark greyish brown.

Epanse.—Male, 39 mm.; female, 43 mm.

Habitat.—Maroni River, French Guiana.

Type.—Cat. No. 8781, U.S.N.M.

HEMICERAS MUSCOSA, new species.

Palpi brown fringed with white. Head and thorax violaceous brown; white hairs at base of antennæ; white scales posteriorly on thorax.

Abdomen brown above, white underneath. Primaries brown; a silky brown shade from cell and along outer margin; a blackish streak at end of cell; a white spot at base; antemedial white spots on veins; a wavy brown line from costa near apex to sinus, preceded by white spots on veins and followed by white spots towards apex, below vein 2 bordered with white; apex whitish; inner margin lobed. Secondaries whitish, the veins and outer margin narrowly brown; no opaque spot.

Expanse.—Male, 58 mm.

Habitat.—Colombia; Venezuela; Southern Brazil.

Allied to *H. sparsipennis* Walker, but quite distinct.

Type.—Cat. No. 8782, U.S.N.M.

HEMICERAS POULSONI, new species.

Head and thorax olivaceous brown; some white on vertex. Abdomen paler. Primaries olivaceous brown; the costa brownish with a streak of lilacine and reddish irrorations between costal and subcostal veins; a dentate fine black antemedial line from subcostal to inner margin; a thick oblique black streak on discocellular; a row of small brown spots from costa near apex to inner margin, followed by a larger black spot on apex, one on vein 7, and one on submedian. Secondaries white, the opaque spot light reddish brown.

Expanse.—51 mm.

Habitat.—Omai, British Guiana.

A recent discovery of Mr. Poulson's at Omai; a second specimen is in the collection of Mr. Dognin from the same locality.

Type.—Cat. No. 8783, U.S.N.M.

Genus HAPIGIA Guenée.

HAPIGIA REPANDENS, new species.

Palpi brown, fringed with violaceous brown. Head and thorax brown, shaded with lilacine; three grey spots behind collar. Abdomen greyish black above, buff underneath shaded with light brown. Primaries brown, shaded with lilacine; a basal grey and greenish line forming three curves from costa to submedian; a grey, fine, wavy antemedial line, shaded with greenish and black on costa, in cell, and on submedian, followed in cell by a small greenish spot circled with black; a small grey spot beyond, and a greenish yellow spot, shaded with black and white on subcostal; a large irregular spot at end of cell, yellowish green, edged partly with black, partly with white; a post-medial row of dark brown points on veins, outwardly shaded with yellowish grey; beyond this a row of white spots, and an irregular black line, partly shaded with white on outer margin, followed at apex by a yellowish green spot. Secondaries brown; basal half of costal margin yellowish white.

Expanse.—63 mm.

Habitat.—Jalapa, Mexico; Venezuela; French Guiana; Brazil.

This is the *H. smerinthoides* of the Biologia; *H. smerinthoides* Walker is very different. This may be an extreme form of *H. notha* Möschler.

Type.—Cat. No. 8784, U.S.N.M.

HAPIGIA GAUDENS, new species.

Palpi and head dark reddish brown, the palpi edged with violaceous. Collar and thorax dark violaceous, thinly irrorated with white. Abdomen above dull dark brown. Primaries violaceous, thinly irrorated with white; a green basal line, an antemedial whitish line, outwardly lunular, almost obsolete in cell, where it is preceded and followed by a green spot; a very large green spot at end of cell extending above, beyond, and below it, crossed by black lines and irrorations, and separated by some white scales from a smaller green spot on subcostal before a postmedial punctiform row of green spots shaded with black; submarginal white shades; a marginal wavy irregular black and white line, a green spot at apex. Secondaries dark brown.

Expanse.—84 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8785, U.S.N.M.

HAPIGIA ANNULATA, new species.

Palpi, head, and thorax lilacine brown. Abdomen black above with transverse grey lines. Primaries lilacine brown, crossed from costal margin by six oblique darker brown shades not reaching inner and outer margins; two antemedial, a medial, interrupted at end of cell by a long silvery spot, partly filled in with lilacine, and three postmedial; a fainter shade before apex followed by an irregular white line edged with dark brown; a few marginal black points. Secondaries greyish brown, the veins blackish. Secondaries underneath are white, the veins black except at base.

Expanse.—90 mm.

Habitat.—Omai, British Guiana; Rio Janeiro, Brazil; Costa Rica.

Allied to *H. nodicornis* Guénéé.

Type.—Cat. No. 8786, U.S.N.M.

HAPIGIA AYMARA, new species.

Head and collar olivaceous brown. Thorax lilacine grey. Abdomen blackish grey above, buff underneath. Primaries with the inner margin excised at middle, deeply lobed beyond as in *H. accipter* Schaus; lilacine brown, darkest on basal half of costa to postmedial at vein 2; an indistinct basal and antemedial paler lunular line; an oblique silvery spot at end of cell, surmounted by a round silver spot, both finely edged with black and containing dark scales; postmedial fine,

paler, slightly curved beyond cell, then nearly straight to inner margin, followed by black points and preceded by short black streaks on veins; a large blackish spot on this line below vein 2; an irregular marginal black line, preceded by silver at apex. Secondaries dark smoky grey; at base dirty white.

Expanse.—54 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8787, U.S.N.M.

Genus CHLIARA Walker.

CHLIARA NOVICIA, new species.

Differs from typical *Chliara* in having the male antennæ fasciculate. Head and thorax reddish lilacine brown; palpi tipped with black; black streaks on frons. Abdomen light reddish above, paler underneath. Primaries light reddish brown, faintly shaded with lilacine; an irregular basal row of black points; antemedial black points on costa; faint striolate darker shadings below cell; two small black annular spots in cell; at end of cell a cross-shaped spot outlined in black, the posterior portion filled in with black in the female; a fine dark postmedial line, with black points on veins; the line is single in female, geminate in the male; an irregular fine black marginal line terminating in a small black spot on costa; a black shade on apex in female. Secondaries light reddish brown.

Expanse.—Male, 42 mm.; female, 56 mm.

Habitat.—Maroni River, French Guiana.

Type.—Cat. No. 8788, U.S.N.M.

Genus ANTÆA Hübner.

ANTÆA OMANA, new species.

Palpi dark greyish brown. Head and collar brown, thorax lilacine brown. Abdomen brown-grey. Primaries lilacine brown, irrorated with reddish brown; lines buff, outwardly edged with darker brown; basal line straight; antemedial straight to submedian, slightly curved below it; a large oval line across cell; a line from median before end of cell, straight up to subcostal, then curving around end of cell to postmedial at vein 3; postmedial slightly incurved at vein 3, then straight to inner margin; a fine median indistinct line from cell; a submarginal line, incurved from costa near apex to vein 4, then broken, wavy, irregular, shaded partly with reddish brown; some black below veins 4 and 3; a blackish brown shade on outer margin from vein 2 to above vein 3; the outer margin crenulate; a dark terminal line. Secondaries blackish brown, paler at base and along inner margin.

Expanse.—71 mm.

Habitat.—Omai, British Guiana.

Allied to *A. juturna* Cramer and *licormas* Cramer.

Type.—Cat. No. 8789, U.S.N.M.

Family MELALOPHIDÆ.

Genus ROSEMA Walker.

ROSEMA MAGNIPLAGA, new species.

Palpi light brown. Head white. Collar and thorax bright green; a white patch posteriorly. Abdomen ochreous. Primaries bright green; the costa broadly roseate white, edged with buff; a large whitish patch irrorated with brown from just below subcostal at middle of wing to near outer margin from just above submedian to vein 4. Secondaries brownish yellow.

Expanse.—50 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

This species is allied to *Moresa costalis* Walker.

Type.—Cat. No. 8790, U.S.N.M.

ROSEMA NADINA, new species.

Palpi roseate brown. Frons whitish buff. Vertex and patagia green. Collar and thorax greyish. Primaries bright green; the costa finely whitish; a black discal point; an upright whitish streak on inner margin before middle. Secondaries whitish, faintly tinged with roseate.

Expanse.—30 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8791, U.S.N.M.

ROSEMA PALLIDICOSTA, new species.

Head and thorax green; a white spot on vertex. Abdomen ochreous brown; a large grey subdorsal patch at base; whitish anal hairs. Primaries acute, bright green; the costal margin broadly pale roseate; a minute yellow discal point. Secondaries yellowish white.

Expanse.—48 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Closely allied to *R. costalis* Felder, which is evidently the same as the species in the Oxford Museum for which I proposed the name of *walkeri*.

Type.—Cat. No. 8792, U.S.N.M.

ROSEMA FALCATA, new species.

Palpi brown. Head and patagia green. Collar and thorax blackish brown. Abdomen light brown. Primaries very acute, green; a white discal point; fringe brown at apex, otherwise greyish, tipped

with brown. Secondaries light brown. This species is allied to *R. marona* Schaus and differs in its larger size, more acute primaries, and lighter secondaries.

Expanse.—44 mm.

Habitat.—Bolivia.

Type.—Cat. No. 8793, U.S.N.M.

ROSEMA MARONA, new species.

Palpi brown. Head green. Collar and thorax dark brown; patagia green. - Abdomen light brown. Primaries convex at outer third, the apex slightly prolonged, green; a black discal point, a dark spot just below apex on outer margin; the costa finely yellowish. Secondaries brown; the outer margin darker. Underneath, primaries light brown; the inner margin pale green; the apex, except on costa, and outer margin dark leaden grey. Secondaries brown on costa and at base, the outer space greyish; the inner margin pale brown.

Expanse.—32 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8794, U.S.N.M.

Some corrections in the genus *Rosema* are: *zellica* Stoll preoccupies *dorsalis* Walker; *languida* Schaus preoccupies *lucia* Druce; *simois* Druce preoccupies *luna* Schaus; *sciritis* Druce preoccupies *lappa* Schaus.

Family EUPTEROTIDÆ.

Genus APATELODES Packard.

APATELODES PANDARIOIDES, new species.

Body brown; a dark velvety brown streak between tegula; a similar transverse band on basal segment of abdomen; some dark brown hairs on anal segment. Wings brown. Primaries: an antemedial dark velvety brown spot on inner margin, followed by a dark brown line; a dark curved medial line; a more heavily marked postmedial line only slightly curved; a subterminal line, oblique from costa at three-fourths from base, angled at vein 6, then straight to inner angle, followed on costa by a triangular dark brown spot outwardly edged with buff. Secondaries: the outer third of wing darkest; an indistinct fine postmedial line; some dark brown streaks on inner margin, chiefly at base. Underneath paler; the outer margin of primaries dark brown; a dark brown shade on secondaries between veins 2 to 4 from cell to outer line, which is straight from costa, and angled at vein 2.

Expanse.—44 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Allied to *pandara* Druce and probably the form figured as that species in the Biologia.

Type.—Cat. No. 8795, U.S.N.M.

Genus OLCECLOSTERA Butler.

OLCECLOSTERA MORESCA, new species.

Palpi and abdomen brown, the latter irrorated with white. Head and thorax grey, slightly streaked with brown. Primaries grey, the base broadly reddish brown, limited by an antemedial grey line, outwardly edged with dark brown, this line wavy and angled on median vein; a dark brown medial spot on costa across cell; a similar spot on inner margin, extending above submedian; a fine, brown, lunular, postmedial line, followed by a dark spot on costa, and a brownish shade from vein 4 to inner margin; an inwardly lunular subterminal dark brown line from costa to vein 3, preceded between 6 and 7 by a quadrate hyaline spot. Secondaries reddish brown; some grey at anal angle and on inner margin, where it is crossed by dark brown lines. Underneath brown; the secondaries with two finely wavy lines near the middle of wing, and a grey shade from base to anal angle with darker spots.

Expanse.—39 mm.

Habitat.—Carabaya, S. E. Peru.

Type.—Cat. No. 8796, U.S.N.M.

OLCECLOSTERA ANNA, new species.

Palpi and frons reddish brown. Collar and thorax lilacine grey. Abdomen light brown. Primaries lilacine grey, the outer margin narrowly brown; an antemedial dark streak on costa; a black spot at end of cell; a fine dark lunular postmedial line, preceded by a dark shade below vein 2; a small dark medial spot on inner margin; two subterminal hyaline spots between 5 and 7. Secondaries brown. Underneath brown; a fine dark postmedial line on both wings.

Expanse.—36 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. No. 8797, U.S.N.M.

OLCECLOSTERA LEPIDA, new species.

Palpi brown. Body grey; a brown dorsal streak on collar and thorax. Primaries angled at vein 5, grey, thinly irrorated with dark brown; the markings dark brown; a large antemedial spot on costa, and one on inner margin farther from base, connected by brownish lines; a fine line on discocellular; an elongated space on costa from above discocellular to near apex; a postmedial indistinct line, punctiform on veins; a subterminal lunular line from veins 3 to 7, preceded by a hyaline spot between 6 and 7; fringe dark brown. Secondaries brown, tinged with grey at anal angle. Underneath grey. Primaries: the disc pale brown; a brown postmedial line; the subterminal fine, lunular, followed by a darker brown shade. Secondaries: a dark

point at end of cell; a medial brown shade; a postmedial punctiform line.

Expanse.—37 mm.

Habitat.—Geldersland, Dutch Guiana.

Type.—Cat. No. 8798, U.S.N.M.

OLCECLOSTERA ORIUNDA, new species.

Body and wings buff-brown. Abdomen with a lateral row of black points. Primaries slightly angled at vein 5; the base irrorated with lilacine, limited by a dentate fine dark grey line, which is followed by a broad darker brown shade; a black point on discocellular; a dark brown postmedial shade, curved beyond cell, followed by a lunular dentate dark grey line, outwardly shaded with pale grey below vein 5; a small subterminal hyaline spot between 5 and 6, and a marginal lilacine shade from vein 5 to inner angle. Secondaries: a darker brown medial line, and a narrower postmedial line. Underneath: a dark point at end of cell, followed by a brown shade, and then by a fine dark line punctiform on veins.

Expanse.—35 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8799, U.S.N.M.

OLCECLOSTERA (?) OSTENTA, new species.

Palpi dark velvety brown, fringed with lighter brown. Head mottled brown and lilacine buff, the thorax of the latter color. Abdomen buff, irrorated with brown, and a fine dark brown subdorsal line. Primaries lilacine buff, thinly irrorated with dark brown; three fine dark brown transverse lines, the first antemedial and angled on median vein, the second from just beyond middle of costa to middle of inner margin, the third at three-fourths from base; a marginal row of pale lines, outwardly edged with black-brown from end of vein 7, incurved to vein 4, then straight to vein 2; a blackish spot at end of cell. Secondaries: the basal third light brown, otherwise darker brown, with a postmedial light brown shade. Underneath lilacine buff. Primaries: a dark point at end of cell, followed by a straight brown line; marginal lunules as above. Secondaries: the inner margin broadly clear whitish grey, otherwise irrorated with black and dark brown, thickly beyond a fine medial line, and before some subterminal black lunules.

Expanse.—36 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8800, U.S.N.M.

OLCECLOSTERA UMBRILINEA, new species.

Palpi and frons brownish. Collar and thorax lilacine grey, irrorated with brown; a subdorsal brown streak. Abdomen brown.

Primaries with three brown lines; from base to second line lilacine fawn, irrorated with brown; first line crossing discocellular, where it is more strongly marked, inwardly oblique to inner margin at one-fourth from base; second line nearly straight from beyond middle of costa to middle of inner margin; outer half of wing dark lilacine grey; the third line at three-fourths from base, inwardly shaded with whitish; some whitish lunules on outer margin, outwardly shaded with dark brown. Secondaries violaceous brown, palest at base, and a similar postmedial shade. Underneath the primaries have the basal half pale lilacine grey; a dark spot on discocellular; a postmedial brown line followed by a broad lighter brown shade; the apex and outer margin shaded with grey. Secondaries: the inner and outer margins grey; the costa brown, the base greyish; a dark medial line followed by a broad brown shade from vein 2 to costa.

Expanse.—34 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8801, U.S.N.M.

Genus TAMPHANA Schaus.

TAMPANA PRÆCIPUA, new species.

Head and thorax violaceous brown. Abdomen reddish brown. Primaries brown, darkest at base, and shaded with lilacine below cell and vein 4; a buff spot on costa before middle, followed by a dark line, angled at end of cell, inwardly oblique to inner margin at one-third from base, and followed by a reddish brown parallel line; a postmedial curved, finely dentate, reddish brown line, followed below vein 7 by a blackish lunular line; some buff on costa before apex, shaded below with reddish brown. Secondaries reddish brown. Underneath pale buff, with fine brown lines; a postmedial and subterminal line on primaries; a medial and a postmedial line on secondaries.

Expanse.—26 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8802, U.S.N.M.

Genus COLLA Walker.

COLLA GAUDIALIS, new species.

Head and thorax white. Abdomen lilacine brown above, white below; anal hairs brown. Primaries: basal two-thirds brownish white; the costal margin olivaceous, extending into cell antemedially, interrupted medially by a buff shade, also buff at apex; a silvery white streak on discocellular; a faint ochreous medial shade on inner margin; ochreous shades on veins beyond cell; a silvery white line from costa at three-fourths from base curved to vein 4, and preceded by a broad greyish shade and silvery points on veins, also preceded by grey

on inner margin; the outer margin white with a subterminal and a marginal grey shade. Secondaries thinly scaled, white, a dark medial spot on inner margin; reddish brown shades subterminally at and near inner margin. The fringe ochreous red at anal angle.

Expanse.—29 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8803, U.S.N.M.

COLLA ALBESCENS, new species.

White. The abdomen above reddish brown. Primaries: the costa finely light brown; a grey spot on inner margin near base; a small grey spot between veins 2 and 3; an interrupted grey postmedial shade; an interrupted subterminal grey line below vein 4; a marginal grey shade between veins 2 and 7; a terminal fine ochreous line; fringe grey between 2 and 7. Secondaries: inner margin spotted with olivaceous brown; a grey subterminal spot near inner margin; some faint grey marginal spots.

Expanse.—22 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8804, U.S.N.M.

COLLA UMBRATA, new species.

Palpi brown. Head and thorax white. Abdomen pale brown above, white underneath. Wings white. Primaries: the costa finely light brown, a greyish basal shade on inner margin; a greyish medial shade from cell to inner margin; a greyish postmedial shade not extending above vein 5, but continued as two fine brownish lines from vein 4 to costa; an olivaceous spot on the inner line at vein 5; outer margin broadly shaded with grey; a large terminal olivaceous patch from veins 5 to 7; fringe olivaceous. Secondaries shaded with grey below vein 4; the inner margin light brown and olivaceous.

Expanse.—23 mm.

Habitat.—Amazons.

Type.—Cat. No. 8805, U.S.N.M.

Family LASIOCAMPIDÆ.

Genus CLAPHE Walker.

CLAPHE NARAXA, new species.

Body mottled grey and brown, darkest subdorsally on abdomen at base. Primaries brown, irrorated with white medially, in cell and costa; lines blackish, finely dentate; a dark brown basal line; antemedial line geminate, divided by grayish scales; a black point in cell; postmedial line single, very slightly angled below costa, followed by grey points on veins, and grey irrorations on costal margin; a light

brown spot on costa beyond; an irregular subterminal dark shade; fringe spotted with grey. Secondaries lighter brown; a dark line on discocellular, beyond which and above vein 5 the wing is grey; a subterminal dark grey wavy line; marginal greyish spots between the veins; fringe grey spotted with dark grey-brown. Underneath light brown; a darker postmedial line on primaries outcurved below costa, also a submarginal dark shade. On secondaries the outer half grey, separated from basal half by a dark line angled on vein 5; a dark spot on costa before apex; a marginal whitish shade.

Expanse.—37 mm.

Habitat.—Castro, Parana, Brazil.

Type.—Cat. No. 8806, U.S.N.M.

CLAPHE ROXANA, new species.

Head and collar creamy grey. Thorax blackish brown. Abdomen light brown; a dark brown subdorsal basal patch. Primaries creamy grey, with a few brown irrorations; black-brown streaks at base of costa, below cell at base, and on inner margin to postmedial line; the postmedial fine, dentate, lunular, brown, indistinct; a large round black-brown spot in cell; a dark brown shade on costa before apex; veins on outer margin faintly streaked with black; brown spots on fringe between the veins. Secondaries light brown, the apical portion creamy grey; a submarginal, dark brown-grey, irregular shade; fringe dark, streaked with white at ends of veins. Underneath very pale brown; a submarginal brown shade, heaviest at apices.

Expanse.—33 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8807, U.S.N.M.

CLAPHE SALANDRIA, new species.

Head and collar grey. Thorax black-brown. Abdomen brown; anal segment dark grey. Primaries grey, irrorated with brown; a vague darker spot in cell; a brown spot on costa before apex, and one on middle of inner margin; lines finely dentate, geminate; a wavy submarginal brown line; veins on outer margin streaked with black; a brownish shade from cell between veins 3 and 4; fringe brown with pale spots at ends of veins. Secondaries similar; the inner area below cell and vein 5 light brown. Underneath brown; a dark subterminal line; costa of secondaries irrorated with black and grey.

Expanse.—31 mm.

Habitat.—Geldersland, Dutch Guiana.

Type.—Cat. No. 8808, U.S.N.M.

CLAPHE MELCA, new species.

Body grey above, pale brown underneath. Primaries pale grey, irrorated with brown and black; a black point in cell; an indistinct

postmedial row of white points on veins; a dentate submarginal grey line, preceded by a whitish shade and followed by blackish streaks on veins; fringe dark grey, spotted with white at ends of veins. Secondaries similar; the inner margin broadly pale brown; the subterminal line followed by paler blotches. Underneath whitish grey; traces of a submarginal darker line; the costal margin of secondaries irrorated with darker grey.

Expanse.—40 mm.

Habitat.—Merida, Venezuela.

Type.—Cat. No. 8809, U.S.N.M.

CLAPHE HERBERTI, new species.

Head and thorax grey, thinly irrorated with brown. Abdomen dark brown; anal segment dark grey. Primaries grey, thickly irrorated with black and brown; antemedial line black, indented below median vein and connected to base by a fine black line; no spot in cell; postmedial nearly straight, closely lunular, emitting short black streaks inwardly on veins; subterminal line very distinct, irregular, lunular-sagittate, followed by fine black streaks on the veins; fringe dark grey, with pale spots at the ends of the veins. Secondaries brown; the costal margin broadly grey; the subterminal distinct above vein 5, dentate; below vein 5 more regular and indistinct. Underneath light brown; a darker subterminal line; a dark median streak on costa of secondaries.

Expanse.—47 mm.

Habitat.—Santo Domingo, S. E. Peru.

I am indebted to Mr. Herbert Druce for a specimen of this species.

Type.—Cat. No. 8810, U.S.N.M.

CLAPHE IRESCA, new species.

Head, thorax, primaries, and costal margin of secondaries grey, irrorated rather thickly with brown. Abdomen and secondaries otherwise light brown. Primaries: lines brown, finely dentate; a fine brown streak in cell; the antemedial and postmedial lines slightly angled below costa; the subterminal outcurved below costa, incurved between veins 4 and 6; fringe spotted with dark grey-brown. Secondaries: traces of antemedial and postmedial lines on costal margin; the subterminal slightly wavy. Underneath dull brown without markings.

Expanse.—36 mm.

Habitat.—Geldersland, Dutch Guiana.

Type.—Cat. No. 8811, U.S.N.M.

CLAPHE ALBIPLAGA, new species.

Head greyish brown. Collar and thorax white. Abdomen dark grey; anal hairs yellow. Primaries dark grey, really a white ground thickly irrorated with black and fawn scales; a white space at base

extended on inner margin; a large white space at inner angle from inner margin to vein 4; a large white apical space; an elongated white space on costal margin medially; an oval black spot with white center at end of cell; a geminate postmedial darker shade, partly followed and divided by whitish scales, all very indistinct. Secondaries grey, the veins darker; apical area white; the basal half, a postmedial and a subterminal shade darker grey.

Expanse.—47 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. No. 8812, U.S.N.M.

CLAPHE PAREPA, new species.

Head buff-brown. Thorax violaceous brown. Abdomen blackish brown. Primaries brown; a medial white space from costa to median vein, inclosing a large round brown spot at end of cell, and crossed on either side by fine brown lines; some grey antemedial scales below cell; subterminal black spots outwardly shaded with grey. Secondaries blackish brown; the costal margin grey, crossed by a submarginal brown spot. Underneath brown; traces of black submarginal spots on primaries.

Expanse.—27 mm.

Habitat.—Castro, Parana, Brazil.

Type.—Cat. No. 8813, U.S.N.M.

CLAPHE SEMITA, new species.

Head and collar grey, irrorated with brown. Thorax and abdomen above brown-black. Underneath light reddish brown. Primaries: the costa greyish; the cell and below vein 4 brown-black, crossed by black veins; above vein 4 pinkish buff, irrorated with black, the veins streaked with black, also with white close to cell; a subterminal finely lunular black line from costa to vein 5. Secondaries light brown, the costa broadly and apical area greyish brown; an irregular darker submarginal line. Underneath brown, with traces of a dark submarginal line.

Expanse.—37 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8814, U.S.N.M.

CLAPHE VITHERSI, new species.

Head light reddish brown and grey. Collar grey. Thorax blackish. Abdomen dark brown dorsally, otherwise brown. Primaries dark grey, the veins black; the costal margin and a large round space at end of cell pale grey, the latter limited outwardly by velvety black striae on veins, closely followed by a fine postmedial darker line; traces of a subterminal dark line at apex; fringe spotted with white

apically. Secondaries brown, the costa and apical area light grey; a black geminate median line; a black subterminal line.

Expanse.—30 mm.

Habitat.—St. Jean, Maroni River, French Guiana; Geldersland, Surinam River, Dutch Guiana.

Named after Mr. G. B. Withers, of Geldersland, who has sent me some very interesting species.

Type.—Cat. No. 8815, U.S.N.M.

CLAPHE PETROVNA, new species.

Body light brown, somewhat darker on thorax. Primaries light brown; the base dark brown, limited by the antemedial line, which is geminate, wavy, black; a small brown spot in cell; the postmedial line wavy, geminate, dark brown; a submarginal row of dark spots reduced to blackish points at apex. Secondaries black brown; the costal margin broadly light brown, crossed by a dark medial and subterminal shade, outwardly shaded with greyish brown. Underneath brown, with traces of dark medial and subterminal lines.

Expanse.—31 mm.

Habitat.—Petropolis, Brazil.

Type.—Cat. No. 8816, U.S.N.M.

CLAPHE VARMA, new species.

Head and thorax mottled dark grey and brown. Abdomen dull greyish brown. Primaries grey, thickly irrorated with lilacine brown; the basal third blackish brown, limited by a wavy black line, outwardly shaded with light grey; a small black spot at end of cell; an irregular postmedial row of whitish streaks on veins; a subterminal blackish line. Secondaries dull lilacine brown; the costal margin like the primaries; a thick black median shade on costa.

Expanse.—36 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8817, U.S.N.M.

CLAPHE DIRECTILINEA, new species.

Head and abdomen dull brown, the thorax darker, irrorated with grey. Wings brownish grey; a little more than the basal third brown, limited by a velvety brown line, straight on primaries, irregular on secondaries where it widens on costa to a blackish brown space; traces of a subterminal dark line. Underneath brown.

Expanse.—37 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8818, U.S.N.M.

CLAPHE RUNDALA, new species.

Body brown. Primaries steel grey; the inner and outer margin to vein 7 brown; an elongated brown spot on costa close to apex; a dark blackish brown spot near base in and below cell; a faint, darker grey, antemedial line; two black points in cell; a paler grey postmedial line, geminate on costa, angled below it, preceded by a fine dark wavy line below vein 5, and followed by a brown spot between veins 3 and 4; an interrupted subterminal dark line, outwardly shaded with steel grey. Secondaries brown; the costal margin broadly steel grey to subterminal line, and crossed by darker median lines. Underneath brown.

Expanse.—33 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8819, U.S.N.M.

CLAPHE OBLITERATA, new species.

Body brown, the shoulders grey. Primaries dull lilacine grey; the inner and outer margin to vein 6 light brown; a small brown spot on costa near apex; an indistinct brownish antemedial line; two black points at end of cell; the postmedial consisting of dark streaks on veins from costa to vein 4, linear below that; a fine subterminal grey line interrupted by the veins; fringe dark brown between the veins. Secondaries light brown; the costa broadly lilacine grey to an inwardly oblique apical line; a dark median line not crossing cell. Underneath brown; subterminal grey streaks at apices of wings.

Expanse.—35 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8820, U.S.N.M.

CLAPHE VECINA, new species.

Head and thorax dark brown, some grey on patagia. Abdomen light reddish brown. Primaries grey-brown irrorated with brown; the inner margin and outer margin to above vein 5 clearer brown; the two lines meeting above submedian vein, the antemedial wavy, the postmedial oblique from costa, angled, incurved and rounding to join the other line; no discal marks; a light brown costal spot near apex. Secondaries light reddish brown; the costal margin greyish brown to a subterminal dark streak at apex. Underneath brown.

Expanse.—33 mm.

Habitat.—Cayenne, French Guiana.

Type.—Cat. No. 8821, U.S.N.M.

CLAPHE NAMORA, new species.

Body pale lichen grey above, underneath luteous. Primaries rich brown, irrorated with black; the inner margin and outer margin to

above vein 4 pale lichen grey; the postmedial line darker brown outwardly shaded with buff, slightly curved from costa to vein 4, then wavy to base of wing above the submedian vein; a row of subterminal darker brown spots outwardly shaded with buff to vein 4; a larger brown spot below vein 4 and a smaller one below vein 3 more remote from margin. A terminal lunular buff line, outwardly shaded with dark grey; the fringe greyish. Secondaries light reddish brown; the costal margin darker brown; traces of a median and a subterminal buff line.

Expanse.—31 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8822, U.S.N.M.

CLAPHE NIGROPUNCTATA, new species.

Body and wings light reddish brown. Primaries: a black spot at end of cell; postmedial geminate black streaks on veins from costa to vein 3, united by a blackish shade; veins at apex streaked with black; subterminal black spots between the veins, the spot between veins 5 and 6 extending inwardly. Secondaries: subterminal black spots, preceded on costa by a black space.

Expanse.—29 mm.

Habitat.—Central Brazil.

Type.—Cat. No. 8823, U.S.N.M.

CLAPHE TERESINA, new species.

Head and thorax grey. Abdomen light reddish brown; anal hairs grey. Primaries grey, irrorated with black; the veins streaked with black; an antemedial geminate, dentate, black line; a black postmedial line, deeply dentate and geminate from costa to vein 6; partly formed by the streaks on veins; a black dentate subterminal line. Secondaries: the inner half light buff-brown; the costal half grey, crossed by a dark geminate postmedial line, and a subterminal line which extends to anal angle. Underneath brown; a dark subterminal line.

Expanse.—37 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8824, U.S.N.M.

CLAPHE SULGA, new species.

Palpi dark velvety brown, fringed with buff. Head and thorax grey. Collar blackish. Abdomen dark grey above, reddish brown underneath. Primaries blackish grey; a light grey patch on middle of inner margin; a vague oblique buff shade near base of costa; a black point in cell; the veins black; some buff hairs on outer half below vein 6; a dark subterminal shade. Secondaries: the base and inner half brown; the costal half like primaries; buff terminal spots

separated by the veins. Underneath light brown; a subterminal black shade; black subcostal shades on primaries; on secondaries, black apical shade and a postmedial geminate black line.

Expanse.—37 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8825, U.S.N.M.

CLAPHE MYA, new species.

Body above blackish, streaked with grey and fawn. Primaries blackish brown, the outer margin broadly whitish grey, on which the dentate black subterminal line is very conspicuous; the extreme margin irrorated with darker grey; a postmedial row of white spots on veins, preceded by velvety black streaks; terminal black streaks on veins. Secondaries dark brown, the costa blackish; the apical area whitish grey crossed by a dentate dark subterminal line; a whitish postmedial line on costa. Underneath smoky brown, the outer margins paler, showing traces of the subterminal.

Expanse.—37 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8826, U.S.N.M.

CLAPHE DURTEA, new species.

Head, thorax, and anal segments grey; abdomen otherwise light reddish brown with black subdorsal tufts at base. Primaries dark grey, the veins black; light reddish brown streaks below costa, at base of cell, above submedian and between veins 5 and 6; antemedial and postmedial geminate dark lines; a subterminal dentate black line; a black discocellular line. Secondaries light brown, the costal and apical area like primaries; a short dark postmedial line; a subterminal line; the veins on outer half black.

Expanse.—36 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

A smaller and duller species than its close ally, *C. deusta* Walker (*C. rubiginosa* Felder.)

Type.—Cat. No. 8827, U.S.N.M.

CLAPHE TAMILA, new species.

Head and collar light grey. Thorax black. Abdomen dark grey-brown. Primaries buff, shaded with dark brown below cell and vein 4; a large grey patch on middle of inner margin preceded by a velvety black line which is part of the antemedial line, which is otherwise very indistinct; veins, except costal, streaked with black; two black points on discocellular; a fine geminate postmedial brown shade; subterminal line oblique from costa, curved at apex, slightly incurved between 5 and 6. Secondaries; the inner half light brown; the costal

half light grey, thinly irrorated with black; a black medial line, punctiform on veins, partly geminate; a dark subterminal line. Underneath light brown; the apical area of secondaries greyish.

Expanse.—39 mm.

Habitat.—St. Laurent, Maroni River French Guiana.

Type.—Cat. No. 8828, U.S.N.M.

CLAPHE NAPALA, new species.

Body dark brown; the head and collar mottled with buff; the thorax shaded with black. Wings dull brown, the veins darker. Primaries: a blackish antemedial shade; the postmedial line oblique from and geminate at costa; a fine subterminal line, very deeply dentate, forming lanceolate spots divided by the veins. Secondaries: the costal margin irrorated with darker brown; a geminate dark postmedial line; a dark subterminal line. Underneath dull brown, with traces of a dark subterminal line.

Expanse.—38 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8829, U.S.N.M.

CLAPHE GENESA, new species.

Body dull greyish brown. Primaries light grey; the basal third brownish, crossed by a grey line; a small round spot at end of cell; a geminate postmedial line, the inner portion heaviest, slightly incurved between veins 4 and 8; a subterminal darker grey shade starting from a dark blotch shortly beyond the postmedial. Secondaries greyish brown, the apical area broadly light grey, crossed by a darker subterminal shade; basal half of costa dark brown.

Expanse.—Female, 54 mm.

Habitat.—Castro, Parana, Brazil.

Type.—Cat. No. 8830, U.S.N.M.

CLAPHE NARCETA, new species.

Head, thorax, and primaries grey, irrorated with brown. Primaries: a vague darker spot at end of cell; traces of the two lines; a white spot on costa; a fine dark subterminal line; dark terminal streaks on veins; fringe dark grey, streaked with buff. Abdomen and secondaries brown, the costal margin grey; a dark subterminal line. In the female the postmedial is more clearly defined as a whitish line, the subterminal less distinct, and the irrorations more lilacine brown.

Expanse.—Male, 42 mm.; female, 64 mm.

Habitat.—Castro, Parana; Rio Janeiro, Brazil.

Type.—Cat. No. 8831, U.S.N.M.

CLAPHE VIRIDIFLAVA, new species.

Palpi and frons dark brown. Vertex, thorax, and anal hairs greenish yellow. Abdomen dull lilacine brown. Primaries greenish yellow with dull lilacine brown irrorations forming antemedial and postmedial shades, the latter with darker streaks on veins; a wavy subterminal shade, and a broad terminal shade between veins 2 and 7; a dark spot at end of cell and a brown shade from it to postmedial. Secondaries lilacine brown, the apical area greenish yellow, crossed by a dark medial line and a subterminal brown shade.

Expanse.—30 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8832, U.S.N.M.

CLAPHE ALBIGRISEA, new species.

Palpi reddish brown. Thorax dark brown-grey. Abdomen brown-buff, shaded with grey subdorsally. Primaries white, the veins irrorated with grey and brown; the inner margin narrowly dark grey-brown to middle, then entirely so and along outer margin broadly to vein 7; a darker wavy postmedial line separates the white and grey portions, and is followed above vein 7 by an irregular white shade towards apex. Secondaries white; the inner margin broadly light brown; the fringe dark grey-brown, with a white spot at apex.

Expanse.—27 mm.

Habitat.—Omai, British Guiana.

Allied to *C. argyphaea* Berg.

Type.—Cat. No. 8833, U.S.N.M.

CLAPHE FOLIA, new species.

Head and thorax buff brown, also the anal hairs. Abdomen dark brown. Primaries dark grey-brown irrorated with ochreous scales; the veins ochreous; the inner margin and outer margin below vein 3 pale buff-brown with the lines white; an antemedial whitish geminate line; a postmedial whitish line, lunular below vein 4, geminate on costa and below vein 3; a white lunular subterminal line, filled in with dark grey which is preceded by some whitish shades between veins 3 and 5, and 6 and 8; outer margin paler. Secondaries dark brown; the costal margin dark grey, crossed by a whitish medial line; the subterminal dark, wavy, outwardly shaded with white and buff; inner margin pale buff-brown.

Expanse.—41 mm.

Habitat.—Rio Janeiro, Brazil.

Closely allied to *C. claudia* Cramer.

Type.—Cat. No. 8834, U.S.N.M.

CLAPHE HORRIFER, new species.

Body above black-brown, underneath reddish brown. Primaries brown, the basal two-thirds suffused with black; the veins black; a postmedial row of white points on veins; a subterminal black line, finely lunular, and toothed towards base. Secondaries brown, the veins black; the costal margin suffused with black; traces of a geminate black postmedial line; a subterminal dark brown shade; black points on tips of veins. Underneath lighter brown; the apex of secondaries irrorated with grey and black.

Expanse.—36 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8835, U.S.N.M.

CLAPHE LAPANA, new species.

Body brown, the collar and thorax mottled with buff. Primaries light brown; oblique dark brown streaks on costal and inner margins, the commencement of basal, geminate antemedial, geminate postmedial, and subterminal lines; basal and postmedial dark streaks on veins, the latter connected by a broad greyish shade; dark brown terminal streaks on veins and a terminal brown line; the subterminal consisting of dark grey spots between the veins; fringe dark grey with a pale basal line. Secondaries reddish brown; a black terminal line at apex.

Expanse.—26 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8836, U.S.N.M.

CLAPHE PASTICA, new species.

Body dark grey; a few whitish irrorations on collar and thorax. Primaries dark grey, the veins slightly irrorated with pale brown; a small rufous spot at end of cell, containing a black point; whitish postmedial points on veins; marginal white lunules between the veins. Secondaries dark greyish brown; the costal margin irrorated with white; an irregular whitish subterminal line. Underneath dark grey with a whitish subterminal line; apices buff; costal margin of secondaries blackish.

Expanse.—23 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8837, U.S.N.M.

CLAPHE DALTHA, new species.

Body dark brown, some buff irrorations on collar and thorax. Primaries dark brown, irrorated with fine whitish scales; a blackish brown streak at base of cell, and a similar patch at upper angle of cell; a darker brown, wavy, geminate, antemedial line, and a finely dentate,

geminate postmedial line; a lunular subterminal line edged with whitish at apex; a small white spot at anal angle. Secondaries dark brown; a black-brown subterminal line at apex; traces of a postmedial line. Underneath paler brown; a whitish line at apex of primaries; some dark brown at apex of secondaries, and a short postmedial and subterminal white line.

Expanse.—27 mm.

Habitat.—Geldersland, Dutch Guiana.

Type.—Cat. No. 8838, U.S.N.M.

CLAPHE LAURENA, new species.

Body dark brown above, paler underneath. Primaries brown, shaded with grey on costa and apex and at base of inner margin; a dark brown streak at base of cell and on vein 6 close to cell; a faint brown antemedial line edged with greyish; a fine postmedial line with darker points on veins; a dentate subterminal line at apex; veins 3, 4, and 5 streaked with brown on outer margin. Secondaries brown; the costa shaded with grey; a short, pale grey postmedial line; a subterminal dark brown line at apex.

Expanse.—27 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8839, U.S.N.M.

CLAPHE FARINA, new species.

Body dark brown above; violaceous brown tufts on abdomen; a pale line behind antennae. Primaries light brown, somewhat darker at base; a fine antemedial line edged with greyish buff on costa; a dark velvety brown medial and postmedial line oblique from costa, then wavy to inner margin; discocellular dark brown, a similar shade on vein 6 to postmedial; an oblique velvety brown streak from costa near apex; a greyish buff space between the two lines above vein 3; a subterminal dark shade, fine and dentate near apex; a small white spot at anal angle. Secondaries dark brown, the costal margin greyish, with a fine dark geminate postmedial line, and a thick velvety subterminal shade. Underneath light brown with the dark apical shades.

Expanse.—29 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8840, U.S.N.M.

CLAPHE TALMA, new species.

Body and wings dull smoky grey. Primaries: a small darker spot at end of cell; an indistinct darker postmedial and subterminal line; fringe with minute buff spots at ends of veins.

Expanse.—Male, 27 mm.; female, 43 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8841, U.S.N.M.

CLAPHE TORNIPUNCTA, new species.

Head and thorax dark grey brown. Abdomen light brown. Primaries dark brown, the costal margin broadly irrorated with grey; antemedial and postmedial lines marked by white points on veins; a small dark spot at end of cell; an indistinct darker dentate subterminal line; a white spot at inner angle. Secondaries light brown; the costal margin broadly white with some blackish scales forming indistinct lines. Underneath light brown; the apices greyish; a dark submarginal line, and traces of a median line on secondaries.

Expanse.—35 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8842, U.S.N.M.

CLAPHE MORENS, new species.

Antennæ ochreous. Body dull black. Primaries dull black; two velvety black points at end of cell; faint traces of a paler postmedial and subterminal line. Secondaries: the costal and inner margins broadly black, the outer margin narrowly so; the discal area white.

Expanse.—41 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8843, U.S.N.M.

CLAPHE GIULIA, new species.

Body and primaries dark grey brown. Primaries: a black spot at end of cell; darker postmedial and subterminal bands, coalescing below vein 3. Secondaries: the costal, inner margin, and fringe dark grey brown, otherwise smoky white.

Expanse.—38 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8844, U.S.N.M.

CLAPHE MEDIACLARA, new species.

Head and collar mottled brown and buff. Thorax blackish, mottled with lilacine grey. Abdomen light reddish brown, with darker subdorsal tuft. Primaries light brown at base and broadly on outer margin; a broad lilacine space on middle of inner margin; a large white space at end of cell inclosing a round black spot; blackish antemedial and postmedial shades coalescing between the lilacine and white spaces; a blackish dentate submarginal line. Secondaries light brown; the costal margin broadly irrorated with black and lilacine, becoming whitish at apex; a dark subterminal line. Underneath light brown; blackish postmedial and subterminal shades on both wings.

Expanse.—39 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8845, U.S.N.M.

CLAPHE ONESCA, new species.

Head and thorax blackish brown. Abdomen light brown, with darker transverse bands. Primaries: the base and outer half below vein 4 black brown, otherwise light grey, thinly irrorated with dark scales; a small dark spot at end of cell, below which a lunular dark line to inner margin; fine postmedial dark streaks from costa to vein 6; a submarginal dentate dark line from apex to vein 4; a grey spot at inner angle. Secondaries brown; the costal margin and outer margin to vein 4 greyish with dark irrorations; a straight dark postmedial line; a dentate marginal line.

Expanse.—40 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. No. 8846, U.S.N.M.

CLAPHE PUTRIDA, new species.

Body blackish brown; reddish brown subdorsal tufts on abdomen. Primaries: the base and inner area below vein 5 dull blackish brown, otherwise dull drab-brown; a white point at base; a broad irregular antemedial drab-brown shade divided by a dark line; two dark points on discocellular; a dark postmedial interrupted line from costa on pale portion, becoming drab-brown on dark portion below vein 5; an interrupted similar postmedial line. Secondaries blackish brown; irregular darker medial and subterminal lines. Underneath dull drab-brown; two black spots at apex on secondaries.

Expanse.—38 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8847, U.S.N.M.

CLAPHE TEMBLORA, new species.

Body dark grey. Primaries: the basal third black brown, irrorated with grey, and a light brown shade below cell, limited by a wavy black line straight from costa to inner margin, preceded by a fainter dark line; outwardly this line is shaded with light grey, beyond which the wing is light greyish brown; a black point at end of cell; a darker brown postmedial line, angled below costa, then nearly straight to inner margin and spotted with buff on veins 5 to submedian; a dark subterminal line incurved at vein 6 and between veins 2 and 3. Secondaries light brown; the apex shaded with dark grey; a black median line to inner margin above anal angle; traces of a subterminal shade.

Expanse.—29 mm.

Habitat.—Castro, Parana, Brazil.

Type.—Cat. No. 8848, U.S.N.M.

CLAPHE RENESCA, new species.

Head and thorax blackish; a white shade anteriorly on patagia. Abdomen light brown. Primaries dark grey; some black points at base; a fine blackish antemedial line, slightly outcurved, and outwardly shaded with white; no discal spot; a dark, fine postmedial line, angled below costa, slightly incurved beyond cell, partly spotted with white on veins; a subterminal dark shade, nearly straight, outwardly shaded with grey above vein 5. Secondaries light brown; the costal margin and apical area grey; a dark median shade on costal margin outwardly shaded with white; a whitish subterminal shade on grey portion, dark below vein 4.

Expanse.—26 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 8849, U.S.N.M.

CLAPHE INCONSPICUA, new species.

Body dark brown, the thorax slightly tinged with dark grey. Primaries dark brown; two superposed black points at end of cell; a geminate postmedial row of dark greyish brown spots, very indistinct; traces of a similarly colored subterminal line. Secondaries blackish brown, the costal margin dark brown. In this species the inner margin of primaries is more rounded. The secondaries have the costal margin straight to vein 9, angled, oblique, and then rounded.

Expanse.—35 mm.

Habitat.—Chiriqui, Panama.

Type.—Cat. No. 8850, U.S.N.M.

CLAPHE SURA, new species.

Body and wings dark smoky grey-brown. Primaries: a dark streak at end of cell; traces of an antemedial and a postmedial whitish line, the latter with minute spots on veins; some whitish subterminal spots. Secondaries with traces of a darker medial shade.

Expanse.—24 mm.

Habitat.—Castro, Parana, Brazil.

Type.—Cat. No. 8851, U.S.N.M.

CLAPHE GERA, new species.

Male.—Body dark grey; the palpi and patagia tipped with buff. Primaries: the basal half light buff with some brown irrorations, limited by a blackish, curved, geminate medial line, which is divided by a light brown line; the outer space mouse grey; a light brown postmedial shade, inwardly edged with darker grey and divided by a darker line; a whitish grey subterminal shade. Secondaries light reddish brown; the costa brown to a dark brown postmedial line; the

apical area and outer margin light grey, with a darker grey subterminal shade.

Female.—Primaries dark lilacine grey; the basal third and a broad postmedial shade light reddish brown, the latter crossed by darker lines; a dark spot at end of cell, a dark grey subterminal shade. Secondaries dark lilacine grey with traces of a paler submarginal shade.

Expanse.—Male, 28 mm.; female, 42 mm.

Habitat.—St. Jean, Maroni River, French Guiana; Aroa, Venezuela.

Allied to *C. limba* Druce.

Type.—Cat. No. 8852, U.S.N.M.

CLAPHE LEMOULTI, new species.

Palpi dark brown, fringed with whitish buff. Head and thorax light grey. Abdomen pale buff. Primaries light grey thinly irrorated with black, chiefly on costal margin; a pale brownish shade from base, through cell, and between veins 3 and 6 to subterminal line, which is white, forming three lunules above vein 6, filled in with blackish grey, and an outer curve between veins 6 and 3; two black points at end of cell; the costa finely buff; a fine geminate antemedial line; a wavy postmedial line. Secondaries light buff; a dark streak at apex; the costa grey; a medial and a postmedial brownish line.

Expanse.—23 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8853, U.S.N.M.

CLAPHE BIPUNCTA, new species.

Body lilacine brown, with darker striæ on thorax, and blackish subdorsal tufts on abdomen. Primaries brown, the base much darker; a greyish shade through cell and on costal margin; a fine wavy antemedial line; two black points at end of cell; a postmedial row of dark streaks on veins, from costa to vein 5, then white points to inner margin; a dark grey, lunular, dentate, subterminal line, partly shaded with whitish. Secondaries light brown; the costal margin grey; a dark grey subterminal shade at apex.

Expanse.—25 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8854, U.S.N.M.

CLAPHE LOLA, new species.

Body light reddish brown; some dark brown behind head and on patagia. Primaries light reddish brown; a black space at base below cell; an antemedial black band, partly divided by a white line; a black spot at end of cell; a postmedial row of black streaks on veins, outwardly edged with white; an irregular row of large black subterminal

spots. Secondaries light brown; dark grey medial, postmedial, and subterminal line on costal margin.

Expanse.—25 mm.

Habitat.—Aroa, Venezuela.

Type.—Cat. No. 8855, U.S.N.M.

CLAPHE OCRUMA, new species.

Head and thorax ochreous buff. Abdomen light buff. Primaries buff, shaded with light reddish brown; two darker spots at end of cell; postmedial very indistinct, followed between veins 4 and 6 by a large dark violaceous brown space to subterminal, and then dark grey on outer margin; a black subterminal spot between 6 and 7; the subterminal light grey, lunular. Secondaries lilacine brown, the base and costa shaded with buff.

Expanse.—27 mm.

Habitat.—Cayenne, French Guiana.

Type.—Cat. No. 8856, U.S.N.M.

CLAPHE MITA, new species.

Body and wings white. Primaries with pale greyish buff markings; an antemedial, medial, two postmedial and a subterminal line, also a marginal shade; the inner margin between medial and first postmedial line similarly colored; two black points in cell; some black irrorations on subterminal between 5 and 6; black points on fringe above vein 4. Secondaries: a black spot on costa before apex.

Expanse.—21 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8857, U.S.N.M.

CLAPHE TREMULA, new species.

Thorax and anal hairs lilacine brown; body otherwise ochreous buff. Primaries lilacine brown, tinged with reddish brown at base and between postmedial and subterminal lines; the lines wavy, whitish yellow; a basal, two antemedial, two postmedial and a subterminal line; a black spot at base of cell and two black points at end of cell; the subterminal preceded by dark brown spots towards apex; a terminal yellowish line; large dark spots on fringe between the veins. Secondaries ochreous buff, the costa mottled grey and brown.

Expanse.—18 mm.

Habitat.—Geldersland, Dutch Guiana.

Type.—Cat. No. 8858, U.S.N.M.

CLAPHE DALCEROIDES, new species.

Body and wings white. Primaries: a faint greyish medial line, dividing below costa and passing on either side of discocellular, meet-

ing below vein 3 and bifurcating on inner margin; a fine, indistinct postmedial line; a dark grey shade at apex; some dark points on fringe. Secondaries: some medial and postmedial grey irrorations on inner margin; outer margin greyish brown.

Expanse.—26 mm.

Habitat.—St. Laurent, Maroni River, French Guiana

Type.—Cat. No. 8859, U.S.N.M.

CLAPHE PALMA, new species.

Body brown irrorated with buff; dark subdorsal tufts on abdomen. Primaries light brown; a large triangular space on basal half of costa irrorated with metallic scales; a velvety black spot at end of cell, followed by a very dark brown shade to postmedial, which is dark brown, wavy, geminate, inwardly punctiform on veins 5 to 2; subterminal dark brown, lunular, dentate, crossing a whitish shade from vein 5 to costa. Secondaries light brown, traces of a darker subterminal shade.

Expanse.—21 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8860, U.S.N.M.

Genus METANASTRIA Hübner.

METANASTRIA LEMOULTI, new species.

Male.—Dark brown; the collar, thorax, and inner margin of primaries slightly suffused with dark grey. Primaries: two antemedial dentate buff lines closer together on inner margin than on costa; two postmedial buff lines, finely lunular, dentate towards costa; an irregular row of submarginal black spots surrounded by lighter brown.

Expanse.—93 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8861, U.S.N.M.

Genus TITYA Walker.

TITYA NIGRIPUNCTA, new species.

Body greyish brown, the head and thorax somewhat darker and irrorated with reddish fawn hairs. Primaries broad, light grey, the veins brown; a dark shade at base; a broad dark brown curved antemedial line; a large velvety black spot at end of cell; a broad brown postmedial shade; a lighter brown subterminal shade; fringe dark brown. Secondaries smoky brown, darkest on inner margin.

Expanse.—45 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

The outer margin of primaries is more rounded than in *T. undulosa* Walker and *T. simulans* Walker, and the postmedial line is not so wavy.

Type.—Cat. No. 8862, U.S.N.M.

Genus TOLYPE Hübner.

TOLYPE JAMAICENSIS, new species.

Female.—Body greyish brown, the anal tuft blackish. Primaries smoky grey; a brownish space at base; a similar shade below cell at veins 3-4; a postmedial brown shade, very broad on costal margin; a narrow marginal brown shade; fringe brown, interrupted by pale spots at ends of veins. Secondaries thinly scaled, pale smoky brown, palest on outer margin.

Expanse.—40 mm.

Habitat.—Jamaica.

Type.—Cat. No. 8863, U.S.N.M.

TOLYPE SEPTEMLINEA, new species.

Body white. Primaries white; a dark streak at base; three antemedial curved grey lines; a black streak at end of cell; four postmedial grey lines, forming three inward curves; a greyish marginal shade; grey spots on fringe. Secondaries white; a dark point at end of cell; veins faintly brownish.

Expanse.—29 mm.

Habitat.—Castro, Parana, Brazil.

Type.—Cat. No. 8864, U.S.N.M.

TOLYPE MULTILINEA, new species.

Body and wings sulphur yellow. Abdomen with darker transverse lines. Primaries with darker sulphur yellow lines; three antemedial and three postmedial finely wavy lines; a subterminal and a marginal shade, the latter with a terminal pale line interrupted by the veins; fringe of the darker shade, with pale spots at ends of veins; a black point at end of cell. Secondaries sulphur yellow; a faintly paler postmedial shade. Underneath yellowish buff with traces of the lines as above.

Expanse.—31 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8865, U.S.N.M.

TOLYPE COLUMBIANA, new species.

Body dark grey above, the head, collar and patagia mottled with buff. Primaries grey, the median space darkest, preceded and followed by two buff lines, the antemedial lines slightly curved, the postmedial incurved opposite cell, and below vein 3; a broad subterminal paler grey space, marginally dentate; a pale terminal line and black spots between the veins; a black spot on discocellular. Secondaries dark grey; a paler median shade; an interrupted terminal dark line. In this species the inner margin of primaries is nearly as long as costal margin.

Expanse.—37 mm.

Habitat.—Colombia.

Type.—Cat. No. 8866, U.S.N.M.

TOLYPE AROANA, new species.

Head, thorax, and abdomen dark grey. Patagia pinkish buff. Primaries dark grey; the veins streaked with ochreous; discocellular black; two antemedial and two postmedial whitish lines, wavy, and nearly meeting on vein 2; a broad whitish subterminal shade; outer margin and fringe pale, spotted with dark grey. Secondaries dark smoky grey.

Expanse.—Male, 34 mm.

Habitat.—Aroa, Venezuela.

Type.—Cat. No. 8867, U.S.N.M.

TOLYPE TARUDA, new species.

Body blackish; the shoulders and patagia outwardly reddish fawn. Primaries blackish grey; the base and outer margin greyish brown; two antemedial and two postmedial wavy pale lines; a subterminal pale line; dark terminal spots; veins ochreous; a black spot on discocellular. Secondaries blackish; a narrow, pale, marginal shade; fringe spotted with black.

The female is more of a dark grey, the lines more lunular, and the terminal black spots larger.

Expanse.—Male, 32 mm.; female, 49 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8868, U.S.N.M.

TOLYPE NIGRA, new species.

Body black. Wings smoky black. Primaries: veins irrorated with white; some ochreous spots on costa towards apex; traces of a whitish antemedial and subterminal line; two black points on end of cell.

Expanse.—38 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8869, U.S.N.M.

TOLYPE ANGUSTIPENNIS, new species.

Male.—Primaries very long and narrow. Body brown. Primaries thinly scaled, irrorated with black, and slightly with white; the veins dark; the base and inner margin dark brown, with traces of antemedial and postmedial paler brown lines; a subterminal black shade. Secondaries dark brown, shaded with black towards outer margin.

Expanse.—39 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8870, U.S.N.M.

TOLYPE LEMOULTI, new species.

Body ochreous fawn color, the abdomen subdorsally blackish grey. Primaries ochreous fawn, the veins darker; the apex shaded with dark grey; the outer margin narrowly brown, more widely so between veins 5 and 6; a black point at end of cell; two slightly darker antemedial lines, very indistinct; three similar dentate postmedial lines, the last outwardly shaded with dark grey below vein 4; the subterminal space buff, indistinctly crossed by a darker line. Secondaries yellowish, shaded with ochreous on inner margin; a brown terminal line.

Expanse.—36 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8871, U.S.N.M.

TOLYPE NEBULOSA, new species.

Head and collar anteriorly brown; the latter posteriorly, and the patagia white, irrorated with brown. Thorax brown subdorsally. Abdomen brown dorsally, pale grey underneath. Wings whitish grey. Primaries: the outer half of costal margin dark grey; a black point at origin of vein 6; two antemedial and three postmedial wavy grey lines; a marginal grey shade. Secondaries: a dark grey shade along inner margin; a broad marginal grey shade from vein 4 to anal angle.

Expanse.—33 mm.

Habitat.—Maroni River, French Guiana.

Type.—Cat. No. 8872, U.S.N.M.

TOLYPE POGGIA, new species.

Male.—Body whitish buff. Primaries whitish grey; the base shaded with pale brown; a black point at either end of discocellular; veins on outer half brown; a wavy dark grey postmedial shade; some grey at apex; a grey marginal spot between veins 5 and 6; a terminal white line; fringe brown, streaked with white at ends of veins. Secondaries light smoky brown; a whitish space in and below cell, also on middle of outer margin.

Female.—Body greyish, the abdomen dorsally shaded with brown. Primaries pale buff to postmedial line except a dark brown spot in cell medially, widening below cell to vein 4 and reaching the submedian vein; a black point at origin of vein 6; postmedial line white followed by a brown shade, outwardly edged with dark grey; subterminal space light grey towards base, outwardly whitish; some dark grey at apex; a terminal fine pale line.

Expanse.—Male, 24 mm.; female, 34 mm.

Habitat.—St. Laurent, Maroni River, French Guiana; Rockstone, British Guiana.

Allied to *T. picta* Felder.

Type.—Cat. No. 8873, U.S.N.M.

TOLYPE GELIMA, new species.

Body whitish buff. Abdomen with transverse brown bands. Primaries brownish buff; veins 2, 3, and 4 black to subterminal; veins whitish on outer margin; a fine brown antemedial and postmedial line, rather indistinct, the latter incurved below cell, and followed by a browner space crossed by a wavy black line to near inner angle; a black point at origin of vein 6; some dark grey at apex; a brown marginal spot between veins 5 and 6. Secondaries brown, darkest toward outer margin, which is itself paler.

Expanse.—23 mm.

Habitat.—Castro, Parana, Brazil.

Type.—Cat. No. 8874, U.S.N.M.

TOLYPE CINELLA, new species.

Head and abdomen pale brown. Collar and thorax white. Primaries buff, streaked with black on basal third and subterminal space; a dark grey subbasal line; a fine antemedial brown line; a similar postmedial line, angled below costa, then wavy to inner margin; a black point at origin of vein 6; the subterminal space broadly greyish, crossed by two fine wavy black lines; a broad, white, wavy marginal line. Secondaries light brown crossed beyond middle by a broad dark grey shade.

Expanse.—23 mm.

Habitat.—Castro, Parana, Brazil.

Belongs to the same group as *poggia* and *gelima*.

Type.—Cat. No. 8875, U.S.N.M.

Family LACOSOMIDÆ.

Genus CICINNUS Blanchard.

Primaries with vein 5 from middle of discocellular; 3 and 4 near together from lower angle of cell; 6 from upper angle; 7 and 8 on short stalk; 9 and 10 stalked; the outer margin below apex more excavated in male than in female. The male with slight frenulum. Secondaries with outer margin rounded; unevenly so in male; veins 3 and 4 near together from lower angle of cell; 5 from middle of discocellular; 6 and 7 from a point or shortly stalked in male; 7 from cell in female.

CICINNUS SUBMARCATA, new species.

Body grey; primaries grey to outer line; the outer margin light brown; two small transparent superposed spots at end of cell, finely

edged with brown; an inner fine irregular brown shade, outwardly angled at costa; a fine dark brown outer line, curved below costa at two-thirds from base, outwardly edged with grey and followed by a fine brown line which diverges to outer margin along vein 8; apex dark grey; an oblique dark mark on costa before outer line; a darker brown shade on outer margin from vein 5 to inner angle. Secondaries: the basal half grey, the outer half light-brown; a black median line close beyond the discal spots, which are similar to those on the primaries; a few black scales scattered over both wings. Underneath: primaries brown; the costa yellowish, followed below by a grey shade; a pale space on outer margin from vein 8 to vein 2, broadest anteriorly; a fine dark brown semilunular outer line. Secondaries dark grey, irrorated with black scales; an indistinct fine irregular broad outer line.

Expanse.—37 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8876, U.S.N.M.

CICINNUS JOANNA, new species.

Thorax reddish brown. Abdomen light brown, the anal hairs dark brown. Wings brown, paler on medial space of primaries, somewhat reddish at base of secondaries. A dark brown narrow medial band, almost black on secondaries, followed by a blackish line, formed of clusters of black scales, each scale white at its base; similar scales are scattered over the outer space, especially on the secondaries, and they do not extend above vein 8 on the primaries; an indistinct black streak at end of cell on primaries. Underneath paler brown, thinly irrorated with black scales; a faint darker outer line shaded with black on inner margin of secondaries and less so on costa of primaries. Fringe reddish brown.

Expanse.—64 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8877, U.S.N.M.

CICINNUS FOGIA, new species.

Thorax light grey. Abdomen light brown above, grey below. Primaries light grey to outer line, the outer margin darker grey; a few scattered black scales; a dark spot on costa at one-third, and one at two-thirds from base; the transparent discal spot small, angled toward base and cut by vein 5, anteriorly edged with brown, posteriorly with reddish scales; the outer line blackish brown, geminate, slightly angled at vein 8, but not extending above it; a bright red shade on outer margin from above vein 5 to above vein 7; the outer line closely followed by a dark brown shade from vein 7 to vein 3, where it diverges to the inner angle. Secondaries: the inner half

light grey with a darker shade at base; the outer half brown, darkest toward anal angle; the extreme outer margin greyish; the discal spot as on primaries; a medial geminate fine dark line; some red scales above and near anal angle. Underneath: primaries light brown irrorated with black; the inner margin and an oblique shade on outer margin from vein 2 to 4 pale grey; a single dark outer irregular line, curved at costa, interrupted between veins 3 and 4; veins about end of cell streaked with red, and the subapical red spot on outer margin more conspicuous. Secondaries pale grey irrorated with black; red streaks above and below discal spot; an irregular interrupted brown outer line spotted with black between veins 4 and 6; a large brown patch at anal angle.

Expanse.—48 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8878, U.S.N.M.

CICINNUS MALCA, new species.

Thorax grey irrorated with black. Abdomen above dark brown, with transverse white shades on last three segments; underneath grey thickly irrorated with black. Primaries dark lilacine grey, irrorated with black scales; a small oblique transparent spot at end of cell; a fine blackish brown outer line from costa at two-thirds from base, outwardly oblique and angled between veins 7 and 8; the costa shaded with light brown at apex; a dark blackish brown line from vein 7, close to outer line, to the inner angle, thickest between veins 3 and 5, and followed by a pale reddish brown shade from veins 5 to 8; a fine dark marginal line from veins 3 to 8. Secondaries dark brown, paler on the costal margin; the outer margin narrowly light brown, limited by a blackish brown line from apex to inner margin close to anal angle; the discal spot transparent, slightly curved, followed by a fine curved blackish line. Underneath dark grey irrorated with black; some red streaks on veins near discal spots; a subapical red marginal shade on primaries.

Expanse.—40 mm.

Habitat.—St. Jean, Maroni river, French Guiana.

Type.—Cat. No. 8879, U.S.N.M.

CICINNUS GILIA, new species.

Body pale fawn color. Wings fawn color, darkest beyond the line. Primaries: an oblique transparent spot on end of cell; a dark brown outer line obliquely curved from costa at two-thirds from base, angled at vein 7, inwardly shaded with paler fawn color towards inner margin; a small brown oblique shade above and below vein 3; fringe brown; the margin slightly excised below vein 2. Secondaries: a dark brown medial line inwardly shaded with pale fawn color. Underneath light

brown. Primaries: a blackish patch beyond outer line from inner margin to vein 3. Secondaries pale fawn color towards base; a fine brown outer line deeply excurred between veins 2 and 5.

Expanse.—Male, 42 mm.; female, 51 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8880, U.S.N.M.

CICINNUS BALCA, new species.

Body and wings pale pinkish fawn color, the latter with a very few scattered black scales. Primaries: costa finely reddish brown; a fine brown line from costa to discal spot, which is transparent, very oblique, divided by vein 5, and bordered above with dark brown; a fine reddish brown outer line, oblique from costa at two-thirds from base, angled at vein 7, close to outer margin, from which point a black line extends to apex; some black marginal shadings at inner angle and between veins 2 and 4. The margin excised below vein 2. Secondaries with a medial reddish brown line, followed by a cluster of black scales on vein 4; some black scales on inner margin above anal angle; the outer margin crenulate, and excised before anal angle. Underneath fawn color irrorated with black. Primaries with markings as above. Secondaries with a very fine outer line outwardly curved from vein 2 to vein 6; no other markings.

Expanse.—55 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. No. 8881, U.S.N.M.

CICINNUS MARONA, new species.

Body reddish fawn color, the abdomen thinly irrorated with black, and with lateral black spots; wings ochreous fawn color, tinged with pink beyond the line. Primaries: an annular black discal spot; a fine blackish outer line from costa at four-fifths from base, slightly oblique, angled at vein 7, and followed by some black scales near inner margin and a row of black spots from vein 4 to inner angle. Secondaries: a medial black line followed by black scales and a few black spots from vein 6 to inner margin; a cluster of black scales on inner margin towards base. Underneath light brown. Primaries: a black discal streak; the outer line lunular, interrupted between veins 4 and 7, followed below vein 4 by black spots. Secondaries: traces of a black outer line; some scattered black scales.

Expanse.—51 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

A specimen, evidently of this species, is brown, with the black irrorations much more pronounced.

Type.—Cat. No. 8882, U.S.N.M.

CICINNUS EUGENIA, new species.

Body and wings olivaceous grey. Primaries: costa finely yellowish; a transparent spot at end of cell, outwardly indentate, edged with brown; a brown outer line from vein 7 to inner margin, shaded on either side with fawn color; an indistinct, fine, oblique, greyish line from costa to outer line at vein 7; the outer margin slightly paler. Secondaries: a medial brown line similar to the outer line on primaries. Underneath somewhat darker; the outer line on primaries less distinct, followed at inner angle by a black space. No markings on secondaries.

Expanse.—41 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8883, U.S.N.M.

CICINNUS MALOBA, new species.

Primaries with vein 6 stalked with 8. In the female vein 7 is absent. Body dark brown, shaded with violaceous; some grey hairs on anal segment. Wings dark violaceous brown; base below cell reddish brown; a transparent spot at end of cell, cut by vein 5; an indistinct lunular outer line, followed below vein 3 by a large light grey spot on which a parallel lunular line is visible; the apex grey; two rows of minute grey spots between veins 4 to 7 separated by three yellowish larger spots. Secondaries with a round vitreous spot at end of cell; some grey at apex and on inner margin above anal angle. Underneath very similar; less grey at apex of primaries; an indistinct submarginal lunular line on secondaries. The female has a more pronounced outer line on both wings, and underneath the lines are submarginal.

Expanse.—Male, 43 mm.; female, 56 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Described from 2 males and 1 female.

Type.—Cat. No. 8884, U.S.N.M.

CICINNUS VITREATA, new species.

Male.—Primaries with vein 6 stalked with 7 and 8. Body pale grey, thinly irrorated with black. Wings lilacine grey; a few scattered black scales; some red scales at origin of vein 2; a wavy, irregular, black median line; a vitreous spot at end of cell cut by vein 5, and transversely divided by a brown line; the outer line fine, black, wavy, interrupted above vein 4; a black spot on costa at two-thirds from base; a reddish marginal shade between veins 6 and 8. Secondaries with the discal vitreous spot larger, closely followed by an indis-

tinct blackish line; some red scales below spot. Underneath the red markings are more distinct and partly extend on the veins.

Expanse.—40 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8885, U.S.N.M.

CICINNUS UNALCA, new species.

Primaries narrow, acute, falcate. Secondaries triangular. Thorax light reddish brown. Abdomen light brown. Wings fawn color tinged with reddish brown at base; outer margin dull olivaceous brown; a few scattered black scales. Primaries: a black discal point at end of cell; a fine brown outer line hardly visible above vein 6, followed by a dark brown shade irrorated with black scales, and which extends to costa. Secondaries: a brown medial line followed by clusters of black scales. Underneath light brown, becoming darker on outer margins; a black discal spot on primaries.

Expanse.—55 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. No. 8886, U.S.N.M.

CICINNUS PARTHA, new species.

Primaries hardly falcate; the inner angle slightly excised. Secondaries produced at vein 5, wavy above it, straight below it. Body and wings light brown; the outer margins paler. Primaries: a small yellowish spot at end of cell; a darker outer line angled at vein 8; a black spot on line between veins 8 and 10; the line is indistinctly shaded outwardly with fawn color. Secondaries: the line as on primaries from costa at apex to inner margin near angle. Underneath the secondaries and outer margin of primaries are more greyish, thinly irrorated with black scales.

Expanse.—39 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8887, U.S.N.M.

CICINNUS ENTHONA, new species.

Primaries somewhat falcate, excised at inner angle. Head, collar, and abdomen light reddish brown. Thorax pale fawn color. Primaries brown; the median space mottled with lilacine; a minute lilacine spot at end of cell, divided by a dark line; the outer line nearly straight and parallel to outer margin from costa to inner margin, fine, very dark brown; a lilacine shade on outer margin between veins 3 and 6. Secondaries: a fine dark medial line; the base irrorated with lilacine. Underneath brown; a submarginal lunular line, shaded with lilacine on either side; a black discal streak on both wings; a large black spot between veins 8 and 10 before apex.

Expanse.—44 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8888, U.S.N.M.

CICINNUS CAUDINA, new species.

Primaries somewhat falcate. Secondaries prolonged at anal angle. Body brown. Primaries brown to outer line, which is white and nearly straight from costal to inner margin; a black streak at end of cell; the outer margin reddish brown, shaded with lilacine grey at apex. Secondaries reddish brown; a medial roseate line; some black hairs at anal angle. Underneath dull reddish brown; black discal streaks. Primaries: a large subapical velvety brown space, limited by a white line from apex along vein 10, inwardly curved and then outwardly curved at veins 3 and 4, an indistinct fine white submarginal line on secondaries.

Expanse.—32 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8889, U.S.N.M.

CICINNUS ALTHEA, new species.

Vein 5 on primaries near lower angle of cell. Body and wings light reddish brown, thinly irrorated with black scales. Primaries: a darker streak below vein 2; a dark streak from middle of costa along vein 6; veins 2 and 6 slightly paler than ground color; the outer line black, thick, strongly angled at vein 7 near outer margin, followed by a grey shade and a finer black line, which diverges to apex above vein 7. Secondaries: a median black line, followed by an indistinct black shade from costa to vein 5, where it diverges to anal angle. Underneath the primaries have the lines the same as above; on the secondaries the outer line is dark brown, irregular. The primaries are falcate, slightly produced at vein 3. The secondaries have the anal angle somewhat produced.

Expanse.—42 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8890, U.S.N.M.

CICINNUS FATELLA, new species.

Wings broad: primaries acute, hardly falcate; male with frenulum. Wings light reddish brown, strongly shaded with lilacine on the inner side of outer line, and on the outer margin. Primaries: a lilacine oblique streak at end of cell; the outer line black, outwardly bordered with lilacine grey, from vein 10 to inner margin. Secondaries: a medial black line, followed by a finer black line. Underneath brown shaded with lilacine; the lines wavy and curved.

Expanse.—33 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8891, U.S.N.M.

CICINNUS ANOCA, new species.

Wings broad. Primaries falcate, excurved at vein 3; male with frenulum. Body and wings olivaceous brown. Primaries darker at apex, and on outer margin between veins 3 and 8; a dark streak at end of cell; a dark brown, fine, outer line from vein 10 to inner margin, followed by an olivaceous brown shade, darker than ground color. Secondaries with similar lines slightly curving towards anal angle. Underneath olivaceous brown. Primaries: a distinct black discal spot; a large velvety brown marginal space from apex to vein 3, limited by a curved roseate line, and containing a roseate line below vein 10.

Expanse.—34 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8892, U.S.N.M.

CICINNUS ESPERANS, new species.

Body and wings grey, slightly irrorated with black scales. Wings broad, the primaries hardly falcate, the secondaries somewhat produced at anal angle. Primaries: the outer margin shaded with pale brown; a semitransparent spot at end of cell cut by vein 5; an outer lunular dark brown line interrupted between vein 6 and costa, followed by two small brownish spots above veins 3 and 4. Secondaries shaded with pale brown except at base; an indistinct outer darker lunular line. Underneath the primaries are browner, the secondaries greyer than above; and the outer line more distinct, but interrupted.

Expanse.—36 mm.

Habitat.—Espiritu Santo, Brazil.

Type.—Cat. No. 8893, U.S.N.M.

CICINNUS LANTONA, new species.

Body greyish fawn color. Wings pale reddish brown. Primaries: basal two-thirds of costa whitish; the inner margin paler; a whitish oblique shade from costa across end of cell; a grey shade beyond cell to outer line, between veins 4 and 6; a fine outer dark brown line from vein 8 to inner margin, connected with costa by an oblique line and indistinct reddish brown line; apex dark brown, with a white streak below vein 10; a white line from vein 8 close to outer line to vein 5, then to outer margin at vein 2; the outer margin otherwise grey. Secondaries paler at base; a fine reddish brown outer line, dentate towards inner margin. Underneath the secondaries are paler

and all the markings are less distinct; on the primaries a black discal spot.

Expanse.—Male, 34 mm.; female, 40 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

In this species there is a frenulum; the wings are broad, the primaries with the apex produced.

Type.—Cat. No. 8894, U.S.N.M.

CICINNUS LUCARA, new species.

Same shape as *P. lantona* Schaus, and also with frenulum. Body grey, shaded with brown. Primaries: base greyish brown limited by an indistinct, irregular, reddish brown line; the costa whitish to outer line, which is deep velvety brown, strongly angled at vein 8; the median space is light brown with some reddish markings below vein 3 and above veins 6, 7, and 8; apex and outer margin grey; a white streak below vein 10, and a white line inwardly curved from vein 8 to outer margin at vein 2; a greyish spot at end of cell. Secondaries greyish, irrorated with black scales on inner margin; a reddish brown median shade, widest on inner margin and crossed by a dark velvety brown line. Underneath greyer, with reddish shades beyond cell on primaries and on anal angle of secondaries; the lines finer, except on costa of primaries.

Expanse.—34 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8895, U.S.N.M.

CICINNUS LOLA, new species.

Wings broad, apex hardly falcate, inner angle of primaries and outer margin of secondaries denticulate. Body and wings grey, thinly irrorated with black scales. Primaries: a fine brown outer line, slightly angled at vein 7; a vitreous spot at end of cell, inwardly shaded with brown. Secondaries: a fine median brown line. Underneath grey, thinly irrorated with black scales.

Expanse.—31 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8896, U.S.N.M.

CICINNUS ROSEA, new species.

Male.—With frenulum. Primaries falcate, incised above and below vein 2. Secondaries slightly crenulate. Head, collar, and abdomen above pale reddish brown. Thorax and body underneath roseate. Wings very pale brown, suffused with roseate on basal half and with a few scattered black scales; a faint trace of a fine darker outer line; fringe black at base, outwardly reddish brown.

Expanse.—36 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8897, U.S.N.M.

CICINNUS VALVA, new species.

Primaries falcate, incurved below apex and vein 3. Secondaries slightly angled at vein 3. Wings dark greyish brown in the male, brown in the female. Primaries: a fawn color outer line, angled below vein 8, inwardly shaded with dark brown. Secondaries with a similar straight median line. Underneath paler, the line on primaries slightly curved and wavy to vein 3, then inwardly oblique and slightly wavy. Secondaries with the line outcurved between veins 3 and 5.

Expanse.—Male, 27 mm.; female, 29 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8898, U.S.N.M.

CICINNUS NARGA, new species.

Frons, thorax, and basal half of abdomen dorsally violaceous. Abdomen dorsally reddish brown on last segments; anal tufts black. Collar shaded with fawn color. Primaries violaceous, thinly irrorated with black scales; a large pale reddish brown spot at end of cell, and a smaller one between veins 2 and 3, partly outlined with darker violaceous; the veins darker from cell to outer line; some reddish brown on costa beyond the cell; a dark oblique line from costa at three-fourths from base to the outer line, which is blackish and curves along vein 8 to inner margin; the apex blackish; the outer margin whitish, shaded with reddish brown terminally; submarginal clusters of black scales. Secondaries violaceous, more thickly irrorated with black; a dark outer line from costa near apex to just above anal angle; outer margin paler, slightly mottled with white and with a row of small black spots on veins. Underneath paler, the lines as above.

Expanse.—32 mm.

Habitat.—60 miles up the Maroni River on the Dutch Guiana side.

Type.—Cat. No. 8899, U.S.N.M.

CICINNUS LEMOULTI, new species.

Head and collar pale reddish. Thorax roseate fawn color. Abdomen pale roseate brown. Primaries acute, falcate, roseate fawn color, thinly irrorated with black scales; the costa olivaceous fawn color; some blackish striæ forming an indistinct median shade; a transparent spot at end of cell, crossed by vein 5; a dark brown outer line angled at vein 8, outwardly shaded with reddish brown below vein 8, and followed by a dull brownish shade below vein 4. Secondaries: the base roseate fawn color somewhat shaded with brown; a dark brown medial line; the outer margin roseate brown at apex, otherwise dark reddish, especially at anal angle. Underneath: primaries reddish; the outer line black, curving from vein 8 to outer margin at vein 3; below this to inner angle broadly roseate. Secondaries roseate irrorated

with black; the anal angle broadly, the outer margin narrowly, dark reddish brown.

Expanse.—45 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Named after Mr. Eugene Le Moul, to whom I am indebted for many new species and great hospitality during my visit to French Guiana.

Type.—Cat. No. 8900, U.S.N.M.

CICINNUS FRATERNA, new species.

Body lilacine buff irrorated with light brown. Wings lilacine buff irrorated with grey. Primaries: a fine brown antemedial line; an oblique hyaline spot beyond cell, edged with brown, darkest anteriorly; an outer line oblique from costa to near outer margin, then inwardly oblique to inner margin at two-thirds from base, dark brown, inwardly shaded with buff; a dark wavy line marginally from veins 4 to 2, and one from vein 2 to inner angle. Secondaries: a dark brown line inwardly shaded with buff just beyond middle. Underneath, this dark line on secondaries is very indistinct, and is followed by a fine dark subterminal line, outwardly curved between veins 2 to 5.

Expanse.—57 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

This species is closely allied to *C. strigifera* Felder, but in that species the line on secondaries below is quite different.

Type.—Cat. No. 8901, U.S.N.M.

CICINNUS CUNONA, new species.

Body and wings brown, the latter tinged with olivaceous. Primaries: a dark spot at end of cell; a dark outer line from costa at three-fourths from base, angled at vein 7, then to near middle of inner margin. Secondaries: a dark antemedial line. Underneath similar but slightly paler.

Expanse.—43 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8902, U.S.N.M.

Genus LACOSOMA Grote.

LACOSOMA OTALLA, new species.

Male.—Head and collar pale vermilion. Body light grey. Wings light grey, thinly irrorated with black. Primaries: the costa finely reddish; vermilion shades in cell, below it, and slightly beyond it below costa; a black streak at end of cell; the outer half of wing darker grey, with traces of a geminate wavy outer line, terminating on costa in a small dark brown spot. Secondaries shaded with brown

at apex; a minute black discal point. Underneath the vermilion shades on primaries become bright red.

Expanse.—30 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8903, U.S.N.M

Family DALCERIDÆ.

SYNOPSIS OF GENERA.

Fore wings without accessory cell; antennæ with a prominent scale tuft at tip.

Fore wings with vein 11 arising from the cell.

Veins 7, 8, 9, and 10 on separate stalks..... *Dalcera*

Veins 8 and 10 absent.

Veins 7 and 9 stalked; 8 of the hind wings separate from the subcostal... *Paracraga*

Veins 7 and 9 separate; 8 of the hind wings broadly joined to subcostal... *Minonoa*

Fore wings with vein 11 stalked with 9 and 10.

Vein 6 arising below the discal vein..... *Dalcerina*

Vein 6 arising above the discal vein..... *Minacraga*

Fore wings with accessory cell; antennæ without scale tuft.

Veins 9 and 10 long stalked but distinct..... *Acraga*

Veins 9 and 10 coincident or nearly so.

Hind wings ovate, rounded..... *Dalcerides*

Hind wings trigonate, inner margin long.

Vein 8 of hind wings running close to subcostal..... *Epipinconia*

Vein 8 broadly joined to subcostal.

Fore wings with the cell normal, discal veins in line, upper edge of cell and vein 11 parallel to costa..... *Ameraga*

Fore wings with upper half of cell and accessory cell retracted, accessory cell forming a projection into the subcostal interspace..... *Acragopsis*

Genus PARACRAGA Dyar.

PARACRAGA INNOCENS, new species.

Body buff white. Wings white. Primaries thinly irrorated with dark brown scales in cell, on inner margin, outer half of costal margin, and on outer margin; costa pale buff; a black point just before middle of inner margin; a curved black line from costa across end of cell, followed by a dark postmedial line curved to vein 3, then wavy to inner margin; the outer margin clouded with light brown below vein 6; some terminal dark points.

Expanse.—18 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8904, U.S.N.M.

Genus MINACRAGA Dyar.

MINACRAGA DISCONITENS, new species.

Palpi dark brown tipped with pale buff. Antennæ buff tipped with black. Head and abdomen pale buff. Thorax light brown; the

patagia dark violaceous brown. Primaries pale metallic buff, except on margins which are dull; a broad dark brown streak at base of inner margin; a black point at end of cell; a subterminal wavy brown line, followed by metallic buff spots between veins 3 and 5, which are again followed by a dark brown marginal shade; the lobe on inner margin light brown. Secondaries creamy buff; the outer margin shaded with blackish brown, chiefly towards anal angles.

Expanse.—30 mm.

Habitat.—Maroni River, French Guiana.

Type.—Cat. No. 8905, U.S.N.M.

Genus MINONOA Dyar.

MINONOA PERBELLA, new species.

Body orange above, paler underneath. Primaries: basal half yellow, partly irrorated with brown; an antemedial brown line; outer half dark brown, irrorated with orange beyond cell; a yellow point at apex; a geminate darker terminal line divided by some orange spots. Secondaries orange; the outer margin broadly shaded with black.

Expanse.—21 mm.

Habitat.—Petropolis, Brazil.

Type.—Cat. No. 8906, U.S.N.M.

Genus ACRAGOPSIS Dyar.

ACRAGOPSIS FLAVETTA, new species.

Body ochreous yellow. The wings citron yellow, the veins in primaries slightly darker.

Expanse.—16 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8908, U.S.N.M.

Genus ACRAGA Walker.

ACRAGA INFUSA, new species.

Head and abdomen deep yellow. Thorax orange. Primaries deep yellow, the margins and a streak along median and vein 4 orange. Secondaries deep yellow, shading to orange at anal angle.

Expanse.—19 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8907, U.S.N.M.

ACRAGA ANGULIFERA, new species.

Body pale lemon color. Wings pale lemon color, the costal margins palest. Primaries: a dark brown inwardly angled line at end of cell; a subterminal brownish shade below vein 7, incurved to vein 2,

then straight to inner margin. Secondaries a brown terminal line at anal angle.

Expanse.—21 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8909, U.S.N.M.

Genus EPIPINCONIA Dyar.

EPIPINCONIA UMBRIFERA, new species.

Body above light brown, underneath white; collar mottled with white. Wings white. Primaries: the markings pale brown; a point at end of cell; a broad postmedial shade, extending to fringe between veins 3 and 5; a narrow shade along inner margin to postmedial. Secondaries a pale brown shade at anal angle, extending on to fringe.

Expanse.—22 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8910, U.S.N.M.

Family AIDIDÆ.

Genus BRACHYCODILLA Dyar.

BRACHYCODILLA PERFUSA, new species.

Palpi dark brown behind, whitish in front. Frons whitish, laterally dark brown. Vertex light brown. Collar dark brown in front, whitish behind. Thorax olivaceous brown; patagia whitish, streaked with buff. Abdomen roseate; a dark brown subdorsal patch at base. Primaries: whitish in and below cell, otherwise thickly irrorated with dark grey, with a blackish postmedial curved shade; an antemedial dark spot below cell. Secondaries roseate; the outer margin black.

Expanse.—25 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8911, U.S.N.M.

Family MEGALOPYGIDÆ.

SYNOPSIS OF GENERA.

Hind wings with vein 8 joined to subcostal to near, or beyond end of cell.

Fore wings with veins 4, 5 separate.

Hind wings with 3, 4 stalked or from a point.

Branch of vein 1 on fore wings distinct *Carana*

Branch of vein 1 on fore wings obsolete *Sulychra*

Hind wings with veins 3, 4 separate.

Frenulum distinct, vein 10 usually stalked.

Fore wings with vein 7 arising after 9.

Wing shape normal *Trosia*

Outer margin bent parallel to costa *Edebessa*

Fore wings with vein 7 before 9 *Thoscora*

Frenulum weak, vein 10 usually from the cell.	
Antennæ over half the length of fore wings.....	<i>Lagoa</i>
Antennæ less than half the length of fore wing.....	<i>Megalopyge</i>
Fore wings with veins 4, 5 stalked.....	<i>Mesocia</i>
Hind wings with vein 8 joined to the subcostal narrowly centrally, or not over two-thirds of the cell.	
Hind wings with veins 3, 4 stalked.	
Veins 4, 5 of fore wings separate.	
Wings rounded; antennæ less than half the length of fore wings.....	<i>Cyclara</i>
Wings less rounded; antennæ over half the length of fore wings.....	<i>Anarchylus</i>
Veins 4, 5 of fore wings stalked.....	<i>Gois</i>
Hind wings with veins 3, 4 separate.	
Fore wings rounded.....	<i>Ochrosoma</i>
Fore wings pointed.....	<i>Podalia</i>

Genus CARAMA Walker.

CARAMA IMPARILIS, new species.

Antennæ ochreous. Palpi and frons blackish brown; white hairs at base of antennæ; vertex pale yellow. Collar and thorax dark grey; patagia white. Abdomen brown, black above, whitish underneath; a subdorsal patch at base, and anal hairs pale yellow. Primaries grey; the costa, veins and fringe white; a faint whitish shade from cell at vein 2 to inner margin. Secondaries darker grey; the fringe white; a whitish spot at end of cell.

Expanse.—24 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8912, U.S.N.M.

CARAMA FLAMMICORNIS, new species.

Body white. Tarsi, mid and fore tibiæ black; a dark spot on fore coxæ; frons dark brown and grey. Antennæ red. Wings white; the costa of primaries finely black.

Expanse.—27 mm.

Habitat.—Geldersland, Surinam River, Dutch Guiana.

Type.—Cat. No. 8913, U.S.N.M.

Genus TROSIA Hübner.

TROSIA PULCHELLA, new species.

Body ochreous, the thorax mottled with roseate. Antennæ and tarsi black. Primaries ochreous, shading to brown and then olivaceous grey terminally; a black streak in cell below subcostal followed by a roseate patch. Secondaries reddish ochreous; the outer margin broadly smoky black from vein 2 to apex, underneath reddish ochreous; the outer margins broadly smoky black.

Expanse.—29 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8914, U.S.N.M.

TROSIA MIRABILIS, new species.

Body white; frons black; antennæ and vertex bright red; mid and fore legs brown; anal hairs black. Wings white; costal margin of primaries black.

Expanse.—37 mm.

Habitat.—Colombia.

Type.—Cat. No. 8915, U.S.N.M.

TROSIA IGNICORNIS, new species.

Body and wings white. Mid and fore legs mottled with black. Antennæ: the shaft crimson; the pectinations ochreous.

Expanse.—21 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8916, U.S.N.M.

TROSIA INCOSTATA, new species.

Head, abdomen, and legs reddish; tarsi black, spotted with white. Collar and thorax yellowish buff, the latter spotted with red. Primaries greenish yellow; a postmedial row of black spots. Secondaries roseate. Underneath dull roseate. In this species the costa of primaries is of the same color as the wing.

Expanse.—34 mm.

Habitat.—Merida, Venezuela.

Type.—Cat. No. 8917, U.S.N.M.

TROSIA PURENS, new species.

Body white; face, tarsi, fore tibiæ, and coxæ black. Wings silvery white. Primaries with the costa finely black, which does not reach apex.

Expanse.—35 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8918, U.S.N.M.

Genus **EDEBESSA** Walker.**EDEBESSA CIRCUMCINCTA**, new species.

Head and thorax black, irrorated with white scales. Tarsi red, irrorated with white hairs. Abdomen red above; the basal segment black; underneath black. Primaries dark mouse grey; a red line along basal third of costa, then below costa and along vein 7 to apex. Another red line from base of costa to inner margin near angle, then up to vein 5 on extreme margin; the outer two-thirds of costa and the outer margin below vein 5 black; fringe between vein 5 and apex yellowish. Secondaries blackish; the outer margin broadly red, except a black line on extreme margin and fringe between vein 3 and anal angle.

Expanse.—41 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8919, U.S.N.M.

EDEBESSA LANGUCIATA, new species.

Head, legs, and thorax black, the latter irrorated with lilacine white scales. Abdomen red, dark brown at base; anal segment light brown. Wings black, the markings red. Primaries: a large annular spot at base from subcostal to submedian; a quadrate spot from vein 3 to costa, filled in with black which is crossed by the discocellular; a red line from outer costal angle of this spot to below apex, then forming large subterminal lunules between the veins to vein 3, and below it twice angled to submedian where it joins the basal spot; a medial lunular spot on inner margin below the submedian. Secondaries: cell red; from lower angle of cell a line extends towards costa at its middle, follows below costa to near apex and forms a subterminal lunular line along the outer margin. Underneath similar.

Expanse.—57 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8920, U.S.N.M.

EDEBESSA MEGALOPYGÆ, new species.

Antennæ white. Frons and body underneath black. Vertex citron yellow. Thorax olivaceous brown. Abdomen above dark brown; a subdorsal basal citron yellow patch. Primaries dark grey with long curly hairs as in *Megalopyge*, which becomes olivaceous brown at base and along inner margin; the apex and outer margin golden olivaceous buff. Secondaries dark grey; the outer margin narrowly and fringe golden olivaceous buff.

Expanse.—48 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8921, U.S.N.M.

Genus MESOCIA Hübner.

MESOCIA LORNA, new species.

Antennæ and frons buff. Vertex white. Collar and thorax pale sulphur yellow. Abdomen black above; anal hairs grey; a subdorsal basal patch like thorax. Primaries: costal margin, cell, and a space below it whitish; some pale yellow at base and along inner margin; outer margin below vein 7, broadly pale grey, crossed by dark brown veins, and with long darker grey streaks between the veins; some yellowish postmedial points on veins. Secondaries grey, darkest along the inner margin; a little white on outer margin; the veins darker, and traces of darker streaks between the veins.

Expanse.—25 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8922, U.S.N.M.

MESOCIA TERMINATA, new species.

Antennæ creamy buff. Frons brown; vertex white. Collar and thorax dark grey; patagia white. Abdomen black; anal hairs white; a white ventral line. Legs white; tarsi pale brown. Primaries grey; the costa finely light brown; apex whitish; outer margin below vein 7 broadly light brown, crossed by black veins and fine black streaks between the veins; a faint subterminal white shade; a postmedial dentate shade, where the grey and brown meet. Secondaries black; the outer margin below apex creamy white.

Expanse.—27 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8923, U.S.N.M.

Genus CYCLARA Schaus.

CYCLARA BRUNNEIPENNIS, new species.

Body dark brown. Antennæ olivaceous brown. Wings dark golden brown. Primaries: a dentate whitish postmedial line from vein 5 to inner margin; a subterminal darker brown spot at vein 7.

Expanse.—16 mm.

Habitat.—Petropolis, Brazil.

Type.—Cat. No. 8924, U.S.N.M.

CYCLARA OBSCURA, new species.

Palpi and frons dark brown. Vertex dark velvety brown. Thorax and abdomen greyish brown. Wings light greyish brown. Primaries: a broad, diffuse, dark brown postmedial shade, partly edged by wavy whitish lines; a black spot at base; a subterminal black spot at vein 7.

Expanse.—17 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8925, U.S.N.M.

CYCLARA AMARGA, new species.

Body black. Abdomen tinged with grey laterally. Primaries brownish black; the apex broadly, the outer margin narrowly light greyish buff; a postmedial whitish line, oblique from costa at two-thirds from base to vein 5, then deeply dentate to vein 2, and wavy to inner margin, separates the dark and light portions; a marginal row of triangular blackish spots, preceded at vein 7 by another spot. Secondaries smoky black, becoming paler on outer margin.

Expanse.—22 mm.

Habitat.—St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 8926, U.S.N.M.

Genus GOIS Dyar.

GOIS NIGRESCENS, new species.

Body and legs black; tarsi tipped with white; a fine subdorsal whitish line on abdomen; anal hairs whitish. Primaries black; the apex broadly pale buff; the black space limited by a white line, oblique from costa at two-thirds from base to vein 4, then lunular and deeply indentate at vein 2, followed by black marginal spots between inner margin and vein 4; a subterminal black point at vein 7. Secondaries black, thinly scaled; the outer margin pale buff.

Expanse.—23 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. No. 8927, U.S.N.M.

Genus PODALIA Walker.

PODALIA MAJOR, new species.

Antennæ, frons, legs, and abdomen brown, the latter banded with white. Collar whitish in front, olivaceous brown behind. Thorax mottled olivaceous brown and white. Primaries white, the markings light olivaceous brown; a small black spot at base below median; a broad median shade, darkest along upper portion of cell, crossed by whitish shades between the veins and limited by a broad white post-medial line, which is followed by cuneiform streaks and spots; a terminal row of spots between the veins. Secondaries white; space below cell and inner margin shaded with olivaceous brown; some faint terminal spots.

Expanse.—Male, 65 mm.

Habitat.—Merida, Venezuela.

Type.—Cat. No. 8928, U.S.N.M.

PODALIA MULTICOLLIS, new species.

Antennæ: shaft black, pectinations light brown. Frons, legs, and body underneath light brown. Vertex and tegula white, the latter edged with dark brown. Thorax brown edged with white in front. Abdomen brown, banded with white. Primaries white, the cell and space below it streaked with grey; costa streaked with black for two-thirds from base; a black streak along median to end of cell; an oblique black shade from cell at vein 2 to near inner angle; discocellular black; the veins on outer portion edged with light greyish brown; fringe brownish. Secondaries white; inner margin broadly pale brown; fringe similar.

Expanse.—Male, 31 mm.

Habitat.—St. Laurent, Maroni River, French Guiana.

Type.—Cat. No. 8929, U.S.N.M.

PODALIA THANATOS, new species.

Antennæ and body black; some brownish transverse shades on abdomen. Tarsi tipped with pale buff. Primaries black; the apex and outer margin grey white, crossed by pale olivaceous brown veins; a subterminal row of black spots. Secondaries: base and inner margin broadly black, otherwise grey white crossed by pale olivaceous brown veins.

Expanse.—31 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. No. 8930, U.S.N.M.

PODALIA HYALINA, new species.

Frons, legs, and thorax dark brown. Vertex and collar ochereous. Abdomen black; anal hairs ochereous. Wings hyaline. Primaries, the veins and costal margin light brown; some darker brown at base and along inner margin. Secondaries: the inner margin broadly shaded with blackish brown.

Expanse.—30 mm.

Habitat.—Petropolis, Brazil.

Type.—Cat. No. 8931, U.S.N.M.

Family COSSIDÆ.

SYNOPSIS OF GENERA.

Male antennæ bipectinate on basal half, the tip simple.

Hind wing with vein 8 free.

Hind wing with veins 4 and 5 from a point.....*Azygophleps*

Hind wing with veins 4 and 5 separate.....*Xyleutes*

Hind wing with vein 8 joined to the subcostal by a bar at end of cell.....*Zeuzera*

Male antennæ unipectinate, one row reduced to serrations.

Hind wings with vein 8 free.....*Hemipecten*

Male antennæ simple, flattened.

Hind wings with vein 8 joined to subcostal by a bar.....*Miacora*

Male antennæ bipectinate or biserrate to the tip.

Hind wings with vein 8 joined to the subcostal by a bar.

Sexes dimorphic; subcostal bar oblique.....*Prionocystus*

Sexes similar.

Hind wings with veins 6, 7 from a point or stalked.

Wings broad; subcostal bar oblique.....*Acossus*

Wings narrow, subcostal bar erect.....*Givira*

Hind wings with veins 6, 7 separate at origin.

Vein 1c. of fore wings present.

Frenulum distinct.....*Ravigia*

Frenulum obsolete.....*Philanglaus*

Vein 1c. of fore wings obsolete.....*Langsdorfia*

Hind wings with vein 8 free.

Accessory cell absent.

Veins 7 and 8 stalked, 9 from the cell.....*Lentagena*

Veins 8 and 9 stalked, 7 from cell or nearly so.....*Trigena*

Accessory cell present.

Fore wings with vein 11 from the discal cell.

Wings broad and ample.....*Cossus*

Wings narrower, more produced.....*Hypopta*

Fore wings with vein 11 from the accessory cell.

Vein 1c. of fore wings present; palpi moderate.....*Cossula*

Vein 1c. absent; palpi very long, deflexed, hairy.....*Acousmaticus*

Genus HEMIPECTEN Dyar.

HEMIPECTEN ECPARILIS, new species.

Head and thorax black; some greenish scales on frons. Abdomen blackish brown. Primaries dark leaden grey, irrorated with buff on outer half of costal margin and beyond cell between veins 2 and 4; lines velvety black; a basal line; an antemedial line bifurcating in cell, the basal branch bifurcating on inner margin; the postmedial geminate and wide apart on costa, meeting at vein 5 where it is also joined by the subterminal, the lines again diverging. Secondaries whitish buff, reticulated with light brown, the inner margin broadly darker brown.

Expanse.—50 mm.

Habitat.—Rio de Janeiro, Brazil.

Type.—Cat. No. 9013, U.S.N.M.

HEMIPECTEN ACUTIPENNIS, new species.

Frons grey; vertex dark velvety brown; collar silvery buff. Thorax and abdomen dirty white; some reddish brown scales posteriorly on thorax. Primaries dirty silvery white; a large dark velvety brown spot in cell; a small one below it and one on inner margin, nearer the base than the spot in cell; a brown streak from cell to apex; costa greyish brown on apical two-thirds; a brown shade on outer margin, narrow below apex and widening toward inner margin, on which are darker brown lines and a white shade. Secondaries whitish; the veins on outer half and outer margin narrowly greyish.

The female has the primaries reticulate with brown, the spot in the cell very much larger and coalescing with the spot below cell; no spot on inner margin. Body and secondaries dark grey.

Expanse.—Male, 39 mm.; female, 47 mm.

Habitat.—Maroni River, French Guiana.

Type.—Cat. No. 9014, U.S.N.M.

HEMIPECTEN COSSULOIDES, new species.

Head pale buff, irrorated with brown; collar and thorax white, thinly irrorated with light brown; abdomen brown grey. Primaries

dark grey with darker striae, a white spot at base, a whitish postmedial space not reaching costa or inner margin, followed by a reddish brown shade, inwardly curved from apex to vein 2, beyond which the margin is buff with a dark-brown streak between veins 4 and 5 and one at vein 7, the two connected by a brown line. Secondaries brownish grey.

Expanse.—47 mm.

Habitat.—St. Laurent, French Guiana.

Type.—Cat. No. 9015, U.S.N.M.

HEMIPLECTEN NIVEOGRISEA, new species.

Frons pale buff; vertex white; collar white, blackish in front. Thorax yellowish buff, abdomen brownish buff; a black subdorsal spot at base. Primaries greyish brown with darker irrorations and faintly reticulated; some white points on costa; outer margin above vein 3 pale yellowish buff, the veins broadly white; a brown terminal shade between veins 4 and 5. Secondaries white, the veins terminally, the apex, and a terminal line brown.

Expanse.—39 mm.

A female in the British Museum has the secondaries all grey.

Habitat.—St. Laurent, French Guiana.

Type.—Cat. No. 9016, U.S.N.M.

HEMIPLECTEN ROTUNDOPUNCTA, new species.

Head, collar, and thorax white, mottled with grey; the patagia tipped with ochereous; abdomen grey; primaries with the cell and inner margin whitish, irrorated with light brown in the former, with dark brown on the latter, a broad reddish brown shade below the cell; a round reddish brown spot on middle of inner margin; the costal margin greyish; the outer space pale reddish brown, irrorated with whitish at apex; a subterminal round reddish brown spot between veins 6 and 8. Secondaries greyish brown.

Expanse.—29 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 9017, U.S.N.M.

HEMIPLECTEN MARMORATA, new species.

Body pale buff, the thorax thinly irrorated with dark brown. Primaries pale buff, shaded with pale brown; the costa greyish with dark-grey points on extreme margin; inner margin with fine transverse pale-brown lines; dark-brown spots in and below cell from base to subterminal space; beyond cell pale-brown oblique fasciæ from costa toward outer margin. Secondaries pale brown, with darker reticulations; a small dark spot at end of cell.

Expanse.—34 mm.

Habitat.—St. Laurent, French Guiana.

Type.—Cat. No. 9018, U.S.N.M.

Genus PRIONOXYSTUS Grote.

PRIONOXYSTUS DUPLEX, new species.

Body blackish; primaries dark brown with a few darker reticulations. Secondaries white, semihyaline; costa narrowly, inner margin broadly dark brown; a fine terminal brown line.

Expanse.—25 mm.

Habitat.—St. Laurent, French Guiana.

Type.—Cat. No. 9019, U.S.N.M.

Genus PHILANGLAUS Butler.

PHILANGLAUS SOBRANA, new species.

Body lilacine brown; primaries reddish brown with slightly darker reticulations. Secondaries pale brown, darkest on margins.

Expanse.—43 mm.

Habitat.—Maroni River, Dutch Guiana.

Type.—Cat. No. 9020, U.S.N.M.

Genus RAVIGIA Dyar.

RAVIGIA BASIPLAGA, new species.

Body grey, darkest on collar; frons brown. Primaries grey with darker lines and reticulations, chiefly on outer margin; a dark spot at end of cell, a dark-brown shade from base below cell to inner margin and almost reaching vein 2, from which it is separated by a white shade. Secondaries whitish, the veins brown; transverse dark grey streaks between the veins.

Expanse.—42 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. No. 9021, U.S.N.M.

Genus GIVIRA Walker.

GIVIRA TRIPLEX, new species.

Head dark brown; collar and thorax whitish; abdomen dark brown, slightly mottled with white. Primaries whitish grey, the costal and inner margins and veins buff; the base, inner margin to near vein 2 and costal margin for two-thirds from base irregularly irrorated with dark brown; a dark curved shade around end of cell; blackish irrorations between veins 3 and 5; terminal dark brown spots at ends of veins, the largest toward inner angle. Secondaries greyish brown.

Expanse.—27 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 9022, U.S.N.M.

Genus HYPOPTA Hübner.

HYPOPTA INGUROMORPHA, new species.

Body grey, the frons darkest; primaries whitish, shaded with grey on margins and in cell; light brown reticulations and some black lines, the most conspicuous being an antemedial line, a medial bifurcating line on inner margin, and an irregular subterminal line, forming a lunule at apex and one from vein 5 to vein 2, both emitting branches to outer margin. Secondaries whitish grey, with dark reticulations between the veins.

Expanse.—25 mm.

Habitat.—St. Laurent, French Guiana.

Type.—Cat. No. 9023, U.S.N.M.

HYPOPTA CRASSIPLAGA, new species.

Body mottled silvery grey and brown. Primaries light brown, with some darker reticulations; a white shade below cell; a white shade beyond cell from vein 3 to costa, extending to outer margin between veins 5 and 6; some black reticulations on inner margin and on outer margin between veins 2 and 3, and 4 and 5; a subterminal blackish spot from veins 6 to 8, emitting branches to costa; some terminal blackish spots. Secondaries brownish grey with darker reticulations; a whitish streak near anal angle.

Expanse.—37 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 9024, U.S.N.M.

HYPOPTA TRIARCTATA, new species.

Head and thorax brown, the latter with very dark brown transverse lines. Collar dark grey-brown, shaded with white posteriorly. Abdomen brown with dark transverse bands and greyish hairs dorsally. Primaries light brown; the medial space above submedian and along costa to near apex, whitish; a broad antemedial blackish brown fascia from costa to submedian; a fine, interrupted medial line; a curved dark fascia across discocellular to submedian; a broad curved fascia at apex, edged on either side with white; a subterminal brown-black shade from just above vein 4 to near vein 2, emitting branches to termen above vein 4 and at inner angle; fine dark striae scattered over the surface. Secondaries dark brown.

Expanse.—40 mm.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 9025, U.S.N.M.

Genus COSSULA Bailey.

COSSULA MAGNA, new species.

Head and collar reddish brown, the latter darkest. Thorax whitish with some brown irrorations. Abdomen dark brown; anal hairs buff. Primaries grey, with darker striæ; inner margin, a spot at end of cell, and irregular postmedial spots becoming very large toward submedian, blackish grey; outer margin light brown, broadly below costa, then narrowing to vein 2, containing a blackish-brown shade from veins 4 to 8; an antemedial fine blackish line. Secondaries dark brown.

Expanse.—80 mm.

Habitat.—Omai, British Guiana.

Allied to *C. norax* Druce, but very much larger.

Type.—Cat. No. 9026, U.S.N.M.

Family PSYCHIDÆ.

SYNOPSIS OF GENERA.

Vein 1 of fore wings with a branch on the lower side.

Wings elongate, narrow.

Hind wings with the apex sharp, veins all present *Oiketicus*

Hind wings rounded, veins reduced in number.

Fore wings with veins 4, 5 coincident *Thyridopteryx*

Fore wings with veins 4, 5 stalked *Biopsyche*

Wings broader, size small.

Vein 6 present on both wings *Platacticus*

Vein 6 absent on both wings *Hyaloscotes*

Vein 1 of fore wings without a branch below.

Veins 4 and 6 of hind wings absent *Chalia*

Veins all present; 4, 5 stalked on fore wings *Thanatopsyche*

Genus THANATOPSYCHE Butler.

THANATOPSYCHE THORACICA, new species.

Veins all present; 4 and 5 of both wings separate at origin. Head, thorax, and base of abdomen ochreous brown, abdomen otherwise grey black. Wings brown black. Secondaries: the cell semihyaline.

Expanse.—46 mm.

Habitat.—Omai, British Guiana.

Type.—Cat. No. 9027, U.S.N.M.

Genus OIKETICUS Guilding.

OIKETICUS SPECTER, new species.

All veins present; cell of hind wing rather short, not over two-thirds the length of wing. Body dark grey-brown. Wings thinly scaled, brown-grey. Primaries: a darker grey shade in and beyond cell, also

near base of inner margin; discocellular paler grey. Secondaries: the inner margin darker grey.

Expanse.—50 mm.

Habitat.—Merida, Venezuela.

Type.—Cat. No. 9028, U.S.N.M.

Genus THYRIDOPTERYX Stephens.

THYRIDOPTERYX MICROPTERA, new species.

Body black; thorax posteriorly and base of abdomen ochreous. Wings hyaline. Primaries: the veins on basal half ochreous. Secondaries: long black hairs except on costa and apex.

Expanse.—23 mm.

Fore wing with only 9 veins. Hind wing with only 3 veins.

Habitat.—St. Jean, French Guiana.

Type.—Cat. No. 9029, U.S.N.M.

Genus PLATÆCETICUS Packard.

PLATÆCETICUS MARONA, new species.

Primaries: all veins present; 4 and 5 stalked. Secondaries: all veins present. Body and wings brownish black.

Expanse.—26 mm.

Habitat.—St. Laurent, French Guiana.

Type.—Cat. No. 9030, U.S.N.M.



SOME NEW SOUTH AMERICAN MOTHS.

By WILLIAM WARREN,
Of Chiswick Lane, London, England.

Mr. William Schaus has put in my hands for determination some moths collected by himself in the Guianas. Among them are several undescribed forms which I characterize herewith at his wish. The types are in Mr. Schaus's collection, now in the U. S. National Museum.

Family THYRIDIDÆ.

Genus BELONOPTERA Herrich-Schaeffer.

BELONOPTERA SANGUINEA, new species.

Forewing.—Semihyaline ochreous, with deep blood red markings; the paler spaces in basal area, along costa, and hind margin, and the area between veins 2 and 5 tinged with rufous; base of inner margin broadly deep red to submedian fold, met there by a band from median vein before the origin of vein 2, and on inner margin just before middle by a much broader oblique band, which forks widely in end of cell and contains a round pale spot; both these bands run ramifying to costa and form a broad irregular costal streak continued to apex, with various pale patches on costal edge and a larger one at base; shortly before apex a narrow brown streak curves parallel to hind margin, with two or three separate streaks beyond it; at anal angle a deep red ochreous blotch rises, its upper end pointed, reaching vein 4 at its middle; in the interval between this and the central band are two irregular red blotches, and some more in the paler space above vein 5; all the pale spaces with small complicated reticulations; fringe rufous.

Hindwing.—Mainly deep red, having pale areas near base between basal blotch and a broad submedian fascia, another larger on costa beyond middle and a small one beyond it, a fourth or submedian fold towards anal angle and a small one at the angle.

Underside with the markings deep chestnut brown instead of red and very much restricted.

Face and prothorax red-brown, varied with ochreous; thorax and abdomen above red; below ochreous smeared with reddish fulvous; a pair of ochreous spots on first segment of dorsum.

Expanse of wings.—70 mm.

Habitat.—St. Jean, Maroni River, French Guiana; 1 female, July, 1904.

Forewing with strongly developed shoulder at base and pointed apex; hindwing with only a blunt projection at the end of vein 7.

Type.—Cat. No. 8932, U.S.N.M.

Genus BRIXIA Walker.

BRIXIA NEAPOLITANA, new species.

Forewing.—Cream color, streaked with flesh colored ochreous; costal edge dotted alternately light and dark; four or five slightly dark patches on costa imply the origin of transverse belts which are obscurely broken up across wing by the pale ground color; the submarginal belt alone is uninterrupted, marked above middle with short dark horizontal streaks ending externally in white patches; from vein 5 to vein 1 the postmedian band becomes green, forming an oblique shuttle-shaped blotch with white edge.

Hindwing.—Whitish, with six transverse parallel darker belts, of which the two middle ones are green; a few fine striæ towards costa; fringe of both wings ochreous.

Underside similar, the markings rather more distinct; the green belts of the hind wing very pale.

Head, thorax, and abdomen ochreous; antennæ ferruginous, thickened, and lamellate; legs brownish ochreous; tarsi pale fuscous with whitish rings.

Expanse of wings.—17 mm.

Habitat.—Geldersland, Surinam River, Dutch Guiana; 1 male.

Type.—Cat. No. 8933, U.S.N.M.

BRIXIA GUTTULOSA, new species.

Forewing.—Pale rufous ochreous, rather deeper towards hind margin; costal area olive tinged, dotted with white, the edge deeper between the dots, from which depend short white streaks; the inner margin below submedian and the outer half of submedian interspace filled with short white ripples; a darker shade from costa before apex, separated by a short white marginal streak from the rufous fringe.

Hindwing.—With the white ripples developed all over, the larger spots forming two white lines, antemedian and postmedian, the included fascia tinged with green and with minute white dots; marginal area and fringe deeper tinted.

Underside deeper rufous; the white markings much as above, but plainer; the fascia of hind wing without any green tinge.

Head and shoulders dark brown; thorax and abdomen like wings; the latter crossed by pale lines with a green belt between; patagia whitish at tips; legs mottled brown and white.

Expanse of wings.—24 mm.

Habitat.—100 miles up Maroni River, French Guiana; 1 female, April, 1904.

Akin to *B. multifasciata* Warren (*Iza*).^a

Type.—Cat. No. 8934, U.S.N.M.

Genus DRACONIA Hübner.

DRACONIA BASIPILETA, new species.

Forewing.—White; the markings and reticulations red brown; the base to two-fifths of inner margin and the costal streak red brown; costal edge white, marked with deep brown dots and streaks; at three-fifths and five-sixths, two deep brown subquadrate blotches depend from the costal streak; from the inner angle of the first a red brown line runs to an urn-shaped mark at two-thirds of inner margin; from its outer angle a line runs obliquely outwards joining a line from inner angle of second blotch to a triangular blotch at anal angle, while from its outer angle a thick line runs to middle of outer margin; vein 2 is red throughout; the pale spaces between the lines are filled up with red cobweb-shaped lines forming figures of irregular size and shape; fringe red, white between the veins.

Hindwing.—With base narrowly, a quadrate blotch on discocellular and another on inner margin above anal angle red brown; the hind margin narrowly red brown; the rest with complicated figures as in fore wing.

Underside similar, but the base of forewing is not red.

Thorax, patagia, and dorsum deep red; face, vertex, and shoulders whitish; base of shoulders, antennæ, a spot in middle of face, and palpi above red brown; abdomen below, pectus, and underside of palpi whitish; legs mottled red and white.

Expanse of wings.—42 mm.

Habitat.—St. Jean, Maroni River, French Guiana; 1 female, May, 1904.

Type.—Cat. No. 8935, U.S.N.M.

Genus IZA Walker.

IZA LILACINA, new species.

Forewing.—Ochraceous, with dark brown streaks and reticulation; but this ground color shows only as two large costal triangles, one before middle, the other reaching to apex, all the rest of the wing surface being suffused with lilac brown, showing a dove-colored sheen in parts; fringe lilac grey.

^aNov. Zool., VII, p. 118.

Hindwing.—With the ochraceous ground color showing partially in middle of wing, the base and outer margin being lilac; a distinct dark cell spot.

Underside deeper ochraceous, without lilac suffusion in the hindwing; the transverse mottlings plainer; forewing with a sinuous, slightly lustrous, cell mark.

Head red brown; thorax and abdomen suffused with lilac; legs yellowish.

Expanse of wings.—26 mm.

Habitat.—Rio Janeiro, Brazil; female.

Type.—Cat. No. 8936, U.S.N.M.

Genus LETCHENA Moore.

LETCHENA FURVA, new species.

Forewing.—Fulvous brown, brighter towards costa, with numerous short, thick transverse striae; a distinct dark spot at end of cell; beneath it, between veins 2 and 3, a silvery hyaline oval spot with blackish edge; fringe fuscous.

Hindwing.—Rather darker and redder; cell spot black; fringe colorous.

Underside of forewing dull brick red tinged with grey; the transverse striae black; cell spot black with a pale center; the dark blotch on hind margin ill-defined; hindwing brighter brick red with the striae well marked; inner margin ochreous.

Head, shoulders, and thorax iron grey; patagia shining pinkish ochreous; abdomen brick red; underside of abdomen and legs grey; forelegs blackish.

Expanse of wings.—29 mm.

Habitat.—St. Jean, Maroni River, French Guiana; female, July 1904.

This may be only a form of *myrtæa* Drury, but the coloring is different. There is a specimen in the British Museum collection from Santo Domingo.

Type.—Cat. No. 8937, U.S.N.M.

Genus MACROPROTA, new genus.

Forewing.—Narrow and elongate; costa straight, convex before apex; hind margin obliquely rounded, minutely crenulate.

Hindwing.—Distinctly crenulate; the apex truncate and vein 7 toothed; hind margin excised below 7; inner margin short.

Antennæ simple; palpi short, upcurved in front of face; second segment thick, third slender, much longer than second. Abdomen and legs long. Neuration simple. Veins of the underside of forewing clothed with lustrous blue scales.

Type.—*Macropota eupitheciata* Guenée (*Siculodes*).

Genus RHODOGONIA Warren.

RHODOGONIA SUBFUSCA, new species.

Forewing.—Fulvous shaded with olive, with darker transverse striae between the veins and toward base and along costal region with some red scaling; costal edge snow-white, with five red dots in basal half and two red dashes beyond middle, at apex reddish brown; a dark spot at end of cell; fringe broadly brown-black in basal half, the apices in the curves between the teeth snow-white, and on each side of the teeth mixed with vermilion.

Hindwing.—With the basal half of wing suffused with vermilion, the outer half clouded with olive brownish; a dark shade from end of cell towards inner margin; costal and abdominal areas yellowish, the fringe of inner margin yellow.

Underside smoky olive fuscous, more ochreous in hindwing, the inner margins in both wings broadly whitish; cell mark and costal marks of forewing blackish; purplish brown clouds before margin on the two folds, larger in hindwing; fringes at base with a line of blue-grey hair scales; their apical portions brightly white and vermilion.

Head and thorax like forewing at base; abdomen like hindwing, fringed with vermilion; face white; basal joint and basal half of shaft of antennae snow-white; middle and hind femora and tibiae yellow and red; fore tibiae red-brown, internally white; tarsi white, chequered with red-brown.

Expanse of wings.—35 mm.

Habitat.—St. Jean, Maroni River, French Guiana; 1 male, July, 1904.

The type of the genus *Rhodogonia miniata* Warren came from British Guiana, but the differences in the present male seem too great to allow of its being referred to that species as the other sex.

Type.—Cat. No. 8938, U.S.N.M.

Genus STRIGLINA Guenée.

STRIGLINA BRUNNEATA, new species.

Forewing.—Snuff colored, with a tinge of olive and a few scattered black specks; an indistinct broadening darker line oblique from apex to middle of inner margin; a few black scales at apex; fringe concolorous or rather deeper brown.

Hindwing.—With the line median, much broader, appearing double.

Underside duller. The striae more clear; inner margin of forewing pale; the oblique line not marked.

Head, thorax, abdomen, and legs all concolorous; the tarsi white.

Expanse of wings.—24 mm.

Habitat.—St. Jean, Maroni River, French Guiana; 1 male, July, 1904.

Type.—Cat. No. 8939, U.S.N.M.

Family URANIIDÆ.

Genus HEMIOPLISIS Herrich-Schaeffer.

HEMIOPLISIS IMMACULATA, new species.

Forewing.—Pale ochreous, covered with short brown striations and washed with pale brown; outer line fairly distinct, pale ochreous outwardly edged with rufous, oblique outwards from three-fourths of costa, angled on vein 7, then oblique to three-fifths of inner margin; basal area slightly darker, limited by a very obscurely marked basal line, of which the upper arm runs from one-fourth of costa to middle of cell parallel to upper arm of outer line, the lower portion also running parallel to that of the outer line; fringe brownish.

Hindwing.—With the line postmedian, slightly bent outwards at middle.

Underside paler, without markings.

Head, thorax, and abdomen like wings; face and front of forelegs dark brown.

Expanse of wings.—27 mm.

Habitat.—Grenada, British West Indies; 1 male; nearest to *H. fallax* Warren from Venezuela.

Type.—Cat. No. 8940, U.S.N.M.

A LIST OF FISHES COLLECTED IN TAHITI BY
MR. HENRY P. BOWIE.

By DAVID STARR JORDAN and JOHN OTTERBEIN SNYDER,
Of Stanford University.

In a brief visit to Tahiti in the months of January and February, 1905, Mr. Henry P. Bowie, of San Mateo, California, made a small collection of the shore fishes of Tahiti, 34 species being taken. Most of these belong to forms characteristic of the South Seas, but among the number are 3 very rare species, which are figured in the present paper, the plates being the work of Mr. William Sackston Atkinson. A series of duplicates has been sent to the United States National Museum.

1. **MYRIPRISTIS INTERMEDIUS** Günther.

Tips of soft dorsal and anal black, otherwise scarcely different from *Myripristis murdjan*; of which it may be a color variation.

2. **HOLOCENTRUS SAMMARA** (Forskäl).

3. **HOLOCENTRUS BOWIEI** Jordan and Snyder, new species.

Head, 2.8 in length to base of caudal; depth, 2.9; depth of caudal peduncle, 4 in head; eye, 4; snout, 3.2; interorbital space, 8.5; maxillary, 3.1; D. XI, 16; A. IV, 11; scales in lateral series, 45; between lateral line and beginning of dorsal, 4; between lateral line and origin of anal, 9.

Dorsal contour of head nearly straight, interorbital space slightly convex; snout pointed, lower jaw projecting; maxillary extending to edge of orbit; eye of medium size, its upper edge even with dorsal contour of head. Villiform teeth on jaws, palatines, and vomer. Pseudobranchiæ large; gillrakers long, pointed, 13 on lower limb of arch; the one above preceded by 3 or 4 small knobs. Lower margin of preorbital concave, with large serrations; suborbital very narrow, its edge finely serrated; length of preopercular spine equal to vertical diameter of eye, edge of preopercle denticulate; opercle striated, its edge strongly denticulated, the angle with 2 flat spines; interopercle striate, its edge with 4 small spines. Scales on cheek below eye, a single row along anterior portion of preopercle, the three upper ones

being enlarged; scales smooth or scarcely ctenoid on breast and anterior parts of body, gradually growing rougher posteriorly; a row along base of anal with their lower edges elongate and spine like; bases of both soft dorsal and anal with a sheath of scales. Lateral line but little curved, passing somewhat above middle of caudal peduncle. Spinous dorsal high, the longest (third) spine 2 in head; the following ones growing successively smaller, the last about one-fifth the length of the third; fourth or fifth ray slightly longer than third spine. Third anal spine heavy, its length, 1.9 in head; its posterior concavity deep enough to receive the fourth spine; longest ray, 1.6 in head. Ventrals pointed, nearly reaching vent. Pectorals pointed, 1.6 in head. Caudal deeply forked, the lobes rounded; 1.7 in head. Color in spirits plain gray. Each row of scales with a faint longitudinal light stripe, the edges of which are darker; a dusky spot

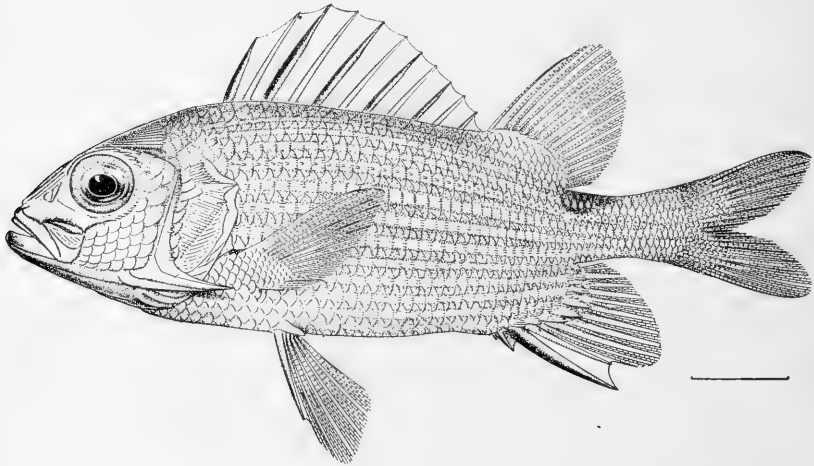


FIG. 1.—*Holocentrus bowiei*.

slightly larger than pupil on caudal peduncle at base of anal, this having been metallic gray in life; opercle somewhat dusky; fins immaculate. No black anywhere. In life, doubtless nearly plain red, with faint, paler streaks and darker edges.

One example, measuring 212 mm., type No. 53044, U. S. National Museum. Collected in Tahiti by Mr. Henry P. Bowie, for whom the species is named.

4. *CARANX IGNOBILIS* (Forskål).
5. *KUHLIA MALO* (Cuvier and Valenciennes).
6. *KUHLIA RUPESTRIS* (Lacépède).
7. *EPINEPHELUS MERRA* (Bloch).
8. *PSEUDUPENEUS MOANA* Jordan and Snyder.

(*Upeneus trifasciatus* Günther, not *Mullus trifasciatus* Lacépède, which is the same as *Mullus bifasciatus* Lacépède.)

9. *MULLOIDES SAMOENSIS* Günther.
10. *ABUDEFDUF CÆLESTINUS* (Lacépède).
11. *PLATAX ORBICULARIS* (Forskål).
12. *CHÆTODON VAGABUNDUS* Linnæus.
13. *CHÆTODON SETIFER* Bloch.
14. *CHÆTODON LUNULA* Lacépède.
15. *CHÆTODON TRIFASCIATUS* Park.
16. *CHÆTODON ORNATISSIMUS* Solander.
17. *CHÆTODON UNIMACULATUS* Bloch.
18. *CHÆTODON RETICULATUS* Cuvier and Valenciennes.
19. *CHÆTODON ULIETENSIS* Cuvier and Valenciennes.
20. *CHÆTODON EPHIPIUM* Cuvier and Valenciennes.
21. *CHÆTODON TRICHOUS* Günther.

A specimen 120 mm. long, apparently belonging to this species, differs considerably in many details of color from Garrett's figure as

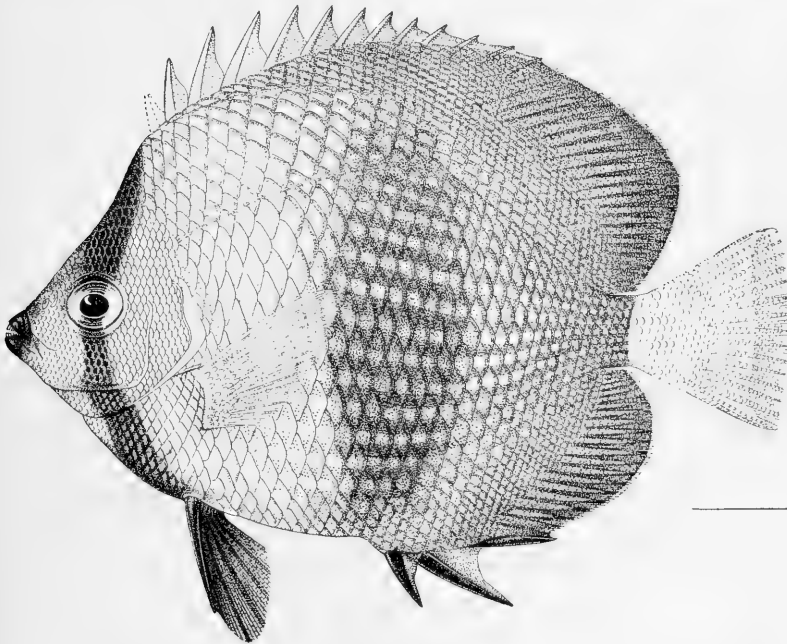


FIG. 2.—*CHÆTODON TRICHOUS*.

reproduced by Günther. The tip of the snout is black. The band passing through eye narrows on the cheek where it is but little broader than the pupil, then widens again as it extends backward.

The median, dark, vertical lenticular blotch extending from back to belly is indistinct on its edges and somewhat broken, tending to fade in spirits, many of the scales in the region having a light, central spot. The blotch is also diffused backward, the whole posterior part of the body, including the soft dorsal and anal fins, being nearly black, slightly shaded with yellowish. The scales posterior to the blotch have white centers as have also those anterior to it, only in a less marked degree. Following the longitudinal rows of scales, the corresponding rows of spots approach the character of stripes, converging and growing narrower on caudal peduncle. Anterior to the blotch the body was yellow in life, the caudal fin bright yellow, some of the color still persisting in spirits. The entire body may have been washed with yellow. The ventrals are black. The soft dorsal and anal have a black border, narrowly edged with white or yellow.

In Günther's plate, the soft dorsal and anal are shown as pale; they are, in fact, almost black.

22. *FORCIPIGER LONGIROSTRIS* (Broussonnet).

23. *HOLOCANTHUS IMPERATOR* (Bloch).

One young specimen with the pale bands broad and only about 12 in number.

24. *HENIOCHUS PERMUTATUS* (Linnæus).

(*Heniochus acuminatus* of authors.)

25. *ZANCLUS CANESCENS* (Linnæus).

26. *ZEBRASOMA FLAVESCENS RHOMBEUM* Kittlitz.

27. *HEPATUS LINEATUS* (Gmelin).

28. *ACANTHURUS LITURATUS* (Forster).

29. *CTENOCHÆTUS STRIATUS* Quoy and Gaimard.

30. *BALISTAPUS UNDULATUS* (Park).

31. *OSTRACION TUBERCULATUM* Linnæus.

32. *TETRAODON HISPIDUS* Linnæus.

33. *TETRAODON OPHRYAS* Cope.

(? *Ovoides setosus* R. Smith.)

One example measuring 180 mm. The entire body, dorsal, anal, and caudal fins are closely covered with small white spots, none of which are quite as large as the pupil. They are largest on upper part of snout, below and behind eye, around base of pectoral, on bases of dorsal and anal, and on caudal peduncle. On occiput and middle of back they are reduced to mere specks. The pectorals are whitish, each ray being dusky. Eye 8 in head; interorbital space 1.8; length of head

contained 2 times in space between tip of snout and base of dorsal. Interorbital space slightly convex. Dorsal contour of snout convex. The prickles are very short, most evident on nape and abdomen.

This species has been hitherto known only from a single young specimen from Samoa. The species on the offshore islands of the west coast of Mexico, called *Tetraodon* or *Oroides setosus* Rosa Smith,

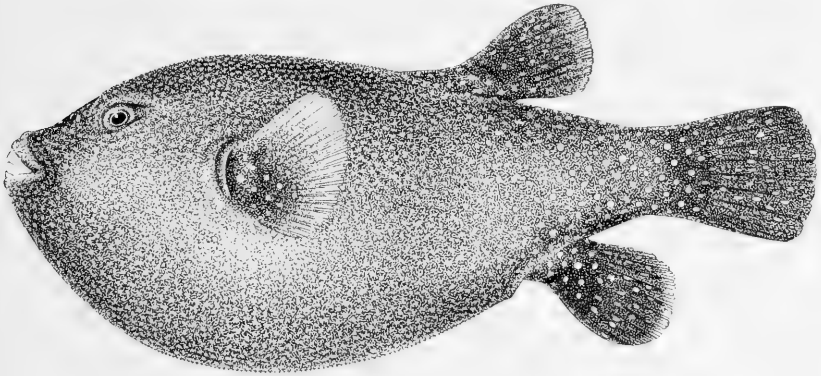


FIG. 3.—TETRAODON OPHRYAS.

does not differ much, if at all, from *Tetraodon ophryas*. *Tetraodon setosus* has normally much the same color as this specimen, but it is subject to very great variations, blue forms and yellow varieties occurring together with the normal brown type.

34. SCORPÆNOPSIS CACOPSIS Jenkins.

One fine specimen not distinguishable from others from Hawaii.



A LIST OF AMERICAN COCHLIDIAN MOTHS, WITH
 DESCRIPTIONS OF NEW GENERA AND SPECIES.

By HARRISON G. DYAR,
Custodian of Lepidoptera.

The South American Cochliidiæ (Limacodidæ) are still very imperfectly known and in the various catalogues and lists are much mixed with other families, more particularly with Megalopygidaë, Dalceridaë, and allies. I have been able to examine most of the described species in the British Museum, the collections of Messrs. William Schaus, H. Druce, P. Dognin, and others, and have arranged them as follows. Ten species described by Walker are unknown to me. The types are not in the British Museum, nor have they been recognized in the Hopeian department of the University Museum at Oxford. They are probably lost, and it is doubtful if the species can ever be recognized, since they may belong in any one of a dozen families. They are listed at the end of this paper. I have included the North American species for the sake of completeness.

SYNOPSIS OF THE AMERICAN GENERA.

1. Antennæ of male bipectinate on basal half or less, the tips serrate or simple	2
Antennæ of male bipectinate to tip, or nearly so	13
Antennæ of male unipectinate or uniserrate	29
Antennæ of male simple or biserrate	30
2. Spurs of hind tibiæ obsolete	<i>Epiclea</i>
Terminal spurs of hind tibiæ present	3
3. Fore or hind wings with less than the usual number of veins	4
Veins all present	5
4. Fore wings with the outer margin entire	<i>Monoleuca</i>
Fore wings slightly excavate below apex	<i>Adoneta</i>
5. Fore wings with the costa convex	<i>Metraga</i>
Fore wings with the costa straight	6
6. Palpi short, not reaching beyond the frontal tuft	7
Palpi longer, at least beyond the front or to vertex of head	9

*These species were described by Walker from the Fry collection. Sir George Hampson says that the specimens were returned by Walker in such condition that their acceptance was refused and it is not known what became of them.

7. Fork of the discal vein long and closed by a cross vein	8
Fork of the discal vein short and open	<i>Protalima</i>
8. Inner margin of fore wing sinuate	<i>Episibine</i>
Inner margin of fore wing straight	<i>Miresa</i>
9. Inner margin of fore wing sinuate	<i>Sibine</i>
Inner margin of fore wing entire	10
10. Palpi porrect or oblique, not reaching the vertex of head	11
Palpi twice as long as the head, reaching the vertex	<i>Talima</i>
11. Fore wings with vein 10 usually stalked with 7-9; wings with little or no green	<i>Euclea</i>
Fore wings with vein 10 usually from the cell; wings with much green	12
12. Antennæ of male bipectinated on the basal half or less	<i>Parasa</i>
Antennæ of male bipectinated for two-thirds	<i>Paraclea</i>
13. Palpi long, three times as long as head	^a <i>Vipsania</i>
Palpi shorter, not over twice as long as head	14
14. Palpi reaching to near, or above vertex	15
Palpi not reaching vertex	19
15. Middle spurs of hind tibiæ absent	16
Middle spurs of hind tibiæ present	17
16. Costa of fore wings convex	<i>Isochates</i>
Costa of fore wings straight	<i>Hepialopsis</i>
17. Palpi reaching above the vertex, the third joint long and slender	<i>Semyra</i>
Palpi reaching near the vertex, third joint short, obtuse	18
18. Antennæ of male slender, shortly bipectinate	<i>Euprosternea</i>
Antennæ of male stout, broadly bipectinate	<i>Platyprosternea</i>
19. Veins 2 and 3 of fore wings separate	20
Veins 2 and 3 of fore wings stalked	27
20. Middle spurs of hind tibiæ absent	<i>Sisyrosea</i>
Middle spurs of hind tibiæ present	21
21. Hind wings with vein 6 absent, coincident with 7	<i>Cryptophobeton</i>
Hind wings with the venation normal	22
22. Palpi reaching well beyond the front	23
Palpi not reaching beyond the frontal tuft	25
23. Fore wing with vein 7 from the cell	24
Fore wing with vein 7 stalked	^a <i>Heuretes</i>
24. Palpi obliquely porrect, truncate	<i>Natada</i>
Palpi upturned to near vertex	<i>Euphobeton</i>
25. Head sunken	26
Head subprominent	<i>Alarodia</i>
26. Male with triangular hind wings, dissimilar to the female	<i>Phobeton</i>
Male with rounded hind wings, similar to the female	<i>Leucophobeton</i>
27. Hind tibiæ with middle spurs present; palpi to front	<i>Perola</i>
Hind tibiæ with the middle spurs absent	28
28. Palpi short, not exceeding the frontal tuft	<i>Paleophobeton</i>
Palpi longer, reaching the middle of the front	<i>Epiperola</i>
29. Antennæ with rod-like single pectinations	<i>Tanadema</i>
Antennæ uniserrate	<i>Dichromapteryx</i>
Antennæ with broad lamellar pectinations	<i>Utania</i>
30. Middle spurs of hind tibiæ absent	31
Middle spurs of hind tibiæ present	32
31. Palpi reaching above vertex; head sunken	<i>Pseudovipsania</i>
Palpi reaching halfway to vertex	^b <i>Heterogenea</i>

^a Not certainly placed, from lack of material.

^b *Kronau* Reakirt may fall here.

32. Palpi upturned to vertex or less.....	33
Palpi reaching slightly above vertex.....	<i>Lithacodes</i>
33. Form robust; antennæ biserrate.....	<i>Prolimacodes</i>
Form slender; antennæ simple.....	33
34. Palpi not reaching vertex; head sunken.....	<i>Slossonella</i>
Palpi reaching vertex or nearly so; head subprominent.....	35
35. Fore wings acute, but rounded at apex.....	36
Fore wings rather square at apex; costa nearly straight.....	<i>Cochlidion</i>
Fore wings broader and more rounded.....	<i>Packardia</i>
36. Internal margin of fore wings straight.....	^a <i>Tortricidia</i>
Internal margin prominent, subsinuate.....	<i>Vipsophobetron</i>

Genus EPISIBINE Dyar.

Episibine DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 234.

EPISIBINE INTENSA, new species.

Male.—Dark glossy brown, the fore wings with a reddish shade toward apex and a blackish one along submedian fold. A large yellow spot on the fold below middle of cell, with a small dot below it on vein 1. Four partly confluent spots subapically—a streak on vein 6 near its base, a spot on 7 at its base, on the stalk of 8, 9, near origin of 7, and a streak on vein 10—the first and last nearer the base than the others. Hind wing with the discal area to margin pellucid, the margin strongly excavate between veins 2 and 7.

Female.—Larger, with the hind wings normal. The spots are large and placed as in the male. Hind wings dark brown.

Expanse.—Male, 28 mm.; female, 45 mm.

Locality.—Three males, two females, St. Jean, Maroni River, French Guiana (W. Schaus).

Type.—Cat. No. 8976, U.S.N.M.

EPISIBINE AUROMACULA Schaus.

Sibine auromacula SCHAUS, Journ. N. Y. Ent. Soc., IV, 1896, p. 56.

Localities.—Venezuela; Brazil.

EPISIBINE SIBINIDES, new species.

Fore wings with the spots large, shaped and colored as in *auromacula* Schaus, the subapical dots more diffused. Hind wings trigonate, with straight outer margin, but the discal area not hyaline, but whitish, crossed by the reddish brown veins. Costal and inner margins dark brown, of the color of the fore wings.

Expanse.—36 mm.

Locality.—One male, Pernambuco [Brazil], from Mr. Schaus's collection.

Type.—Cat. No. 8965, U.S.N.M.

^a See also *Dichromapteryx*.

Genus *SIBINE* Herrich-Schaeffer.

Sibine HERRICH-SCHAEFFER, Ausser. Schmett., I, 1855, p. 7

Sibine DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 233.

SIBINE VIDUA Sepp.

Phalana vidua SEPP, Surin. Vlind., I, 1828, pl. vi.

Nyssia fumosa WALKER, Cat. Brit. Mus., V, 1855, p. 1134.

Sibine vidua DYAR, Ann. N. Y. Acad. Sci., VIII, 1894, p. 216.

Sibine vidua DYAR, Can. Ent., XXIX, 1897, p. 77.

Locality.—Dutch Guiana.

SIBINE NESEA Stoll.

Bombyx nesea STOLL, Pap. Exot., IV, 1781, pl. cccv, fig. C

Sibine nesea KIRBY, Cat. Lep. Het., 1892, p. 539.

Locality.—Dutch Guiana.

SIBINE HORRIDA, new species.

Large, the abdomen of the male far exceeding the hind wings. Body above and legs dark red-brown, shading to red. Fore wings dark red-brown, all the disk semitranslucent, of raised scales between the dark brown veins. A slight red apical shade and one below median vein and vein 2, dark, not well contrasted. Two subapical yellow dots, small or obsolete; a tiny dot on submedian fold before origin of vein 2. Hind wings dark red-brown, the space between the discal nervules nearly to margin transparent red-gray, of raised scales.

The female is larger and lacks the raised scales, but has the dark veins of fore wing.

Expanse.—Male, 45 mm.; female, 56 mm.

Localities.—One male in the British Museum from Panama; two males, one female in the collection of M. Paul Dognin from Paramba, Ecuador (1,050 meters, Rosenberg); San Salvador, Central America; 14 males in the Schaus collection from St. Jean and 100 miles up the Maroni River, French Guiana; Geldersland, Dutch Guiana; Casa Br., Brazil; one male in the U. S. National Museum from Palma Sola, Venezuela.

The specimens from Panama and Ecuador I regard as typical. The others differ in being smaller (expanse 38 to 42 mm.), the fore wings more rounded at apex and the raised scales less distinct, especially on the hind wings. In some of the specimens they are scarcely noticeable on the fore wings either, and these much resemble *nesea* Stoll, except for the absence of the silvery line of that species. I distinguish this form as variety *nitens*, new variety.

Type.—Cat. No. 9095, U.S.N.M.

SIBINE AFFINIS Möschler.

Sibine affinis MÖSCHLER, Verh. z. b. Ges. Wien, XXXII, 1883, p. 353.

Locality.—Dutch Guiana. I have not recognized this species.

SIBINE MEGASOMOIDES Walker.

Eupalia megasomoides WALKER, Cat. Brit. Mus., XXXV, 1866, p. 1928.

Sibine megasomoides KIRBY, Cat. Lep. Het., 1892, p. 539.

Locality.—Bogota. I have not recognized this species.

SIBINE TRIMACULA Sepp.

Phalana trimacula SEPP, Surin. Vlind., I, 1848, pl. XLV.

Streblota bonariensis BERG, An. Soc. Argent., V, 1878, p. 180.

Sibine fusca MÖSCHLER (not Stoll), Verh. z. b. Ges. Wien, XXVII, 1878, p. 671.

Sibine nesca KIRBY (not Stoll), Cat. Lep. Het., 1892, p. 539.

Sibine fusca DYAR (not Stoll), Ent. News, XI, 1900, p. 7.

Localities.—Dutch Guiana; Argentina.

SIBINE EXTENSA Schaus.

Sibine extensa SCHAUS, Journ. N. Y. Ent. Soc., IV, 1896, p. 55.

Locality.—Mexico.

Mr. Schaus has observed the larva of this species at Jalapa, Mexico, many years ago, and has taken the following from his notebook:

“*Sibine extensa* Schaus, larva. Length 1 inch, very stout, rather square, being flattened dorsally and laterally. Head, which is small and brown with black markings, is concealed under the second segment. This segment is brownish with posteriorly a subdorsal black and white spot. Body pale green. On segment 3 are four little green tubercles, covered with short spines. On segments 4 and 5, only two similar tubercles, but somewhat larger. Segments 11 and 12 the same as 4 and 5. Segment 13 has two large velvety brown tubercles; dorsally and posteriorly to these, two small green, spiny tubercles. Laterally on eleventh is another velvety brown tubercle. Lower down on segments 3 to 13 is a single row of little green spiny tubercles, above which ground color changes somewhat to yellow and there is a fine black lateral line. Prolegs yellowish. Live together in large numbers, and when about to form cocoons, collect together on the bark and after spinning a thin hard web, form underneath it their cocoons, which are round and very hard.

“Feeds on the smiquil chiefly.

“Remain in larval condition all winter, becoming pupæ only a few weeks before emerging.”

SIBINE BARBARA, new species.

Very dark, the silky shades prominent, a red shade at both apex and over submedian vein; subapical spots confluent in a pale yellow bar, subbasal dot large. Wings of the female with depressed apices; hind wings of the male dark chocolate brown, the disk whitish to margin, the shape somewhat trigonate, recalling *Episibine*, but the outer margin convex.

Expanse.—Male, 35 mm.; female, 47 mm.

Locality.—One male, one female, Rio Janeiro, Brazil (W. Schaus collection).

This species nearly resembles *S. extensa* Schaus, and is, perhaps, a Southern form of it; but the coloration of the hind wings of the male differs.

Type.—Cat. No. 9096, U.S.N.M.

SIBINE RUFESCENS Walker.

Nyssia rufescens WALKER, Cat. Brit. Mus., V, 1855, p. 1138.

Sibine plora SCHAUS, Journ. N. Y. Ent. Soc., IV, 1896, p. 55.

Locality.—Venezuela. The type of *rufescens* is at the University Museum, Oxford, where I have examined it, thanks to the kindness of Prof. E. B. Poulton.

SIBINE APICALIS Dyar.

Sibine apicalis DYAR, Proc. Ent. Soc. Wash., IV, 1900, p. 424.

Locality.—Mexico. This is possibly a form of *stimulea* Clemens. A specimen from Mr. Kearfott is labeled as bred from a larva exactly like *stimulea*, but the adults do not seem the same.

SIBINE STIMULEA Clemens.

Empretia stimulea CLEMENS, Proc. Acad. Nat. Sci. Phil., XI, 1860, p. 158.

Sibine stimulea DYAR, Bull. 52, U. S. Nat. Mus., 1903, p. 354.

Locality.—Atlantic States, North America.

SIBINE PALLESCENS Dognin.

Sibine pallescens DOGNIN, Ann. Ent. Soc. Belg., 1901, p. 309.

Locality.—Venezuela.

SIBINE MODESTA Cramer.

Noctua modesta CRAMER, Pap. Exot., II, 1779, pl. cxv, fig. C.

Nyssia determinata WALKER, Cat. Brit. Mus., XXXII, 1865, p. 479.

Elysia (?) *modesta* KIRBY, Cat. Lep. Het., 1892, p. 219.

Sibine determinata KIRBY, Cat. Lep. Het., 1892, p. 540.

Locality.—Dutch Guiana.

SIBINE FUSCA Stoll.

Bombix fusca STOLL, Pap. Exot., 1781, pl. cccvii, fig. C.

Sibine neseu KIRBY (not Stoll), Cat. Lep. Het., 1892, p. 539.

I have wrongly identified this with *trimacula* Sepp.^a There are four specimens in the British Museum from Demerara which agree with Stoll's figure of *fusca*. Three are females. The male has rather rounded wings, brown, not very dark, the red shades large, diffused, two subapical yellow dots of good size, but no subbasal ones.

Expanse.—30 mm.

Localities.—Dutch and British Guiana.

^aCan. Ent., XXIX, 1897, p. 77.

SIBINE EUCLEIDES, new species.

Wings rounded at apices, not pointed as usual, but the inner margin sinuate. Dark brown, glossy, but without the usual red tint or shading. Two or three subapical yellowish silvery dots in a line; one dot on submedian fold before origin of vein 2. A black bar from base along submedian fold two-thirds the distance to the margin, with a little reddish ocherous scaling just before the dot. Hind wings light straw color, overspread with chocolate brown, not reddish, scarcely lighter in the disk, no raised scales.

Expanse.—32 to 34 mm.

Localities.—One male in the British Museum, Minas Geraes, Brazil; one female in the collection of M. Paul Dognin, Paraguay (Heyne), and one in the collection of Mr. E. D. Jones from Brazil.

Genus PARASA Moore.

Parasa MOORE, Cat. Lep. East India Co., I, 1859, p. 413.

Parasa DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 234.

Parasa DYAR, Psyche, VIII, 1898, p. 273.

PARASA VIRIDIPLENA Walker.

Neura (?) *viridiplena* WALKER, Cat. Brit. Mus., V, 1855, p. 1142.

Parasa viridiplena KIRBY, Cat. Lep. Het., 1892, p. 546.

Locality.—Brazil.

PARASA LARANDA Druce.

Parasa laranda DRUCE, Biol. Cent.-Am., Lep. Het., I, 1887, p. 215.

Locality.—Guatemala.

PARASA WELLESCA Dyar.

Parasa prasina DYAR (not Alpheraky), Psyche, VIII, 1898, p. 273.

Parasa wellesca DYAR, Can. Ent., XXXII, 1900, p. 347.

Locality.—Mexico.

Named in honor of Miss Wellesca Pollock of Washington, District of Columbia.

PARASA LAONOME Druce.

Parasa laonome DRUCE, Biol. Cent.-Am., Lep. Het., I, 1887, p. 215.

Locality.—Panama.

PARASA IMITATA Druce.

Parasa imitata DRUCE, Biol. Cent.-Am., Lep. Het., I, 1887, p. 215.

Locality.—Central America.

PARASA HERBINA Schaus.

Euclea herbina SCHAUS, Journ. N. Y. Ent. Soc., VIII, 1901, p. 230.

Locality.—Espiritu Santo, Brazil.

PARASA INDETERMINA Boisduval.

Linacodes indetermina BOISDUVAL, Cuvier An. King., 1832, pl. ciii, fig. 1.

Euclea indetermina DYAR, Bull. 52, U. S. Nat. Mus., 1903, p. 355.

Locality.—Southern Atlantic States, North America.

PARASA CHLORIS Herrich-Schaeffer.

Neura chloris HERRICH-SCHAEFFER, Ausser. Schmett., I, 1854, fig. 176.

Parasa chloris DYAR, Journ. N. Y. Ent. Soc., V, 1897, p. 61.

Locality.—Southern Atlantic States, North America.

PARASA MINIMA Schaus.

Parasa minima SCHAUS, Proc. Zool. Soc. Lond., 1892, p. 322.

Parasa minima DRUCE, Biol. Cent.-Am., Lep. Het., II, 1898, p. 442.

Locality.—Mexico.

PARASA PRETIOSA Strecker.

Parasa pretiosa STRECKER, Lep. Rhop. and Het., Suppl., II, 1899, p. 4.

Locality.—Brazil. This is probably an earlier name for *Paraclea dolita* Schaus.

PARASA CEBRENIS Schaus.

Trabala cebrenis SCHAUS, Proc. Zool. Soc. Lond., 1892, p. 323.

Sibine lysia DRUCE, Biol. Cent.-Am., Lep. Het., II, 1897, p. 439.

Euclea cebrenis DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 234.

Locality.—Mexico.

PARASA VIRIDOGRISEA Dyar.

Euclea viridogrisea DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 234.

Locality.—Mexico.

PARASA SCHAUSI, new species.

Female.—Nearly allied to *viridogrisea* Dyar, but the green band is wider and sensibly more even and regular; it does not reach so near to the base and its brown edges are more diffused.

Male.—Small, fore wings pointed trigonate, hind wings elongate. Thorax green with a brown tip on the side of the patagia, but the wings without any green color, blackish brown at base and outer margin, median band chocolate brown, not strongly contrasted.

Localities.—One female, St. Laurent, Maroni River, French Guiana; two males, St. Jean, Maroni River, and Cayenne, French Guiana (W. Schaus).

Type.—Cat. No. 8977, U.S.N.M.

Genus **EUCLEA** Hübner.

Euclea HÜBNER, Verz. bek. Schmett., 1822, p. 149.

Euclea DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 234.

EUCLEA DICOLON Sepp.

Phalæna dicolon SEPP, Surin. Vlind., II, 1848, p. 83.

Sibine dicolon KIRBY, Cat. Lep. Het., 1892, p. 539.

Euclea dicolon DYAR, Ann. N. Y. Acad. Sci., VIII, 1894, p. 216.

Locality.—Dutch Guiana. I have not recognized this species.

EUCLEA ÆMILIA Stoll.

Bombyx æmilia STOLL, Pap. Exot., 1782, pl. CCCXCVII, fig. P.

Semyra æmilia KIRBY, Cat. Lep. Het., 1892, p. 534.

Locality.—Dutch Guiana. I have not recognized this species.

EUCLEA CIPPUS Cramer.

Bombyx cippus CRAMER, Pap. Exot., I, 1775, pl. CIII, fig. E.

Euclea cippus KIRBY, Cat. Lep. Het., 1892, p. 547.

Localities.—Jalapa, Mexico; Chiriqui, Panama; St. Jean and Cayenne, French Guiana; Paramaribo, Dutch Guiana; Trinidad, British West Indies; Peru.

EUCLEA CIPIOR, new species.

Very nearly allied to *cippus* Cramer, but larger, the hind wings yellowish tinted, not uniform brown, the abdomen pale on the sides, dark on the dorsum. The wings are as in *cippus*, the basal green spot with its outer white line divided.

Expanse.—33 mm.

Locality.—One male, Santo Domingo, Carabaya, Peru, sent to Mr. Schaus as "*cippus*" by M. Paul Dognin, who presumably has others.

Type.—Cat. No. 8466, U.S.N.M.

EUCLEA DELPHINII Boisduval.

Limacodes delphinii BOISDUVAL, Cuvier An. King., 1832, pl. CIII, fig. 6.

Euclea delphinii DYAR, Journ. N. Y. Ent. Soc., V, 1897, p. 57.

Parasa incisa HARVEY, Can. Ent., VIII, 1876, p. 5.

Locality.—Atlantic States, North America. The type of *incisa* Harvey is in the British Museum and proves to be *pænulata* with pale hind wings, not the form heretofore identified as *incisa*.

EUCLEA NANINA Dyar.

Euclea nana DYAR (not Herrich-Schaeffer), Ent. News, II, 1891, p. 61.

Euclea nanina DYAR, Journ. N. Y. Ent. Soc., VII, 1899, p. 247.

Locality.—Florida, North America.

EUCLEA MIRA, new name.

Parasa incisa NEUMØGEN and DYAR (not Harvey), Journ. N. Y. Ent. Soc., II, 1894, p. 68.

Locality.—Texas, North America.

EUCLEA NORBA Druce.

Sibine norba DRUCE, Biol. Cent.-Am., Lep. Het., I, 1887, p. 211.

Locality.—Panama.

EUCLEA COPAC Schaus.

Neomiresa copac SCHAUS, Proc. Zool. Soc. Lond., 1892, p. 324.

Euclea copac DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 235.

Locality.—Peru.

EUCLEA PERMODESTA, new species.

Entirely dark brown, the fore wings a little blackish shaded on internal margin, without markings. The veins are a little darker relieved, the abdomen and hind wings lighter chocolate brown.

Expanse.—28 mm.

Localities.—Three males, St. Jean, Maroni River, French Guiana; Geldersland, Surinam River, Dutch Guiana (W. Schaus).

Type.—Cat. No. 8978, U.S.N.M.

EUCLEA PALLICOLOR, new species.

Light fawn color, the hind wings brownish tinted. A submarginal dusky band from apex to inner margin; a subapical curved white bar, preceded by a brown patch; a few white scales above middle of internal margin preceded by brown; a blackish basal dash below median vein at base.

Expanse.—24 mm.

Locality.—One male, St. Laurent, Maroni River, French Guiana (W. Schaus).

Type.—Cat. No. 8979, U.S.N.M.

EUCLEA CUSPOSTRIGA, new species.

Dark brown; fore wings thickly gray-brown, irrorate over the cell, discal venules, and vein 1, leaving a large dark discal dot and spot beyond cell. Apically and below vein 2 a reddish shade. A small white subapical streak; a white cusp in the submedian space below the cell between the reddish patch and the basal brown area.

Expanse.—18 mm.

Localities.—Eleven males, Cayenne and St. Laurent, French Guiana; 60 and 100 miles up the Maroni River, French Guiana; Geldersland, Surinam River, Dutch Guiana (W. Schaus). One specimen has been deposited in the British Museum.

Type.—Cat. No. 8980, U.S.N.M.

EUCLEA DIVERSA Druce.

Semyra diversa DRUCE, Biol. Cent.-Am., Lep. Het., I, 1887, p. 220.

Euclea diversa DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 235.

Locality.—Central America.

EUCLEA BARANDA Schaus.

Euclea baranda SCHAUS, Journ. N. Y. Ent. Soc., VIII, 1901, p. 230.

Locality.—Colombia.

EUCLEA DOLLIANA, new species.

In color and markings resembling *Adoneta spinuloides* Herrich-Schaeffer, but much larger, and differing generically in having 12 veins in fore wings and no incision in the outer margin. Reddish chocolate-brown. An erect, wavy, silvery line on inner third of inner margin, slightly oblique, thickened, irregularly angled, finely produced along vein 2; thence obsolete over the discal venules, but reappears above vein 5 to costa as a curved subapical silvery streak, parallel to outer margin. The basal part of the line is edged with blackish within, and there is a dark suffusion about its angle on vein 2. An elongate-oval, black, discal mark, absent in one specimen. Legs densely hairy, dark chocolate-brown.

Expanse.—26 to 30 mm.

Locality.—Two females, collected by Mr. C. Schaeffer in the Huachuca Mountains, Arizona (Palmerlee, Cochise County).

Named in honor of Mr. Jacob Doll, of Brooklon, N. Y., curator in the museum of the Brooklyn Institute of Arts and Sciences.

EUCLEA PLUGMA Sepp.

Phalæna plugma SEPP, Surin. Vlind., 1848, pl. LXXXIV.

Sibine plugma KIRBY, Cat. Lep. Het., 1892, p. 540.

Euclea plugma DYAR, Ann. N. Y. Acad. Sci., VIII, 1894, p. 215.

Locality.—Dutch Guiana. I have not recognized this species.

EUCLEA BIDISCALIS, new species.

Fore wings deep glossy brown, the cell contrastingly subhyaline, with some raised scales. A row of minute silvery white dots on the veins, from the apex to vein 2, then along median vein and to margin at inner third, edged without with patches of more shining brown, irregular and silky. Hind wings dark brown; a subhyaline patch in end of cell and over three interspaces beyond, halfway to the margin. Body above dark brown, below paler.

Expanse.—20 mm.

Locality.—One male, Panama, in the British Museum.

Genus PARACLEA, new genus.

Nearly allied to *Euclea*, but the pectinations of the male antennæ reach two-thirds the length of the member, whereas in *Euclea* they never exceed one-half; palpi obliquely ascending, longer and more detached than in *Euclea*; fore wings with veins 7 to 10 long stalked,

8 and 9 forking just before the margin. Hind legs with end spurs only. Wings broad, the costa convex.

Type.—*Paraclea dolita* Schaus.

PARACLEA DOLITA Schaus.

Euclea dolita Schaus, Journ. N. Y. Ent. Soc., VIII, 1901, p. 230.

Locality.—Parana, Brazil. See note under *Parasa pretiosa* Strecker.

Genus **METRAGA** Walker.

Metraga WALKER, Cat. Brit. Mus., V, 1855, p. 1129.

Metraga DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 235.

METRAGA PERPLEXA Walker.

Metraga perplexa WALKER, Cat. Brit. Mus., V, 1855, p. 1129.

Neomiresa rufa BUTLER, Trans. Ent. Soc. London, 1878, p. 74.

Euclea chiriquensis SCHAUS, Journ. N. Y. Ent. Soc., VIII, 1901, p. 231.

Localities.—Venezuela; Brazil; Panama.

METRAGA ZYGIA Druce.

Euclea zygia DRUCE, Biol. Cent.-Am., Lep. Het., I, 1887, p. 216.

Locality.—Guatemala.

METRAGA DETERMINATA Druce.

Euclea determinata DRUCE, Biol. Cent.-Am., Lep. Het., I, 1887, p. 216.

Locality.—Guatemala.

METRAGA RUBICOLOR, new species.

Head, thorax, and fore wings red-brown, rather of a crimson tint, without markings. Hind wings reddish brown.

Expanse.—17 mm.

Locality.—One male, Nicaragua (U. S. Nat. Mus., acc. No. 28181), the specimen in poor condition.

Type.—Cat. No. 8467, U.S.N.M.

Genus **MONOLEUCA** Grote and Robinson.

Monoleuca GROTE and ROBINSON, Trans. Am. Ent. Soc., II, 1869, p. 187.

MONOLEUCA SUBDENTOSA Dyar.

Monoleuca subdentosa DYAR, Trans. Am. Ent. Soc., XVIII, 1891, p. 156.

Locality.—Florida, North America.

MONOLEUCA SEMIFASCIA Walker.

Limacodes semifascia WALKER, Cat. Brit. Mus., V, 1855, p. 1151.

Locality.—Southern Atlantic States, North America.

MONOLEUCA SULPHUREA Grote.

Monoleuca sulphurea GROTE, No. Amer. Ent., 1880, p. 60.

Locality.—Florida, North America.

MONOLEUCA OBLIQUA, Hy. Edwards.

Monoleuca obliqua, Hy. EDWARDS, Ent. Amer., II, 1886, p. 10.

Locality.—Florida, North America.

Genus **ADONETA** Clemens.

Adoneta CLEMENS, Proc. Acad. Nat. Sci. Phil., XII, 1860, p. 158.

ADONETA SPINULOIDES Herrich-Schaeffer.

Limacodes spinuloides HERRICH-SCHAEFFER, Ausser. Schmett., I, 1854, p. 187.

Cyclopteryx leucostigma PACKARD, Proc. Ent. Soc. Phil., III, 1864, p. 345.

Euclea ruptilinea WALKER, Cat. Brit. Mus., XXXII, 1865, p. 485.

Adoneta spinuloides DYAR, Bull. 52, U. S. Nat. Mus., 1903, p. 355.

Localities.—Atlantic States to Texas, North America.

ADONETA BICAUDATA Dyar.

Adoneta bicaudata DYAR, Journ. N. Y. Ent. Soc., XII, 1904, p. 43.

Locality.—Southern Atlantic States, North America.

ADONETA PYGMÆA Grote and Robinson.

Adoneta pygmaea GROTE and ROBINSON, Trans. Am. Ent. Soc., II, 1868, p. 189.

Locality.—Texas, North America.

Genus **PROTALIMA** Dyar.

Protalima DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 236.

PROTALIMA SULLA Schaus.

Nyssia sulla, SCHAUS, Proc. Zool. Soc. Lond., 1892, p. 324.

Locality.—Brazil.

Genus **TALIMA** Walker.

Talima WALKER, Cat. Brit. Mus., V, 1855, p. 1120.

TALIMA POSTICA Walker.

Talima postica WALKER, Cat. Brit. Mus., V, 1855, p. 1121.

Localities.—Venezuela; French Guiana.

TALIMA LATESCENS Butler.

Talima latescens BUTLER, Trans. Ent. Soc. Lond., 1878, p. 75.

Locality.—Brazil.

TALIMA STRAMINEA Schaus.

Semyra straminea SCHAUS, Proc. Zool. Soc. Lond., 1892, p. 324.

Idonauton straminea DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 236.

Localities.—Mexico; French Guiana.

Genus **MIRESA** Walker.

Miresa WALKER, Cat. Brit. Mus., V, 1855, p. 1123.

MIRESA CLARISSA Stoll.

Phalena clarissa STOLL, Pap. Exot., Suppl., 1790, pl. xxxiv, fig. 3.

Streblota clarissa HÜBNER, Verz. bek. Schmett., 1816, p. 193.

Nyssia argentata WALKER, Cat. Brit. Mus., V, 1855, p. 1134.

Miresa argentata DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 235.

Localities.—Brazil; Dutch Guiana.

MIRESA VENOSA, new species.

Structurally allied to *argentea*. Body yellow, palpi and legs brown, patagia brownish tinted. Fore wings red-brown at base, thinly and erectly scaled beyond the cell and above vein 2, more grayish, the veins lined with black. A blackish discal dot. A yellow patch on submedian fold below middle of cell and another at tornus. Two faintly indicated blackish lines outwardly, formed by intensification of the venular streaks, below the cell passing between the two yellow spots and becoming brownish. Between them some of the raised scales have a silvery sheen. Hind wings pale yellow.

Expanse.—24 mm.

Locality.—Two males, San Salvador, Central America, in the collection of M. Paul Dognin.

MIRESA ARGENTEA Druce.

Eupalia argentea DRUCE, Biol. Cent.-Am., Lep. Het., I, 1887, p. 218.

Miresa argentea DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 235.

Localities.—Mexico; Central America.

Genus VIPSANIA Druce.

Vipsania DRUCE, Biol. Cent.-Am., Lep. Het., I, 1887, p. 217.

Vipsania DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 236.

VIPSANIA ANTICLEA Druce.

Vipsania anticlea DRUCE, Biol. Cent.-Am., Lep. Het., I, 1887, p. 217.

Localities.—Mexico; Central America. Only females are known.

VIPSANIA UNICOLOR, new species.

Entirely dark brown with a sericeous reflection. The fore wings have the scales arranged in wavy strigæ, but are without markings.

Expanse.—36 mm.

Locality.—One female, Palma Sola, Venezuela, in the collection of the U. S. National Museum. This is not strictly a *Vipsania*, as the costa is convex and the hind tibiæ have short end spurs only; but I prefer to leave it here till the male is discovered.

Type.—Cat. No. 8981, U.S.N.M.

Genus EPICLEA, new genus.

Male antennæ bipectinated, the last dozen joints simple. Palpi slender, curved, nearly porrect, one-and-a-half times as long as head;

hind tibiae with the spurs obsolete. Wings broad, veins 7 to 9 stalked, 10 from the base of the stalk, discal vein long-forked, and open, costa convex.

Type.—*Epiclea elæa* Druce.

EPICLEA ELÆA Druce.

Perola elæa DRUCE, Biol. Cent.-Am., Lep. Het., I, 1887, p. 23.

Locality.—Panama. This identification is based on an examination of Druce's type. In both the Druce collection and the British Museum I found two species mixed under this label, and it is the other species, not the type, which is figured in the Biologia. Compare *Euprosternea elæasa* Dyar.

Genus SEMYRA Walker.

Semyra WALKER, Cat. Brit. Mus., V, 1855, p. 1130.

Semyra DYAR, Jour. N. Y. Ent. Soc., VI, 1898, p. 237.

SEMYRA BELLA Herrich-Schaeffer.

Limacodes bella HERRICH-SCHAEFFER, Ausser. Schmett., I, 1854, fig. 181.

Semyra coarctata WALKER, Cat. Brit. Mus., V, 1855, p. 1131.

Semyra finita WALKER, Cat. Brit. Mus., V, 1855, p. 1131.

Eulimacodes möschleri SCHAUS, Proc. Zool. Soc., Lond., 1892, p. 324.

Localities.—Brazil; Central America; Mexico.

The type of *finita* Walker is in the British Museum and it differs from *coarctata* Walker in having the terminal space rather contrastingly pale and the basal red marks obsolete. I do not think it a distinct species.

SEMYRA IRENA, new species.

Much like *bella* Herrich-Schaeffer, but much larger. The marks are the same, except that the red color beyond the basal broken silver streak is absent.

Expense.—Male, 30 mm.; female, 40 mm. (*bella* expands, male, 20 mm.; female, 27 mm.).

Localities.—Two males, one female, Rockstone, Essequibo River, and Omai, British Guiana; Petropolis, Brazil (W. Schaus).

Type.—Cat. No. 9031, U.S.N.M.

Determined by Mr. Schaus as *distincta* Möschler, but he has since collected specimens agreeing better with Möschler's characterization and from near his type locality.

Named in honor of Miss Louise Irene Hoff, of New York City.

SEMYRA DISTINCTA Möschler.

Eulimacodes distincta MÖSCHLER, Verh. zool.-bot. Ges. Wien, XXVII, 1878, p. 672.

Locality.—Dutch Guiana.

SEMYRA CARDIA Schaus.

Semyra cardia SCHAUS, Proc. Zool. Soc. Lond., 1894, p. 236.

Locality.—Brazil.

SEMYRA PAULA, new species.

Nearly allied to *cardia*, but the hind wings darker, usually solidly chestnut brown, rarely whitish, but distinctly washed with brown. The silvery subbasal streak is less angled than in *cardia*, the upper part being a curved arc, not angled, the lower part, although angled, less deeply so than in *cardia* and smaller. The outer digitate marks are much the same, but there is no orange dash. The subterminal line is less approximated to the margin below and is not dentate; it is linear, pale, bent out nearly to margin about vein 7 and incurved below vein 2. The eyes are larger than in *cardia* and the head a little less sunken.

Localities.—Five males in the British Museum, São Paulo, Brazil (E. D. Jones); Sapucay, Paraguay (W. Foster); one male in the University Museum at Oxford, small and very dark; one male in Mr. Schaus's collection from Peru and ten in Mr. Jones's from Brazil.

Type.—Cat. No. 8982, U.S.N.M.

SEMYRA ZINIE, new species.

Dark brown; basal half of fore wings of this color, containing a subbasal silvery mark, large, lobed above and centrally, attenuate below. A narrow violaceous white line edges this color, starting on inner margin at silvery mark, curving along near the margin to near middle of wing, then upright to vein 7; here it runs outwardly along vein 6, is sharply angled, and retreats to costa, inclosing a slaty gray area. A brown apical patch and one between veins 5 and 6. Outer area light brown with dark veins.

Expanse.—28 mm.

Locality.—One female, Sapucay, Paraguay (W. T. Foster).

Type.—Cat. No. 9032, U.S.N.M.

Named in honor of Miss Zinie Kidder, of Berkeley, California.

Genus HEPIALOPSIS, new genus.

Male antennæ bipectinated to the tip, slender, with rather long pectinations. Palpi very furry in front, upturned nearly to vertex, the third joint conic, short. Hind tibiæ with long end spurs only. Costa straight, veins 7 to 9 stalked, 10 from the apex of the cell, cross vein scarcely angled, the discal fork open. Hind wings with veins 3 and 4 from the end of the cell, 5 retracted, 6 and 7 stalked, 8 anastomosing with cell near base. Fore wings not trigonate as usual, the costa and inner margin nearly parallel.

Type.—*Hepialopsis agemytha* Druce.

HEPIALOPSIS AGEMYTHA Druce.

Semyra agemytha DRUCE, Am. Mag. Nat. Hist. (6), V, 1890, p. 218.

Locality.—Mexico.

Genus SISYROSEA Grote.

Sisyrosea GROTE, Can. Ent., VIII, 1876, p. 112.

SISYROSEA DIANA Druce.

Semyra diana DRUCE, Biol. Cent.-Am., Lep. Het., I, 1887, p. 220.

Locality.—Panama.

SISYROSEA TEXTULA Herrich-Schaeffer.

Limacodes textula HERRICH-SCHAEFFER, Ausser. Schmett., I, 1854, fig. 184.

Sisyrosea textula DYAR, Journ. N. Y. Ent. Soc., IV, 1896, p. 185.

Locality.—Atlantic States, North America.

SISYROSEA OBSCURA, new species.

Allied to *textula* Herrich-Schaeffer, but uniformly brownish without sericeous streaks or variations of color, and all irrorate with black scales. Head, thorax, and abdomen dark brown without ocherous shades.

Locality.—One male, St. Jean, Maroni River, French Guiana (W. Schaus).

Type.—Cat. No. 8983, U.S.N.M.

SISYROSEA SCHAEFFERANA, new species.

Male.—Brownish ocherous to light ocherous brown, unicolorous, the fringe darker tipped on the hind wing. Fore wings with numerous, wavy, raised strigæ, shining on the convex parts, darkened in the concave parts, with a diffuse, brownish, faint discal bar.

Female.—Variable in color as the male, but more flesh colored in tint. The strigæ are much less distinct, though visible in a strong light; there is no discal mark; there are a few scattered blackish scales on fore wing.

Expense.—Male, 28 mm.; female, 30 mm.

Hind tibiæ in both sexes swollen, flattened, without middle spurs.

Locality.—Five males, three females; collected by Mr. C. Schaeffer in the Huachuca Mountains, Arizona (Palmerlee, Cochise County).

The types are in the collection of the museum of the Brooklyn Institute of Arts and Sciences.

Named in honor of Mr. C. Schaeffer, of Brooklyn, New York.

SISYROSEA (?) PHARA Druce.

Semyra phara DRUCE, Am. Mag. Nat. Hist. (7), V, 1900, p. 513.

Localities.—Mexico; French Guiana; Dutch Guiana.

Only females are known. Mr. Druce's type is a female. There is one in the British Museum from the Godman-Salvin collection and Mr. Schaus took five in Guiana. The generic position is uncertain till the male is found.

SISYROSEA (?) PARVA, new species.

Closely allied to *phara* Druce, but smaller, paler, and more yellowish, the head more prominent. Fore wings yellowish ochereous, irrorate with brown, with a narrow outer line parallel to the margin and traces of a discal mark. Hind wings more brownish.

Expanse.—18 mm.

Locality.—One female, Aroa, Venezuela (W. Schaus).

Type.—Cat. No. 8984, U.S.N.M.

SISYROSEA (?) FLEXILINEA, new species.

Allied to *phara* Druce, but larger, darker, the outer line flexuous. Dark reddish brown; an outer line, slender, finely waved, bent inward below vein 2, else arcuate and parallel to the margin. A dark apical shade resting on the line; a dark cloud about origin of veins 2 and 3. Thorax dark purplish; hind wings darker than fore wings.

Expanse.—25 to 27 mm.

Locality.—Two females, St. Jean, Maroni River, French Guiana (W. Schaus).

Type.—Cat. No. 8985, U.S.N.M.

These three species, *phara*, *parva*, and *flexilinea* are not properly referred to *Sisyrosea*, as the costa is not straight as in that genus; but they can not be correctly referred without males. The hind tibiae have no middle spurs.

SISYROSEA (?) ASSIMILIS, new species.

Agreeing with the preceding structurally, except that the palpi are very short and frail, scarcely reaching the front. It probably deserves a new generic name, but must await the discovery of the male.

Coloration of *S. phara* Druce, but the fore wings lighter, the line narrower and the outer margin tinted darker in purplish. Hind wings blackish brown with pale fringes.

Expanse.—21 mm.

Locality.—One female, Jalapa, Mexico (W. Schaus).

Type.—Cat. No. 8986, U.S.N.M.

Genus EUPROSTERNA, new genus.

With the characters of *Natada*, but the palpi long and upturned about to vertex of head. The male antennae are bipectinated to the tip, slender, moderate, with short pectinations.

Type.—*Euprosterna aroënsis* Schaus.

EUPROSTERNA URBA Druce.

Euclea urba DRUCE, Biol. Cent.-Am., Lep. Het., I, 1887, p. 216.

Locality.—Costa Rica.

EUPROSTERNA AROËNSIS Schaus.

Sisyrosea aroënsis SCHAUS, Journ. N. Y. Ent. Soc., VIII, 1901, p. 231.

Locality.—Venezuela.

EUPROSTERNA SAPUCAYA, new species.

Brown, silky, irrorate; base of fore wing brown, with an ochereous tint, especially below median vein at base; outer margin more lilaceous shining. A broad diffused dusky band from the angle of wing near base on inner margin, directed toward apex, but obsolete after the cell. Hind wing pale whitish brown. A small species, the wings rather elongate, not trigonate.

Expanse.—18 mm.

Locality.—One male, Sapucay, Paraguay (W. Foster), in the British Museum.

EUPROSTERNA ELÆASA, new species.

Brown, as in *Sisyrosea*, uniform, a pale outer line from before apex to middle of inner margin, edged within with darker and not quite attaining the costa.

Localities.—Eleven males, St. Jean, Maroni River, French Guiana (W. Schaus); Trinidad, British West Indies (Urich); Demarara, British Guiana (collection W. Schaus); one male in the British Museum, Teapa, Tabasco, Mexico (Godman-Salvin collection).

Type.—Cat. No. 8987, U.S.N.M.

This is the species figured in the *Biologia Centrali-Americana* as *Perola elæa* Druce, and it is mixed under this name in Mr. Druce's collection and in the British Museum; but the type which I have examined through Mr. Druce's kindness belongs to another genus, and will be found under the name *Epiclea elæa*.

EUPROSTERNA PERNAMBUCONIS, new species.

Reddish brown; a white line on fore wings from outer fourth of costa to outer third of inner margin, edged with black within; a fainter line from costa before apex, approaching margin below and ending in a faint curve on tornus, edged with brown within; fringe dark. Hind wing blackish.

Expanse, 15 mm.

Locality.—Two males, Pernambuco, Brazil, January 29, 1883 (A. Koebele), in the collection of the U. S. National Museum.

Type.—Cat. No. 8988, U.S.N.M.

EUPROSTERNA LACIPEA Druce.

Perola lacipea DRUCE, Ann. Mag. Nat. Hist. (6), V, 1890, p. 218.

Locality.—Mexico.

Genus *PLATYPROSTERNA*, new genus.

With the characters of *Natada* as modified in the description of *Euprosterma*, but the male antennæ large and stout, with long pectinations, reaching to the tip.

Type.—*Platyprosterna elæetta* Dyar.

PLATYPROSTERNA ELÆETTA, new species.

The description of *Euprosterma elæasa* will apply to this also. The moth is larger, broader, and squarer winged and the line is more basally placed, running from the outer third of costa to before middle of inner margin.

Localities.—Two males, São Paulo, Brazil (E. D. Jones); Rio Janeiro, Brazil (W. Schaus); one in the British Museum from São Paulo, and several in Mr. E. D. Jones's collection.

Type.—Cat. No. 8989, U.S.N.M.

PLATYPROSTERNA ANTIQUA, new species.

Ocherous brown on basal half of fore wings; a narrow brown line from outer fourth of costa to middle of inner margin with a narrow, whitish outer border. Beyond the line, pale creamy brownish, a slender dark line from costa, half way between inception of first line and apex to anal angle, gradually approaching the termen, and at the angle very faintly continued along inner margin to first line. Hind wings testaceous whitish, the fringe darker, creamy. Below all a little more brownish; no marks.

Expanse.—18 mm.

Localities.—One male, Burchell collection in the Hopeian Museum at Oxford, taken November 5, 1828, in Brazil; two specimens in the collection of Mr. E. D. Jones, Castro, Parana, Brazil.

PLATYPROSTERNA CERES Druce.

Perola ceres DRUCE, Biol. Cent. Am., Lep. Het., 1, 1887, p. 219.

Localities.—Mexico; Guatemala.

Genus *NATADA* Walker.

Natada WALKER, Cat. Brit. Mus., V, 1855, p. 1108.

NATADA QUADRATA Walker.

Semyra quadrata WALKER, Cat. Brit. Mus., V, 1855, p. 1132.

Natada quadrata KIRBY, Cat. Lep. Het., 1892, p. 541.

Locality.—Venezuela.

The spurs of the hind legs are reduced, but present. I observed in Walker's type specimen one stout apical spur and two very small middle spurs. The species resembles *Sisyrosea*, but has a dark dif-fused half-band on inner margin.

NATADA SARDITES Druce.

Perola sardites DRUCE, Ann. Mag. Nat. Hist. (7), V, 1900, p. 512.

Locality.—Colombia.

There are three males in Mr. Druce's collection. The spurs of the hind tibiae are partly aborted, the upper spurs being one minute, the other dwarfed. The species is therefore transitional to *Sisyrosea*.

NATADA DEBA, new species.

Allied to *sardites* Druce, but the middle spurs of hind tibiae not aborted. Dark brown, irrorate, a cupreous shade at anal angle. Discal dot, an oblique band from below it to middle of inner margin and a subterminal band blackish, the latter distinct only centrally, not reaching costa or margin. Hind wings blackish brown.

Expanse.—24 mm.

Locality.—Two males, St. Jean, Maroni River, French Guiana (W. Schaus).

Type.—Cat. No. 8990, U.S.N.M.

NATADA DEBELLA, new species.

Similar to *deba*, but lighter, sericeous creamy brown, of the color of *Sisyrosea textula*, but not mottled. A black discal dot and a small patch at origin of veins 3, 4. Antennae testaceous.

Expanse.—25 mm.

Locality.—Five males, St. Jean, Maroni River, French Guiana (W. Schaus).

Type.—Cat. No. 8991, U.S.N.M.

NATADA DOGNINI, new species.

Moderately sized, silky creamy brown, like *Sisyrosea*, head and base of fore wing reddish. Fore wing sparsely irrorate with black scales, the apex and outer margin purplish, fringe more brownish. A diffuse blackish patch on veins 3 to 5 shortly beyond their origin. Hind wings light brown.

Expanse.—25 mm.

Locality.—One male, Micay, Colombia (August, 1896), in the collection of M. Paul Dognin.

NATADA LUCENS Walker.

Amydona lucens WALKER, Cat. Brit. Mus., V, 1855, p. 1111.

Sisyrosea lucens DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 238.

Locality.—Brazil.

NATADA SIMOIS Stoll.

Bombyx simois STOLL, Pap. Exot., IV, 1780, pl. cccviii, fig. F.

Romosa abscissa WALKER, Cat. Brit. Mus., XXXII, 1865, p. 473.

Bombycoecera senilis FELDER, Reise Novara, Lep., IV, 1874, pl. lxxxiii, fig. 13.

Localities.—Dutch Guiana; Brazil; Callao, Peru (Mrs. M. J. Pusey).

NATADA BERGII, new name.

Rhinaxina quadrata BERG, Ann. Soc. Arg., XIII, 1882, p. 259.

Localities.—Dutch Guiana; Argentina.

NATADA INCRESCENS, new species.

Very similar to *bergii*, and possibly only a large specimen of that species. It is much larger, expanse 40 mm., with the same markings, but the base of the wing even darker, obscuring the inner line, and there is a patch of light-ocher scales below the cell at the origin of vein 2.

Locality.—One male, Geldersland, Surinam River, Dutch Guiana (W. Schaus).

Type.—Cat. No. 8992, U.S.N.M.

NATADA SUFFICIENS, new species.

Allied to *bergii* and *increscens*. Brownish ochraceous, head, center of thorax, and abdomen tinged with dark red. A white point at base of antennae; palpi black-brown. Wings ochraceous creamy brown with sparse black irrorations, especially along costa and over median nervules. A dusky discal dot; a brownish shading over the median venules. Hind wing with a dark-brown shade parallel to and before inner margin.

Expanse.—48 mm.

Locality.—One male, St. Jean, Maroni River, French Guiana (W. Schaus).

Type.—Cat. No. 8993, U.S.N.M.

NATADA INCANDESCENS, new species.

Head, thorax, and base of abdomen bright red, the rest of the insect silky brown. Fore wings variegated in dark brown and lilaceous, in transverse bars, the brown forming subbasal, median, and submarginal broad, diffuse bands and a discal line.

Expanse.—30 mm.

Localities.—One male, St. Jean, Maroni River, French Guiana (W. Schaus); Micay, Colombia (collection of M. Paul Dognin).

Type.—Cat. No. 8994, U.S.N.M.

NATADA MYCALIA Stoll.

Bombyx mycalia STOLL, Pap. Exot., Suppl., 1790, pl. xxxv, fig. 4

Natada (?) *mycalia* KIRBY, Cat. Lep. Het., 1892, p. 541.

Localities.—Dutch Guiana; Brazil.

NATADA FUSCA Druce.

Trabala (?) *fusca* DRUCE, Biol. Cent.-Am., Lep. Het., I, 1887, p. 207.

Locality.—Panama.

NATADA COCHUBA Schaus.

Natada cochuba SCHAUS, Journ. N. Y. Ent. Soc., VIII, 1901, p. 231.

Locality.—Brazil.

NATADA NASONI Grote.

Sisyrosea nasoni GROTE, Can. Ent., VIII, 1876, p. 112.

Sisyrosea nasoni KIRBY, Cat. Lep. Het., 1892, p. 554.

Natada nasoni DYAR, Journ. N. Y. Ent. Soc., VII, 1899, p. 61.

Locality.—Southern Atlantic States, North America.

NATADA DAONA Druce.

Perola daona DRUCE, Biol. Cent.-Am., Lep. Het., I, 1887, p. 219.

Locality.—Costa Rica. Probably conspecific with the preceding.

NATADA SALTA Druce.

Perola salta DRUCE, Ann. Mag. Nat. Hist. (7), V, 1900, p. 512.

Locality.—Colombia.

NATADA PERPECTINATA, new species.

Dark reddish brown with the markings of *nasoni* or *daona*, the hind wings light red brown. Antennæ unusually heavily pectinated and the white spots at the tips of the fore coxæ very large.

Expanse.—24 mm.

Localities.—Two males, Nova Friburgo and Rio Janeiro, Brazil (W. Schaus); one male, in the British Museum, Espiritu Santo, Brazil; one male in the university museum at Oxford. Another male in the Burchell collection at Oxford (No. 164, collected Nov. 6, 1828) is of the same reddish color, but the dark lines are defined only by pale shades and are more oblique, the terminal space all whitish brown. The male antennæ seem moderately bipectinated, but the specimen is very old and partly destroyed.

Type.—Cat. No. 8995, U.S.N.M.

NATADA SUBPECTINATA, new species.

Dark purplish brown, the hind wings blackish, markings of *nasoni*, but the outer line as distinct as the inner, equally well pale edged and curved at the anal angle to inner margin. White spots on fore coxæ large. Antennæ shortly bipectinated, decreasing gradually to serrations at the tip.

Expanse.—18 mm.

Localities.—One male, Geldersland, Surinam River, Dutch Guiana (W. Schaus); one male in the University Museum at Oxford.

Type.—Cat. No. 8996, U.S.N.M.

NATADA CARIA Druce.

Perola caria DRUCE, Biol. Cent.-Am., Lep. Het., I, 1887, p. 219.

Locality.—Panama.

Genus HEURETES Grote and Robinson.

Heures GROTE and ROBINSON, Trans. Am. Ent. Soc., II, 1868, p. 190.

HEURETES PICTICORNIS Grote and Robinson.

Heures picticornis GROTE and ROBINSON, Trans. Am. Ent. Soc., II, 1868, p. 190.
Locality.—St. Thomas, West Indies.

Described from the female only; no other specimens known. The generic position is uncertain.

Genus PALEOPHOBETRON Dyar.

Paleophobetron DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 239.

PALEOPHOBETRON DERTOSA Druce.

Perola dertosa DRUCE, Ann. Mag. Nat. Hist. (7), V, 1900, p. 513.

Locality.—Colombia. I am much indebted to Mr. Herbert Druce for a specimen of this species.

PALEOPHOBETRON ARCUATA Druce.

Semyra (?) *arcuata* DRUCE, Biol. Cent.-Am., Lep. Het., II, 1898, p. 444.

Paleophobetron arcuata DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 239.

Locality.—Mexico.

PALEOPHOBETRON VAFERA Druce.

Perola vafera DRUCE, Ann. Mag. Nat. Hist. (7), V, 1900, p. 512.

Locality.—Colombia.

Genus EPIPEROLA Dyar.

Epiperola DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 238.

EPIPEROLA DRUCEI Schaus.

Trabala drucei SCHAUS, Proc. Zool. Soc. Lond., 1892, p. 323.

Locality.—Mexico.

EPIPEROLA LAGOAPHILA, new species.

Light straw yellow, thorax ocher, brown shaded, the tufted hairs tipped with gray. Fore wings shaded with silky brown from base, except along outer margin and over veins 2 to 4, where the straw color prevails. A black patch at origin of veins 2 to 4 and a small submarginal dot on veins 3 and 4, with a few dark scales on veins 7, 8, and 9 near their origin. Hind wings a little grayish shaded, especially on the veins.

Expanse.—25 mm.

Locality.—Four males, St. Jean, Maroni River, French Guiana (W. Schaus).

Type.—Cat. No. 8997, U.S.N.M.

EPIPEROLA PERORNATA, new species.

Straw color, thorax brown, abdomen shaded with black on the sides and segmental rings. Tibiæ with black hairs. Fore wings shaded with purplish brown, the apex broadly straw color. A black dot in the base of the cell and a discal dot. An outer line from costa subapically to middle of inner margin, twice arcuate, whitish, slender, edged without with brown varying in width, and by black within. Below the cell and on inner margin the black widens out into a patch. Two white dots on vein 1, preceding and following the black patch, the outer dot cutting the transverse line and with some orange scales superposed. A black bar on vein 5 in the upper angle of the transverse line with some lilaceous scales subapically below it, and a lilaceous dot below vein 7, below median vein and on vein 1 at base. Hind wings blackish, fringe of both wings straw color, spotted with black.

Expanse.—26 mm.

Locality.—One male, St. Jean, Maroni River, French Guiana (W. Schaus).

Type.—Cat. No. 8998, U.S.N.M.

EPIPEROLA SOMBRA, new species.

Brown black, the fore wings narrow and elongate. Two conspicuous white dots on collar. A semipellucid pale dilution below the median vein, running over the discal nervules. Hind wings semitransparent over the disk to outer margin.

Expanse.—22 mm.

Locality.—Two males, St. Jean, Maroni River, French Guiana (W. Schaus).

Type.—Cat. No. 8999, U.S.N.M.

EPIPEROLA ALBIMARGINATA Kaye.

Sisyrosea albimarginata KAYE, Trans. Ent. Soc. Lond., 1901, p. 158.

Localities.—Trinidad; French Guiana.

EPIPEROLA PELUDA Dognin.

Perola peluda DOGNIN, Ann. Soc. Ent. Belg., XLIII, 1899, p. 7.

Localities.—Colombia; French Guiana. M. Dognin has kindly sent me his unique type, which agrees with specimens collected by Mr. Schaus.

Genus PEROLA Walker.

Perola WALKER, Cat. Brit. Mus., IV, 1855, p. 920.

Perola DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 238.

PEROLA VILLOSIPES Walker.

Trabala villosipes WALKER, Cat. Brit. Mus., XXXII, 1865, p. 555.

Phocoderma (?) *villosipes* KIRBY, Cat. Lep. Het., 1892, p. 538.

Perola villosipes DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 238.

Localities.—Colombia; French Guiana.

PEROLA SERICEA Möschler.

Asbolia sericea MÖSCHLER, Verh. zool.-bot. Ges. Wien., XXVII, 1878, p. 671.

Pseudasbolia sericea KIRBY, Cat. Lep. Het., 1892, p. 877.

Perola sericea DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 238.

Localities.—Dutch and French Guiana; Orizaba, Mexico.

PEROLA AFFINIS, new species.

Nearly allied to *sericea*, but the outer line nearer the margin, sub-continuous, dentated inward at vein 6 and slightly at vein 2. A silky whitish lilaceous shade below median vein, on vein 1 at base and over posterior half of thorax. All the veins streaked with red brown.

Expanse.—42 mm.

Locality.—One male, 60 miles up Maroni River, French Guiana (W. Schaus).

Type.—Cat. No. 9000, U.S.N.M.

PEROLA PETROPOLIS, new species.

Allied to *sericea* and *affinis*. Outer line more retracted than in *sericea*, curving from apex under median vein over discal nervules to base of wing, indented at vein 6. Veins brown within this area. Lilaceous color overspreads the area without the line faintly and covers all of thorax.

Localities.—Two males, Petropolis, Brazil (W. Schaus); one male, Mogy Guassa, São Paulo, Brazil.

Type.—Cat. No. 9001, U.S.N.M.

PEROLA PENUMBRA, new species.

Dark brown with a slight reddish bronzy tint. Body and legs a little lighter, the hind legs especially, pale brown. Fore wings umber brown, the veins, except along costal edge, lined in dark brown. Outer line faint, broad, well indicated at its inception on costa near apex, faint and clouded below, appearing strongly as a diffuse patch on vein 1c, below end of cell. Outer margin darkly clouded almost to the line; interspaces in cell and beyond slightly yellowish. Hind wings dark brown, a little lighter toward costa.

Expanse.—37 mm.

Locality.—One male, San Salvador, Central America, in the collection of M. Paul Dognin.

PEROLA INVARIA Walker.

Romosa invaria WALKER, Cat. Brit. Mus., V, 1855, p. 1115.

Asbolia micans MÖSCHLER, Stett. Ent. Zeit., XXXIII, 1872, p. 359.

Pseudasbolia micans KIRBY, Cat. Lep. Het., 1892, p. 877.

Localities.—Honduras; Dutch Guiana.

PEROLA PLATONA Schaus.

Perola platona SCHAUS, Journ. N. Y. Ent. Soc., IV, 1896, p. 56.

Locality.—Venezuela. Larger than *invaria*, but scarcely differing otherwise.

PEROLA DRUCEIODES Dognin.

Trabala druceioides DOGNIN, Ann. Ent. Soc. Belg., XXXVIII, 1894, p. 682.

Perola druceioides DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 239.

Locality.—Ecuador.

PEROLA CICUR Schaus.

Trabala cicur SCHAUS, Proc. Zool. Soc. Lond., 1892, p. 323.

Perola cicur DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 239.

Locality.—Brazil.

PEROLA RUBENS Schaus.

Trabala rubens SCHAUS, Proc. Zool. Soc. Lond., 1894, p. 237.

Perola rubens DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 239.

Locality.—Brazil.

PEROLA BRUMALIS Schaus.

Trabala brumalis SCHAUS, Proc. Zool. Soc. Lond., 1892, p. 323.

Perola brumalis DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 239.

Locality.—Brazil.

PEROLA BURCHELLI, new species.

Shape of *brumalis*. Dull ochraceous, a brown spot in center of thorax. Fore wings divided by a whitish line from base along median vein to end of cell, then curving gently to apex; another white line along outer margin from apex to middle of inner margin before the ochreous brown fringe. Costal area bright red brown, a little more ochreous on costal edge. Inner space red brown on basal half, the outer and larger part blackish gray. Hind wings whitish, brown on costa and tips of wings. Legs ochraceous, fore tibiae and palpi reddish brown.

Expanse.—31 mm.

Locality.—One male, Burchell collection, Hopeian Museum at Oxford (No. 743, collected Nov. 7, 1827) from Goyaz, Brazil.

PEROLA BISTRIGATA Hampson.

Orthocraspeda bistrigata HAMPSON, Trans. Ent. Soc., Lond., 1898, p. 259.

Perola lucia SCHAUS, Journ. N. Y. Ent. Soc., VIII, 1901, p. 231.

Locality.—St. Lucia, Grenadines.

Mr. Schaus's type and the three specimens in the British Museum have all lost the hind legs, leaving the correct generic reference in some doubt.

PEROLA CILIPES Walker.

Camila cilipes WALKER, Cat. Brit. Mus., V, 1855, p. 1126.

The type is without locality. I have seen no other specimens.

PEROLA SUCIA Schaus.

Perola sucia SCHAUS, Journ. N. Y. Ent. Soc., IV, 1896, p. 56.

Amydona sucia DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 237.

Locality.—Brazil.

PEROLA PUNCTATA Walker.

Candyba punctata WALKER, Cat. Brit. Mus., VII, 1856, p. 76.

Candyba punctata HAMPSON, Moths of India, I, 1894, p. 397.

Candyba punctata SWINHOE, Cat. Lep. Oxf., I, 1892, p. 235.

Locality.—Brazil. Prof. E. B. Poulton kindly brought me the type to London for examination. There is a second specimen in the Schaus collection from Geldersland, Surinam River, Dutch Guiana.

PEROLA SUBPUNCTATA Walker.

Amydona subpunctata WALKER, Cat. Brit. Mus., V, 1855, p. 1110.

Natada sericea BUTLER, Trans. Ent. Soc. Lond., 1878, p. 75.

Perola dora DRUCE, Biol. Cent.-Am., Lep. Het., I, 1878, p. 219.

Localities.—Brazil; Panama.

PEROLA PARALLELA, new species.

I shall describe this species more fully in an article Prof. E. B. Poulton will publish on the Burchell collection, made in Brazil in 1827–1828 and now in the Hopeian collection at Oxford. It is ochereous with two oblique subparallel lines.

PEROLA UMBER, new species.

Almost exactly like *Epiperola drucei* Schaus, but all dark bronzy brown instead of ochraceous, and differing generically by the four spurs on the hind tibiae. The line is edged with grayish outwardly below and there is a little of this color on the median vein. Beyond the line the ground color is lighter, divided by the dark veins.

Expanse.—26 mm.

Localities. One male, St. Jean, Maroni River, French Guiana (W. Schaus); one female, Callao, Peru (Mrs. M. J. Pusey).

Type.—Cat. No. 9002, U.S.N.M.

PEROLA MURINA Walker.

Perola murina WALKER, Cat. Brit. Mus., IV, 1855, p. 920.

Locality.—Brazil.

PEROLA REPETITA Druce.

Perola repetita DRUCE, Ann. Mag. Nat. Hist. (7), V, 1900, p. 512.

Localities.—Colombia; French Guiana.

Genus ISOCHÆTES Dyar.

Isachates DYAR, Journ. N. Y. Ent. Soc., VII, 1899, p. 208.

ISOCHÆTES BEUTENMUELLERI Hy. Edwards.

Limacodes beutenmuelleri HY. EDWARDS, Can. Ent., XIX, 1887, p. 145.

Semyra beutenmuelleri KIRBY, Cat. Lep. Het., 1892, p. 534.

Locality.—Southern Atlantic States, North America.

Genus EUPHOBETRON, new genus.

Male antennæ shortly bipectinated to the tip, palpi slender, upturned to vertex; thorax robust, head sunken; hind tibiæ with four spurs. Fore wings with veins 7-9 stalked, normal.

Type.—*Euphobetron cupreitincta* Dyar.

EUPHOBETRON AQUAPENNIS, new species.

Large, robust; fore wings pale testaceous toward apex, purplish brown along inner margin. A fine pale waved line begins on inner margin and runs to costa; a branch leaves it on median vein curves down to vein 2, runs along it a short distance, then becomes submarginal and is lost in the subapical paler area. Below the line is purplish brown, above it red brown, fading to the pale subapical area; a brown discal dot. Apex dark brown with a costal spot before it. A terminal waved red line duplicated by small cusps. Hind wing bright red, overspread with brown broadly on the disk. Throat ochre brown, abdomen red.

Expanse.—36 mm.

Localities.—One male in the British Museum, Potaro River, British Guiana (C. B. Roberts); one male in the U. S. National Museum, Sapucay, Paraguay (W. T. Foster), the hind wings entirely red.

Type.—Cat. No. 9003, U.S.N.M.

EUPHOBETRON CUPREITINCTA, new species.

Antennæ testaceous, tarsi light, legs purplish black. Head light above, thorax black; abdomen black above, lighter at tip and with purplish basal tufts. Wings marked as in *Phobetron*, purplish black, a cupreous brown patch filling lower half of median space; above it to outer line dull ochraceous, shaded with black, somewhat digitately divided by the dark veins. Black lines, transverse anterior, transverse posterior and subterminal, undulate, bent nearly together above cupreous patch, the subterminal denticulate, none reaching costa. Hind wings blackish.

Expanse.—23 mm.

Localities.—Nine males, St. Jean, Maroni River; 60 miles up Maroni River; Cayenne, French Guiana (W. Schaus). One specimen

has been placed in the British Museum. There is a specimen in poor condition at the University Museum, Oxford.

Type.—Cat. No. 9004, U.S.N.M.

EUPHOBETRON MOOREI Kirby.

Narosa rufotessellata MOORE, Proc. Lit. Phil. Soc. Liverpool, XXXVI, 1883, p. 366.

Narosa (?) moorei KIRBY, Cat. Lep. Het., 1892, p. 529.

Locality.—Brazil. Mr. Schaus collected a badly rubbed specimen which may be this species. I have not seen the type. It is at Liverpool.

EUPHOBETRON NATADOIDES, new species.

Dark chestnut brown, palpi paler, a red brown tuft at back of thorax tipped blackish; abdomen dark brown. Fore wings dark chestnut brown, irrorate with violet blue scales. Base dark blackish, obliquely limited without from basal third of inner margin, diffused above; beyond lighter chestnut brown. A line of violet scales from outer fourth of costa, oblique for a short distance, then sharply bent down and straight to above tornus. Within it a large blackish brown area of the color of the basal area and nearly touching it at the end of the cell. Apex dark, but less brown. Hind wings blackish, lighter at the base.

Expanse.—24 mm.

Locality.—One male, Paranapanema, Province of St. Paul, Brazil, in the collection of M. Paul Dognin. The type is without antennæ, but I assume they are bipectinated to the tip.

Genus PHOBETRON Hübner.

Phobetron HÜBNER, Verz. bek. Schmett., 1827, p. 398.

PHOBETRON HIPPARCHIA Cramer.

Bombyx hipparchia CRAMER, Pap. Exot., II, 1777, pl. CLXXXV, fig. D.

Sphinx coras STOLL, Pap. Exot., IV, 1780, pl. CCCXII, fig. A.

Euryda variolaris HERRICH-SCHAEFFER, Ausser. Schmett., I, 1854, fig. 182.

Nemeta bifuscies WALKER, Cat. Brit. Mus., IV, 1855, p. 968.

Nemeta basifusca WALKER, Cat. Brit. Mus., V, 1855, p. 1083.

Localities.—Venezuela to Brazil.

PHOBETRON PITHECIUM Smith and Abbot.

Phalæna pithecium SMITH and ABBOT, Lep. Ins. Ga., II, 1797, p. 74.

Phobetron pithecium DYAR, Journ. N. Y. Ent. Soc., IV, 1896, p. 178.

Locality.—Atlantic States, North America.

Genus LEUCOPHOBETRON Dyar.

Leucophobetron DYAR, Journ. N. Y. Ent. Soc., V, 1897, p. 122.

Leucophobetron DYAR, Proc. Ent. Soc. Wash., VI, 1904, p. 77.

LEUCOPHOBETRON ARGENTIFLUA Hübner.

Euproctis argentiflua HÜBNER, Samml. Exot., Schmett., II, 1824.

Heterogenea argentiflua DEWITZ, Nov. act. k. Leop.-Car. Deut. akad. Nat., XLIV 1882, p. 252.

Euproctis argentiflua MÖSCHLER, Abh. Senck. nat. Ges., XVI, 1890, p. 349.

Altha rufipuncta HAMPSON, Ann. Mag. Nat. Hist. (7), VII, 1901, p. 253.

Locality.—Cuba, West Indies.

LEUCOPHOBETRON ARGYRORRHŒA Hübner.

Euproctis argyrorrhœa HÜBNER, Zutr. ex. Schmett., II, 1823, p. 13.

Locality.—Dutch Guiana. I have not seen this species, but place it here provisionally.

LEUCOPHOBETRON (?) PUNCTATA Druce.

Euclea (?) punctata DRUCE, Ann. Mag. Nat. Hist. (7), VII, 1901, p. 435.

Locality.—Colombia. Unknown to me and probably not belonging to this family. The type should be in Mr. Druce's collection, but he was unable to find it at the time I visited him.

Genus ALARODIA Möschler.

Alarodia MÖSCHLER, Abh. Senck. Ges., XIV, 1886, p. 35.

Alarodia DYAR, Journ. N. Y. Ent. Soc., V, 1897, p. 121.

ALARODIA IMMACULATA Grote.

Phryne immaculata GROTE, Proc. Ent. Soc. Phil., V, 1865, p. 246.

Calybia immaculata KIRBY, Cat. Lep. Het., 1892, p. 446.

Eupoeya nivalis PACKARD, Ent. News, IV, 1893, p. 169.

Calybia immaculata DYAR, Journ. N. Y. Ent. Soc., V, 1897, p. 121.

Locality.—Cuba.

ALARODIA SLOSSONIÆ Packard.

Eupoeya slossoniæ PACKARD, Ent. News, IV, 1893, p. 169.

Locality.—Florida and Texas, North America.

ALARODIA PYGMÆA Grote.

Euproctis pygmæa GROTE, Proc. Ent. Soc. Phil., VI, 1867, p. 320.

Calybia pygmæa DYAR, Journ. N. Y. Ent. Soc., V, 1897, p. 121.

Locality.—Cuba.

ALARODIA FUMOSA Grote.

Euproctis fumosa GROTE, Proc. Ent. Soc. Phil., VI, 1867, p. 321.

Locality.—Cuba. I have not seen this species. Described from a female.

ALARODIA MACULATA Schaus.

Altha maculata SCHAUS, Trans. Am. Ent. Soc., XXX, 1904, p. 138.

Locality.—Cuba. This may be the male of the preceding.

ALARODIA NANA Möschler.

Alarodia nana MÖSCHLER, Abh. Senck. Ges., XIV, 1886, p. 35.

Locality.—Jamaica. I have not seen this species. Described from one male.

ALARODIA JAMAICENSIS Schaus.

Eupoeya jamaicensis SCHAUS, Journ. N. Y. Ent. Soc., IV, 1896, p. 57.

Locality.—Jamaica. I am much indebted to Lord Walsingham for a male of this species taken by himself at Runaway Bay, Jamaica. It has a row of black dots on the discal nervules.

Genus **CRYPTOPHOBETRON**, new genus.

Antennæ of male bipectinated to the tip, the pectinations moderate; palpi short, slender, appressed, upturned, reaching the lower third of the front; hind tibiæ with four spurs, the upper pair short and appressed. Fore wings with 12 veins, 7 to 10 stalked, 2 and 3 separate; hind wings with 2 to 5 well spaced, 6 and 7 coincident, 8 anastomosing with the subcostal at middle of cell.

CRYPTOPHOBETRON OROPESO Barnes.

Limacodes oropeso BARNES, Can. Ent., XXXVII, 1905, p. 215.

Locality.—Arizona. In originally determining this species for Doctor Barnes as undescribed, I refrained from indicating its exact generic position.

Expanse.—14 mm.

Genus **VIPSOPHOBETRON**, new genus.

Antennæ simple in both sexes; palpi slender, upturned nearly to the vertex; hind tibiæ with very long middle and end spurs in both sexes. Thorax moderate, head subprominent. Wings alike in the two sexes, trigonate, produced. Fore wings with veins 8–10 stalked, else normal, or vein 10 from the end of the cell in the female.

Type.—*Vipsophobetron marona* Dyar.

VIPSOPHOBETRON MARONA, new species.

Dark blackish brown, lustrous purplish shining. Inner, outer, and submarginal lines hardly relieved from the ground color, but not shining and edged with a few ocher brown scales. Hind wings dark brown.

Expanse.—Male, 13 mm.; female, 19 mm.

Localities.—Two males, one female, St. Jean, Maroni River, and Cayenne, French Guiana (W. Schaus).

Type.—Cat. No. 9005, U.S.N.M.

VIPSOPHOBETRON MARISA Druce.

Semyra marisa DRUCE, Ann. Mag. Nat. Hist. (7), V, 1900, p. 513.

Locality.—Colombia.

VIPSOPHOBETRON (?) MARINNA, new species.

Dark blackish brown, thickly sprinkled with violet scales. Outer line curved, dentate, dark red brown, in the bend around the cell the intravenular spaces are paler and somewhat digitate. A large dark discal cloud. Apex to middle of outer margin ochraceous. Hind wings dark brown.

Expanse.—25 mm.

Locality.—Two females, Cayenne, French Guiana (W. Schaus).

Type.—Cat. No. 9006, U.S.N.M.

This may prove referable to *Isochætes* when the male is known.

Genus PSEUDOVIPIPSANIA Dyar.

Pseudovipsania DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 239.

PSEUDOVIPIPSANIA FRIGIDA Schaus.

Vipsania frigida SCHAUS, Proc. Zool. Soc. Lond., 1892, p. 323.

Locality.—Mexico.

PSEUDOVIPIPSANIA INVERA, new species.

Head retreating but scarcely sunken, thorax projecting well before insertion of wings; wings elongate. Head and thorax pink, shading to straw color on patagia and brown on metathorax, black irrorate. Abdomen reddish brown above, straw color below. Fore femora dark brown, middle legs with black hair on tarsi. Both wings somewhat transparent. Fore wings brown along costa and at base, straw yellow medially, shaded with purplish terminally; a subterminal line waved on the veins, traces of another line beyond the cell from costa to vein 5; a discal arc and broken mesial line. A black dot at extreme base. Hind wing pale ochreous, reddish along abdominal margin.

Expanse.—29 mm.

Localities.—Two males, St. Jean and St. Laurent, Maroni River, French Guiana (W. Schaus).

Type.—Cat. No. 9007, U.S.N.M.

Genus ULAMIA Möschler.

Ulamia MÖSCHLER, Verh. zool.-bot. Ges. Wien, XXXII, 1883, p. 339.

ULAMIA DOLABRATA Stoll.

Bombyx dolabrata STOLL, Pap. Exot., IV, 1780, pl. cccvi, fig. F.

Scopelodes whitelyi DRUCE, Proc. Zool. Soc. Lond., 1893, p. 299.

Locality.—Guianas.

ULAMIA SERICEA Schaus.

Amydona sericea SCHAUS, Proc. Zool. Soc. Lond., 1892, p. 324.

Amydona sericea DYAR, Journ. N. Y. Ent. Soc., VI, 1898, p. 237.

Locality.—Peru.

Genus *TANADEMA*, new genus.

Male antennæ singly pectinate, the pectinations slender, dense, decreasing rapidly, the terminal half simple. Palpi upturned nearly to vertex. Hind tibiæ with four spurs. Wings trigonate, ample, fore wings with veins 7-10 stalked, hind wings with 6 and 7 from a point, normal.

Type.—*Tanadema mas* Dyar.

TANADEMA MAS, new species.

Purple brown, glossy; palpi, vertex of head, and basal abdominal tufts bright ocher. Fore wings with an obscure dark discal dot and two parallel wavy lines, distinct only below vein 3. Hind wing brown.

Expanse.—17 to 19 mm.

The female is like the male, but larger, with simple antennæ, the wings less pointed.

Localities.—Six males, St. Jean and St. Laurent, Maroni River, French Guiana; Geldersland, Surinam River, Dutch Guiana (W. Schaus); 3 males in the British Museum, Rockstone, British Guiana (W. J. Kaye); 1 female in the British Museum, British Guiana (C. B. Roberts).

Type.—Cat. No. 9008, U.S.N.M.

TANADEMA FEMINA, new species.

Similar to *mas*, but smaller, of a more vivid brown, almost red, the ocherous tufts of abdomen hardly visible, and the outer line of fore wings slenderer, more excurved around the cell and retracted below vein 2.

Expanse.—10 mm.

Locality.—Two males, St. Jean, Maroni River, French Guiana.

Type.—Cat. No. 9009, U.S.N.M.

TANADEMA INCONGRUA, new species.

Fore wings sharply pointed, the costa straight to apex. Dark purplish brown on basal area, sharply limited from middle of costa to just before anal angle, the apical half of wing paler, darkened again along costa and clouded marginally. Hind wings blackish brown.

Expanse.—20 mm.

Localities.—One male, St. Jean, Maroni River, French Guiana (W. Schaus); one male in the University Museum at Oxford. Resembles the members of the next genus, but has pectinate antennæ.

Type.—Cat. No. 9010, U.S.N.M.

Genus *DICHROMAPTERYX*, new genus.

As in *Tanadema*, but the male antennæ shortly uniserrate, without any pectinations.

Type.—*Dichromapteryx dimidiata* Dyar.

DICHROMAPTERYX OBSCURA, new species.

Purplish brown, sharply limited on fore wings by a dull lilaceous shade from middle of costa to anal angle, apex again broadly darkened with the basal color, faintly indicating a dark submarginal shade and trace of discal bar. Hind wing blackish brown.

Expanse.—20 mm.

Localities.—Two males, St. Jean, Maroni River, French Guiana; Surinam River, Dutch Guiana (W. Schaus).

Type.—Cat. No. 9011, U.S.N.M.

DICHROMAPTERYX DIMIDIATA, new species.

Palpi, head, and thorax lilaceous, shading to brown on posterior part of thorax and abdomen. Basal half of wings dark brown, paler basally, sharply limited from middle of costa to anal angle. Apical half pale lilaceous whitish, shading to brown at apex. Two superposed black discal points. Hind wings dark brown.

Expanse.—23 mm.

Locality.—Two males, St. Jean, Maroni River, French Guiana (W. Schaus).

Type.—Cat. No. 9012, U.S.N.M.

DICHROMAPTERYX ULTIMA, new species.

Antennæ of male simple, smooth, flattened, without serrations. Head, fore legs, body, and base of fore wings dark chocolate brown, on fore wings sharply limited by a whitish line, straight from middle of costa to anal angle; beyond purplish brown, rather dark, suffused with the basal color at apex, obliquely inward and curving to tornus. Hind wings pale brown, lighter at base. Below uniformly pale brown.

Expanse.—20 mm.

One male in the University Museum at Oxford.

Genus **PROLIMACODES** Schaus.

Prolimacodes SCHAUS, Journ. N. Y. Ent. Soc., IV, 1896, p. 56.

PROLIMACODES TRIANGULIFERA Schaus.

Prolimacodes triangulifera SCHAUS, Journ. N. Y. Ent. Soc., IV, 1896, p. 56.

Locality.—Mexico.

PROLIMACODES (?) GIBBOSA Sepp.

Phalæna gibbosa SEPP, Surin. Vlind., 1848, pl. cxxix.

Locality.—Dutch Guiana. Not known to me in nature.

PROLIMACODES SCAPHA Harris.

Limacodes scapha HARRIS, Rep. Ins. Mass., 1841, p. 303.

Prolimacodes scapha DYAR, Journ. N. Y. Ent. Soc., IV, 1896, p. 172.

Locality.—Atlantic States, North America.

PROLIMACODES TRIGONA Hy. Edwards.

Limacodes trigona Hy. EDWARDS, Pap., II, 1882, p. 12.

Prolimacodes trigona DYAR, Bull. 52, U. S. Nat. Mus., 1903, p. 356.

Locality.—North America, Arizona. Mr. C. Schaeffer has taken this species in some numbers in the Huachuca Mountains. The serrations of the male antennæ are much longer than in *scapha*.

The following genera are confined to North America and the Holarctic region, so far as at present known.

Genus **HETEROGENEA** Knoch.

Heterogena KNOCH, Beitr. Ins., III, 1793, p. 60.

HETEROGENEA SHURTLEFFII Packard.

Heterogena shurtleffii PACKARD, Proc. Ent. Soc. Phil., III, 1864, p. 346.

Locality.—Atlantic States.

Genus **KRONÆA** Reakirt.

Kronæa REAKIRT, Proc. Ent. Soc. Phil., III, 1864, p. 347.

KRONÆA MINUTA Reakirt.

Limacodes minuta REAKIRT, Proc. Ent. Soc. Phil., III, 1864, p. 251.

Locality.—Atlantic States. No specimens of this species are known to exist.

Genus **TORTRICIDIA** Packard.

Tortricidia PACKARD, Proc. Ent. Soc. Phil., III, 1864, p. 347.

TORTRICIDIA FISKEANA Dyar.

Tortricidia fiskeana DYAR, Ent. News, X, 1900, p. 333.

Locality.—Atlantic States.

TORTRICIDIA GRÆFII Packard.

Lithacodes græfii PACKARD, Ent. Amer., III, 1887, p. 52.

Locality.—Texas.

TORTRICIDIA FLEXUOSA Grote.

Limacodes flexuosa GROTE, No. Am. Ent., I, 1880, p. 60.

Locality.—Atlantic States.

TORTRICIDIA TESTACEA Packard.

Tortricidia testacea PACKARD, Proc. Ent. Soc. Phil., III, 1864, p. 348.

Locality.—Atlantic States.

TORTRICIDIA CRYPTA Dyar.

Tortricidia testacea var. *crypta* DYAR, Proc. U. S. Nat. Mus., XXV, 1902, p. 395.

Localities.—Colorado; Manitoba; British Columbia.

TORTRICIDIA PALLIDA Herrich-Schaeffer.

Limacodes pallida HERRICH-SCHAEFFER, Ausser. Schmett., 1854, fig. 183.

Locality.—Atlantic States.

Genus **SLOSSONELLA** Dyar.

Slossonella DYAR, Proc. Ent. Soc. Wash., VI, 1904, p. 117.

SLOSSONELLA TENEBROSA Dyar.

Slossonella tenebrosa DYAR, Proc. Ent. Soc. Wash., VI, 1904, p. 117.

Locality.—Florida.

Genus **COCHLIDION** Hübner.

Cochlidion HÜBNER, Tentamen, 1806.

COCHLIDION BIGUTTATA Packard.

Limacodes biguttata PACKARD, Proc. Ent. Soc. Phil., III, 1864, p. 341.

Locality.—Atlantic States.

COCHLIDION RECTILINEA Grote and Robinson.

Limacodes rectilinea GROTE and ROBINSON, Trans. Am. Ent. Soc., II, 1868, p. 188.

Locality.—Atlantic States.

COCHLIDION LATOMIA Harvey.

Limacodes latomia HARVEY, Can. Ent., IX, 1875, p. 75.

Locality.—Texas.

COCHLIDION Y-INVERSA Packard.

Limacodes y-inversa PACKARD, Proc. Ent. Soc. Phil., III, 1864, p. 341.

Locality.—Atlantic States.

Genus **LITHACODES** Packard.

Lithacodes PACKARD, Proc. Ent. Soc. Phil., III, 1864, p. 345.

LITHACODES FASCIOLA Herrich-Schaeffer.

Limacodes fasciola HERRICH-SCHAEFFER, Ausser. Schmett., I, 1854, fig. 186.

Locality.—Atlantic States.

Genus **PACKARDIA** Grote and Robinson.

Packardia GROTE and ROBINSON, Ann. Lye. Nat. Hist. N. Y., VIII, 1866, p. 373.

PACKARDIA ELEGANS Packard.

Cyrtosia elegans PACKARD, Proc. Ent. Soc. Phil., III, 1864, p. 342.

Locality.—Atlantic States.

PACKARDIA GEMINATA Packard.

Cyrtosia geminata PACKARD, Proc. Ent. Soc. Phil., III, 1864, p. 343.

Locality.—Atlantic States.

PACKARDIA ALBIPUNCTATA Packard.

Cyrtosia albipunctata PACKARD, Proc. Ent. Soc. Phil., III, 1864, p. 344.

Locality.—Atlantic States.

UNIDENTIFIED SPECIES.

The following have been described as Limacodidæ or referred to that family, but I am unable to identify them:

Agisa basalis WALKER, Cat. Brit. Mus., VII, 1856, p. 1757.—Rio Janeiro, Brazil.

Limacodes concolor WALKER, Cat. Brit. Mus., XXXII, 1865, p. 487.—Amazon region.^a

Niaca curvimargo WALKER, Cat. Brit. Mus., V, 1855, p. 1156.—Rio Janeiro, Brazil.

Mareda ferruginea WALKER, Cat. Brit. Mus., V, 1855, p. 1157.—Rio Janeiro, Brazil.^b

Surida incisa WALKER, Cat. Brit. Mus., V, 1855, p. 1145.—Rio Janeiro, Brazil.

Renada lateralis WALKER, Cat. Brit. Mus., III, 1855, p. 771.—Rio Janeiro, Brazil.

Amydona punctata WALKER, Cat. Brit. Mus., V, 1855, p. 1111.—Rio Janeiro, Brazil.

Agisa rufostava WALKER, Cat. Brit. Mus., V, 1855, p. 1129.—Rio Janeiro, Brazil.

Clanara terminata WALKER, Cat. Brit. Mus., V, 1855, p. 1099.—Rio Janeiro, Brazil.

Nyssia varia WALKER, Cat. Brit. Mus., V, 1855, p. 1137.—Habitat unknown.

All the other South American species mentioned in Kirby's Catalogue Lepidoptera Heterocera as Cochlidiidæ (Limacodidæ), except those listed in this paper, belong to other families.

^a Probably belonging to the Dalceridæ.

^b Perhaps a species of *Natada*.

NEW GENERA AND SPECIES OF HYMENOPTERA FROM THE PHILIPPINES.

By WILLIAM H. ASHMEAD,
Assistant Curator, Division of Insects.

In this paper I describe three new genera and twenty-seven new species of Hymenoptera from the Philippines, based principally upon material received recently from Father Robert Brown, S. J., of the Philippine Weather Bureau. Two of the species, however, belonging to genera known only in India and Japan, and of great economic importance, since they destroy destructive scale-insects of the family *Coccidæ*, were sent to me by Prof. T. D. A. Cockerell, of Boulder, Colorado, who received them, together with their hosts, from Prof. Tyler Townsend, now in the Philippines.

The new genus, *Elasmognathus*, is very remarkable in many of its characters, and totally unlike any other genus so far discovered in the tribe Ichneumonini, where it is placed at present. It may ultimately be considered as the type of a distinct tribe.

Family DIAPRIIDÆ.

Genus GALESUS Curtis.

1. GALESUS MANILÆ, new species.

Female. Length 3 mm. Polished black, with the legs, except the coxæ, the extreme apex of the hind femora, and the basal three-fourths of the hind tibiæ outwardly, red; the coxæ, the extreme apex of the hind femora, and the basal three-fourths of the hind tibiæ are black.

The head is a little longer than wide, smooth, shining, and impunctate, but with a delicate carina on each side anteriorly just above the eyes, and an inclosed area in front of the front ocellus that is connected with carinæ, which extend to the lateral ocelli; the antennal sockets are deep; the face near the insertion of the antennæ is flat, with a large quadrate fovea, but anteriorly it is subtectiform, or sloping off on each side from a delicate median carina; there is also a delicate carina extending from the base of the eyes to the back of the head;

the projecting mandibles are large and have three teeth at apex; the 12-jointed antennæ are thickened toward apex, the scape stout, dilated at apex, with the inner apical margin angulated, the pedicel longer and stouter than the first joint of the funicle, the latter being obconical and longer than any of the following joints, except the last, which is cone-shaped and about twice as long as the penultimate joint; the thorax is smooth, shining, and impunctate, except the metathorax, which is opaque, with some ridges, and clothed with a pale pubescence; the parapsidal furrows are distinct, complete; the scutellum has two large foveæ at base; the abdominal petiole is stout, fully twice as long as thick, longitudinally furrowed, and pubescent, while the body of the abdomen is long, oval, smooth, and shining, the first segment occupying very nearly the whole surface, the other segments being visible as transverse lines. Wings hyaline, pubescent, the veins pale, the radius represented by a fuscous streak, so as to form a large, open marginal cell.

Male.—Agrees with the female, except in having a different shaped head and antennæ. The head is not nearly so long, although it has the carina and areas anteriorly as in the female, while the antennæ are longer, 14-jointed, filiform, the joints of the flagellum cylindrical, more than thrice as long as thick, the first two a little shorter, the last joint the longest and slenderest, more than four times as long as thick.

Type.—Cat. No. 8950, U.S.N.M.

Manila. (Father Robert Brown.)

2. GALESUS LUZONICUS, new species.

Male.—Length 1.9 mm. Polished black, impunctate; legs, except the coxæ, red; wings hyaline, pubescent. On the face and along the anterior margin of the mesonotum are some sparse whitish hairs, while the hind margin of the head laterally back of the eyes and on the cheeks, the metathorax, the abdominal petiole, and the base of the abdomen beneath, are clothed with a whitish pubescence.

The head is carinate anteriorly; the antennæ are 14-jointed, black, and extend almost to the apex of the abdominal petiole, the scape being shining and longitudinally striated, with the apex slightly emarginate, inclosing part of the pedicel, the flagellum being subopaque, sparsely pubescent, the joints, except the last, being oval, hardly twice as long as thick, the last being cone-shaped and fully thrice as long as thick. The scutellum has two large foveæ at base and a broad grooved line on each side; while the abdomen is similar to *G. manilæ*.

Type.—Cat. No. 9034, U.S.N.M.

Manila. (Father Robert Brown.)

Easily distinguished from the previous species by its small size and the great difference in the length of the antennal joints.

Family SCELIONIDÆ.

Genus OPISTHACANTHA Ashmead.

3. OPISTHACANTHA NIGRICLAVATA, new species.

Female.—Length 1 mm. Black, subopaque, microscopically shagreened, the scutellum and the body of abdomen alone smooth and shining; scape, pedicel and funicle of antennæ, and the legs flavotestaceous, the club of the antennæ being black, the joints transverse; the postscutellar spine is minute but distinct; the metapleura are covered with a silvery white pubescence; the lateral ocelli touch the eye margin; the abdomen seen from above is pointed ovate, depressed, a little longer than the head and thorax united, smooth and polished, except the petiole, which is opaque and striated. Wings hyaline, the veins, except the short marginal vein which is brown, being pale yellowish.

Type.—Cat. No. 8751, U.S.N.M.

Manila. One specimen. (Father Robert Brown.)

Genus HADRONOTUS Förster.

4. HADRONOTUS FLAVIPES, new species

Female.—Length about 0.8 mm. Black; basal half of the scape of the antennæ, the apex of the pedicel, and the legs yellow. The head is about thrice as wide as thick antero-posteriorly, wider than the thorax, deeply emarginate posteriorly, convex anteriorly, and reticulately sculptured; the 12-jointed antennæ terminate in a 6-jointed club, the joints of which, except the last, are transverse, the last being conical; the pedicel is obconical, about $2\frac{1}{2}$ times as long as thick, and much longer and stouter than the first joint of the funicle; the funicle joints after the first are a little wider than long; the thorax is finely, closely punctate, subopaque, and without parapsidal furrows; the abdomen is broadly oval, smooth and shining, the first segment longitudinally striated, the second segment with some delicate striae at base. Wings hyaline, pubescent, the marginal, stigmal, and postmarginal veins brownish, the marginal being the shortest and stoutest of the three veins, or a little shorter than the shaft of the stigmal vein.

Type.—Cat. No. 9035, U.S.N.M.

Manila. (Father Robert Brown.)

Family FIGITIDÆ.

Genus KLEIDOTOMA Westwood.

5. KLEIDOTOMA PHILIPPINENSIS, new species.

Male.—Length 0.9 mm. Polished black, the legs, including the coxæ, reddish-yellow, the first two joints of the antennæ dark red, the flagellar joints dark brown, and all, except the first, beautifully, although delicately, fluted.

The 15-jointed antennæ are longer than the body; the scape is obconical, longer than thick, the pedicel round, the joints of the flagellum long, cylindrical, except the first which is clavate, slightly bent, and a little longer than the second, the joints beyond are about four times as long as thick; the scutellum, except the cup, is striated, the fovea at base is divided by a delicate median carina, the cup is ellipsoidal with a puncture at base and a fovea toward apex; the metathorax is bicarinate, subopaque, pubescent laterally; the abdomen has a tuft of white wool on each side at base. Wings hyaline, slightly emarginate at apex, ciliated, the veins pale yellowish, slightly brownish in the thickened parts, the marginal cell open along the front margin.

Type.—Cat. No. 8952, U.S.N.M.

Manila. (Father Robert Brown.)

Family TORYMIDÆ.

Genus PHILOTRYPESIS Förster.

6. PHILOTRYPESIS FICICOLA, new species.

Female.—Length to tip of ovipositor 4.8 mm., to tip of abdomen 2.8 mm. Brownish yellow, smooth and shining, the dorsum of abdomen with some brownish spots down the center, the apical or tubercularly produced segments with a black median line at base and clothed with black sparse hairs or bristles, the sheaths of the ovipositor black and pubescent, clavate at tips; scape and pedicel of the antennæ, and the legs, including the coxæ, paler yellowish; flagellum brown-black, pubescent, the funicle joints all longer than thick; eyes pale greyish, with a faint bluish tinge in certain lights; ocelli pale; tibiæ with bristly hairs, more noticeable on the hind pair. Wings hyaline, iridescent, pubescent, the veins light brownish.

Male.—Length about 1 mm. Apterous, rufo-testaceous, and highly polished, the abdomen triangularly pointed, depressed, yellowish, becoming whitish at apex; the hind femora are also paler or yellowish; the tibiæ are beset with short, stiff, bristly spines; the head is large, trapezoidal, a little wider behind than in front, but not quite as wide as the thorax, with a deep triangular emargination anteriorly in which repose the antennæ, the surface surrounding the emargination delicately aciculated; the antennæ are yellowish white; eyes oval, brown, faceted and placed near the anterior lateral angles; mandibles large, blackish, and dentate, the two apical teeth acute; the pronotum is large, wider than long, and longer than the mesonotum and metanotum united; the metanotum is a little shorter than the mesonotum; the wings are represented by two white, thread-like appendages on each side of the mesonotum.

Type.—Cat. No. 9038, U.S.N.M.

Manila. Several specimens obtained by Father Robert Brown from the fruit of *Ficus heterophylla* Linnæus.

This species, the first in the genus to be noted in the Philippines, appears to be closest allied to *P. spiniger* Mayr, described from Java and Borneo.

Genus MEGASTIGMUS Dalman.

7. MEGASTIGMUS IMMACULATUS, new species.

Female.—Length 1.6 mm.; ovipositor about the length of the whole insect. Brownish yellow, with the scape and pedicel of the antennæ, cheeks and face anteriorly, and the legs pale yellowish or yellowish white; eyes circular, red; sheaths of ovipositor black; wings hyaline, the subcostal vein, the stigmal vein, and its large rounded knob brown, the other veins whitish or hyaline.

The whole insect is smooth and shining, impunctate, but with some delicate transverse striæ on the vertex back of the ocelli, on the pronotum, the mesonotum, and scutellum.

Type.—Cat. No. 8953, U.S.N.M.

Manila. (Father Robert Brown.)

Family CHALCIDIDÆ.

Genus STOMATOCERA Kirby.

8. STOMATOCERA SULCATA, new species.

Male.—Length 4.2 mm. Black and shining, but distinctly, rather closely punctate, the metathorax reticulately punctured, the depression on the mesopleura longitudinally striate; tegulæ and the front and middle legs, except coxæ, brownish yellow; their femora, especially above, brown; the hind trochanters, a large spot at base of hind femora beneath and slightly along their base, a small spot at apex, and the hind tibiæ and tarsi reddish brown; all coxæ and the hind femora, except as already noted, black; the hind coxæ are concave posteriorly for the reception of the base of the swollen femora when elevated; the hind femora have a slight elevation beneath toward apex and are finely serrated; the head is broadly concave in front, the concavity surrounded by a delicate carina, the carina across the vertex separating the front ocellus from the lateral ocelli; the antennæ are inserted far anteriorly and are separated by a carina; the flagellum is filiform, the first joint the longest, the others becoming slightly shorter and shorter; the punctures on the lateral mesothoracic lobes posteriorly are separated and rather sparse, the surface being smoother and more shining than elsewhere; the scutellum is emarginate at apex and has a sulcus down its middle; the abdomen is cone-shaped, the basal segment occupying a little less than its basal half, the other segments being

subequal. Wings hyaline, the veins, except the short marginal vein, pale yellowish.

Type.—Cat. No. 8954, U.S.N.M.

Manila. One specimen. (Father Robert Brown.)

Genus DIRHINUS Dalman.

9. DIRHINUS AURATUS, new species.

Female.—Length 3 to 4.2 mm. Head and thorax metallic gold green, rather coarsely, reticulately punctate, sparsely pubescent, some of the hairs on the vertex, the thorax, and scutellum being golden yellow, the others white or silvery white; the metathorax areolated and carinated, there being a large, somewhat oval area at base, separated into two divisions by a median carina, with carinae on either side, and back of the large basal area are two more or less triangular areas; the metapleura are armed with two teeth on their lower hind margin; the abdomen is smooth and shining, the short petiole with longitudinal carinae, the first segment of the abdomen proper, which is very large and occupies the larger portion of the abdomen, being longitudinally striate at base above; the antennae tegulae, front and middle legs, except coxae, and the hind tarsi brownish yellow, the rest of the hind legs black. Wings hyaline, with a faint yellowish tinge, the veins dark brownish, the stigmal and postmarginal veins not developed.

Male.—Length 2.8 mm. Dull bronze green, the frontal horns longer, with a slight tooth on each side of the face, opposite the apex of the eyes, the antennae brownish yellow, the pedicel and the two or three apical joints brownish, the abdomen clavate, pear-shaped, the petiole longer than in the female, fully twice as long as thick, longitudinally furrowed, the base of abdomen with some short striae near its junction with the petiole, otherwise similar to the female.

Type.—Cat. No. 8955, U.S.N.M.

Manila. Described from five specimens received from Father Brown.

This species is quite distinct from *D. anthracia* Walker, the only other species known from the Philippines, in color and sculpture.

Family MISCOGASTERIDÆ.

Genus ORMOCERUS Walker.

10. ORMOCERUS PALLIDIPES, new species.

Female.—Length 3.8 mm. Head, coxae, and abdomen dark blue, the abdomen along the venter testaceous, the eyes whitish, the thorax bronze green, the scape of the antennae and the legs pale yellowish, the femora brownish toward apex above, the flagellum brown, the first

joint more than twice longer than thick. Wings hyaline, the veins brownish yellow.

The head is transverse, wider than the thorax, at least four times as wide as thick antero-posteriorly, smooth and shining, but under a strong lens the surface in front appears finely, reticulately sculptured; the thorax is smooth, but the middle mesothoracic lobe and the scutellum exhibit a fine, delicate, reticulate sculpture similar to that on the face, only more distinct, this sculpture being less distinct on the lateral mesothoracic lobes and entirely absent on the pronotum and the axillæ.

The metathorax is impressed on each side, the middle lobe thus formed being smooth and brassy, and produced into a neck that extends over the base of the abdomen; it has also a delicate median carina that is connected with a transverse carina at apex; the lateral depressions are aeneous black; the abdomen is conically pointed, blue, longer than the head and thorax united, flat or subconcave above, compressed beneath; the ventral segment projecting and forming a prominent keel. Wings hyaline, the veins brown, the marginal and postmarginal veins very long, only a little shorter than the subcostal vein; the stigmal vein is clavate at apex and about one-third the length of the marginal.

Type.—Cat. No. 8956, U.S.N.M.

Manila. One specimen. (Father Robert Brown.)

Family ENCYRTIDÆ.

Genus HOWARDIELLA Dalla Torre.

11. HOWARDIELLA TARSATA, new species.

Female.—Length 2 mm. Black and shining, the head subopaque, with two rows of microscopic punctures from the front ocellus, the tibiæ brown black, the tarsi, except the last joint, yellowish white.

The head is sublenticular, about as wide as the thorax, with an excavation anteriorly for the reception of the antennæ, which are inserted far anteriorly, with a ridge between; eyes very large, occupying most of the sides of the head, long oval, strongly faceted, and slightly converging above, the upper inner margin touching the lateral ocelli, the latter being close to each other; the flagellum is brown black, thickened toward apex, the pedicel being long, as long as the three following joints united, the funicle joints broadening toward the club and wider than long; the pronotum is very short, hardly visible from above; the mesonotum is wider than long and hardly as long as the large scutellum, the axillæ widely separated; the metathorax is very short, perpendicular with the apex of the scutellum; the abdomen is sessile, seen from above subcordate, and hardly as long as the thorax; the first joint of the hind tarsi is as long as joints 2 and 3 united and thicker. Wings hyaline, the veins brown, the marginal and submar-

ginal veins short, the stigmal vein rather long, slightly curved and clavate.

Type.—Cat. No. 8957, U.S.N.M.

Manila. One specimen. (Father Robert Brown.)

Genus APHYCUS Mayr.

12. APHYCUS ALBICLAVATUS, new species.

Male.—Length 1 mm. Head and thorax mostly orange red, the eyes brown black, the mouth parts, sides of thorax, legs, and the abdomen on each side at base white, the rest of the abdomen brownish, with a median streak toward apex, and a median spot at apex of the basal segment, black or dark fuscous. The antennæ are black, but the scape broadly at apex, the pedicel narrowly at apex, and the three last joints of the flagellum, representing the club, are snow white; the scape is dilated beneath, the flagellum long, subfiliform and pubescent, the joints of the funicle being about thrice as long as thick. Wings hyaline, the veins brown.

Type.—Cat. No. 8958, U.S.N.M.

Manila. One specimen. (Father Robert Brown.)

This beautiful species is evidently allied to *A. dactylopii* described from Hongkong, China, and known only in the female sex, so that there is a probability of its being the opposite sex of that species. This can not be settled positively until the female is discovered or until the male of *A. dactylopii* is made known.

Family PTEROMALIDÆ.

Genus PARASAPHES Ashmead.

13. PARASAPHES TOWNSENDI, new species.

Female.—Length about 0.8 mm. Bluish black, with a faint aeneous tinge especially noticeable on the hind margin of the pronotum; the hypopygium toward apex is testaceous; ocelli pale, arranged in a triangle; scape of antennæ and the legs brownish-yellow, the sutures of the joints, the knees, and the tarsi whitish; flagellum brown, pubescent, the funicle joints longer than thick, the first being the longest, about $1\frac{1}{2}$ times as long as thick. Wings hyaline, iridescent and pubescent, the marginal and stigmal veins brown, the other veins pale; the marginal vein is fully four times as long as the stigmal vein, or as long, or very slightly longer, than the subcostal vein.

The large head is transverse, a little wider than the thorax, about $3\frac{1}{2}$ times as wide as thick antero-posteriorly; behind it is broadly, shallowly concave; anteriorly it is convex; the pronotum is very slightly longer than the mesonotum, but not quite so wide; the mesonotum is much broader than long, with distinct parapsidal furrows that con-

verge posteriorly and almost meet at the base of the scutellum, the latter being convexly rounded; the metanotum is rather short, with a distinct median carina; the abdomen is fully as long as the thorax, ovate, depressed, beneath subcompressed, the hypopygium slightly projecting, plowshare-shaped.

Male.—Length about 6.5 mm. Differs from the female in being proportionally smaller, a little darker in color, the head more aeneous black, with purplish and metallic reflections, the abdomen smaller, less than two-thirds the length of the thorax, and depressed, the anterior legs and the middle coxæ more yellowish white than in the female.

Type.—Cat. No. 8465, U.S.N.M.

Manila. Described from 5 female and 3 male specimens bred by Prof. Tyler Townsend from a coccid and sent to Prof. T. D. A. Cockerell, of Boulder, Colorado, who transmitted them to me.

Genus EURYCRANIUM Ashmead.

14. EURYCRANIUM SAISSETIÆ, new species.

Female.—Length 0.8 to 0.9 mm. Head and thorax blue black, the eyes black, the abdomen wholly brownish yellow, the scape of the antennæ and the legs, except the coxæ, yellowish, the front and middle legs mostly metallic bluish but with the front tarsi and the middle tibiæ and tarsi yellowish. Wings hyaline, the veins yellowish.

Male.—Length about 0.7 mm. Head and thorax aeneous black, the head anteriorly in front bluish, the small, very short, depressed abdomen black with a strong violaceous tinge; the scape of the antennæ is more or less bluish; the legs black or brown black, the sutures of the joints, the knees, and tips of tibiæ yellowish, the tarsi whitish. Wings hyaline, the veins brownish, darker than in the female.

Type.—Cat. No. 9037, U.S.N.M.

Manila. Described from 3 female and 7 male specimens received from Prof. T. D. A. Cockerell and bred by Prof. Tyler Townsend from a coccid, *Saissetia nigra* Nietner.

The type of this genus, *E. alcocki* Ashmead, was bred from a coccid, *Ceroplastes actiniformis* Green, at Calcutta, India, by Major Alcock.

Family ICHNEUMONIDÆ.

ELASMOGNATHUS, new genus.

Head very large, quadrate, similar to that in the genus *Trigonalys* Westwood, seen from above only a little wider than long, the temples wide, as wide as the eyes, the clypeus not at all separated from the face, slightly angulated anteriorly and projecting slightly over the mandibles; mandibles very broad and flat, terminating in two acute teeth, the outer margin of the mandibles being strongly curved from base to apex; labial palpi short, apparently only 3-jointed, the first

joint the longest, clavate, the second about twice as long as thick, stouter than the last but shorter; maxillary palpi long, apparently 4 jointed, the joints long, subequal in length, the second dilated into a compressed, obtusely triangular lobe beneath toward apex, the other joints cylindrical; antennae tapering off toward apex, apparently 37-jointed, with a broad white annulus at the middle, the scape rather long and stout, about *four* times as long as thick; the mesonotum is without a trace of the parapsidal furrows; the scutellum is subconvex and delicately keeled at the lateral margins; the metanotum is areolated, the areola being hexagonal, longer than wide, the spiracles elongate; the abdomen is subcompressed toward apex, with a distinctly projecting ovipositor, although short, as in some *Cryptines*; the second segment alone is distinctly punctate, the others being smooth and shining, the gastroceli being large and transverse; the venation of the wings is very similar to that in *Ichneumon*, the areolet being pentagonal, the median and submedian cells equal, the transverse median nervure being distinctly interstitial with the basal nervure; in the hind wings the transverse median nervure is straight but broken by the subdiscoidal nervure far *below* its middle.

15. ELASMOGNATHUS CEPHALOTES, new species.

Female.—Length 6.5 mm.; ovipositor projecting considerably beyond the tip of the abdomen, or the length of the second joint of the hind tarsus. Black marked with yellowish white as follows: An oval spot on vertex back of eyes, the upper inner orbits, the hind orbits broadly for two-thirds the length of the eyes, the cheeks, the face except an oblong black median spot, the mandibles except the teeth, the palpi, the anterior margin of the prothorax, the hind margin of the same to the tegulae, but broadly interrupted at the middle, two short lines on the disk of the mesonotum, the scutellum and post-scutellum, the tegulae, a spot beneath same, a broad band on the mesopleura, a spot at the insertion of the hind wings, a spot on each side at base of the metathorax inclosing the spiracles, a spot back of these on the hind angles and connected with a large quadrangular spot on the upper hind angles of the metapleura, the basal half or more of the abdominal petiole, the apical margin of same, the basal margin of the second segment including the gastroceli, and the apical margins of segments 2 to 7, most of the ventral membrane, except some lateral spots and the last two segments basally, the front and middle coxae and trochanters, the hind coxae broadly at apex, and the hind tarsi except pulvilli and the basal half of the first joint, all white or yellowish white, the scutellum being more distinctly yellow; rest of the legs, except as noted, mostly red; the hind coxae basally, the hind trochanters, except a white spot above, a stain at apex of hind femora above, the base of hind tibiae, the basal half of the first joint of hind

tarsi, and the middle tarsi, black or fuscous; joints 8 to 15 of the antennæ and joints 16, 17, and 18 *beneath* are white.

The large quadrate head is smooth and shining and impunctate; the mesonotum and the scutellum are distinctly, but not reticulately, punctured; the lateral depressions on the prothorax and the mesopleura are lineated, the former, as well as the sternum, the metapleura and the hind coxæ, being also punctate; the metathorax, except the surface of the areola and the basal lateral areas which are smooth and shining, is rugulose with irregular raised lines and punctures, the surface of the long petiolar area being transversely rugulose; the abdomen, except the second segment, is smooth and shining, the second segment being distinctly punctured, the punctures more dense toward the base, sparser toward apex, and obsolete on the white apical margin. Wings hyaline, the stigma and veins brown.

Type.—Cat. No. 8959, U.S.N.M.

Manila. One specimen. (Father Robert Brown.)

This curious species is totally unlike any other in the tribe Ichneumonini, the only place it could be arranged in according to the present classification.

Genus ISOTIMA Förster.

16. ISOTIMA ALBICINETA, new species.

Female.—Length 5 mm.; ovipositor half the length of the abdomen. Head and abdomen, except the petiole and a white band at apex of the second and last segments, black; the petiole of the abdomen is ferruginous, with a white band at apex; the thorax, all coxæ, and the legs, except the hind legs which are black with white tibial spurs and a white annulus at base of tarsi and in the incision of the joints, and the first joint of the front and middle trochanters which are fuscous, are ferruginous, the middle tibiæ and tarsi more or less fuscous above, paler beneath; palpi white; antennæ black, the last three joints red; wings hyaline, the front pair with a broad dark-brown band across from the lanceolate stigma and the areolet; there is a paler, narrower band before the basal nervure.

The transverse head back of the eyes is smooth and impunctate, the scrobes emarginate, the vertex coriaceous and opaque, the face below the antennæ and the clypeus are shining, the eyes large, strongly faceted; the thorax, except the metathorax, is smooth with distinct parapsidal furrows, but with some striæ in the depressions laterally on the collar and on the mesopleura, the metathorax, except the surface of the three basal areas which is smooth and shining, is rugoso-punctate, the areola being defined only at base, the apical transverse carina being obsolete medially.

Type.—Cat. No. 8961, U.S.N.M.

Manila. One specimen. (Father Robert Brown.)

17. ISOTIMA METATHORACICA, new species.

Male.—Length about 4 mm. Head and thorax, except the metathorax and a spot just above the middle coxæ on the lower hind margin of the mesopleura, and the abdomen, except white bands at the apex of the first, second, and third segments, a large white spot on the last segment above, and the base of the petiole, which is ferruginous, black; the metathorax, the spot on mesopleura above the middle coxæ, the base of the abdominal petiole, and the legs, except the front and middle coxæ and trochanters, which are white, and the first joint of the hind trochanters, a spot at apex of the hind femora, the apex of the hind tibiæ, and the hind tarsi, which are blackish or fuscous, are ferruginous; an oblong spot on the middle of the face, a spot on vertex at the apex of the eyes, the mandibles except the teeth, the palpi, the scutellum, except the fovea across the base, the tegulæ, a spot in front and beneath, the front and middle coxæ and trochanters, a small spot at the metathoracic spiracles, the apical margins of the abdominal segments 1 to 3, and the large spot on the last segment are white; first two joints of antennæ yellow, rest of antennæ black; the first joint of the flagellum long, about 6 times as long as thick. Wings hyaline, the venation fuscous, the stigma paler within. The insect is smooth and shining, with the second and third segments of the abdomen punctate; the parapsidal furrows distinct; the middle lobe with a crenate depression in front of the scutellum, while the metathorax is completely areolated.

Type.—Cat. No. 9040, U.S.N.M.

Manila. (Father Brown.)

18. ISOTIMA ALBIFRONS, new species.

Female.—Length 8.5 mm.; ovipositor half the length of the abdomen. Black; the palpi, a spot at base of the mandibles, the clypeus, a large spot on the face extending from the clypeus to the insertion of the antennæ, a stripe on each side of it close to the eye, a large spot on the vertex close to the apex of the eye and leaving a triangular black spot inclosing the ocelli, the tegulæ and a spot beneath, the scutellum, except the depression across the base, the front and middle coxæ and trochanters, the knees and front tibiæ toward base and beneath, the base of the middle tibiæ and beneath, a broad annulus at base of the hind tibiæ, the hind tarsi, except an annulus at base and the last joint, broad bands at the apex of the first and second segments of the abdomen, and a large spot on the last two segments are white; the metathorax, the base of the first segment of the abdomen, and rest of the legs, except as noted and the hind tibiæ, are ferruginous; the hind tibiæ, except the annulus at base, the tibial spurs, the annulus at base of tarsi and the last joint, are black; the two basal joints of the antennæ and the front coxæ *above* are yellowish, the rest of the antennæ,

except a broad white annulus, black; wings hyaline, with a broad brown band across the stigma, the stigma and veins black or brown-black.

The metathorax is rugulose, with two transverse carinae and a pleural carina, the first transverse carina being connected with a triangular area just back of the metascutellum, the spiracles large; the insect otherwise, except the mesopleura anteriorly, which are finely rugulose, and the second and third abdominal segments, which are closely finely punctate and opaque, is smooth and shining.

Type.—Cat. No. 9441, U.S.N.M.

Manila. (Father Brown.)

19. ISOTIMA CINCTICORNIS, new species.

Female.—Length nearly 5 mm.; ovipositor not quite as long as the abdomen. Colored as in *I. albicincta*, only the antennae have a distinct white annulus not present in that species, while the legs too are slightly differently colored, being mostly red, with the hind pair black from the trochanters, with only the tibial spurs white; the tarsi wholly black, not white basally as in *I. albicincta*.

Type.—Cat. No. 9042, U.S.N.M.

Manila. (Father Brown.)

Genus AGROTHEREUTES Förster.

20. AGROTHEREUTES NIGRITARSIS, new species.

Female.—Length about 7 mm.; ovipositor not half the length of the abdomen. Head, prothorax, mesonotum, and the abdomen, except the apical margins of the first and second segments and large spots on the last two segments which are white, black; rest of the thorax and the legs, except the front and middle coxae and an annulus at base of hind tibiae which are white, and the hind tibiae and tarsi which are black, are ferruginous or red; the antennae, except joints 8, 9, and 10 *in front* which are white, are black, the three or four basal joints being brownish. Wings hyaline, faintly dusky at apex, the stigma and veins dark brown.

The whole insect is mostly smooth and shining, but the face from the antennae to the clypeus and the depressions laterally on the pronotum are finely rugulose, the mesopleura, except a spot at the upper hind angles and the metathorax, are rugulose, while the second and third segments of the abdomen are closely, opaquely punctate.

Type.—Cat. No. 9043, U.S.N.M.

Manila. (Father Brown.)

21. AGROTHEREUTES ALBIPALPIS, new species.

Male.—Length 6 mm. Head and thorax, except the metathorax, which is red, and the abdomen mostly black, but marked with white

as follows: The palpi entirely, the mandibles, except the teeth, an oblong spot on the middle of the face, an oblong spot on the vertex on each side between the ocelli and the eyes, the tegulae and a spot beneath, a large spot back of the insertion of the hind wings, the front and middle coxae, the front femora beneath their tibiae and tarsi, except the last joint, the middle tibiae, the apical margins of abdominal segments 1, 2, and 3, and a large spot on the last segment are white; the suture between the fourth and fifth dorsal segments of the abdomen is also white; the scape of the antennae, the front and middle femora above, the metathorax, the hind legs (except the trochanters, apex of tibiae, and tarsi, which are black), and the base of the first joint of the abdomen are red. Wings hyaline or only faintly tinted, the stigma and veins black. The whole insect, except some minute punctures on the face, some wrinkles laterally on the prothorax and the mesopleura, the finely rugulose metathorax, and the closely, opaquely punctate second and third segments of the abdomen, is smooth and shiny.

Type.—Cat. No. 9044, U.S.N.M.

Manila. (Father Brown.)

AMAUROMORPHA, new genus.

This new genus belongs to the tribe Lissonotini, and, on account of the abdomen being petiolate, not sessile, falls into the section with the genera *Atropha* Kriechbaumer and *Taschenbergia* Schmiedeknecht.

My table of the genera. Classification of the Ichneumon Flies, page 49, may be modified to include it as follows:

Abdomen petiolate; head transverse.

Metathorax exareolated, *without* a transverse apical carina. (For further characters see Classification).

Atropha Kriechbaumer and *Taschenbergia* Schmiedeknecht

Metathorax exareolated, but *with* an apical carina and a basal carina.

Abdomen petiolate, the gaster finely, densely punctate, subsericeous, the petiole very slightly and gradually thickened to the apex, sparsely punctate, but not abruptly bent, the spiracles very minute placed at the middle; parapsidal furrows not distinct, only vaguely indicated; metathorax rather long, the spiracles elongate, linear; front wings *without* a distinct areolet, the submedian cell not quite as long as the median, the transverse median nervure joining the median vein just before the basal nervure; transverse median nervure in hind wings angularly broken *above* the middle.

Amauromorpha, new genus

22. AMAUROMORPHA METATHORACICA, new species.

Female.—Length 9 mm.; ovipositor about one-third the length of the abdomen. Black, very finely, closely punctate, and clothed with a fine, sericeous pubescence, the metathorax, the front legs, except the coxae, trochanters, and tarsi, the middle coxae and femora, the hind coxae and the hind femora being orange red; antennae brown-black; palpi black, but with the first joint narrowly yellowish at apex; wings

hyaline, the lanceolate stigma and the veins black or brown-black, the second recurrent nervure being distinctly interstitial with the first transverse cubitus; the areolet is wanting, but there is a trace of the second transverse cubitus present by a small stump of a vein from the radius.

Type.—Cat. No. 9045, U.S.N.M.

Manila. (Father Brown.)

Genus XANTHOPIMPLA Saussure.

23. XANTHOPIMPLA KRIEGERI, new species.

Female.—Length 9 mm.; ovipositor less than one-third the length of the abdomen. Yellow; a spot inclosing the pale ocelli, a round spot on each side of the mesonotum, a minute spot on each side of the first abdominal segment just back of the spiracles, a small round spot on each side of the second segment, a large oblong oval spot on each side of the third, fourth, fifth, and seventh segments, that on the seventh being emarginate within, a V-shaped mark on the eighth segment, and the sheaths of the ovipositor black; eyes brown, slightly emarginate within; antennæ black, with the first four or five joints yellow beneath, the first joint or the scape being triangularly emarginate laterally at apex; the tips of the tarsal claws and the teeth of the mandibles are black. Wings hyaline, the stigma and the veins, except the subcostal vein and the stigma within which are yellowish, are black; the areolet is trapeziform, subpetiolate. The metanotum has three areas across the base, and another area on each side back of the lateral basal areas, or five in all; the pleural carinæ and a carina at the apex of the metanotum are distinct but very delicate.

Type.—Cat. No. 8962, U.S.N.M.

Manila. Two specimens. (Father Robert Brown.)

This interesting new species, the first to be discovered in the Philippines, is named in honor of Dr. Richard Krieger, who monographed the species in the genus *Xanthopimpla* Saussure in 1899.

Family ALYSIIDÆ.

Genus GONIARCHA Förster.

24. GONIARCHA MALAYENSIS, new species.

Female.—Length 2 mm.; ovipositor about the length of the basal joint of the hind tarsi. Head, except the eyes, and the abdomen, except the first segment, ferruginous, the eyes, the thorax, the hind coxæ, and the first segment of the abdomen, black; the second dorsal segment of the abdomen is more or less brownish; the antennæ are dark fuscous, becoming black toward apex, but with the first four or five joints yellowish; the palpi, tips of coxæ, and all trochanters are

white, the rest of the legs, except the pulvilli and the hind tarsi, which are fuscous, are testaceous; mandibles yellowish, tridentate at apex; wings hyaline, the stigma yellowish, the veins fuscous. The head, the thorax, except the metathorax, and the abdomen, except the petiole, are smooth and shining; the metathorax is coarsely reticulated with irregular elevated lines, while the petiole is longitudinally striated.

Type.—Cat. No. 8963, U.S.N.M.

Manila. One specimen. (Father Robert Brown.)

Family BRACONIDÆ.

Genus HOMIOPTERUS Girard.

25. HOMIOPTERUS PACIFICUS, new species.

Male.—Length 1.6 mm. Head and thorax brownish yellow, the eyes brown-black, the metanotum subfuscous, with elevated lines, the abdomen pale brownish with the petiole rugulose and black; the palpi and legs are yellowish white; the antennæ are very long, the flagellum subfuscous above, becoming black toward apex; wings hyaline, the stigma pale, the venation typical of the genus and fuscous.

The whole insect, except the metathorax and the petiole of the abdomen, is smooth and shining, and quite different in this respect from the delicately, longitudinally sculptured species known in the North American fauna.

Manila. One specimen. (Father Robert Brown.)

Genus MICROBRACON Ashmead.

26. MICROBRACON LUTEICEPS, new species.

Female.—Length 1.3 mm.; ovipositor not quite half the length of the abdomen. Head, except the eyes and a large spot inclosing the ocelli, most of the thorax, except as hereafter noted, and the abdomen beneath, luteous or pale yellowish; legs yellowish, the hind femora and tarsi and the last joint of the front and middle tarsi, dark fuscous; the antennæ, the eyes, the spot on vertex inclosing the ocelli; the disks of the lateral and middle lobes of the mesonotum, the base of the scutellum, the metanotum, sutures beneath the tegulae, a spot on the mesosternum, the abdomen above, and the sheaths of the ovipositor, are black. Wings hyaline, with a grayish tinge; the stigma and veins brownish, the stigma paler within.

Type.—Cat. No. 9036, U.S.N.M.

Manila. One specimen. (Father Robert Brown.)

HEMIGLYPTUS, new genus.

This new genus falls in the tribe Braconini and comes next to *Glyptomorpha* Holmgren, to which it is closely related.

My table of the genera, Classification of the Ichneumon Flies^a may be modified to include it as follows:

4. Abdominal segments 2-3 or 2-4 with oblique lateral impressions, and all segments longitudinally striate, or aciculate; metanotum *without* a median carina; first and second abscissæ of the radius not nearly straight, but forming an obtuse angle, the second cubital cell not wider at base than at apex, usually a little narrower *Glyptomorpha* Holmgren.
- Abdominal segment 2 alone with an oblique lateral impression, the second and third segments alone longitudinally striate, the following smooth or nearly; metanotum *with* a median carina; first and second abscissæ of the radius in a straight line, or nearly, the second cubital cell much wider at base than at apex *Hemiglyptus*, new genus.

27. HEMIGLYPTUS FLAVUS, new species.

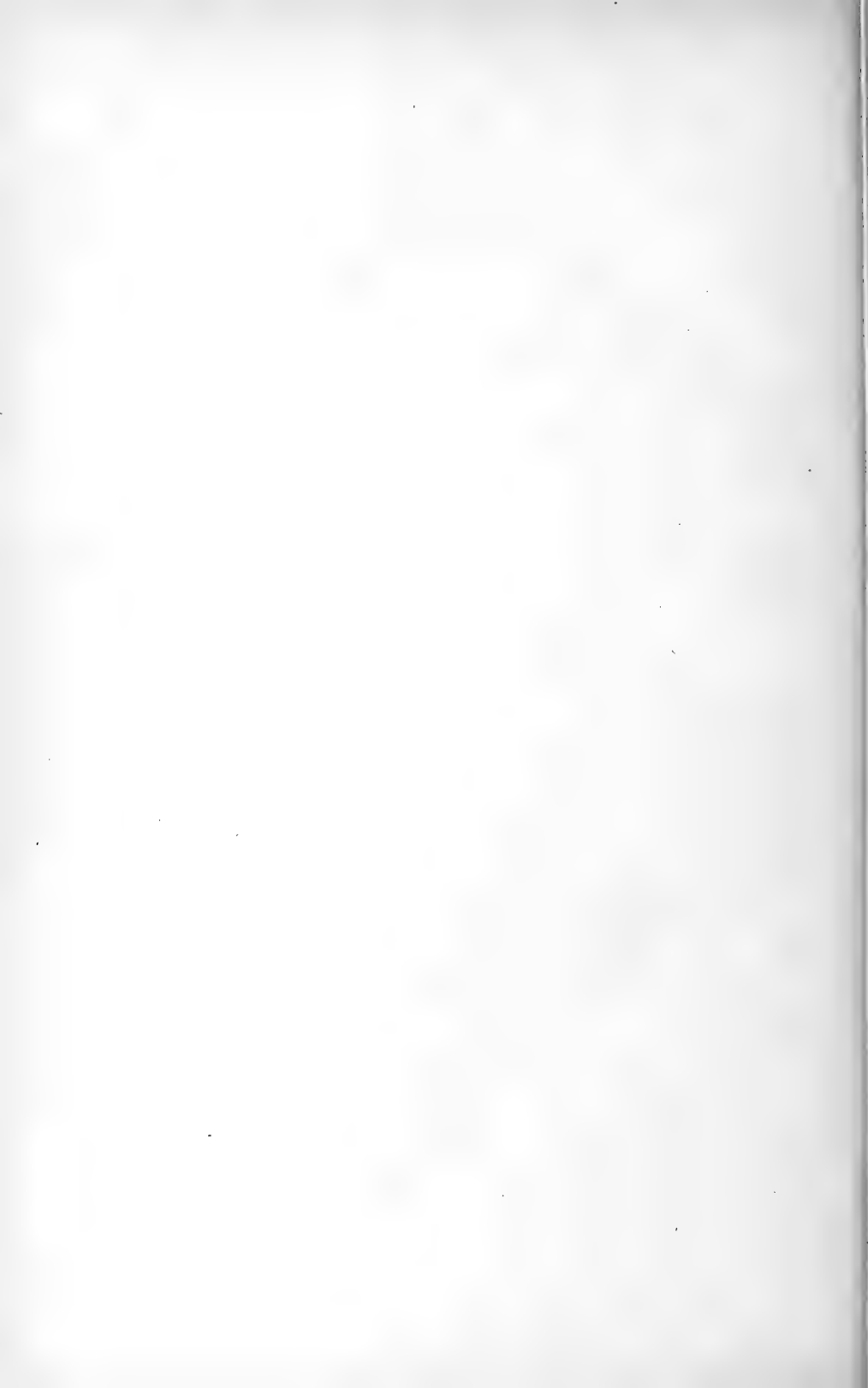
Female.—Length 4.2 mm. Pale brownish yellow, the eyes brown, the antennæ, except the two basal joints, and the sheaths of the ovipositor, which are nearly as long as the abdomen, are black, the hind tarsi faintly dusky, the wings hyaline, the large stigma and the costæ black, the internal veins brown.

The head and thorax are smooth and shining, but exhibit some sparse, microscopic punctures; the parapsidal furrows are distinct posteriorly from the anterior third of the mesonotum; the metanotum is smooth, but has a distinct median carina; the abdomen has two crenate furrows on the first segment that converge anteriorly, the second and third segments being longitudinally striate, while the following segments are smooth.

Type.—Cat. No. 9046, U.S.N.M.

Manila. (Father Robert Brown.)

^aProc. U. S. Nat. Mus., XXIII, 1900, p. 137.



THOMAS MARTYN AND THE UNIVERSAL CONCHIOLOGIST.

By WILLIAM HEALEY DALL,

Curator, Division of Mollusks.

The career of Thomas Martyn, the artist publisher of the most beautiful iconography of shells ever prepared, the medalist of a pope and four kings, is little known. He has been confused with a distinguished cotemporary botanist of the same name in some bibliographies, and the facts now discoverable about his life, and even his publications, are disappointingly scanty. In Nichols' *Literary Anecdotes* (VIII, p. 432) he is styled "the entomologist, a native of Coventry." In the *Biographical Dictionary of Living Authors* (London, 1815-16) he is described as "an ingenious naturalist in London;" while Dryander, in his catalogue of the library of Sir Joseph Banks (V, p. 347, 1800), has the brief note, "mercator rerum naturalium Londini." The notice in the *Dictionary of National Biography* (XXXVI, p. 321, 1893) more appropriately refers to him as a "natural history draughtsman and pamphleteer," flourishing between 1760 and 1816. No clue to the dates of his birth and death has been found, but it appears to be certain that he was a resident of London from 1781 to 1816, living successively at 26 King street, Covent Garden, 16 and 12 Great Marlborough street, and 62 Great Russell street, Bloomsbury. His name appears on the list of subscribers to the publication of Da Costa's *British Conchology* in 1778. Maton and Rackett, in their *Historical Account of Testaceological Writers* (1804), speak of him as a "dealer," which is also implied by Dryander's note above cited; but if he dealt in anything except his publications these two references are the only traces of it. His name does not appear in a long series of London business and post-office directories of the period which I have consulted. He was evidently a man of education, the language of his text is correct, he knew French, some Latin, and possibly some Greek (there is a Greek subtitle on his frontispiece); he tells us that his work had received the approbation "of many noble and learned

persons, and more particularly of Sir Joseph Banks, "a sanction, too, given in a manner the most flattering." He was allowed to dedicate his *Universal Conchologist* to the King, which meant, in those days, that at least he was a person properly vouched for. We may fancy he was not inimical to the Roman faith, since his first copy, or at least the copy among those presented to dignitaries which was earliest rewarded by a medal, was sent to the Pope Pius VI. That he was a man of alert mind, interested in many things, is indicated by the list of his publications, which begins with a quarto essay on ballooning, having a colored frontispiece representing a supposedly dirigible balloon of the author's design. This is followed by the *Universal Conchologist*; by a pamphlet suggesting a national assessment for the maintenance of disabled soldiers and sailors; by the *English Entomologist*, including illustrations of more than five hundred British beetles; by a work on spiders, based in part on Albin's original drawings purchased at the sale of the Portland collection in 1786,^b plates of plants and lepidopterous insects; an anti-Napoleonic pamphlet; and one entitled *Great Britain's Jubilee Monitor*; the list finally winds up with a new edition of the *Natural System of Colors*, by the late Moses Harris, edited by Martyn in 1811, a quarto publication dedicated to our own Benjamin West, "the British Raphael."^c

All this shows a man of alert and original mind, artistic, scientific, philanthropic, and patriotic. The character of the illustrations which have come down to us show that the artistic faculty of Martyn, as regards the representation of objects of natural history, was something quite out of the ordinary. His presence in that part of the *Dictionary of Living Authors* which was (as indicated by the running date) prepared in 1815, leads to the conclusion that he was then living, and a note in the preface to his pamphlet of 1804 informs us of the existence of a son, who, by the favor of the Duke of York, to whom the pamphlet was dedicated, had been recommended for a commission in the royal army.

The manner of preparing the plates of his iconographies is described by Martyn in the preface to the second issue of his *Conchologist*, in 1789, and is creditable to his ingenuity.

Finding that considerations of expense and discipline made it impracticable to secure the service desired from independent artists, "he

^aBanks, who was on excellent terms with George III, may very possibly have procured the royal consent to the dedication of the *Universal Conchologist* to his majesty.

^bPortland Catalogue, p. 119, No. 2623.

^cThe first edition, published in the author's lifetime, had been dedicated to Sir Joshua Reynolds. Harris, like Martyn, was an entomologist and artist of no mean capacity, and his *British Aurelian* has passed through four editions, the last edited by Westwood so late as 1840. Harris is believed to have died about 1785, and his career may have been instrumental in leading Martyn to undertake his own iconographies.

thought it probable that in the productions of boys, all of whom had received their first rudiments of good taste from the same common preceptor, and who should execute whatever they did under his immediate inspection and control, there would generally be found that uniformity and equality of style, conception, and execution which it would be in vain to require from a variety of independent artists." Impressed with this idea, he now directed his attention to the discovery and instruction of "a number of young persons who, born of good but humble parents, could not from their own means aspire to the cultivation of any liberal art, at the same time that they gave indications of natural talent for drawing and design."

One of this character soon presented himself and made rapid and satisfactory progress, and by the end of a year was sufficiently proficient to serve as a tutor himself, when two more were engaged, and in two years such advances were made that the exhibition of specimen plates excited an admiration the sincerity of which was evinced by orders for copies of the proposed work. At the end of three years from the beginning of the undertaking, seventy copies of the first two volumes (comprising 80 plates) had been completed.

On comparison of the later work with the earlier, however, the latter appeared so inferior that Martyn decided to totally reject the whole of what had been done, and began again, "in that improved style of execution which was ultimately to determine the fate and reputation of the work." Here spoke the artist, and the "dealer," if he existed, totally disappeared with the rejected copies. Finally, the etchings on copper, from which were printed the plates serving as a base for the color work, were taken from outside engravers and made in what he fondly terms his academy, so that the whole work could be prepared in his own establishment.

All this cost money, of course, and Martyn admits having "sunk in it no inconsiderable share of a private competence," but in return he had "the singular gratification of seeing his most sanguine expectations realized by the event," and his publication rendered "as worthy of himself, of his country, and of the learned world as art and his utmost abilities of every kind could effect."

Apart from its product the little academy seems to have been a source of pride to Martyn as furnishing society with an accession of useful members in the persons of his pupils, whose number finally grew to nine, instructed and supervised by Martyn himself, and he winds up his account of it with the declaration that in this little seminary duty toward God and man is earnestly enforced, since the conductor of it "would feel it a nobler boast to have educated one good citizen than any number of artists, however ingenious."

While the essay on a dirigible balloon appears to have been earlier published, the *Universal Conchologist* seems to have been Martyn's

magnum opus, and the one to which his interest was most attached. The planning to prepare a work which should be of a unique excellence was done with this special object in mind, and the subsequent publications on insects, spiders, plants, etc., were incidental to the possession of the facilities which had been provided for the conchologist. For his insects Martyn accepted the system of Linnaeus, but in his conchological work he projected a system which should be his own, while preserving a binomial nomenclature. He explains^a that his new classification "will be found to stand on the firm and unalterable basis of truth and nature," his leading idea being to avoid lengthy descriptions by substituting for them figures of such perfection as to convey fully the essential characters of the shells. "Accordingly, the synoptic table," which was to display the scheme of classification devised by the author, "will not appear until sufficient progress shall have been made in the work to prepare the mind of the student for a candid decision on its comparative merits." Meanwhile, to render the work useful from the beginning, "an explanatory table will be given, showing, in different columns * * * the English name and family with an initial letter denoting the genus or division of the family to which the shell belongs, according to the system of the author; thirdly, the Latin name; fourthly, where the shell is found; and lastly, in what cabinet it is preserved."

"The work will commence with the figures of the shells (most of them rare and nondescript) which have been collected by the several officers of the ships under the command of Captains Byron, Wallace, Cook, and others in the different voyages made to the South Seas. The whole of which will be contained in two volumes."

"The author presumes that the method which he has adopted,^b of displaying the figure of each shell in two positions, would generally be preferred * * * as it would have been impossible, from so small a number as the South Sea shells afford, to select proper companions of the same size and genus to be given in the same plate, and that, too, repeatedly. In future volumes^c it is proposed to give at least two different shells of the same genus in each plate."

I have already described the organization by which Martyn intended to carry out his plan, the outcome of which is described by Maton and Rackett (1804) in the following remarks:

"In the year 1784 Martyn, a dealer, began one of the most beautiful and costly conchological works this country has ever seen. * * * But before this ingenious artist had completed his two volumes of

^a All the citations not otherwise explained are from the text of the introduction and preface to the *Universal Conchologist*.

^b In the two volumes above referred to.

^c That is, in those volumes projected to contain the figures "of every known shell," but of which only two were prepared.

South Sea shells he discovered the impossibility of procuring purchasers sufficient to compensate him for his labour and expense—a misfortune generally experienced by private individuals who embark in such extensive and sumptuous undertakings. He therefore did not proceed beyond 160 plates; which, however, as they include all the species then known to the Southern navigators, may be regarded as constituting a complete work, so far as it goes, and it was all that Mr. Martyn had absolutely engaged himself to execute. There is only one species on a plate, but each is exhibited in different aspects, with incomparable elegance, and with great correctness of drawing and coloring.”

The reader will perceive from Martyn's account of the manner in which his plates were prepared—and from an intimation in his introduction that the plates were intended to be arranged when the work was completed, according to his new system of classification—that it was practicable for the author to prepare copies to meet the demand, be the same slow or rapid; also, that mere prudence would lead the author to prepare no great number of sets of plates beyond those for which he had received or expected orders.

This probably accounts for the rarity of the work, and it will be recalled that the first “edition,” if it may be so termed, the one which was rejected on account of the want of uniformity in its execution, consisted of only seventy copies of the first eighty plates.

By the citations which follow the reader will see that the bibliographers have been unfortunate or careless in their references to this work, and that the dates of publication, the meaning of the word “volume” when used in connection with these plates, and some other statements in regard to them, are ambiguous or involved in more or less doubt. The citations are given in the order of their dates:

Portland Catalogue, 1786 (*circa* April 1).

The Universal Conchologist, exhibiting the Figure of every known shell, accurately drawn and painted after Nature, with a new systematical arrangement, by Thomas Martyn, 1784.

NOTE.—The compiler of the Portland Catalogue, who is unknown, makes copious references to the figures in Martyn up to plate 80, or by Martyn's estimate volumes I and II, but he assigns to that work the date of 1784, the date of the Catalogue being early in 1786. Dr. Solander, whose manuscript names are thus illustrated by Martyn's figures, without acceptance of Martyn's previously published names, must have obtained the shells and labeled them between the arrival of the expedition late in 1780 and the date of his own death, in May, 1782. The Catalogue is largely based on Solander's manuscript description of the Portland Cabinet, which must have been chiefly prepared before the appointment of Solander as keeper of the printed books in the British Museum, in 1773. The references to Martyn appear to have been added by the anonymous compiler. In looking over the entries in this Catalogue one often finds references to Martini's Conchylien Cabinet, with the name misprinted Martyn. These can, however, be at once discriminated from the ref-

erences to the real Martyn by the numbers cited for figures, which are invariably larger than 160.

The latest volume of Martini referred to is III, 1777, although nine volumes of the Cabinet had appeared by 1786.

Dryander, Bibl. Banksiana, II, p. 319, 1796; V, p. 347, 1800.

The Universal Conchologist in english and french. Vol. I, pagg. 27, tab. æneæ color. 40. London, 1784, fol. obl.

NOTE.—Dryander took charge of the Banksian Library in 1782 in succession to Solander. He is generally regarded as a very accurate person, though the above title is far from impeccable. It is somewhat odd, considering the relations mentioned between Banks and Martyn, that the library of the former should contain only the first forty plates of the Universal Conchologist, and leads one to wonder if Solander's loyalty to Linnæus and Martyn's rejection of the Linnean classification of shells had anything to do with it.

Maton and Rackett, Linn. Trans., 1804.

Thomas Martin, Universal Conchologist, London, vol. 1, 1784; vol. 2, 1786, fol., with 160 most elegant plates.

NOTE.—It would appear from the above that Maton and Rackett regarded as a "volume," not the 40 plates so denominated in Martyn's own introduction, but the 80 plates which were bound actually into a volume, as in one I have seen in an apparently contemporaneous binding. They are not alone in this view, and it would follow that, if their citation be correct, plates 1-80 appeared in 1784 and 81-160 in 1786.

Dillwyn, Rec. Shells, vol. I, 1817, p. x.

The Universal Conchologist by Thomas Martyn, London, vol. I, 1784, vol. II, 1786.

Chenu, Bibl. Conch. 1ère Ser. tome II, 1845.

Reprint of the French text of Martyn's Introduction and preface, reproduction of his figures on 56 plates, with a brief "avertissement" by the editor, in which he states that the work was published in London from 1769 to 1784, in four folio volumes. The rarity of this beautiful work and the style of its execution, he says, have placed it among the most remarkable books of the epoch, but its costliness and rarity are such that it would be easy to mention all the libraries which possess it; thus in Paris it is only found complete in that of M. Benjamin Delessert (of which Chenu was then custodian); the two first volumes alone in the public libraries and those of some rich amateurs. A second edition, in quarto, was issued in 1789. "Mr. Gray (J. E.), director of the British Museum, has informed me (Chenu) that a fifth volume of the Universal Conchologist exists, but this volume, unfinished by Martyn, has not been published, and the figured species are not even named, so that it forms merely a collection of plates of no scientific interest."

NOTE.—We shall show that Chenu's first date is erroneous. Whether his statement that volumes 3 and 4 appeared by 1784 has any foundation in fact is doubtful; it is at any rate erroneous. The fifth volume spoken of was doubtless a collection of plates which had been prepared after the issue of volume 4, and were on hand when the decision was made to abandon the publication. Chenu's work is useful, notwithstanding a certain number of misprints, but it would have been still more so

from our standpoint if he had given a careful bibliographic collation of the complete set in the Delessert library.

Englemann, *Bibl. Hist. Nat.*, I, 1846, pp. 182, 462.

(1) Figures of nondescript shells collected in the several voyages to the South Seas. 2 vols., with 80 col. plates. 4°. London, 1764.

(2) *The same*, with 80 original drawings, exquisitely colored. Atlas in folio. London (Bohn). 18£.

(3) The universal conchologist: exhibiting the figure of every known shell, accurately drawn and painted after nature; with a new systematic arrangement (in engl. and french). 4 vols., with 161 plates, comprising 322 figures of shells, colour. by the author. gr. broad in folio. London, 1784.

(4) *The same* (in engl. and french). 2 vols., with 160 colour. pl. of shells in roy. 4°. London (1785 oder), 1789.

(5) Exposé succinct de la nature, de l'origine et des progrès d'un établissement particulier, former pour instruire la jeunesse dans l'art d'expliquer et de peindre des sujets d'histoire naturelle (en Anglais et en Franç.). 4°. London, 1789.

NOTE.—The date to No. 1 is obviously incorrect and was perhaps a misprint for 1784. The consensus of the references is that the work appeared both in folio and quarto, which, being merely a matter of paper, is not unlikely to be the case. The date of No. 3 was probably taken from the first title-page of the bound volume, the others being overlooked. No. 4 is bound, as usual, in two volumes; the second corresponds to volumes 3 and 4 of Martyn and appeared not later than 1789, but perhaps in 1786. No. 5 is the preface to this second half of the work and was probably distributed as an advertisement of the whole publication. On the whole, Englemann's citations give the impression of data obtained at second-hand, with a praiseworthy endeavor to get as much as possible, though unable to verify it in detail.

Carpenter, *P. P.*, *Rep. Brit. Assoc. for 1863*, p. 517, 1864.

Thomas Martyn, *Universal Conchologist*, London, 1784.

NOTE.—Carpenter remarks that those who know this work only from Chenu's reprint can form but a poor idea of the exquisite beauty of the original. He notes that it may be consulted at the British Museum, Royal Society, and the Royal College of Surgeons. He cites fifteen northwest American species and gives references to figures in the Conchylien Cabinet, Vols. X and XI, copied from Martyn.

Davies Sherborn, *Index Anim.*, 1902, p. xxxvii.

I. Martyn, *Thos. (zoologist)*, *Univ. Conchologist*. 4 vols. fo. Lond. With tables, &c.

I. 40 pl. and table. 1784 [not 1769 as often quoted.]

II. 40 pl. and table. 1788.

III. 40 pl. and table. 1789.

IV. 40 pls., table, and 2 pls. of medals. 1792 (?).

[I have seen a unique example of this book, dated 1789, which contains 110 of the 160 plates, bound up with the engraved t. p. and the Dedication to the King. It is uncoloured, shows the plates to be highly finished mezzotints, and has a label on the cover which reads: "About 120 plates | of | figures | of | nondescript shells, | collected in

the Different Voyages to the | South Seas | since the year 1764. | By Thomas Martyn. | Price Two Guineas." |]

II. — Short account of a private establishment. 4°. Lond. 1789.

[This is the "Advert." found in his "Univ. Conch." and contains Born's letters and the plates of medals.]

NOTE.—Considering the stupendous undertaking upon which Mr. Sherborn is engaged, of which the *Index Animalium* is only a preliminary instalment, this is doubtless as full an account as could reasonably be expected. We shall show, however, that the dates probably need some revision. The "unique" collection of uncolored plates is perhaps such a gathering as is responsible for Englemann's entry No. 1, elsewhere alluded to.

National Museum, Sectional Library, Div. Moll., 1905.

Figures | of | non-descript shells, | Collected in the different Voyages to the South Seas | since the year 1764. Published by | Thomas Martyn, | And sold at his House, No. 16, Great Marlborough Street, London. | — | Des | Figures des Coquilles | jusqu'à présent Inconnues, recueillies en | Divers Voyages a la Mer du Sud depuis l'année 1764, | et | données au public, par | Thomas Martyn. | Elles se vendent chez lui au No. 16, Great Marlborough Street, Londres. | MDCCLXXXIX. |

Large quarto, colored frontispiece, not numbered, exhibiting *Turritella terebra* Lam., with the legend $A\Phi P\Theta\Delta ITH$; engraved titlepage; engraved dedication to the King (George III); engraved plate of medals, as follows:

I. Obverse, Pivs. Sextvs. Pont. Max. A. VIII; reverse, Sacra. solem. festo. die. S. Pii. V. Augustæ. vindelic. acta. (around the margin); Pius. VI. P. M. præsentia | sua. auxit | MDCCLXXXII. |

II. Obverse, Pivs. Sextvs. Pont. Max. An. IX; reverse, Sacrarivm. basil. Vaticanæ. | A. fvdamentis. extrvctivm | An. MDCCLXXXIII. |

III. Obverse, Iosephvs II Avgvstvs; reverse, Cvrandis. millitvm. morbis. et. vvlneribvs. Academia medico-chirvrgica institvta. Vienæ. MDCCLXXXV.

IV. Obverse, Ferdinandvs IV et Mar. Carolina; reverse, Firmvm imperii fvdamentvm. Neap. Cl̄ĪC̄C̄LXXVII.

This plate is supplied with the following legend: Aurea Numismata; | Thomæ Martyn, Londinense a Principibus donata in testimonium | favoris et studii quibus novum magnum ejus de Conchis opus acceperunt. | 1788. |

[NOTE.—The date on medal number IV is probably that of the foundation and not of the donation.]

Second plate of medals:

I. Obverse, Carolvs Caroli fil. Philippi Nep. Avgvstvs; reverse, Acclamatio Avgvsta. Matriti. XVI. Kal. Febrvrias. MDCCLXXXVIII.

II. Obverse, Carolvs III, Rex Catholicvs; reverse, Regnorvm regimine svcepto. Matriti. XVI. Kal. Febrvrias. MDCCLXXXVIII.

The legend to this plate is the same as to the last, except the date, which is 1792.

Two engraved explanatory tables. Bastard title: | The | Universal Conchologist | — | Le | Conchyliogiste Universel. |

P. [2]. Introduction [in English, reproduced in French on opposite page, ending page 23, page 24 blank]; page 25, subtitle, "Preface;" p. 26 the preface begins as before, English and French, continuing to page 35. Page 36 begins with testimonial letter from Baron von Born, dated Aug. 18, 1787, announcing the receipt of the work and the dispatch of the medal; page 38 continues the reprint of letters, that of June 15th, 1788, acknowledging the receipt of volume second of the shells and proof sheets of the English entomologist; on the opposite pages the text is reproduced in French; page 40 is blank; then follow plates 1 to 80, the plates illustrating one species each and headed fig. 1, etc., instead of plate 1, etc. The two views usually given of each shell are not separately numbered or lettered; the work is delicate etching on copper, colored by hand in the most perfect manner. There is no legend to any of the plates.

The total sums up 81 colored plates, two plates of medals, 1 engraved title page and two engraved explanatory tables, with 38 pages of printed text in English and French, plus two blank pages. The collection is in an apparently contemporaneous binding of tree calf in one volume, trimmed to 11 by 12 $\frac{7}{8}$ inches.

I have gone into what may seem to be excessive detail in regard to the plates of medals, because they have an important bearing on the earliest date of issue of this rare work, as will shortly appear.

The copy above described appears to be practically identical with copies in the library of the Academy of Natural Sciences at Philadelphia, and of the Zoological Museum at Berlin, the latter being the subject of a paper by E. von Martens.

I have, unfortunately, had no opportunity for consulting the original of the volumes called III and IV by Martyn, and my knowledge of them is confined to the information I have been able to derive from Chenu's reprint and the literature. However, they are of less importance than volumes I and II. In the absence of an explicit statement from the author as to the date when copies of the first 80 plates were distributed, it becomes necessary to rely upon collateral and circumstantial evidence on this point.

We may begin by pointing out that the first and second forty plates both contain illustrations of shells from the northwest coast of America, chiefly King George's Sound, on the southwest side of Vancouver Island, better known as Nootka Sound. The expedition of Cook, by which these shells were collected, was the first to collect or explore

the fauna on this part of the coast. The expedition arrived in Bantry Bay, August, 1780, on its return, and sailed thence for England; so it is evident that these shells could hardly have come into the hands of Martyn for figuring before the autumn of 1780. This fixes a date anterior to which his plates could not have been made, to say nothing of being published. Owing to the manner in which his plates were made, it is obvious that (admitting that they were bound by the purchaser, as usual) variations might be expected in the number found between one pair of covers; and that the extra plates of medals were engraved and added to the others without reference to the time when the first regular plates might have been issued.

It is admitted on all hands that the first forty plates were issued as early as 1784, and the citations in the Portland Catalogue show that eighty plates were published and in use at the time, April, 1786, when that catalogue was issued; moreover, the bibliography included in it gives only the date 1784 for the whole eighty.

Now, Martyn speaks in his preface (p. 34) of his first four medals and states that an engraving of them stands at the head of his preface (also issued separately as an advertisement), and this plate is dated 1788. He also says (p. 26) that at this time it is upwards of seven years since he commenced the design of the work and that a principal inducement was the number of new species he had purchased of several officers "then lately returned from the Pacific Ocean." The expedition returned in the autumn of 1780; seven years and a half would, if deducted from 1788, bring his purchases into the first half of the year 1781. Three years and a half from the time of beginning, Martyn tells us, "upwards of 70 copies of two volumes (80 plates) were finished." This would bring the date of conclusion to 1784, which agrees with the record.

It is highly improbable that any one would proceed in the expensive duplication of copies without to some extent advertising the project, and, in accordance with a custom not yet wholly extinct, it is evident he did so by sending copies to certain dignitaries—the King, the Pope, and various foreign monarchs. The copies were doubtless, in accordance with common sense, of the best he had, perhaps finished by his own hand.

The testimony of the medals shows that he received a medal for two successive years from Pope Sixtus, which we may assume represented his "volumes" I and II, or the first and second forty plates, which therefore were in existence, respectively, in 1782 and 1783.

After rejecting the bulk of the plates finished by 1784 in order to bring the earlier made ones up to the standard of the later drawings, there is a pause in the sequence of the medals, the next being dated 1785, which would correspond well enough to the time needed to bring the series up to standard.

A year later if we accept Maton and Dillwyn's authority, the second eighty plates was ready. Then, in an endeavor to push the work, stimulate sales and avoid losses, a new preface was written, with a plate showing the medals, and testimonials from Baron Born, the celebrated custodian of the Imperial Museum at Vienna, a new title-page was engraved, the whole sent out together, or the preface and medal plate as a circular together; and last of all, in 1792 the subsequent medals were engraved for the second plate, in what seems to have been a vain attempt to make the sales pay the expenses. Martyn's "Psyche," of which the U. S. National Museum possesses the first two numbers, issued in 1797, though the plates are good, is in a much less ambitious and artistic style of coloring, but even that seems to have died of inanition.

I think there is no reason to suppose that any part of the shell plates of the *Universal Conchologist* were delayed until 1792, the date of the second medal plate, which was probably added to sets in stock as an advertisement.

Maton and Rackett, writing in the lifetime of the author, and Dillwyn, only a few years later than Martyn's last publication, both state that there were two volumes, one issued in 1784 and the other in 1786, in all containing 160 (really 161) plates. The latter date may have been taken from an advance copy, but in default of other evidence must be allowed to stand.

A point to which I wish to urge attention is that Martyn and his bibliographers have not always used the word "volume" in the same sense—the work being, as it appears, issued in two batches of eighty plates each, for the most part, and these batches binding conveniently into two volumes. Where Martyn, as in his prospectus, counted forty plates as a volume and the whole as four, his bibliographers have been prone to regard the work, in accordance with the binding, as composed of two volumes only.

I am not aware of any other copies of the *Universal Conchologist* in America than the one I have described and a similar copy in the library of the Academy of Natural Sciences, Philadelphia, but possibly some of those naturalists in Europe who have access to the libraries of Rome, Vienna, Paris, Madrid, or London may be able to furnish at first hand some additions or corrections to the account I have given above.

Martyn, like most of the early writers, was ambitious to propose a system of his own, which he intended to give in full, with diagnoses, at the close of the work. Owing to the cessation of publication with the 160th plate, this scheme was never developed. In the two explanatory tables to the first eighty plates the place in Martyn's system to which each genus belonged is indicated by a lower-case letter following the trivial name in the first column of the table. In the second eighty

plates, according to Chenu's reprint, these indicatory letters are omitted. The plan was given up. The cost of making the work cover all the known species of shells proved prohibitory. The fifth proposed volume, of which Dr. J. E. Gray once possessed some proof plates, was never issued and the system never made public.

The only discussion of Martyn's work as a whole which I have found in the literature is contained in an article by E. von Martens in the *Malakozoologische Blätter* (VII, pp. 141-148, Aug., 1860). This author does not investigate the question of dates or editions and seems not to have grasped the inwardness of the puzzling arrangement of the lettering on the explanatory plates. He comes to the conclusion, since there are no definitions and since Martyn did not accept some of the Linnean genus names, that, therefore, we should reject Martyn's names for genera, while his specific names may stand. This conclusion is obviously not in accordance with present methods of treating nomenclature and can not be accepted. According to our current code of rules for such matters, the names of both categories must stand or fall together.

In the main Martyn accepted the Linnean generic names. A few names proposed by prelinnean authors, especially Rumphius, are preferred to those of the illustrious Swede. Some of the Linnean names are used for different groups from those which they originally covered, and a few names, familiar in prelinnean literature but practically new in a systematic sense, are employed in this work for the first time binomially. The writer took the trouble to arrange the various genera as indicated by the letters above referred to, hoping to get an outline of Martyn's larger grouping, but found the result so unsatisfactory as not to repay the trouble. The only influence the book should have on contemporary nomenclature is connected with a few names for the first time used binomially in its tables. The arrangement of the names in the tables is at the first glance a little puzzling, but a small amount of careful study soon enables one to understand it.^a

The first name used is *Alata* of Klein and other nonbinomial authors (*Strombus* Linneus), and it is applied to *Strombus pacificus* Swainson, the *Alata aratrum* of Martyn, whose specific name, as long ago pointed out by Mörch, will take precedence.

Buccinum Martyn, is a hotch-potch of Linnean whelks and murices, including species of *Chrysodomus*, *Fusus*, *Struthiolaria*, *Latirus*, *Purpura*, *Acanthina*, etc., but a good many of his specific names have been accepted. *Bulla* Martyn, as far as indicated by his first species, equals *Hydatina* (*physis* Linneus), but he would doubtless have included all the Linnean Bullas (= *Bullaria* Rafinesque, 1815).

Clava Martyn as first used contained a *Vertagus* and a *Potamides*. By taking his first species as the type, as I showed in 1892, we are

^a See page 429, *postea*.

enabled to preserve *Cerithium* Bruguière 1789, not Lamarck 1799. The type is *C. asper* Linnæus (+*rugata* Martyn).

Cypræa Martyn is identical with *Cypræa* Linnæus plus *Orula* Bruguière. *Patella* Martyn is identical with the Linnean genus as far as his species indicatè.

Mitra Martyn is identical with *Mitra* Rumphius, usually cited as of Humphrey or Lamarck. As Martyn was the first to use the name binomially, he should be credited with the genus. His first species is *M. tessellata* Martyn, a name which has been generally accepted.

Martyn's next name is *Limax*, but it is not *Limax* of Linnæus (1758). The former is very heterogeneous and seems to have been intended to contain all land snails not operculate and a variety of holostomate marine forms, as well as species of *Terebra* and *Cantharidus*.

In the Museum Calonnianum the name *Lituus* was adopted from Martyn in a generic sense and *Lituus brevis* Martyn cited as a species. But I believe that the whole name was *Limax lituus* var. *brevis* and that, owing to peculiarities of engraving explained elsewhere in this paper, the author referred to was misled. The name *Lituus* as a genus is expunged from a copy of the Museum Calonnianum in my possession, in a hand supposed to be that of Humphrey or one of his clerks, and another name substituted. Mr. Davies Sherborn came to the same conclusion, in the Index Animalium, and placed *Lituus* Martyn among the specific names.

Helix Martyn begins with (*Amphibola*) *crenata* Martyn, whose specific name should be retained. The group otherwise comprises species of *Turbo* of the subgenus *Marmorostoma*, and does not contain a single species of the forms ordinarily known as *Helix*.

Trochus Martyn is equivalent to *Trochus* Linnæus, but *Voluta* Martyn, which follows, contains only species of *Conus* and one coniform *Voluta* in the Linnean sense, while several typical Linnean volutes are referred to *Buccinum* by Martyn.

Cochlea Martyn, contrary to the usage of his nonbinomial fore-runners, is a receptacle for bivalves, like *Venus* and *Cardium*. The only species in volume I is *C. radiata* Martyn, a species of *Meretrix*, which I do not find in the monographs. This being the first binomial use of the name, Geoffroy not coming under that category, it may have to supplant *Meretrix*. In volume II it is used for two species of *Cardium* but in the later volumes *Cardium* is substituted for it, including various *Veneridæ*, *Cardium* (Linnæus), and *Echinochama*.

Haliotis Martyn agrees with the genus as restricted by Lamarck from the Linnean mob.

Purpura Martyn is the first binomial use of the name, used by the ancients colloquially to indicate the muricoid shells from which the Tyrian purple was derived. In harmony with this tradition it is applied by Martyn to a shell which Linnæus would have called *Murex*,

and which has been usually known as *Cerostoma foliatum* Martyn, after Carpenter. This is Martyn's only species of *Purpura* in volumes I and II, and hence the type. In 1798 Bolten adopted the same view, and began his list of *Purpuras* with the group of *Murex trunculus*. There seems to be no doubt that, if any of Martyn's names are valid, *Purpura foliata* must typify the group bearing this ancient designation.^a

Schumacher, in 1817, was the last of the early writers to maintain this view; it is probable that the influence of Lamarck's *Animaux sans Vertèbres* was too powerful to be withstood. The shells usually known as *Purpura* will probably take the name of *Thais* Bolten, 1798, as pointed out by Mörch half a century ago.

Martyn's *Mytilus* includes *Modiolaria*, *Mytilus*, and *Modiolus*. This genus was exactly adopted by Bruguière in his plates of the *Encyclopédie Méthodique* in 1797, and part of the figures appear to have been copied from Martyn's plates.

Volumes III and IV are less interesting; *Nerita* of Martyn is identical with *Nerita* Linnæus. *Tellina* also agrees with the Linnean genus and *Pecten* Martyn is the same as *Pecten* Müller, 1776. In volume III the volutas (which had been included in *Buccinum* in volume II) are transferred to *Voluta*, which here comprises both the cones and volutes: *Purpura* continues to be a muricoid group. All the species of *Spondylus* figured are called *Ostrea*, but no true oyster is figured. *Oliva* is the same as *Oliva* Bruguière, in 1789, though two oliviform cones have been unwisely included.

To sum up: Martyn uses in the Linnean sense the following Linnean genera: *Bulla*, *Patella*, *Trochus*, *Nerita*, *Tellina*.

He uses the following Linnean names, but not, or not wholly, in the Linnean sense: *Buccinum*, *Limax*, *Helix*, *Haliotis*, *Cypræa*, *Voluta*, *Mytilus*, *Cardium*, *Ostrea*.

He adopts from nonbinomial or pre-Linnean authors, and gives a binomial status to:

Alata (Klein, = *Strombus pars* Linnæus): Type, *A. aratrum* Martyn (sole example). *Purpura* (Fabio Colonna, = *Murex pars* Linnæus). Type, *P. foliatum* Martyn (sole example).

He proposes for the first time binomially and in a sense wholly new:

Clava Martyn, 1784. Type, *Murex asper* Linnæus. Adopted by Hwass, 1797. (= *Vertagus* of Authors.) Adopted by Dall, 1892.

Mitra Martyn, 1784. Type, *M. tessellata* Martyn. Adopted by Hwass, 1797, and Lamarck, 1799.

Cochlea Martyn, 1784. Type, *C. radiata* Martyn. Heterogeneous and not accepted by later authors.

Oliva Martyn, 1786. Type, *O. corticata* Martyn. Adopted by Bruguière, 1789; Hwass, 1797; Cuvier, 1798; Lamarck, 1799.

^aSee Proc. Biol. Soc. Wash., XVIII, 1905, p. 189.

Of the above *Mitra* derives from Rumphius, 1705; and *Oliva* probably from *Olea* Argenville, 1757. How he came to apply *Cochlea*, which had always been used for some form of gastropod, to a group of bivalves remains a mystery.

I close this discussion by giving a list of the species figured by Martyn from his Explanatory tables, those of the first 80 plates from our own copy, those of the second eighty from Chenu's reprint, which is unfortunately more or less marred by typographical errors.

These names are not followed by an authority after the specific name, and they are not all due to Martyn. Some of the species are Linnean, and *Cypræa carneola* derives from Rumphius. Moreover, until one is familiar with the tables the arrangement is sometimes puzzling. The columns are narrow, space limited, and the engraver seems to have had an artistic fervor for keeping his masses 'balanced.' Thus, when a number of species of one genus follow one another, in several cases the generic name is not put opposite the first one, but at the middle of the group with dashes or vacancies above and below. Then again the specific names are not ranked to the right of the column uniformly, but part to right and part to left, to give the column balance and avoid ungraceful lines—a true engraver's trick. To one accustomed to regular columns of type in tabular order the arrangement seems at first glance helter-skelter; but in nearly every case the context, or the indicatory letters of the early plates, enable the puzzle to be solved after a little consideration.

There are 190 specific names and eight varietal names (engraved as trinomials quite in modern fashion) on the explanatory tables. Among the one hundred and ninety regular specific names there are seven compound nouns, such as *pellis-erminea* and *crista-galli*; these were not usually at that date hyphenated as we are now accustomed to do. Linnæus used such names, and they have never been regarded as inconsistent with binominal nomenclature. I have hyphenated these names in the list. There is one case in which the generic name has been accidentally omitted, while the English and French trivial names in the column to the left give no clue, as I have not been able to find either of them in any of the lists of early conchological synonyms.

One of Chenu's entries, number 82, has been so mangled that I can make nothing of it. It was probably *Buccinum vexillum*, the figure representing *Voluta vexillum* of modern authors.

The name *subrubicunda* for a *Tellina* is repeated in the references to plates 156 and 159 in Chenu's reprint. The species are different and probably one of these names should be *rubicunda*. Similar errors can be corrected only by reference to an original copy.

Some one in conversation was disposed to question whether Martyn can be regarded as consistently binomial on account of the presence of the eight trinomials, which are not categorically stated to be varieties. But considering that there is at best no room in the column for even the usual abbreviation of the word "variety," and that the practice in each case is perfectly regular, I think there is no merit in this suggestion. Such authorities as Gmelin, Bolten, Dillwyn, Lamarck, Pfeiffer, Shubert and Wagner, Carpenter, and Stearns have accepted Martyn's names without demur, and, indeed, while looking into the matter I have not anywhere in print found the regularity of his nomenclature questioned except by von Martens.

VOLUMES I AND II.

TABLE I.

Fig.	
1.	<i>Alata aratum.</i>
2.	<i>Buccin(um) prismaticum.</i>
3.	<i>aplustre.</i>
4.	<i>spinosum.</i>
5.	<i>nodosum.</i>
6.	<i>fimbriatum.</i>
7.	<i>striatum.</i>
8.	<i>maculosum.</i>
9.	<i>haustrum.</i>
10.	<i>calcar.</i>
11.	<i>Bulla virgata.</i>
12.	<i>Clava rugata.</i>
13.	(<i>Clava</i>) ^a <i>herculea.</i>
14.	<i>Cypræa carneola.</i>
15.	(<i>Cypræa</i>) <i>reticulata.</i>
16.	<i>Patella tramoserica.</i>
17.	(<i>Patella</i>) <i>ænea.</i>
18.	(<i>Patella</i>) <i>calyptra.</i>
19.	<i>Mitra tessellata.</i>
20.	(<i>Mitra</i>) <i>fasciata.</i>
21.	(<i>Mitra</i>) <i>sphæculata.</i>
22.	(<i>Mitra</i>) <i>nexilis.</i>
23.	(<i>Mitra</i>) <i>versicolor.</i>
24.	(<i>Limax</i>) <i>opalus.</i>
25.	<i>Limax fibratus.</i>
26.	(<i>Limax</i>) <i>echinatus.</i>
27.	(<i>Limax</i>) <i>lituus.</i>
28.	(<i>Limax</i>) <i>lituus brevis.</i>
29.	<i>Limax undulatus.</i>
30.	<i>Trochus heliotropium.</i>
31.	<i>inaqualis.</i>

TABLE I—Continued.

Fig.	
32.	<i>Trochus canaliculatus.</i>
33.	<i>annulatus.</i>
34.	<i>costatus.</i>
35.	<i>sulcatus.</i>
36.	<i>punctulatus.</i>
37.	<i>granosus.</i>
38.	<i>bullatus.</i>
39.	(<i>Voluta</i>) <i>cingulum.</i>
40.	<i>Cochlea radiata.</i>

TABLE II.

41.	<i>Buccin(um) striatum.</i>
42.	<i>laciniatum.</i>
43.	<i>liratum.</i>
44.	<i>plicatum.</i>
45.	<i>succinctum.</i>
46.	<i>lima.</i>
47.	<i>saturum.</i>
48.	<i>linea.</i>
49.	<i>maculatum.</i>
50.	<i>calcar-longum.</i>
51.	<i>nodatum.</i>
52.	<i>arobicum.</i>
53.	<i>vermis.</i>
54.	<i>papulosum.</i>
55.	<i>scutulatum.</i>
56.	(<i>Fusus</i> ?) ^b <i>toreuma.</i>
57.	<i>Clava maculata.</i>
58.	(<i>Clava</i>) <i>rubus.</i>
59.	<i>Cypræa aurantium.</i>
60.	(<i>Cypræa</i>) <i>tortilis.</i>

^a Where the Latin name is omitted for any reason, but indicated by the context, the result is here put in parentheses.

^b The shell is a *Fusus*, but the Latin name is omitted. It is called crane or grue in the column for English and French names. *Fusus colus* was named the Great Crane shell by DaCosta in 1775, and I find in his other work, and in the Portland Catalogue, various species of *Fusus* referred to as Crane shells.

VOLUMES I AND II—Continued.

TABLE II—Continued.

- Fig.
 61. *Haliotis iris*.
 62. (*Haliotis pulcherrima*.
 63. (*Haliotis nevosa*.
 64. *Patella personata*.
 65. (*Patella denticulata*.
 66. *Purpura foliata*.
 67¹. *Limax nucleus*.
 67². (*Limax faba*.
 68¹. *Limax coccinea*.
 68². (*Limax purpurata*.
 69. (*Helix crenata*.

TABLE II—Continued.

- Fig.
 70. (*Helix anguis*.
 71. *Helix staminea*.
 72. (*Helix porphyrites*.
 73. (*Helix smaragdus*.
 74. (*Helix smaragdus minor*.
 75. *Trochus tigris*.
 76. *pulligo*.
 77. *Mytilus cor*.
 78. (*Mytilus canaliculus*.
 79. *Cochlea orum*.
 80. (*Cochlea corbis*.

VOLUMES III AND IV. (CHENU.)

N. B.—There are many misprints in this reprint by Chenu, most of which, however, are obvious. He does not indicate the original division into tables, if any.

TABLE III.

- Pl.
 81. *Buccinum ficus*.
 82. *Vexillum broc.* (?)
 83. *Buccinum coronatum*.
 84. *lineatum*.
 85. *tessellatum*.
 86. *nux-odorata*.
 87. *incisum*.
 88. *costatum*.
 89. *scabrum*.
 90. { *turris picta*.
 turris clavata.
 91. { *galea variatum*.
 galea ferrea.
 92. { *ornatum*.
 luteolum.
 93. { *vittatum*.
 varium.
 94. *cælatum*.
 95. { *Bulla circulata*.
 villosa.
 96. *Cypræa subfuscata*.
 97. *Clava tessellata*.
 98. { *nigra*.
 fusca.
 99. *Patella scapula*.
 100. *testudinata*.
 101. *morionis-pileus*.
 102. *umbrella*.
 103. { *Mitra rugata*.
 denticulata.
 104. { *staminea*.
 fasciata.

TABLE III—Continued.

- Pl.
 105. { *Mitra limosa*.
 vermiculosa.
 106. *Nerita nux-castanea*.
 107. *acutipictus*.
 108. *diversicolor*.
 109. { *pellis-erminea*.
 hebræa.
 110. { *stellatus*.
 fasciatus.
 111. { *Oliva corticata*.
 striata.
 112. { *interpuncta*.
 fenestrata.
 113. { *Purpura scabra*.
 senticosa.
 114. { *tubulata*.
 ramosa.
 115. *Limax aureus*.
 116. *tiara*.
 117. *lampas*.
 118. *vittatus*.
 119. *scaber*.
 120. *serpens*.
 121. { *spicatus*.
 fusca.
 122. *flammeus*.
 123. *scutulatus*.
 124. *Trochus petrosus*.
 125. { *Voluta fagina*.
 cosmographia.
 126. *reticulata*.
 127. { *undata*.
 interpuncta.

VOLUMES III AND IV—Continued.

TABLE III—Continued.

Pl.	
128.	<i>Voluta ducis-navalis.</i>
129.	{ <i>scutulata.</i>
	{ <i>zonaria.</i>
130.	{ <i>Cardium bicolor.</i>
	{ <i>nevilis.</i>
131.	{ <i>tigrina.</i>
	{ <i>aquosa.</i>
132.	{ <i>crista-galli.</i>
	{ <i>hystrix.</i>
133.	{ <i>implexa.</i>
	{ <i>purpurea.</i>
134.	{ <i>triangularis.</i>
	{ <i>coccinea.</i>
135.	<i>dentrachalis.</i>
136.	{ <i>nimbata.</i>
	{ <i>marmorata.</i>
137.	{ <i>calata.</i>
	{ <i>arborescens.</i>
138.	{ <i>kussa.</i>
	{ <i>palatum.</i>
139.	{ <i>undatum.</i>
	{ <i>fumosa.</i>
140.	<i>nebulosa.</i>
141.	<i>castrensis.</i>
142.	{ <i>virgulata.</i>
	{ <i>inscripta.</i>

TABLE III—Continued.

Pl.	
143.	<i>Cardium albida.</i>
144.	<i>vininea.</i>
145.	{ <i>acupicta.</i>
	{ <i>maculosa.</i>
146.	<i>columbina.</i>
147.	<i>striata.</i>
148.	<i>gilva.</i>
149.	<i>violacea.</i>
150.	<i>personata.</i>
151.	{ <i>Mytilus fuscus.</i>
	{ <i>viridis.</i>
152.	{ <i>viridis undata.</i>
	{ <i>fuscus undata.</i>
153.	{ <i>Pecten rubidus.</i>
	{ <i>bombycinus.</i>
154.	<i>Ostrea echinata.</i>
155.	<i>spinosa.</i>
156.	{ <i>Tellina cinnamomea.</i>
	{ <i>subrubicunda.</i>
157.	{ <i>alba.</i>
	{ <i>rosea.</i>
158.	<i>barbata.</i>
159.	{ <i>subrubicunda</i> (?).
	{ <i>purpura.</i>
160.	{ <i>adumbrata.</i>
	{ <i>rubescens.</i>

THE MOUNTED SKELETON OF TRICERATOPS PRORSUS.

By CHARLES W. GILMORE,
Preparator, Department of Geology.

Among the vertebrate fossils included in that part of the Marsh collection, now preserved in the United States National Museum, are the remains of several individuals pertaining to the large Cretaceous dinosaur, *Triceratops*. All of this material, which comes from the Laramie division of the Cretaceous, was collected by or under the supervision of the late Mr. J. B. Hatcher in the northeastern part of Converse County, Wyoming, a locality made historic by the researches of this enthusiastic student. From this one region he collected the remains of more than forty individuals of the *Ceratopsia*, a record that has never been equaled.

The skeleton of *Triceratops prorsus* recently placed on exhibition in the court devoted to vertebrate paleontology is the first one of this extinct genus to be mounted. As all of the specimens referred to above were more or less fragmentary, the most complete one (No. 4842^a) [Sk. C, 2082 and 2084]^b was used as a basis for the present restoration. The missing parts were substituted from other individuals of about the same size and belonging to the same species. When suitable bones were not available, as was the case in a few instances, these parts were restored in plaster colored to somewhat resemble the bones, but having the shade differ sufficiently to be easily recognized. Thus we have been able to present a fairly accurate representation of the skeletal structure of this peculiar reptile. Every bone used in the skeleton bears its catalogue number, and all plaster bones are marked with a red +. There is thus preserved a definite record of all the associated material comprising the composite skeleton.

In 1901, under the direction of Mr. F. A. Lucas, the skeleton of this animal was reproduced in papier-maché, and was included in the

^aCatalogue number of the U. S. National Museum.

^bMarsh's numbers.

National Museum exhibit at the Pan-American Exposition^a in Buffalo. Because of the general interest aroused by this reproduction, Dr. George P. Merrill, head curator of geology of the National Museum, conceived the idea that the original specimen would be not only an attractive but an instructive addition to the paleontological division of the Museum, and it has been largely through his enthusiasm and encouragement that the specimen was at last ready for exhibition.

The skeleton as mounted is standing on a base of artificial matrix, calculated to represent the color and texture of the Laramie sandstone in which the remains of these animals are found.

From the tip of the beak to the end of the tail the skeleton as restored is 19 feet 8 inches in length. The skull, which is 6 feet long, equals nearly one-third of this length. At the highest point (the top of the sacrum) it is 8 feet 2 inches above the base. The mounted skeleton presents several features which would otherwise be lost to the observer if seen in the disarticulated condition. The short body cavity, the deep thorax, the massive limbs, and the turtle-like flexure of the anterior extremities are characters only appreciated in the mounted skeleton. The position of the fore limbs in the present mount appears rather remarkable for an animal of such robust proportions, but a study of the articulating surfaces of the several parts precludes an upright mammalian type of limb, as was represented by Marsh in the original restoration. Moreover, a straightened form of leg would so elevate the anterior portion of the body as to have made it a physical impossibility for the animal to reach the ground with its head.

The fore feet are perhaps the most conjectural part of the whole restoration. Mr. Hatcher, after a careful study of all of the fore-foot material known, was unable to arrive at a satisfactory conclusion as to the arrangement of the bones or the number of digits comprising the manus. In constructing these parts we have followed Marsh's drawing, assisted somewhat by fore-foot material kindly loaned by Dr. H. F. Osborn, of the American Museum of Natural History, New York City.

The nasal horn of the skull used in the present skeleton appears to be missing, and on account of the unsatisfactory evidence as to whether the horn is wholly or only partly gone, it was decided not to attempt a restoration at this time. This will account for the absence of one of the important features upon which the name of the animal is based, *Triceratops* meaning three-horn face, in allusion to the presence of the two large horns above the eyes and the third smaller horn on the nose.

^aThis papier restoration has since been exhibited at the expositions in Charleston, South Carolina, and St. Louis, Missouri, and is now in the Portland Exposition in Oregon.

It may be of interest to mention here that Prof. O. C. Marsh used this skeleton (No. 4842), supplemented by other remains now preserved in the collections of the Yale Museum, for the basis of his restoration of *Triceratops prorsus*, published as Plate LXXI in the *Dinosaurs of North America*.^a Plates LXIV–LXVIII in the same work were also largely reproductions of parts of this same individual.

A comparison of the above restoration by Marsh with the mounted skeleton (see Plates I and II) shows several differences in points of structure, due chiefly to the better understanding of these extinct forms. The most striking dissimilarity is in the shortening of the trunk by a reduction of the number of presacral vertebræ. Marsh's error was due to an overestimate of the length of this region, a mistake also made in his restoration of *Brontosaurus* (*Apatasaurus*), as has been shown by Riggs.^b Mr. Hatcher determined, from a well-preserved vertebral column in the Yale Museum, the number of presacrals as twenty-one, this being six less than ascribed to the animal by Marsh.

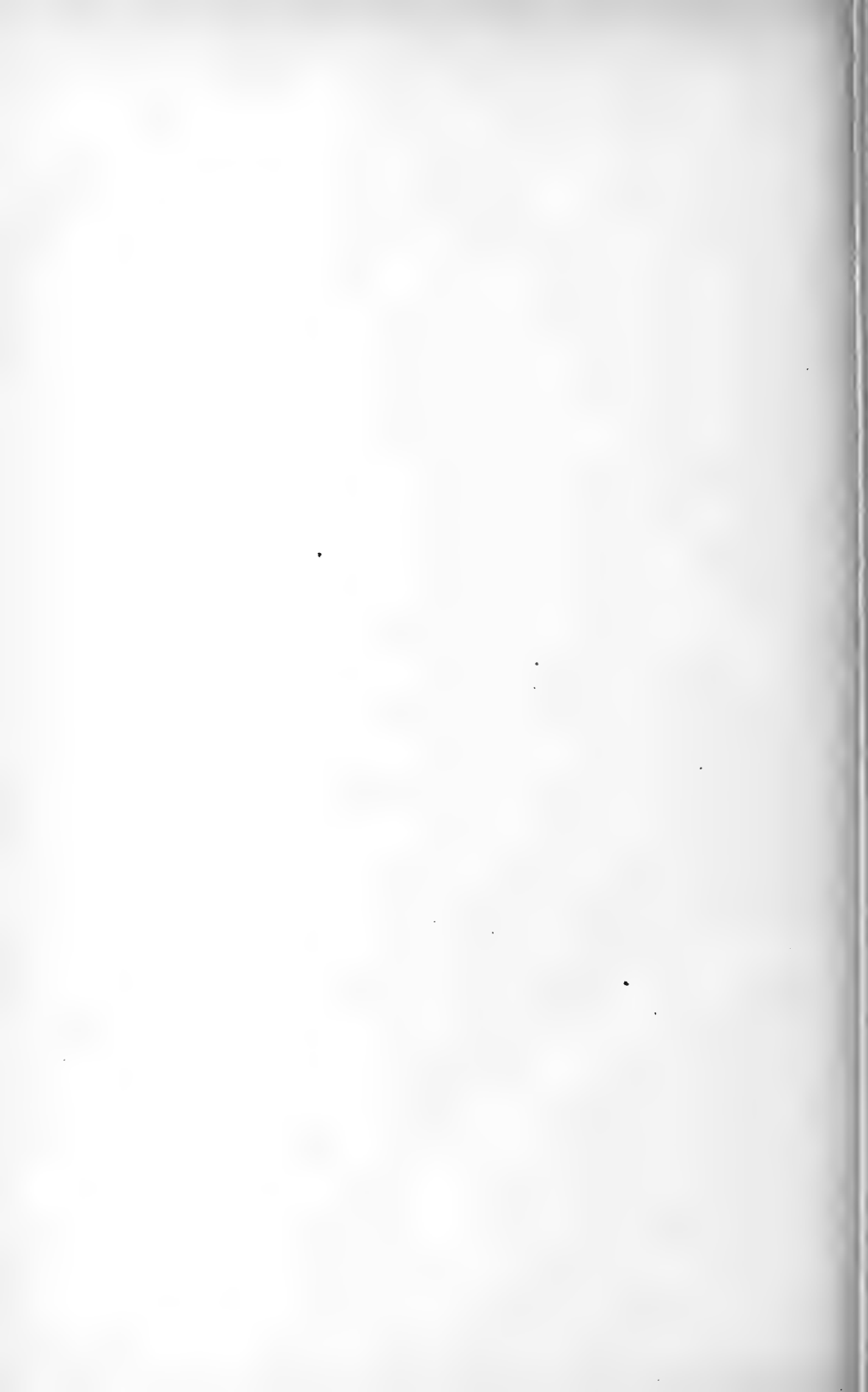
At the time of his death Mr. Hatcher had about completed a monograph on the *Ceratopsia* for the United States Geological Survey. This report was begun some years before by the late Professor Marsh, but after his untimely demise it fell to the lot of the collector of this material to finish it.^c In studying all of the specimens preserved in the museums of this country, Hatcher was able to make several corrections in the structure of this animal, as originally figured by Marsh. These discoveries, as far as known, have been embodied in the present mount, though it must be understood there are many points in the structure yet to be determined.

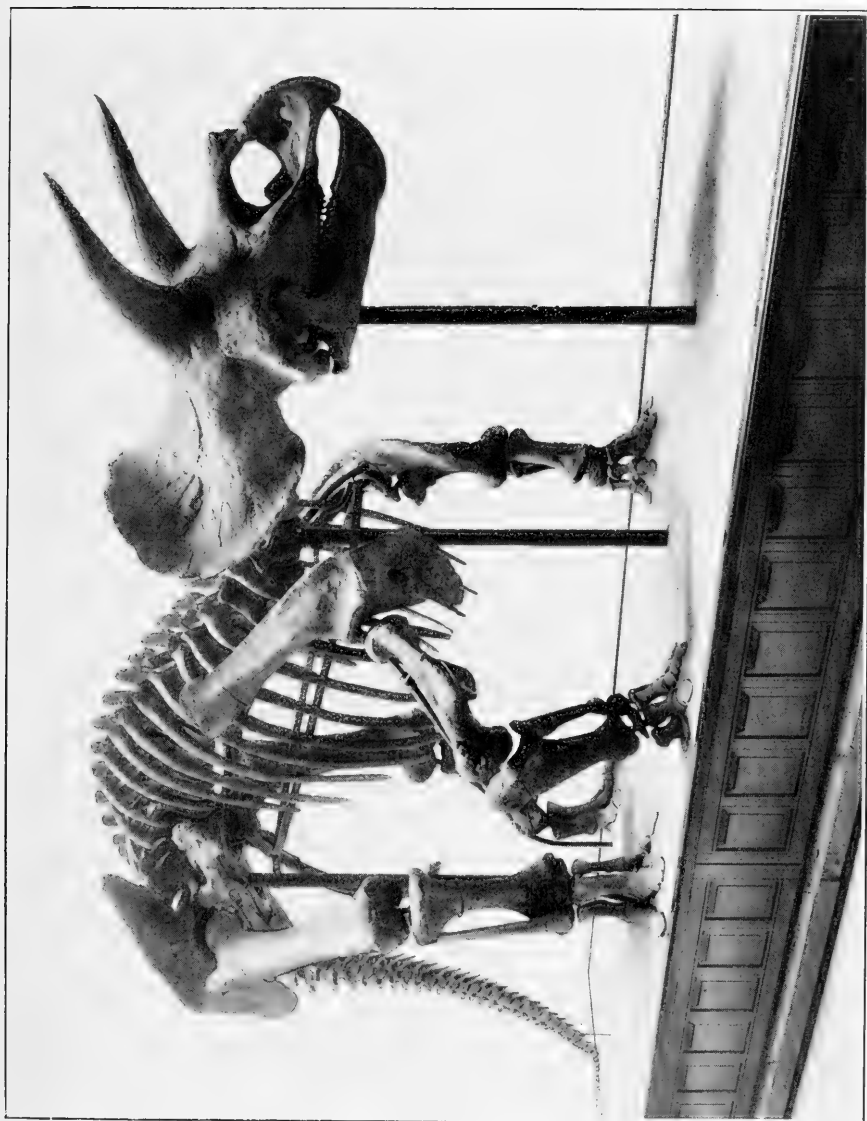
The skeleton was mounted by the present writer, being very ably assisted by Mr. Norman Boss, but the author alone must be held responsible for whatever anatomical inaccuracies may be detected in the reconstruction.

^aIncluded in the Sixteenth Annual Report of the U. S. Geological Survey.

^bScience, n. s., XVII, March 6, 1903.

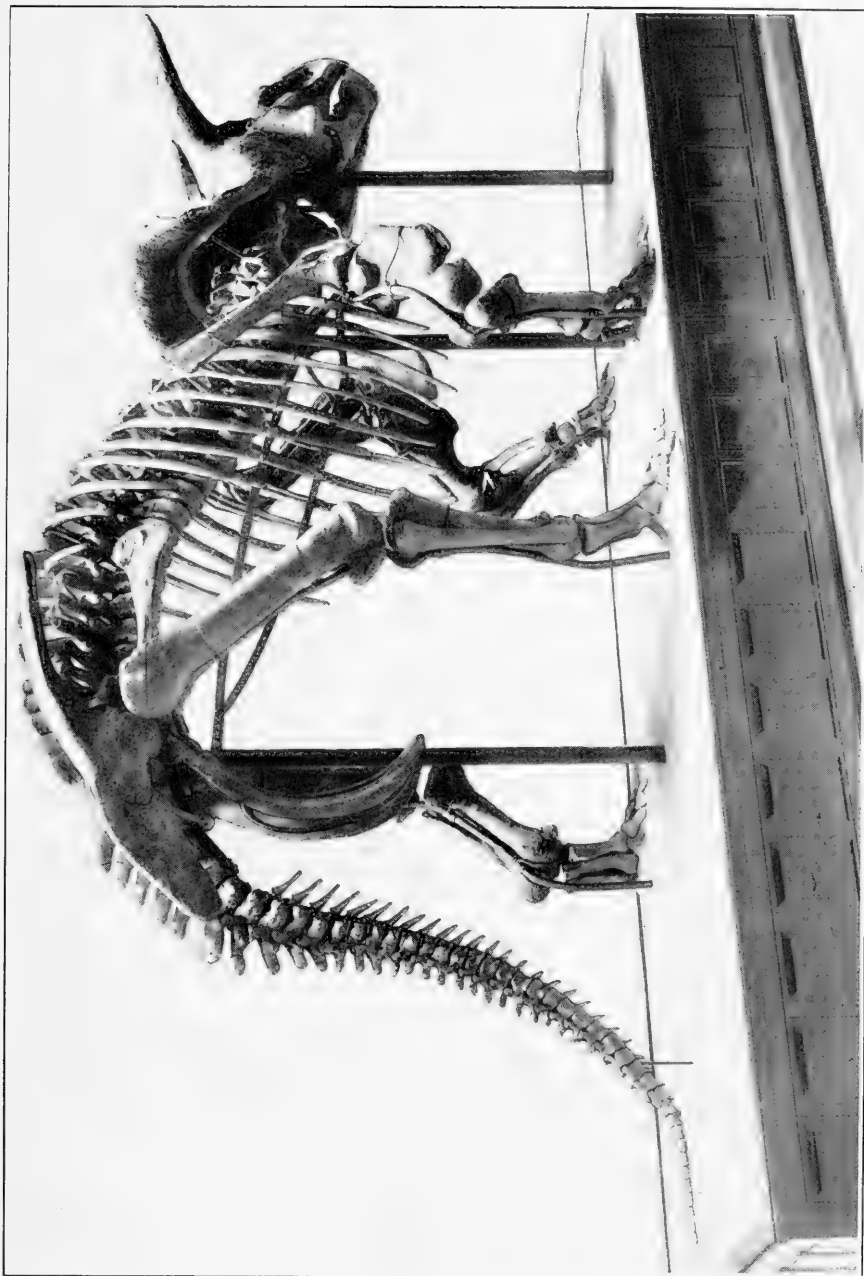
^cMr. Hatcher's manuscript has recently been placed in the hands of Dr. R. S. Lull, of Amherst College, who will attend to its final preparation for publication.





SKELETON OF TRICERATOPS PRORSUS IN THE U. S. NATIONAL MUSEUM.
Three-quarters front view.





SKELETON OF TRICERATOPS PRORSUS IN THE U. S. NATIONAL MUSEUM.
Three-quarters hind view.



FIVE NEW SPECIES OF MEXICAN PLANTS.

By J. N. ROSE,

Associate Curator, Division of Plants.

The new species of *Dahlia* and *Polygonum* described below have flowered recently in the greenhouse of the Department of Agriculture, and, as both are soon to be distributed, it is desirable to have their names published at once. The new species of *Heuchera* is published so that it may appear in a forthcoming number of the North American Flora. The new *Parnassia* is the first species of the genus reported from Mexico. The *Nolina* here described has long been known in our collections under a wrong name.

The type specimen of each of these species is in the United States National Herbarium.

POLIANTHES ELONGATA Rose, sp. nov.

Bulb 12 to 35 mm. in diameter covered with light-brown scales; stem 80 to 90 cm. high, glabrous throughout, reddish at base, glaucous above; basal leaves elongated, oblanceolate, 30 cm. long, 10 to 12 mm. broad near the apex, green, hardly if at all glaucous, flat above, trough-shaped below; stem leaves 6 or 7, much reduced above, becoming bract-like; raceme of 20 or more pairs of flowers; bracts ovate-linear, acuminate, as long as the pedicels, 10 to 15 mm. long, reddish; corolla red, slender, 2 cm. long, bent just above the base almost at right angles with the axis of the ovary; lobes short, rounded, somewhat spreading; stamens attached to the perianth near its base; anthers 6 mm. long, their tips just projecting from the mouth of the perianth; styles finally projecting a short distance beyond the mouth of the perianth.

Collected by Frederick Chisholm from Hacienda de Trinidad, Arcelia, Guerrero, June, 1904 (Section Plant Intro. Dept. Agr., no. 11260).

NOLINA ALTAMIRANOANA Rose, sp. nov.

Trunk 2 to 3 meters high, crowned by a rosette of ascending leaves; leaves 40 to 60 cm. long, 7 cm. broad at insertion, 2 cm. broad a little above the base, thence gradually tapering into a long slender acumination, pale green, the margin serrulate; inflorescence 1 to 2 meters long, forming a much-branched panicle; bracts subtending the flowers very thin and papery; perianth of male flowers with obtuse segments; female flowers with the 3 outer perianth segments persistent, scarious-margined; fruiting pedicles slender, jointed near the base, glabrous; fruit 3-lobed, a little broader than high, the walls very thin, 3-celled, each cell 2-ovuled; seeds nearly globular.

Known only from the Valley of Mexico.

Specimens examined:

Mountains of Guadalupe, M. Bourgeau, 1865-1866 (no. 520).

Slopes of Rio Hondo Canyon, C. G. Pringle, April 22, 1898 (no. 6787). Bluff above Santa Fe, C. G. Pringle, March 23, 1899 (no. 8060, type); J. N. Rose, July 11, 1901 (no. 5388).

Certain specimens of this species were taken by Mr. Baker to be one of his varieties of *B. recurvata* or the equivalent of Lemaire's *B. stricta*, and by Mr. Hemsley to be his *Nolina recurvata*. The habits of these plants, however, are very different indeed. The one here described as new never has a swollen base; the leaves are not very long, are rather stiff, and are not drooping except in age.

PARNASSIA MEXICANA Rose, sp. nov.

Petioles of the basal leaves slender, 2 to 4 cm. long; blades oblong, obtuse, cuneate at base, 4 to 6 cm. long, 1 to 2 cm. broad; scape 30 to 35 cm. high; bract ovate, obtuse, borne below the middle of the scape; sepals oblong, obtuse, 5 to 7-nerved, 7 mm. long; petals oblong, 12 mm. long, 5-nerved, fimbriate towards the base; filaments stout; staminal scale broad, with several long gland-tipped filaments.

Collected by C. H. T. Townsend and C. M. Barber, in the Sierra Madre near Chuichupa, Chihuahua, September 6, 1889 (no. 431).

This species is probably nearest *P. intermedia*, but it has very different leaves.

HEUCHERA ACUTIFOLIA Rose, sp. nov.

Perennial, with strong, erect or ascending rootstock; flowering branches 30 to 50 cm. high, green, slightly hairy below, above somewhat glandular-puberulent; blades of the basal leaves 3 to 6 cm. wide, cordate, somewhat 3 to 5 lobed, the lobes triangular and more or less acute, when young very pubescent on both sides, sharply toothed, the teeth tipped with long hairs; petioles usually much longer than the blades, sometimes 10 cm. long, densely clothed with long spreading

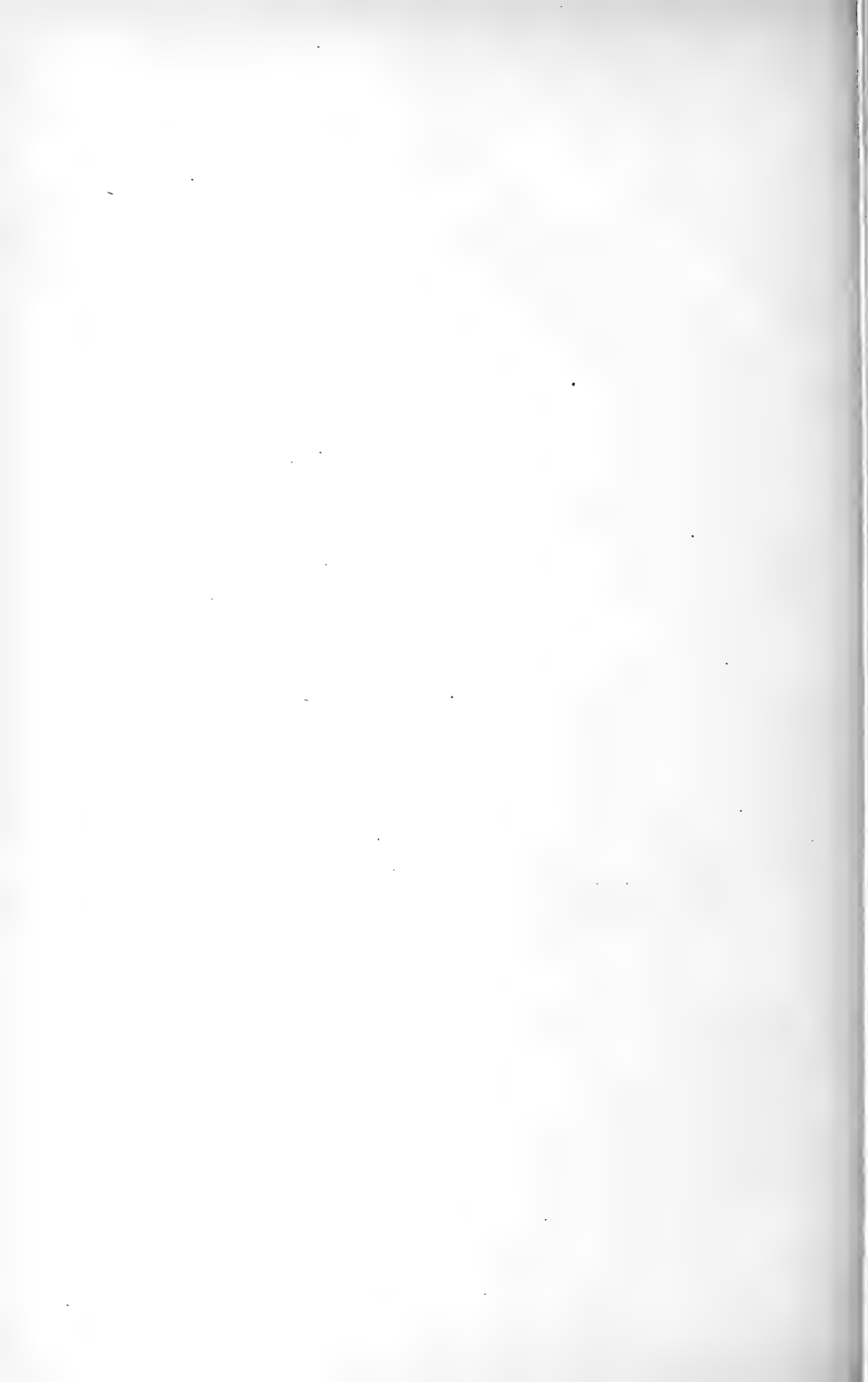
hairs; stipules broad, the free portion obtuse; pedicels bearing sessile glands; hypanthium whitish or rose-colored, the sepals 3 to 4 mm. long; sepals broadly oblong, green at the rounded obtuse tip; petals white, narrowly linear-oblong, about twice as long as the sepals; stamens and styles long-exserted.

Collected by C. G. Pringle at Trinidad, on the border of the States of Puebla and Hidalgo, 1904 (no. 8806).

DAHLIA CHISHOLMI Rose, sp. nov.

Stems 1 to 2 meters high, simple at base, but with long slender branches above; leafy part of stem 5 to 7 cm. long, bearing 4 or 5 pairs of closely set leaves, very hispid, upper part smooth, almost naked, glaucous and purplish; leaves very variable either simple or with 3 to 5 leaflets, very hispid on both sides, like the lower part of the stem, strongly serrate, acute, the terminal leaflet cuneate at base; peduncle 20 to 40 cm. long, slender; flowers few; outer bracts of involucre 5, reflexed, green, ovate; inner bracts 8, erect; rays 8, a deep brick red, oblong, 25 mm. long, spreading at right angles with the disk.

Collected by Frederick Chisholm on Hacienda de Trinidad, near Arcelia, Guerrero, in 1904, and flowered in the greenhouse of the Department of Agriculture in November, 1904 (no. 10573); also sent from Guadalajara (station not mentioned) in 1904, and flowered in May, 1905 (no. 9884, type).



TWO NEW UMBELLIFEROUS PLANTS FROM THE COASTAL PLAIN OF GEORGIA.

By J. N. ROSE,

Associate Curator, Division of Plants.

The two new plants described below were collected by Mr. Roland M. Harper in the course of his extensive study of the flora of Georgia. The new genus, which I have founded upon one of them and have named in Mr. Harper's honor, is a very peculiar one. The fruit much resembles that of *Carum*, while the leaves are reduced to hollow-jointed phyllodia somewhat like those of *Oxyopolis filiformis*, but in other respects the plant is unlike both.

HARPERIA Rose, gen. nov.

Calyx teeth present, small, persistent. Fruit flattened laterally, shortly oblong in outline, rounded at both ends, glabrous; carpels hardly flattened, terete or somewhat angled in section; ribs rather prominent for the size of fruit, equal; stylopodia conical; styles slender. Oil-tubes solitary in the intervals, two on the commissural side. Seeds nearly terete in section.

A smooth aquatic perennial without normal leaves but bearing instead slender terete-jointed phyllodia, with very inconspicuous involucre and involucre bractlets, and white petals.

HARPERIA NODOSA Rose, sp. nov.

Stems erect, branching, fluted, 100 to 120 cm. high; basal and lower stem leaves 20 to 40 cm. long; peduncles slender, 2 to 4 cm. long; rays 5 to 15.

Collected by Roland M. Harper, in shallow exsiccated pond near Ellaville, Schley County, Georgia, July 10, 1902, in fruit (no. 1411, type); and in large shallow pine-barren pond between Pinehurst and Unadilla, Dooly County, May 21, 1904, in flower (no. 2220).

The type sheet is no. 514914 in the U. S. National Herbarium.

Explanation of plate III.—Fig. *a*, plant, natural size; *b*, fruit; *c*, cross section of carpel—*b* and *c* enlarged ten times.

The following note about this plant and its distribution is furnished me by Mr. Harper:

“Both localities are in the costal plain, and within 35 miles of each other, but in quite different surroundings, the former being outside of the pine-barren region (which in Georgia comprises approximately the lower three-fourths of the coastal plain) and the latter just within. The plant is quite abundant at both places, especially at the second, where I first noticed it from a moving train. Suspecting it to be the new genus, I went back the next day and collected it. *Oxyppolis filiformis*, which has about the same adaptations to environment—i. e., terete bladeless leaves—grew with it there, but as it (*Oxyppolis*) flowers about two months later the two plants are not likely to be confused. The new plant must be very local in its distribution, for I have explored every county in the coastal plain of Georgia more or less without meeting with it elsewhere.”

ZIZIA ARENICOLA Rose, sp. nov.

Stems slender, 40 to 60 cm. tall, sparingly branched above; basal leaves long-petioled, once to twice ternate, the two lower first divisions often simple and long-stalked; stem leaves few, similar to the basal but more reduced; leaflets lanceolate to orbicular often rounded at apex, coarsely toothed or crenate; rays few, nearly erect, subequal, 1.5 to 2.5 cm. long; fruit oblong, 4 to 4.5 mm. long.

Collected by Roland M. Harper, at base of sand hills of Ochlocknee Creek near Moultrie, Colquitt County, Georgia, August 22, 1903 (no. 1940, type), and in rather dry sandy woods southeast of Americus, Sumter County, Georgia, June, 1897, and July 8, 1901 (no. 1020).

This species comes nearest *Zizia bebbii* but differs in having more compact umbels, shorter rays, and larger and more elongated as well as differently shaped fruit. Then, too, *Z. bebbii* is principally a mountain species, preferring cool shaded situations, while this one grows in exposed sandy places in the Atlantic coastal plain at an altitude of about 90 meters.

Mr. Harper, who collected this species, agrees with me in considering it distinct, saying in part: “From phytogeographical considerations alone I should think it would be reasonable to separate nos. 1020 and 1940 from *Zizia bebbii*.”



HARPERIA NODOSA ROSE.

FOR EXPLANATION OF PLATE SEE PAGE 441.



DESCRIPTIONS OF THREE MEXICAN VIOLETS.

By J. N. ROSE and H. D. HOUSE,
Of the Division of Plants.

Although the number of known violets in Mexico is comparatively small, the few that have been observed are not well understood. Those who have been studying the Mexican flora have long wished for a revision of the species. In the United States National Herbarium considerable material has been brought together for this purpose, but much more is needed before a satisfactory presentation can be made. It is hoped that much information will be obtained by Mr. Rose in his field work the present season in Mexico. The following notes, however, need not be held for the formal paper which we hope to present at some future time.

VIOLA FLAGELLIFORMIS Hemsley.^a

Excellent specimens of this rare species have recently been collected at Alvarez in the region of San Luis Potosi and distributed by Dr. Edward Palmer (no. 117, 1902). The type of *V. flagelliformis* is Palmer's no. 1033, collected in 1879, "en route from San Luis Potosi to Tampico." *Viola pubescens* Ait.^b is credited to Mexico by Hemsley^c upon the strength of Parry & Palmer's no. 36, collected in the region of San Luis Potosi in 1878, which, however, proves to be identical with the present species.

V. flagelliformis is densely pubescent with spreading hairs; the root leaves are conspicuous by their number, long petioles, and large orbicular-reniform blades. It differs in many important particulars from the northern *V. pubescens*, but is more nearly related to that than to the following new species from the higher altitudes of central Mexico.

VIOLA PAINTERI Rose & House, sp. nov.

Cauliscent; apparently glabrous but more or less puberulent as seen under the lens; stems 2 to 5 from a slender, vertical, perennial

^aHemsley, Biol. Cent. Am. Bot. 1: 49. 1879.

^bAiton, Hort. Kew. 3: 290. 1789.

^cHemsley, l. c. 51.

root, spreading or ascending, 6 to 20 cm. long; stem leaves 3 to 8, ovate, 1.5 to 3.5 cm. long, shallowly cordate, acute, dark green, paler beneath, the margins irregularly but not conspicuously crenate-dentate, petioles longer than the blades, the lower ones longest; root leaves few or none, small, rounded-ovate, crenate; stipules somewhat toothed, ovate or ovate-lanceolate, obtuse or acute, 4.5 to 8 mm. long; pedicels filiform, equaling or exceeding the blades, 3 to 9 cm. long, bibracteolate above the middle with linear bractlets; sepals glabrous, linear-lanceolate, acute, 6 to 7 mm. long, 1 to 1.5 mm. broad at the base, the auricles very short, rounded or subtruncate; petals bright yellow, veined and the two upper strongly tinged with reddish-brown, equal, 8 to 10 mm. long, the odd petal broadly spatulate and truncate or somewhat emarginate, the paired petals obovate-lanceolate, the lateral pair with truncate ends, the upper pair with rounded ends; capsules subglobose-ovoid, 8 to 9 mm. long, slightly exceeding the spreading sepals.

Specimens examined:

Hidalgo: Sierra de Pachuca, Rose & Painter, September 1, 1903 (no. 6731), sheet no. 450286 in the U. S. National Herbarium (type); Rose & Hay, 1901 (no. 5580); Rose & Hough, 1899 (no. 4470).

Mexico: Sierra de las Cruces, under firs, 3,030 meters, C. G. Pringle, 1892 (no. 4193) and 1903 (no. 11373); near Salazar, Rose & Painter, 1903 (nos. 6999 and 8028); near Cima, Rose & Painter, 1903 (no. 7161).

All of the specimens examined are from an altitude of about 3,000 meters or more in the States of Mexico and Hidalgo. The species is usually found under firs.

Explanation of plate IV.—Fig. *a*, plant two-thirds natural size; *b*, petals, natural size.

VIOLA PRINGLEI Rose & House, nom. nov.

V. reptans Robinson, Proc. Am. Acad. 27: 165.1892, not *V. reptans* Presl. in Reichb. Fl. Germ. Excurs. 705.1830–32.

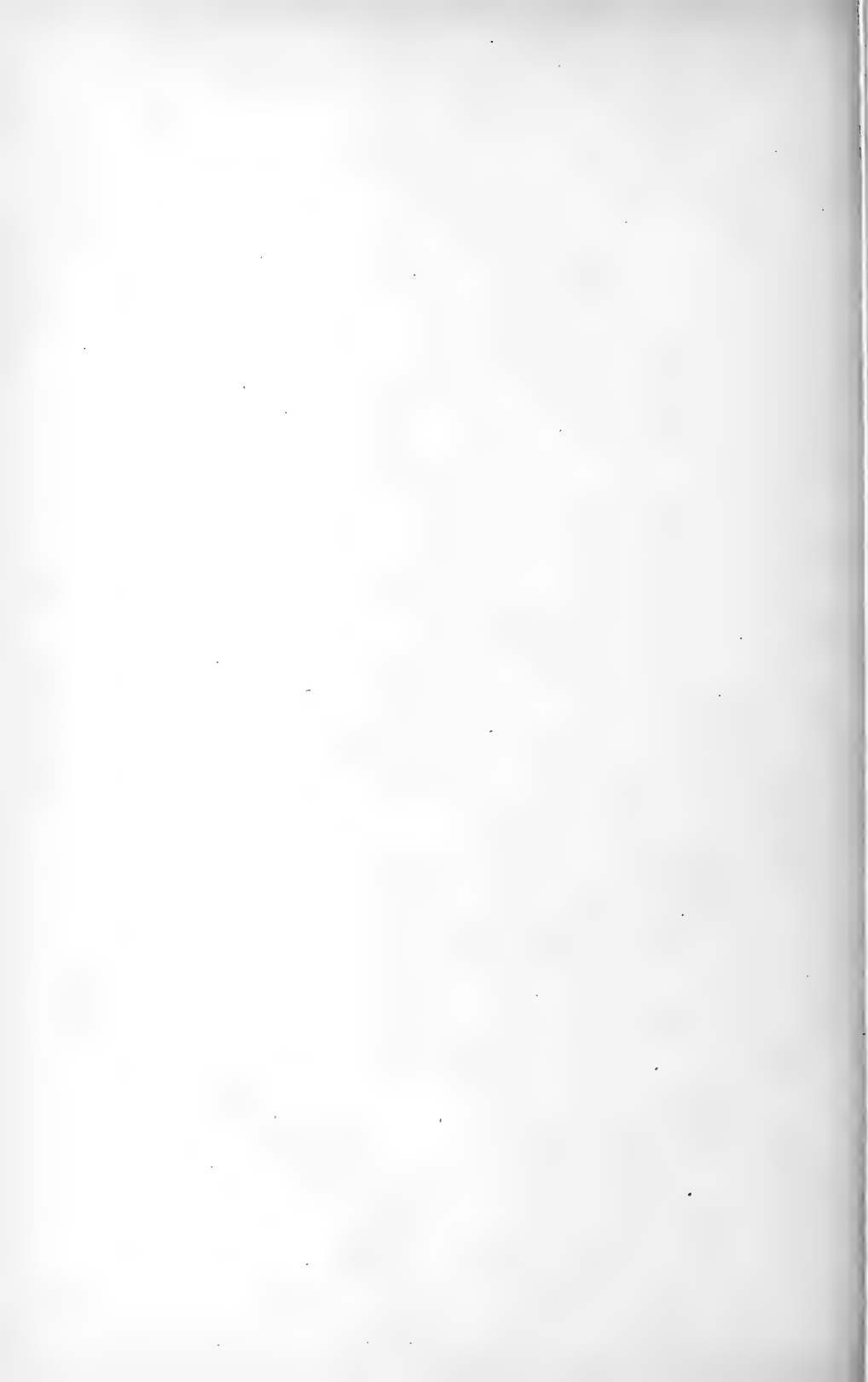
From its stoloniferous character and white flowers, *V. pringlei* is related, but by no means closely, to *V. blanda* Willd.^a of the northern United States and Canada. The type of *V. reptans* Robinson, and therefore of *V. pringlei*, was collected by C. G. Pringle near Patzcuaro, Michoacan, November, 1890 (no. 3591) and is in the Gray Herbarium. Pringle's no. 4148, 1892, from the same locality is identical.

^a Willdenow, Hort. Berol. pl. 24. 1806.



VIOLA PAINTERI ROSE AND HOUSE.

FOR EXPLANATION OF PLATE SEE PAGE 443.



DESCRIPTION OF A NEW SPECIES OF LIVONECA FROM
THE COAST OF PANAMA.

By HARRIET RICHARDSON,

Collaborator, Division of Marine Invertebrates.

The species to be described below was collected in Panama by Dr. W. L. Jones in 1885. The type and only specimen is in the collection of the University of Pennsylvania.

LIVONECA CONVEXA, new species.

Body twice as long as wide, 9 mm.: 18 mm.

Head wider than long, 2 mm. long: 3 mm. wide at the base. The anterior end is 2 mm. wide and is roundly truncate. The posterior margin is widely rounded, with a slight indication of a small median lobe. The eyes are small, round, and vanishing, but still distinct. The first pair of antennae are separated by a distance of $1\frac{1}{2}$ mm. They are composed of seven articles and extend one-fourth the length of the first thoracic segment. The second pair of antennae are composed of nine articles and extend to the middle of the first thoracic segment.

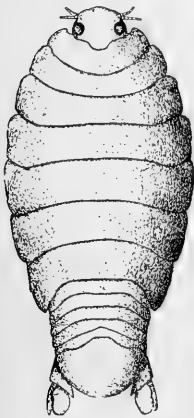


FIG. 1.—LIVONECA CONVEXA. $\times 3$.

The first and fourth thoracic segments are each about $1\frac{1}{2}$ mm. long. The second and third segments are shorter than the first and fourth and are subequal,

each being 1 mm. in length. The last three are about equal in length and are the longest, each being 2 mm. long. The epimera are present on all the segments, with the exception of the first, and extend the full length of the lateral margins.



FIG. 2.—LIVONECA CONVEXA.
SEVENTH LEG. $\times 11\frac{1}{4}$.

All six segments of the abdomen are distinct. The sixth or terminal segment is very convex. There is a depressed line at the base. The posterior margin is rounded. The uropoda extend some distance beyond the extremity of the terminal abdominal segment. The inner distal angle of the peduncle reaches the extremity of the terminal abdominal segment. The branches are about equal in length, each being $1\frac{1}{2}$ mm. long, and extend almost their entire length beyond the terminal segment of the abdomen. The inner branch is wider than the outer branch and rounded posteriorly, while the outer branch is acutely pointed. Both branches in the normal position lie folded under the abdomen.

The seven pairs of legs are prehensile. There is a low rounded carina on the basis of the last four pairs.

Only one specimen, a female, was collected at Panama by Dr. W. L. Jones in 1885. The type is in the University of Pennsylvania.

THE BREEDING HABITS AND THE SEGMENTATION OF THE EGG OF THE PIPEFISH, SIPHOSTOMA FLORIDÆ.

By EUGENE WILLIS GUDGER,
Of the Johns Hopkins University.

INTRODUCTION.

Through the kindness of Prof. W. K. Brooks, it was made possible for me to go to Beaufort, North Carolina, in the summer of 1902, and while there I began, at his suggestion, to collect material for the development of the head skeleton of the pipefish. I soon found young embryos and segmenting eggs, and, wishing to take up the embryology of this fish, I deferred the former work till a later date.

The collecting of further material and the observations on the breeding habits were made at Beaufort during the summers of 1903 and 1904, when, with running sea water at hand, the difficulties necessarily attendant on this work were materially reduced.

This preliminary work was done in the laboratory of the United States Bureau of Fisheries at Beaufort, North Carolina. I am indebted to the Commissioner, Hon. George M. Bowers, for the opportunity to make use of the most excellent facilities at hand there. To the director, Dr. Caswell Grave, I am under obligations for many helpful suggestions.

The further work was done in the biological laboratory of the Johns Hopkins University. To Prof. W. K. Brooks, I am very grateful for the interest taken in my work and for advice and direction. I also wish to thank Dr. E. A. Andrews and Dr. Caswell Grave for advice in overcoming the technical difficulties of my work.

MATERIAL AND METHODS.

Male pipefishes with full pouches were brought into the laboratory, and there the upper end of the pouch was opened with forceps and a few eggs removed and put under the microscope. If these were in a stage wanted, the head of the fish was cut off, the flaps of the pouch slit open with scissors and removed (frequently bringing eggs with them), and the eggs removed by tearing with needles the tissue binding

them down. If the eggs were too young, the fish was put back in running water and examined again later, although it rarely survived a second operation unless the eggs were newly laid and hence came out easily. This is a wasteful process, since many eggs are spoiled in removing them. The obtaining of a series of eggs and embryos of *Siphostoma* is a long, slow, and laborious task and is quite as much the result of chance as of skill and knowledge.

A variety of killing fluids has been used. The oil drops under the germ disk were so blackened by osmic acid and Flemming's fluid that these reagents could not be used. Acetic alcohol, Kleinenberg, sublimate-acetic, picro-acetic, all gave good blastoderms, but the yolks generally went to pieces. Excellent results were obtained with *fresh* Perenyi, 10 per cent, and 20 per cent formalin, and, for later stages, Gilson's and Worcester's fluids. This latter is one of the best fluids for killing teleostean eggs with which I am acquainted. It is composed of saturated sublimate in 10 per cent formalin, 90 parts; glacial acetic, 10 parts. The eggs are left in this from thirty to sixty minutes, washed in water, run up into 70 per cent alcohol, and the excess of sublimate removed with iodine.

The eggs, bound up in masses when taken from the watery killing fluids, were sometimes put into a 10 per cent solution of hypochlorite of sodium or potassium to soften the connective tissue and the transparent egg membranes. Over-exposure to these fluids was very hurtful to the blastoderms, and generally the eggs were run up into 70 per cent alcohol and the shells removed with needles.

The younger blastoderms were picked off the yolks and sectioned, but the protoplasmic processes from the periblast made it impracticable to get the blastoderms in late stages away whole. These eggs were cut whole, and for this purpose those killed in Perenyi's fluid, on account of their soft yolks, were especially good. The yolks of eggs killed in formalin, if kept in alcohol long, tend to become hard, hence they should be gotten into paraffin as quickly as possible.

In order to orient whole eggs in the paraffin it is necessary to stain them. By putting them in full strength borax-carmines for from one to two minutes, the embryonic tissues take the stain before the yolks, and there result red blastoderms on yellow yolks.

The eggs were embedded in paraffin, and sections cut from 5 to 10 microns thick and stained either in Mayer's hæmalum or Heidenhain's iron hæmatoxylin. The former gave such beautiful preparations and was so easy to manage that it was almost exclusively used.

HABITAT.

Pipefishes are found in all the warm and temperate oceans of the world, but are not exclusively marine. Day (1865) reports that *Syngnathus argyrostictus* ascends rivers in Cochin China miles above tide

limits. Again (1878), he finds that *S. spicifer*, *Ichthyocampus carce*, and three species of *Doryichthys* go up the rivers of India. Duncker (1904) reports *Doryichthys boaja* and *fluvialilis* in the rivers of the Malayan Peninsula. Such are some of many records.

In the harbor at Beaufort, in quiet shallow waters where there are muddy bottoms, forests of *Zostera* abound and in them the pipefishes live. By fishing in these with a fine-meshed seine, they may be caught in considerable numbers.

It may be well to note that the color of these fishes changes with the seaweeds among which they may be found. *S. floridæ* among tufts of muddy eelgrass is dark green, but put into aquaria with *Codium* or *Ulva* it becomes bright green. *S. fuscum* is ordinarily of a muddy brown color, but several specimens caught in a tide pool filled with red seaweed were brick red in color, and from this were thought to be a new species.

THE LITERATURE ON THE REPRODUCTION OF THE LOPHOBRANCHS.

The history of the progress of our knowledge of the sexual characters, breeding habits, and embryonic structures of the Lophobranchs has never been fully written. Duméril, in his *Histoire Naturelle des Poissons*, published in 1870, and Smitt, in his revision in 1895 of *A History of Scandinavian Fishes*, give imperfect accounts. In the course of my work on *Siphostoma floridæ*, I have read all the papers to which I have found reference, and it seems of interest and value to put the facts into systematic order. It is a pleasure to acknowledge my indebtedness to Dr. Theodore Gill, of the Smithsonian Institution, who has generously given me of his time and assistance. It is safe to say that had I not had the benefit of his encyclopædic knowledge of fish literature this chapter would never have been written. I wish also to thank Dr. M. L. Raney, assistant librarian Johns Hopkins University, for his kindness in procuring for me the large amount of literature not found in our library.

For our earliest knowledge of the pipefish, the *Belone* of the Greeks and the *Acus* of the Romans, we must go back to Aristotle, in the third century B. C. Aristotle's observations were singularly accurate when one considers the erroneous opinions held by scientists as late as 1830. In Book VI, chapter 12, he says: "That fish which is called *Belone*, at the season of reproduction, bursts asunder, and in this way the ova escape; for this fish has a division beneath the stomach and bowels like the serpents called typhlina. When it has produced its ova it survives and the wound heals up again." Again, in Book VI, chapter 16: "The *Belone* is late in producing its young and many of them are burst by their ova in the act of parturition, for these ova are

not so numerous as they are large." In Book V, chapter 9, he says "*Belone* breeds in winter."

Pliny the Elder, in the first century A. D. in his Natural History, Book IX, chapter 26, simply repeats Aristotle and does not seem to have made any personal observations.

Not so, however, Claudius Aelianus, a Roman of about 200 A. D., whose book On the Nature of Animals was written in Greek. In Book IX, section 60, he writes: "Since the *Sea Belone* are small and have the uterus unfit for holding their offspring, they do not bear the increase of the fetuses within, but burst, and in this way do not produce but throw out their young." He seems, however, to have been acquainted with Aristotle's writings.

For nearly fourteen hundred years no further references are to be found. There is a blank until 1554, when Rondelet published his epoch-making "*De Piscibus Marinis*." In Book VIII he describes the long slit which progresses backward from the anus and in which the eggs are placed. He says *Syngnathus acus* casts the eggs into this slit and keeps them there for some time, and he declares that he saw excluded from the pouch, which is formed on the female, many fetuses with perfect parts. He testifies that, after exclusion of the fetuses, the edges of the slit coalesce. Couch quotes him that three separate deposits of eggs were made in one pouch, and that this took place in early winter, and that these eggs were unequally developed, some nearly ready for hatching and others barely showing eyes and snout—but this has not been verified. Rondelet studied the fishes alive in the water and his observations are very accurate, barring the one error as to the sex of the pouch-bearing fish. This error, however, was perpetuated for nearly three hundred years and was only overthrown after a controversy which lasted from 1831 to 1872.

Conrad Gessner, whose great Thierbuch was published in Zurich in 1563, describes the slit which the female bears, and says that it is filled with eggs in the winter. This is evidently an echo of Rondelet. Aldrovandi (1613), however, is more explicit as to the structure of the pouch, for he says it is made of a fold of skin on each side so that the *belly* can be distended when the fish is pregnant.

Artedi (1738) says that the females are easily known from the males by the large oblong sac, which extends behind the anus to the diminishing part of the tail, and in which many ova are held. He thinks the pipefishes are viviparous, since fetuses are found in the pouch alive. Evidently he deems this pouch an internal structure.

Pallas, in 1767, speaks of finding ova protruding from the longitudinal slit on the belly of the mother, and wonders if the male has a similar sac. He does not understand how the sperms are transferred, wonders if sperms are used to fecundate the eggs, and, since he finds

only females with eggs, doubts if there are any males. In short, he seems to think that the fishes are hermaphrodite.

The works of Willoughby (1786) and Cavolini (1787) are not at hand, but references to them indicate that they added nothing of value to the discoveries of Rondelet.

The first real discovery since the time of Rondelet was made by John Walcott, who in 1784-85 described the "false belly" found under the tail of the egg-bearing fish as being always and only on the male fish. His words deserve quotation. "The male differs from the female in the belly from the vent to the tail fin being much broader and in having, for about two-thirds of its length, two soft flaps which fold together and form a false belly. They breed in summer, the females casting their roe into the false belly of the male. This I can assert from having examined many and having constantly found only in the summer roe in those without a false belly, but never in those with one, and on opening them later in the summer, there has been no roe in those which I have termed female, but only in the false belly of the male." This discovery was buried in Walcott's manuscript History of British Fishes until it was found by Yarrell and made known in his work of the same title published in 1836.

Pallas, in 1831, speculates as to whether the mothers recover from the rupture of the belly in parturition, and, finding only females in the Baltic Sea, is confirmed in his idea that the fishes are hermaphrodite.

In this same year the Swedish naturalist, Eckstroem, writing from information obtained at first hand, at Skärgård, on *Syngnathus acus*, started a controversy which lasted forty years. He declares that the male only possesses the pouch and bears the eggs, that a regular copulation takes place which must be repeated several times, that the pouch becomes filled with a clear white mucus in which the eggs are imbedded and on which the embryos will later be nourished. He writes that in fall and winter the covers of the pouch are depressed and its mucous contents very greatly diminished. He finds that many eggs are lost in transfer, that the females are generally larger than the males, and in number about ten to one of the latter. He concludes that fertilization takes place in the pouch. The work of the writer on the pipefishes of Beaufort confirms Eckstroem in all respects save that the difference in relative numbers of the two sexes is not so great.

Eckstroem explicitly describes how a male *S. acus*, which he had put into a small pool of water, bent its body so that the tail described a curve with the bow downward. This caused the lips of the pouch to open and the young came out and swam about in the water. On being disturbed, the father bent the body as before and the young crept back into the marsupium. This was repeated several times. One is loth to think that so excellent an observer as Eckstroem is in error, but no one has ever seen this phenomenon since. Later writers

quote him, or say "fishermen report." It certainly is not true of the pipefishes of Beaufort. In the dozens of cases in which males were delivered of young in aquaria there, the parent and the young paid no attention to each other, the latter swimming about unconcernedly even when the father was caught with the hand and transferred to another tank.

For *Syngnathus ophidion*, this observer declares that it is the male which carries the eggs glued to the belly, and that if the fish is killed the eggs come away easily in a mass. The latter is true of *Siphostoma floridae*, and Rathke reports the same for the Black Sea species.

Eckstroem was ignorant of Walcott's work and is due the credit for discovering (1) that the male carries the eggs, (2) that there is a copulation several times repeated, (3) that the embryos are nourished while in the pouch—though not as he thought. When published, Eckstroem's results started a great controversy, and he asked his friend Retzius to undertake an independent investigation. This the latter did, by dissection, in 1833, and emphatically declared that Eckstroem was correct, that it is the male fish only which carries the eggs, and he wondered that anybody ever thought otherwise.

In 1836, Yarrell made known Walcott's discovery and confirmed it from his own dissections of *S. acus*. He agrees with Walcott that the young begin to breed when $3\frac{1}{2}$ inches long. The youngest *Siphostoma* with a pouch, which the writer has seen, was $4\frac{1}{2}$ inches long and was laden with eggs. Walcott, Eckstroem, and Yarrell were the first naturalists who broke away from the statements of the older writers and investigated for themselves.

In 1836, Rathke described from dissections the sexual organs of *S. variegatus* from the Black Sea. He excised the ovary of a fish bearing eggs and described round bodies projecting on the inner walls of the tubes. These he thought to be eggs in their follicles. In the various forms of the Lophobranchs, however, the ovary contains a nearly central raphe, from which eggs are budded off in a spiral, and, even in a very young ovary, the eggs are of a yellow-red color. Sections of a testis reveal just such large vesicular cells as he has reported. He described the skin-folds of the pouch as being resorbed at the end of the breeding season, and correctly located the genital opening of both sexes on the hinder edge of the anus.

Rathke's larger and more important paper on the Syngnathids of the Black Sea appeared in the following year (1837), and while his results are different from those of any other observer save Marcusen, they are given with such careful attention to details that one must give them some credence. He reports that the pouch is formed *de novo* each breeding season and at its end is atrophied. He gives sections through the tail to show this and declares that he has seen this change many times. According to his figures, however, the horny dermal

armature grows downward to help form the sides of this pouch (so in *S. floridae*), and it is hard to understand how this can undergo the changes above noted.

Rathke thinks that since the anus in his fishes (*S. variegatus*, *bucculentus*, and *argentatus*) is inclosed in the upper end of the pouch, the eggs glide out of the oviduct and into the pouch accompanied by an albuminous fluid, which on contact with the water cements the lips of the pouch together. He finds that the interior of the pouch is like a "schleimhaut," and that finally, through the great development of the capillaries, it becomes "like an inflamed mucous membrane."

In the ovaries, lying in an albuminous fluid, he finds large white cells, which when put into water become tightly stretched. In some individuals with cells, like the above, free in the lumen of the ovary, he finds not the least trace of a pouch; others have the skin under the tail very much thickened into angles at the outside, and others have broad folds. Hence he concludes that the ripening of the eggs and the formation of the pouch keep pace with one another.

Rathke thinks Eckstroem's discoveries need confirmation, since no other fish in the world possesses such a peculiar testis. He positively affirms that, even if his opponent be correct, the females at the breeding season possess the rudiments of a pouch. His great objections to Eckstroem's discovery are (1) that the fishes have no organs to hold themselves together during the transfer; (2) that he can not conceive how the skin folds can open for the reception of eggs and close again, nor how the brood cavity can become filled with eggs to the very end. My own discoveries make these points clear.

Rathke confirms the Swedish naturalist that, in addition to the yolk, the liquid filling the brood pouch serves as nourishment for the embryos, and thinks that they absorb it through both skin and mouth. His description of the development of the larvæ is very full and correct. Noteworthy is his discovery that at first the entire operculum is free and that it begins to grow fast to the other parts in the antero-ventral region and the closing proceeds posteriorly and dorsally.

In 1838, Valentin (reference from Marcusen not verified) described females bearing pouches, thus confirming Rathke. In the same year Fries, without entering into the controversy, accepted Eckstroem's results. He put a male *Syngnathus lumbriciformis* having eggs, with young outlined (48 to 60 hours old, probably) and cemented onto the belly, into an aquarium, and on the ninth day thereafter some young were hatched and on the next day the others. These lived seven days, and in that time nearly doubled their length.

The adult fish has neither pectorals nor caudal and the rounded tail is prehensile, the body is densely pigmented, and the operculum is bound down to the shoulder girdle, leaving only a small dorsal opening. Fries, however, figures and describes the newly hatched young.

which he says paid no further attention to the father, with large gill openings, with perfectly transparent bodies, and, strangest of all, with both pectorals and caudals, which they used freely. This caudal was a continuous fin-fold, extending from a point anterior to the true dorsal backward around the tail and forward on the ventral surface to the anus; that is, it was a structure identical in appearance and use with the permanent caudal of the eel. This fin-fold is permanent in the Falkland Island genus, *Protocampus*, which Günther thinks may be an embryonic Nerophien. Yarrell reports such a temporary fin-fold in salmon embryos.

In 1840, Krohn, from dissections made the year previous, affirmed that the female *Hippocampus brevirostris* bears the egg-pouch, and that this has lining it a "*schleimhaut gefassreichen*," thus confirming Rathke. In this same year, this later writer described a female *S. æquoreus* (a Nerophien) with eggs on the belly, and says that the ovary (testis?) of this specimen contained ova of various sizes, each with a germinal vesicle. Sections of the testis of *S. floridæ* show large vesicular spermatocytes lining its lumen. Probably these are what Rathke saw.

Von Siebold, desirous of settling this much-controverted question, spent some time at Trieste in 1841, and in the following year published his results. He found that the males of *Syngnathus rynchænus*, *pelagicus*, *typhle*, and *æcus*, and of *Hippocampus longirostris* and *brevirostris*, bear the eggs. He got these results: (1) by "stripping" the fishes and noticing the white fluid containing spermatocytes; (2) by dissecting ovaries and testes and noticing the golden-red eggs shining through the ovarian walls; (3) by making microscopic examinations of the products of 1 and 2. He wondered how Rathke or anyone else could have fallen into such palpable errors.

The French naturalist, Quatrefages, published in this same year (1842) a paper on the embryos of *S. ophidion* in which he described the external structures of young nearly ready to hatch. These eggs are plastered on the belly in the (at this time) much thickened integument of which they make depressions. The shells are filled with an albuminous fluid in which the young move.

Kroyer, whose book is dated 1853, says that the females of *S. typhle* are usually larger than the males, and that their numbers are about ten times as great. He finds that the eggs are arranged in regular rows in the pouch, embedded in mucus, and that this mucus disappears and the lids of the pouch sink in, but are not absorbed after gestation. He conjectures that fertilization takes place at time of transfer.

Vogt and Pappenheim in 1859 say that when the young leave the pouch the yolk sac is completely absorbed, which is not true of the *Siphostomus* at Beaufort. They examined fishes by hundreds and never found a female with or a male without a pouch, which they

describe as cutaneous and outside the dermal exoskeleton. They are the first who describe the slit-like opening at the anterior end of the marsupium. They think that Rathke mistook *Scyphius*, which never forms a pouch, for *S. acus* with this sac in the very first stage of development, and that, by imagination, he supplied the other stages necessary to complete the formation. They do not see how anyone could possibly have mistaken for a male a female with yellow eggs in the ovary.

William Andrews, writing in 1860, says of *S. typhle* that the ova liberated by the female are received into the abdominal pouch of the male, who has power of expanding its flaps and of fastening the ova by a highly viscous secretion. He is the first to observe that the full development of the ova forces open the pouch and liberates the young. He finds *S. æquoreus* individuals clinging side by side to bits of *Zosteræ* by their tails, in which position he thinks that the male is enabled to attach the eggs to his abdomen. He says that *S. typhle* and *acus* swim with their tails, which fact is also noted by Weinland and others.

S. acus, according to Jonathan Couch (1867), has developing ova in the pouch from April to October, and is very retentive of life. *S. floridæ* is very amphibian-like in this latter respect, swimming about and even jumping out of the aquarium some time after its head has been cut off. Couch anticipates Huot in discovering that the air bladder has an anterior thick-walled and posterior thin-walled part. He describes three *adult* specimens of *S. æquoreus* (?) with well-developed dorsal and ventral fin-folds.

In the same year (1867), Lockwood was so fortunate as to see the delivery of young in sea-horses kept in aquaria. One male stood vertically in the water, and pressing the point of his tail against the bottom of the pouch, forced the young out at its mouth. The other, catching its tail under the edge of a winkle shell, pulled the body downward, rubbed the pouch against the shell, and thus expelled the young. This was repeated, with intervals of rest (the fish seemed to tire easily), for six hours. In August, 1902, I had opportunity to see the delivery of the young from the pouch of a male *Hippocampus hudsonius* at Beaufort, but beyond a mere relaxing of the sphincter muscle at the mouth of the sac nothing was remarked.

Lockwood says that at the time the ova are received into the pouch its walls are thick and well lined with fat, but that, when the young are excluded, the walls are only one-sixth as thick. Hence he concludes that this fat serves as food for the young. He adds that the walls again become thick, so that he was several times led to think the pouch gravid when it was not. The writer was similarly deceived once, even so far as to try to open the pouch, whose walls must have been five or six times as thick as those of a breeding pipefish.

To Lafont is due the credit for discovering the mode of transfer of

the eggs. In 1869, in an aquarium where he had a number of *S. aiguille*, he noticed two closely embracing each other. These he separated, and found that the pouch of the male was empty, but that the two folds were gelatinous, vascularized, and soldered throughout their whole length, save for a little opening at the anterior end. The end of the oviduct of the female projected some 6 to 8 mm. beyond the anal region, and this was introduced into the opening of the sac of the male. They were put back into the water and came together time after time, the female repeatedly putting the end of the oviduct into the opening of the pouch. He noted that only at the time of laying was the oviduct so elongated, at other times it was only about 2 mm. long.

The observations I have made substantiate these in all respects. Lafont, however, stated that the eggs, after being laid directly into the pouch, were arranged in four ranks around a central axis; that they went with ease into all parts of the pouch, where they were implanted in the mucus by the aid of fibers which came to anastomose with the central axis, and served to nourish the fetuses. As will be shown later, this is not true of *S. floridæ*. His idea of nourishment in the pouch falls in, however, with the conclusions of Eckstroem, Rathke, Lockwood, and others. This most important and interesting account, of which the above is almost a literal translation, seems to have been lost sight of—Dunéril and Smitt being the only authorities who cite it.

Canestrini, in 1871, hypothesized the manner of transfer, thought that fertilization took place after the deposition of the eggs, and discovered a minute anal fin in the duct made by the anterior end of the pouch in the Lophobranchs. The same was reported by Rathke (1837) in the young of the Black Sea *Syngnathus argentatus*. The anal is very minute in *S. floridæ*, and so hidden that it was unnoticed until I had first found it in the embryos.

Canestrini affirmed that in the young of *Hippocampus brevirostris*, 5.75 mm. long, he found a small but perfectly distinct caudal fin, and refers to a fossil sea-horse (?) *Calamostoma* which had a caudal. Dr. Theodore Gill, however, informs the writer that *Calamostoma* was not a sea-horse at all, nor was it in anywise nearly related. In the young of *H. hudsonius*, 8 mm. long, just hatched from the pouch, there is, projecting beyond the end of the notochord, a blunt, spine-like body which Ryder (1881) figures and describes as a "caudal fold," but which is wholly devoid of fin rays.

Marcusen and his pupil, Passentewitsch, spent several months at Odessa, on the Black Sea, in 1872, reviewing Rathke's observations on the Syngnathids. Their work may be summed up as follows:

(1) In *S. argentatus* and *tenuirostris* both males and females possess caudal pouches.

(2) In hundreds of specimens examined, no female of these species was ever found with eggs in the pouch.

(3) Females of these two species without pouches were found.

(4) Males of *S. bucculentus* have pouches; females never do.

(5) Males only of *Scyphicus teres* possess the pouch.

Thus was the work of Rathke corrected in part, confirmed in part, and wholly cleared up. It may be well to say here that, in hundreds of pipefishes at Beaufort, males without and females with pouches have never been found by the writer.

In 1874, Dufossé described how sea-horses under his observation in 1854 held themselves tightly together by their twisted tails. Observations made in the year of publication showed that, while thus held, the female passes the eggs into the pouch of the male. Dufossé noted that at this time the pouch possesses many thick folds, which secrete a mucus for the nourishment of the young. He seemed to have been wholly ignorant of the work of his compatriot, Lafont.

In May of the same year Fanzago, working in the Zoological Station at Naples, independently made the same discovery. He writes that the sea-horses make use of their prehensile tails as an aid in the act of coition. A few eggs only, perhaps just one, are passed at a time, hence the coition must be repeated. The male apparently is passive and invites the female to introduce the oviduct into the mouth of the pouch. Contact is short and is repeated five or more times in a short while. As will be seen later, in *S. floridæ* there is a sexual embrace in which both animals are active.

A. H. Malm, in his inaugural dissertation at Lund, in 1874, finds no continuous fin-fold in *S. typhle*, but states that the tail is at first protocercal, secondly heterocercal, and finally homocercal by resorption of the end of the notochord. Malm agrees with Eckstroem that the transfer takes place in deep water, and thinks with Kroyer that fertilization takes place after transfer. He found a young male 90 mm. (3.6 inches) long with a pouch, and another 140 mm. (5.6 inches) long with eggs. It is noteworthy that Malm concludes that the "slime" in the pouch is identical with that on the body, but, protected by the pouch, it is not washed away; thus in a sense he anticipates both Huot and Cohn, but he does not think that it is used for food.

At Kiel, Heincke (1880) found that in *S. typhle* the females are larger and more numerous. Both these points hold good for the pipefishes of Beaufort, the proportionate numbers being about three males to every seven females. In *S. typhle* the pouch is not filled at one time, but there may be several transfers extending over several days. This is true of *S. floridæ*, sometimes eggs of three different stages being found in the same pouch. For the period of gestation, Heincke, not knowing the ages of the eggs at the beginning, fixes a minimum period of fourteen days. As will be seen later, the period for *S. floridæ* seems to be ten days. Breeding in *S. typhle* takes place from May to August; the pouch is not resorbed and the young do not go

back into it. The young grow rapidly and become sexually mature in one year.

From observations made in 1881, and prior thereto, Ryder thinks that the eggs of the pipefishes are impregnated at the time of transfer, and that the period of development is from twelve to fourteen days. He avers that in the young of *S. peckianus* (*S. fuscum*) there is developed a low, continuous fin-fold which, however, is never so prominent as in other Teleosts—for example, *Gadus*. However, on the contrary, in 1884, Ryder writes that “there is no continuous fin-fold developed at all in *Siphostoma* or *Hippocampus*.” In his earlier paper (1881), he says that the operculum is from the beginning tied down, leaving only a spiracular-like opening, thus contradicting Rathke (1837).

McMurrich (1883), from work on *S. fuscum* at Beaufort, affirms that the young when born are 10 to 11 mm. long and have the yolk-sac completely absorbed. I have young of this species nearly ready to hatch, but possessed of a very large yolk-sac—one too large to be absorbed before hatching. The hatched young of *S. floridae*, 11.5 mm. long, possess the remnants of the yolk-sac inclosed within the abdominal walls. This is not visible in the whole mounts, but is shown in sections. Two young (species unknown) from the “tow,” one 15 mm. the other 18.5 mm. long, show a considerable remnant of the yolk inside the body walls. They are the largest young in my possession, the next oldest being 90 mm. long, and (males at any rate) sexually mature.

McMurrich further says: “In young stages an anal is present, which, however, does not pass beyond the stage in which fibrillation begins, but aborts, and is entirely wanting in the adult.” Larvæ of this species 5.5 mm. long and with a great yolk-sac (some days away from hatching) possess the rudiments of the anal, and adult examples in my possession have very small but perfectly distinct anals. Kupffer (1868) says of a European *Syngnathus* (species not given) that the young on hatching (whether from shell or pouch is not stated) have a relatively large yolk-sac. Just here it may be of interest to say that the newly hatched young of *H. hudsonius* have no yolk-sac visible in the whole mounts. Sections, however, show a small remnant within the body wall.

Ryder in 1886 speaks of an “exceptionally discontinuous fin-fold” in *Siphostoma*, from which dorsal, caudal, and anal fins are developed, and says that T. H. Bean showed him a *Siphostoma* with a secondary anal fin, which could only be explained by development from such a fin-fold. He figures a homocercal tail for a young pipefish. In the young of *Siphostoma floridae* up to a length of 18.5 mm. (my latest stage) I find what seems to be the remnants of a continuous fin-fold, especially plain on the ventral surface. This shows both in the whole

mounts and sections, and its only explanation seems to be that it is an embryonic structure comparable to what Fries described for *S. lumbriciformis* in 1838. Ehrenbaum and Stradtman (1904, fig. 7) figure a larva of *Clupea sprattus*, 14 to 18 mm. long, having on the ventral surface of the tail from the anus to the caudal a delicate membrane, the counterpart of that found on *S. floridæ*.

One is at a loss, in view of Ryder's acquaintance with the pipefishes and his presumed knowledge of the literature, to understand why he should write in 1887: "The eggs of *Siphostoma* are developed under a pair of integumentary folds * * * developed on the under side of the tail of the *female*." However, in this same paper he refutes McMurrich's error as to the anal fin of *S. fuscum*.

There is nothing in W. A. Smith's (1887) paper that need detain us. He theorizes as to the origin of the elongated jaw apparatus, and his statement that the young retreat into the pouch is seemingly an echo of Eckstroem.

Lilljeborg (1891) thinks that fertilization takes place in *S. typhle* at the time of transfer, since the male genital opening is inside the anterior end of the pouch. He notes that breeding females are very much larger than the males, and thinks that the mucus fastening the eggs to the belly of *Syngnathus* or *Nerophis ophidion* is secreted by both parents at the time the eggs are deposited, and that several transfers are made.

In 1900, Duncker published an interesting and valuable paper on the habits of the Lophobranchs, and though this does not strictly come within the scope of this chapter, still it may be not uninteresting to summarize it here.

Duncker says that the Syngnathidæ swim almost exclusively with the dorsal, but when excited may use the caudal. "In free swimming this (the caudal) is almost useless, and never takes the place of fin action." He describes the 8-shaped figure made by the dorsal, and characterizes the caudal as a "rudder" merely. *S. floridæ* stands vertically in the water and slowly propels itself by its dorsal fin, the pectorals being used merely to maintain its perpendicular position; but when frightened or when it wishes to go from one place to another it throws itself into a horizontal position and glides with great rapidity with sinuous right and left lashings of its tail, at which times its resemblance to a serpent or an eel is very marked. In this connection it is worthy of note that the only other fishes which are known to swim in a vertical position are *Amphioxus* according to Parker and Haswell, *Loricaria* according to Noll, and *Centrisceus* (*Amphisile*) according to Willey. Duncker's observations were probably made on fishes in small aquaria; those on *S. floridæ* were on specimens in an 8-foot tank and in the waters of the harbor at Beaufort.

Duncker quotes Heincke as to the immunity of these fishes from

enemies, and accounts for this on the ground of their having a horny coat of mail. Another explanation for the pipefishes of Beaufort may be found in the very peculiar and offensive odor of their skin and flesh. After handling or dissecting them, one's hands become saturated with a peculiar and pungent odor, very offensive and very hard to get rid of.

Duncker says the Lophobranchs feed on small crustacea and the young of their own species. Eckstroem says they eat the spawn of other fishes. Yarrell, Couch, and others say that their food consists of small crustaceans and larvæ of various kinds. Microscopic examination of the intestinal contents of *S. floridae* shows its food to consist of minute crustacea and reveals the presence in some cases of a very small tapeworm scolex. Specimens of various pipefishes have been kept at Beaufort for weeks in aquaria with running water and have seemed to thrive. In this connection Duncker is the first to explain the curious snapping noise made by these fishes in feeding. All water is expelled from the snout and pharynx by muscular action. Into the vacuum thus formed, water and small crustacea rush with the smacking noise when the mouth is suddenly opened, a bird-like pecking motion of the head accompanying it.

Duncker says that at the breeding season the dorsal part of the pouch becomes much swollen and vascularized; that an epithelial cement binds the lips of the pouch fast (in this he anticipates Huot and also Cohn); that the eggs go through their whole development without ever coming in contact with the water; and, finally, that the embryos are bathed in the blood of the father. In short, he thinks this pouch a physiological uterus-placenta.

The egg laying, he avers, takes place at night or early in the morning, which is true of *S. floridae*; and the filling of the pouch takes place from before backward, from behind forward, or from the middle in both directions, whereas in *S. floridae* it is only from before backward. He further says that the development of the eggs takes place unequally rapidly (true of *S. floridae*), and that at the end of about twenty days the foremost ones slip out, and, finally, that when hatched the young are deserted by their parents. In the Nerophiens, Duncker says that the females have sexual coloration at the breeding season and that they approach the males.

In 1902, Huot published the best and most comprehensive paper ever written on the Lophobranchs. He is ignorant of the work of Lafont, Dufossé, and Fanzago, for he says that the transfer has never been observed. He finds the eggs in the marsupium of a male about equal in number to those in the ovary of a female of the same size. In *S. floridae*, transfer has never been observed to take place in specially paired fishes unless they are of approximately the same size.

Huot figures, in sections through the pouch, the external epidermis

continued into and lining the pouch as an epithelium with many mucus-secreting cells (see Lilljeborg on this subject). This epithelium becomes folded to form “*nids*” for the eggs, with the membranes of which, since there is no *zona radiata*, it comes in very intimate contact, proliferating to fill all interstices between. Into these proliferations blood vessels, forming dense networks, penetrate and form a virtual placenta by means of which the eggs and embryos are provided with oxygen and food through osmosis. The lips of the pouch are cemented by a gummy secretion, which at the same time keeps out the water and enables them to withstand the pressure as the young, surrounded by a clear serum-like fluid, grow and distend the pouch.

In his efforts to determine the time of hatching and the age of the embryos, Huot took fresh-laid eggs from the pouch and put them into running water. This he also did with embryos ranging from early stages up to those with vitellus nearly gone and almost ready to hatch, but in all cases they died within forty-eight hours at the utmost. He also tried in vain to introduce eggs into the pouch. He concludes that the eggs of *S. dumerilii* are fertilized at the time of transfer. His work on the development is confined practically to organogeny in the late larvæ and in the young. He confirms Couch, though ignorant of his work, as to the thick and thin walled parts of the swim bladder. The young fish when hatched has a “notable reserve vitellus inclosed within the skin of the belly.”

Two years later (1904), Ludwig Cohn, working on *S. typhle*, reviewed Huot's work on the marsupium. In thin sections, through the region of the marsupium, under the oil immersion lens, he finds that these eggs have a *zona radiata*, that the skin-epithelium is continued into the whole of the pouch and surrounds the eggs save where these are in contact, and that there are mucus-secreting cells in the outer but none in the inner epithelium. He ascertains that only the connective tissue of the pouch contains blood vessels, and that the perivitelline space is filled with the albuminous fluid which Huot noted.

Cohn finds that the lining epithelial cells have “*spitzen*”-like processes, and that these penetrate the pores of the *zona radiata*. Hence he concludes that food stuff and oxygen are transmitted to the perivitelline space by osmosis through these slender pseudopods, and that in this way the young are nourished. He notes that at the pole of the egg, where the embryo is formed, the epithelium is folded into glands whose mouths abut onto the adjacent *zona radiata*. He finds, however, that there is no definite position for the germinal disk. In *S. floridae*, eggs have been noted with the germinal disk turned downward—that is, toward the folds of skin forming the pouch, and upward—that is, toward the body of the fish.

The work of Cohn, confirms and extends that of Huot, and the two together show that the older writers were correct in their vague ideas

about the young in the pouch receiving nourishment from it. They have definitely established the fact that the marsupium of the *male* of the Lophobranchs, with its epithelial lining and its capillaries and lymph vessels, is a *functional uterus-placenta*.

I have no fishes especially killed for sections through the pouch, and the sections cut are so imperfect that no figures will be given, but on the whole they confirm the results of Huot and Cohn."

THE BREEDING HABITS OF SIPHOSTOMA FLORIDÆ.

The following observations on the breeding habits of *Siphostoma floridæ* were made in the laboratory of the United States Bureau of Fisheries at Beaufort, North Carolina, July 17, 1903. The transfers were witnessed by three other workers. When my account thereof had been written it was submitted to them and their additions were included in this full statement.

A female fish ready to give up eggs may be recognized by her much distended abdomen, due to the presence of ripe eggs in the ovary, but much more by the oviduct protruding—as first noted by Lafont (1871)—and filled with eggs, some of which may escape from time to time. In the nonbreeding male the flaps of skin forming the pouch lie flat in the ventral concavity formed by the outward and downward projecting skin-covered horny plates of mail, but when sexually excited these flaps rise, become thrown into folds and finally unite their edges into the long middle seam, and form the closed pouch.

The act of copulation is preceded by a very curious "*liebesspiel*." The two fishes swim around in the aquarium with their bodies in nearly vertical positions, but with the head and shoulder region sharply bent forward like the letter f. Then they swim slowly past each other, their bodies touching and the male being perhaps more demonstrative. Just before the actual transfer, the male becomes violently excited and demonstrative, shakes his head and anterior body-parts in a corkscrew fashion and with his snout caresses the female on the belly. The female responds to this but does not become so excited. This is repeated several times, the fishes becoming more excited each time they touch each other. Presently, quick as a flash, the sexual embrace takes place and then the fishes separate to begin again in a few minutes.

This embrace consists in the fishes intertwining their bodies like two capital letter S's, the one reversed on the other, thus bringing them face to face. Thus they hold their bodies together while the eggs pass from the oviduct into the pouch. Their bodies touch at three places—in the anterior region, just back of the pectorals; in the pos-

"Since this paper was sent to the printer, I have received from Dr. Theodore Gill a copy of his paper on the Life History of the Sea-Horses (Hippocampids). Through Doctor Gill's kindness I was permitted to read his paper in manuscript and to avail myself of the valuable information contained therein.

terior region, at a point about two-thirds of the way from the anus to the caudal; and at the anal openings. The anal papilla, or the protruding oviduct of the female, is, at the moment of contact of their bodies, thrust into the buttonhole-shaped opening at the anterior end of the marsupium. Some eggs, in number a dozen or more, now pass into the pouch and are presumably fertilized at this moment.

The eggs are now in the anterior end of the pouch and no more can be received until these have been gotten into the posterior end. To bring this about, the male performs some very curious movements. He stands nearly vertically, and, resting his caudal fin and a small part of the tail on the floor of the aquarium, bends backward and forward and twists his body spirally from above downward. This is repeated until the eggs have been moved into the posterior end of the pouch. I do not think that any means other than the above are used to bring

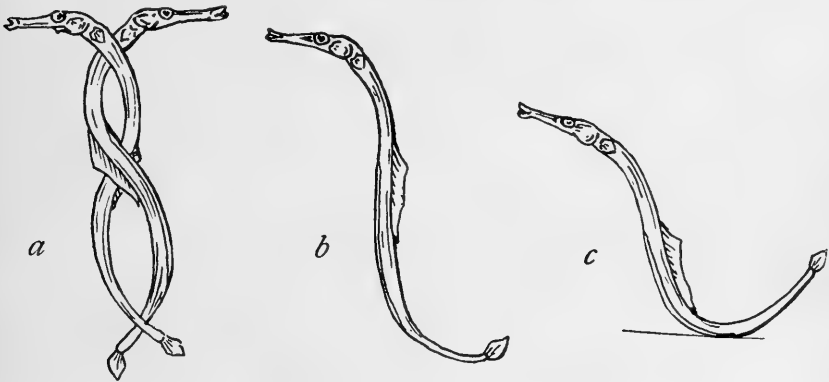


FIG. 1.—TRANSFER OF EGGS IN SIPHOSTOMA (SEMI-DIAGRAMMATIC). *a*, POSITION OF FISHES DURING TRANSFER OF EGGS; *b*, ATTITUDE ASSUMED BY MALE WHILE MOVING THE EGGS BACKWARD IN THE POUCH; *c*, POSITION OF MALE DURING PERIOD OF REST FOLLOWING SEVERAL TRANSFERS.

this about. The pouch in a “pithed” fish was opened and carmine scattered over its inner surface, but there was no evidence of ciliary action. Sections from pieces of both dorsal and ventral parts of the sac killed in formalin, in Flemming’s or in Worcester’s fluids, failed to show cilia.

Then for some time the animals remain quiescent, the male with the back concave, assuming the form of a broad flat capital U. The head is extended in a nearly horizontal direction, and the body in the region of the middle of the tail touches the floor of the aquarium. This position is retained for a time varying from five to ten minutes. Convulsive movements, lasting only for a moment, may take place.

The processes above described are repeated until the pouch is filled. In one pair the first copulation took place at 9.45 o’clock and the second at 10.05 o’clock. In another pair there were four contacts, as follows: 10.15; 10.34; 10.39 o’clock, at which time the eggs were only

halfway down the pouch; and at 11.06 o'clock. These observations were made at night, between 9.45 and 11.30 o'clock, in the brightly lighted laboratory. It is very probable, however, that the transfer may take place at any and all hours of the night. It is to be noted in passing that the fishes seemed entirely unaffected by the lights. No attempt to handle them was made. (See Lafont.)

It does not seem likely that all the eggs are transferred at once—first, because of the curious means used to move them backward in the pouch; in the second place, because males are frequently found with the pouch only half filled; thirdly, because males with eggs of two and three stages and layings are not infrequent. When the above processes have been repeated several times, the animals are seemingly exhausted and remain quiet for at least two and one-half hours (the extent of my observations). On this same night a third small male in an aquarium with three females “courted” two of them alternately, but no transfer was made, though they had protruding oviducts. For coition to take place, it seems necessary that the fishes should be nearly equal in size. A ripe female paired with a male three-fifths her size dropped her eggs into the water.

This curious love play above described is not without parallel in other lower vertebrates. Jordan (1891) records for *Diemictylus* a very interesting series of observations of a courtship, lasting several hours, in which caressings play an important part. Dean (1895), in his account of the spawning of *Lepidosteus*, describes how the males with wide-spread fins swim around the females and caress them with their snouts. Nor is such a courtship unknown among the invertebrates. Racovitza (1894) has described how the male of *Octopus vulgaris* strokes and caresses the female. All these contacts seem to be intended to excite the animals preparatory to the sexual act.

The arrangement of eggs in the pouch depends wholly on the size of the latter. There are always two sets of eggs, one on each side. Each set may consist of one, of two, or of three rows of eggs, and these may be one or two eggs deep. As noted, there may be one, two, or even three deposits of eggs in one pouch. In what order these young would emerge from the pouch I can not say. Ordinarily the seam breaks at points all along its length to set free the young.

The age at time of hatching can be given as ten days (with a variation of eight hours) from one lot only. These young lived four days, feeding on copepods with the same bird-like motion of the head and the same smacking mouth motion found in the parents. In another case, when the father died four days after the transfer, the little fishes were with free tails.

The eggs within twenty-four hours after deposition may easily be extracted from the pouch, coming out in masses, without injuring the father. In two cases, males relieved of eggs received a fresh lot during

the following night. One of these, stripped the second time, died after taking on a third lot. When the eggs have been in the pouch thirty-six or forty-eight hours they become firmly fastened to it both at top and bottom, so that it becomes necessary to kill the fish and then cut away the flaps of skin before one can extract the eggs.

The fishes vary in size. The extremes in egg-bearing males of *S. floridae* I have found to be 4.5 to 8.9 inches, and in females 3 to 8.4 inches. As a general rule, however, the females are somewhat the larger.

THE SEGMENTATION OF THE EGG OF THE PIPEFISH— *SIPHOSTOMA FLORIDÆ*.

I. THE OVARIAN EGG.

The ripe egg of this fish is of fairly good size, having a diameter of about 1 mm. It possesses a thin transparent membrane or shell, which, under the one-twelfth homogeneous oil immersion lens, shows no structure in sections, but in surface views presents, when stained lightly with hæmalum, a notably punctate appearance. These membranes were generally removed after killing the eggs, but, if left on the eggs, do not get very hard and offer no obstruction to embedding and sectioning processes. The eggs are formed in ovaries which, viewed from without, present the ordinary Y-shaped structure common to the Teleosts. These ovaries are two tubular organs situated in the posterior dorsal portion of the body cavity, and are confluent behind to form the short oviduct which opens on the posterior lip of the anal aperture.

However, when one of the ovaries is sectioned, a very interesting structure is revealed. Running lengthwise throughout the whole extent of the ovary is a raphe situated about two-thirds of the distance from one wall. From this eggs are budded off in succession to form a spiral of eggs which surrounds the raphe, the outermost egg being the oldest and largest. As this egg ripens it markedly increases in size and crowds the other eggs together with the raphe closely to one side of the tube. In the ovaries of older and larger fishes, two or three eggs may ripen side by side and then the raphe and its young eggs are very much crowded and contorted. As the eggs become ripe they enormously distend the ovaries both in diameter and length—in length until they frequently extend forward to the region of the stomach. At this time females ready to spawn are noticeable for their greatly distended abdomens.

The young eggs, as first pointed out by Cunningham (1897), have large nuclei with several nucleoli, but in the older ovarian eggs the germinal vesicle is not so apparent. The grown egg, still attached in the ovary, is surrounded by a layer of peripheral oil drops. This same structure persists in the eggs after extrusion, so that the ger-

minimal vesicle can not be seen. The sections I have made of eggs just extruded are so unsatisfactory and so little understood that further investigation is necessary before sections are figured. The older observers, Retzius (1833), Rathke (1836, 1837, 1840), Vogt and Pappenheim (1859), although they studied the ovary with the microscope, missed these peculiar structures. Later observers—Brook, McLeod, Cunningham (1897), and Huot (1902) have made sections but have not gone very far into the structure, nor will I myself do so now, since it is my intention to work up the organization and development of this organ later, the material for this being now on hand.

II. THE METHOD OF DEPOSITION.

This has already been described in the first part of this paper, but it may be well to emphasize the fact that the process is such as to prevent absolutely any contact of the eggs and sperms with the sea water.

III. FERTILIZATION.

The egg of *Siphostoma floridæ*, as before mentioned, possesses a very thin and perfectly transparent shell. This surrounds an egg made up of straw-colored yolk having many orange-red oil globules imbedded in its periphery and these surrounded in turn by a thin pellicle of protoplasm. The colored oil globules render the egg so opaque that I have never been able to find the micropyle. Yet, strange to say, the egg of a related European form, *Syngnathus ophidion*, was the first fish and possibly the first vertebrate egg in which this opening was discovered. Whether this egg is transparent or not I can not say, but in it Doyère (1849) found the micropyle just over the "*disque proligère*," and gave its diameter as $\frac{1}{115}$ mm.

A. Natural fertilization.—Different investigators vary in their conclusions, or, more correctly, their conjectures, as to the time of fertilization. *A priori*, one would expect the fertilization to be effected at the time of transfer. Probably the surest way to determine the time of impregnation would be to take a male immediately after the transfer, cut through the pouch just back of the forward end behind the genital opening, and then examine the eggs in the hinder part of the pouch for spermatozoa. This I had intended to do during each of the past summers. Although there were numerous transfers between fish kept in aquaria each summer, yet I saw the copulation on one night only (in 1903) between two pairs of fish. The seeming necessity for keeping these fish for the early stages of segmentation prevented my sacrificing either to determine this point.

Huot (1902), Lilljeborg (1891), Ryder (1881), and others think that the fertilization takes place at the time of copulation, while A. H. Malm (1874) and Kroyer (1853) think that it follows later, and Ekstroem (1831) believes it takes place while the eggs are in the pouch.

My own belief is that sperms and ova are emitted simultaneously, and while I have no direct evidence, the following facts corroboratory of this conclusion are adduced.

I believe that the extraordinary "*liebesspiel*," or period of sexual excitation of these fishes, described above, is intended to prepare them for the mutual discharge of the sexual products. In the description of the copulation and attendant phenomena, attention has been called to similar sexual excitements in an Amphibian, a Ganoid, and a Cephalopod, which are preparatory to the discharge of sperms as well as of eggs.

But the second set of phenomena is still more strongly corroboratory. On July 6, 1904, two fish were paired and during the night they copulated. They remained in the same aquarium for four days, and then the female was killed, her ovaries excised, cut up, and put into fixing fluids, while some of the ovarian eggs, which fell into the body cavity, were also killed. When these eggs were examined some months later, among them were found two embryos with the blastopore closed. None of the other eggs showed any trace whatever of impregnation. Again two lots of eggs, from a male killed in 1902, were examined two years later and found to be in the eight to sixteen-celled stage. In one lot, however, there was found an embryo with black eyes and free tail, and in the other two eggs in which the blastoderms covered one-half, the embryos one-fourth, of the circumference of the egg. These two lots of eggs had never been removed from the shells, and these shells were still bound together in masses as they came from the pouch. Thus all chance of the eggs having been mixed is eliminated. Again a lot of eggs put up in August, 1904, were found to be in the eight-celled stage, but among them were found two embryos with pectoral fins.

It is true that in opposite ends of the pouch eggs of different layings, and consequently different ages, are found, but never with differences of age more than thirty-six hours, against about three to five days in the above cases. From these facts I can draw but one conclusion—that at the time of coition both spermatozoa and ova are simultaneously extruded, and, as the female withdraws her oviduct from the button-hole-shaped opening of the marsupium, sperms lodge on it and work their way through it into the ovary and there fertilize eggs. This happens only occasionally, but it seems to me a strong proof of my contention as to the time of fertilization. Gill (1905) quotes Nordquist, Ehrenbaum, and Eckstroem that internal impregnation occurs occasionally in non-viviparous fishes, such as the Sculpin. See Gill's interesting article on the Sculpin.

B. Artificial fertilization. This was tried twice by the wet method and once by the dry. The eggs and the torn-up testes were thoroughly mixed in sea water, and after a few minutes were aerated in strained

sea water. From a third lot of eggs the water was carefully drained, and over them was poured sperm from testes which had been torn up in a perfectly dry dish. These were allowed to stand for a few minutes, and were then placed in clean, running sea water. The females were certainly ripe for spawning, and the males were well grown and had not recently borne eggs, so they were presumably fertile. A control experiment was made by putting a batch of this last lot in running sea water without the addition of sperms. In *all* cases the results were the same. At the end of one and one-half hours protoplasm could be seen collecting at the upper pole. After two to three hours it was noticed that the eggs had flattened slightly at the animal pole and that there was being formed a pretty clearly defined round germinal disk, resting on a layer of orange-red oil drops. At the age of four to six hours the germinal disk was at its prime, but neither then nor at any subsequent time was there any trace of segmentation. From this time on the germinal disk gradually lost its sharp outlines, flattened down, and went to pieces. In one lot of eggs at the age of twenty-six hours the germinal disk had gone bad; in another after twenty-five hours it was no longer round, and its edges were irregular and fragmentary; in a third lot less than 10 per cent of the eggs were alive after twenty-three and one-half hours.

These eggs were all alike save that in one lot some, when taken from the ovary, showed a very faint aggregation of protoplasm at the germinal pole, while in another lot the eggs were of unequal size. This latter condition is, however, by no means an uncommon occurrence. Such differences are met with repeatedly in my preserved material, where eggs one-half to two-thirds the size of the normal ones are found. Save that the blastoderms are somewhat smaller, there is nothing unusual about the development of these small eggs. In this connection Brook (1887) says that the eggs of the herring vary in size in the same fish or in fishes of different localities, but thinks that this in no wise affects their development.

From my experiments it seems pretty clear that artificial fertilization is not possible in the pipefish, thus confirming the *a priori* opinion that this would not take place in fishes provided with such extraordinary apparatuses for the deposition and impregnation of the eggs, without their ever coming in contact with the water. Since the eggs will live for some twenty hours in sea water, it must be the spermatozoa which are disastrously affected by it. It has long been known that the sperms of both salt- and fresh-water fishes lose their vitality if left in the water any time and can not impregnate eggs. Quatrefages first ascertained this for the pike and other fresh-water fishes. Hoffmann (1881) says that the sperms of *Scorpena* die quickly in salt-water. Reighard (1893) found that the sperms of the wall-eyed pike die after one minute in the water.

In this connection the experiments of Huot (1902) are very interesting. He took the eggs of *Syngnathus dumerilii* from the marsupium of the male, and, being careful not to break the egg membranes (these eggs were presumably fertilized), put them in clean aerated sea water. This he did also with eggs just before deposition (ovarian eggs), but in no case did development go on more than a few hours. Then he put into the water larvæ old enough to move freely, but these too died within forty-eight hours. I can confirm all his results. I have found that eggs in segmentation will go on dividing for a short while, but that within eighteen hours all die. The discoveries of Huot (1902) and of Cohn (1904), that the pouch and its contents act as a physiological placenta, offer the explanation for the above phenomena. The eggs and embryos, depending on this for oxygen and food, can not exist out of the pouch.

IV. MATURATION.

Unable to fertilize artificially the eggs of *Siphostoma floridae*, and having found it impossible to get from the pouch eggs young enough to show the formation of polar bodies, I am unfortunately not in position to say anything of the process of maturation. For the latest and best work on this phenomenon the reader is referred to Behren's paper (1898).

V. FORMATION OF THE GERM DISK.

In the pipefish, fertilization is not necessary to bring about the formation of the germinal disk. Immersion in water supplies the stimulus as it does in many other fishes. All workers on the Salmonoids, Ziegler (1882), His (1899), and others, so report. Kowalewski (1886) found it true for the goldfish, as did Agassiz and Whitman (1885) for *Ctenolabrus*, though they state that for pelagic eggs the germ disk is generally not formed until after impregnation. Brook (1887) confirms this for the herring, but I have found that the eggs of the sargassum fish, *Pterophryne histrio*, form the germ disk shortly after extrusion. Hertwig says (Handbuch, p. 544): "One can emphatically say for almost all fish eggs that by their transfer into water such a powerful force is brought into play that the concentration of the germ disk results," but that "if they are impregnated first, a more rapid growth and larger size for the germ disk follows."

All writers, notably Brook (1887) and Ryder (1887), describe this formation as brought about by the streaming of the protoplasm to the germinal pole. There are three modes in which this may take place:

(1) By streams from the circumference only. This is the method in most fishes, especially those with pelagic eggs. (See Brook, Ryder, Kingsley and Conn, and many others.)

(2) By streams from the circumference with the help of little "processions" from the interior of the yolk (Ziegler, 1882, and Oelacher, 1872, for the trout).

(3) In all directions from the yolk, the streaming goes to the germinal disk (*Carassius*, Kowalewski, 1886).

As best I can determine, the pipefish comes under class two. This matter will be further referred to in the section dealing with the periblast.

Intimately connected with the foregoing is the collecting of the oil drops underneath the germ disk. In pelagic eggs, generally the oil is in one great globule near the center of the yolk, but in the pipefish many small orange-red globules are imbedded in the periphery of the yolk. When the protoplasm moves up to the animal pole, the oil globules go also and are collected under the germ disk to form the "*disque huileux*" of Lereboullet. This is a phenomenon very common among Teleosts. It has been reported by all workers on the Salmonoids, by Ransom (1867) for the stickleback, Kowalewski (1886) for *Carassius*, and by many others. Rathke (1837) first described these processes in pipefishes from the Black Sea. He says that the germinal disk is formed after the eggs come into water, and that the yellow-red "*fett*" drops which surround the yolk flow up to and spread out under the disk in a layer covering about one-third of its upper surface. Kupffer (1868), describing the egg of a European form, says, "This fat forms a mass of drops of different sizes, which incloses the germ disk underneath and laterally."

The two phenomena described above are intimately connected with and in fact bring about another known as the "clearing of the egg." As the protoplasm is withdrawn from the center and the oil globules from the periphery, the pipefish egg becomes "clear;" that is, the yolk, freed from these substances, becomes homogeneous and translucent. At this stage the egg of *Siphostoma* (Plate V, fig. 1) consists of a button-shaped protoplasmic disk resting on an orange-red layer of oil globules embedded in yolk and covering about one-fourth of the egg, the other three-fourths consisting of clear milky yolk. This "clearing" has been described, essentially as above, by Fusari (1890), Kowalewski (1886), and Agassiz and Whitman (1885), for *Cristiceps*, *Carassius*, and *Otenolabrus*, respectively.

In connection with the above processes, many workers, especially the students of the Salmonoids, have described amœboid movements of the germ disk, and His, in a recent paper (1899), has described such activities in the blastomeres up to the sixteen-celled stage. Ransom (1867) has also figured and described amœboid movements in the yolk of *Gasterosteus*. These movements seem to assist in freeing the yolk of protoplasm and the germinal disk of yolk. The opacity of the egg, which prevented my making out much about the "streaming," operated here against the detection of such movements. Once or twice, however, I thought that I did make them out, and in several hardened germs there were found such protuberances as are figured by Hennequy (1888) in trout germs hardened in chromic acid.

The oil drops in the pipefish egg are not numerous enough to make it float, but from their location they maintain the germ in an upright position. If the eggs are overturned, this buoyancy causes them to rotate quickly in the liquid filling the "breathing chamber" of Ransom. How long this rotation persists I can not say, but certainly until after the closure of the blastopore. Rathke (1837) first noted this in the eggs of Black Sea forms. He also described, as best I can make it out, an albuminous material coagulable in water or in air, which fills the "*zwischenraum*" referred to above. Whatever may be the liquid filling this space in *S. floridæ*, it does not coagulate in water, air, or in any of the fixing fluids I have used. It might be well to add here that this rotation of the egg is not a new phenomenon, having been reported, notably by Ziegler (1882) and His (1899) for the salmon family.

My earliest preservations of eggs with forming germ disk were made four to five hours after the eggs had been placed in the water, hence I am not able to describe by sections its formation. In any case, however, I could not hope to add anything to the classic paper of Agassiz and Whitman on *Ctenolabrus*, or to the more recent memoir of Behrens on the brook trout. Since I preserved eggs at intervals of from five to twenty-five hours, I have sections which illustrate the progressive degeneration of the blastodisc. So far as I know this has never been shown, and hence it may be of interest to give a few figures illustrating this phenomenon.

Fig. 1, Plate V, represents the sharply marked off blastodisc resting on the yolk sphere. It shows the relative diameters of blastodisc, "*disque huileux*," yolk sphere and egg membrane. Fig. 28, Plate VII, is a central section of a germ disk five hours old. The concentration of protoplasm is not yet perfect. As best I can make it out, all has not yet emerged from the central yolk. The dotted line marks off a region where protoplasm and yolk are so closely intermingled as to be indistinguishable. Oellacher (1872, fig. 17) figures and describes a similar germ disk for the trout. Fig. 29, Plate VII, shows a degenerating blastodisc ten hours and twenty minutes old. Such structures are not unfrequent in unfertilized eggs found among others in the four to sixteen celled stages in ages from eight to twelve hours. They are also found in eggs which have been in water about ten hours, and, I am inclined to think, are of fairly regular occurrence in degenerating blastodiscs of unfertilized eggs.

Stricker, in 1865, described what he called an entirely new mode of cell formation in the blastoderm of the brook trout—that is a budding off of cells—which he thought originated in the amœboid activities of the protoplasm. His figures show blastoderms with from one to twenty-three "buds," lumps, or vesicular swellings on the outer surface, and his one section is very inconclusive. Unfortunately, I have no surface views of pipefish eggs showing any of these structures. The following

year Ransom reported a similar bud formation in the unimpregnated eggs of the pike. These "showed a lobulation of the concentrated formative yolk, a sort of irregular asymmetrical cleavage." After twenty-five hours "portions of the discus proligerus were pinched off and appeared as projecting buds." His reported in 1899 that unfertilized salmon and trout eggs after lying in water four weeks formed hillocks on the surface of the germinal disk by the outpushing of fluid drops under the surface membrane. Neither he nor Ransom give figures. Fig. 29, Plate VII, makes clear these various observations.

As to the further fate of the blastodisc in the unimpregnated egg of the pipefish, I can only say that it flattens out and finally disappears. Fig. 30, Plate VII, is a central section through a blastodisc twenty-six and one-half hours old, which shows this flattening. Fig. 31 on the same plate shows a blastodisc taken from a lot of eggs in the invagination stage (forty to forty-eight hours). It is much larger and its lower surface is comparatively free from yolk. The contrast is evidently due to the fact that one egg has been lying free in the sea water, while the other has been under more favorable conditions in the marsupium. Just here it may be of interest to note that while unimpregnated eggs are often met with in the pouch with embryos of all stages, none of them ever "go bad." Ransom (1866) reports that he has kept unfertilized trout eggs alive in running water forty-three days. More recently, His (1899) gives four weeks for the maximum time, and describes the mass of germ-plasm in the unfertilized eggs of the trout and salmon as decreasing day by day and becoming more and more set through with oil drops and yolk spheres. The degenerating blastodiscs of the pipefish in some cases show these inclusions, but in general are quite free from them.

VI. SEGMENTATION.

Before going into a description and discussion of the segmentation of the egg of *Siphostoma floridæ*, I wish to say that this is extraordinarily irregular. These irregularities begin as early as the two-celled stage and become very marked when eight cells are formed. The egg under consideration equals and perhaps exceeds that of the Salmon family in abnormality of cell division. The surface views were nearly all drawn from the hardened germs in 80 per cent alcohol or xylol, the opaque egg making it impossible to draw *in situ* blastoderms beyond the eight-celled stage. The drawings were all made with a Bausch and Lomb microscope (the tube drawn out to 160 mm) and camera lucida. The surface views were all made with the 1-inch eyepiece and the two-thirds objective. Sections were drawn with the 2-inch eyepiece and the one-sixth objective. Plates V and VI have been reduced one-half, the others two-thirds.

ONE-CELLED STAGE.

This is shown in fig. 1, Plate V, from above, and in fig. 32, Plate VII, in section. It is high arched and falls steeply into the outer periblast, from which it is clearly marked off by the circumferential furrow of the authors. This furrow is sometimes so pronounced in the germ disk of the Salmon family that the disk literally overhangs its base. See His (1898, fig. 1) for the trout and (fig. 2) for the salmon. Kupffer (1868), however, says that in a European *Syngnathus* (species not given) the germ disk is not sharply marked off from the periblast, and that this condition holds till the end of the four-celled stage. Most workers on the Salmonoids, Behrens (1898), and, notably, His (1899), represent the unsegmented blastodisc as somewhat sunken in a saucer-shaped depression. In the pipefish, however, the blastodisc, fig. 1, Plate V, underlaid with oil globules, rests on a slightly flattened area at the upper pole. Below it is not sharply marked off from the yolk, but across its base extends a band, about as wide as the periblast to the right, composed of mixed yolk and protoplasm. The section shows several vacuoles to the right, which in the living egg were probably filled with oil. Brook (1887) describes in the herring a blastodisc with yolk base; His (1899), the like in the salmon.

This blastodisc was found in a batch of eggs in the eight to sixteen-celled stage (eight to twelve hours). His (1899) says the germ disk in the Salmon is formed in from one to four days. Hertwig (1903) says that the formation of the germinal disk in the herring takes place in two hours, and in the trout from seven to eight hours. Evidently the time varies with the kind of fish, the temperature, and the purity of the water. In the pipefish I have found it to take place in from four to six hours. It is noteworthy that in none of the blastodiscs which were sectioned have I ever found a nucleus. Brook (1887) could find no nuclei in the herring until after the appearance of the third furrow.

TWO-CELLED STAGE.

As in Teleosts generally, the blastodisc elongates slightly before the appearance of the first furrow, and, as a result, one axis is somewhat longer than the other. This is shown in fig. 2, Plate V, the normal two-celled stage, in which the blastomeres are equal. In fig. 3, however, we have an irregular segmentation, with one cell much larger than the other and with a vacuole in the line of division. Of this type quite a number were found.

Fig. 33, Plate VII, shows a flat two-celled blastoderm, not definitely marked off on the right from the outer periblast, in which the nuclei have divided, the external furrow has formed, but the cell wall has not yet come into existence. In the line of division, the protoplasmic reticulum has formed a very delicate network of dendritic fibrils

arranged transversely to the plane of cleavage. Oellacher (1872, fig. 20) describes and figures a section through two cells of a four-celled stage in the brook trout very like this. He says an indistinct streak made up of faint granulations runs vertically from the external groove toward the base. Henne-guy (1888, fig. 60) gives a figure of a two-celled stage very like fig. 33, Plate VII, and says that the fine line dividing the two cells is bordered on each side by clear protoplasm which is traversed by very fine lines parallel to each other and perpendicular to the median line, and that these fine lines lose themselves in the surrounding protoplasm. His (1898, figs. 7, 8) illustrates and describes similar structures in the syncytium at the base of the trout germ in early stages. In fig. 34 we have a high arched two-celled stage in which the perfectly distinct cell wall is interrupted by a vacuole near its center. This is plainly a derivative of fig. 32, as the preceding is of fig. 28.

Fig. 35 is a section through fig. 3, Plate V, in the plane $a-b$, and shows the split between the two cells dilated into a large vesicle at the bottom. Very frequently the division between the two cells takes the form of a deep cleft with nearly vertical walls, and at the bottom the cleft may or may not dilate to form a small vesicle. These structures are shown in fig. 36, and are oftentimes much larger than figured here. In fig. 37 we see the split being formed by the breaking down of the walls of a series of vesicles placed vertically over one another in the center of the blastoderm. This formation of vesicles in the line of cleavage was, so far as I know, first figured and described, for the trout, by Oellacher in 1872. Balfour (1878, figs. 6, 6a, and 6b, Plate I) illustrates and at some length describes vacuoles in the early furrows of the skate. He describes such a beaded structure, as shown in my fig. 37, and thinks that these vacuoles are more common than supposed, and that they play a considerable part in the segmentation. Brook (1887) describes the like in the herring but gives no figures. Kowalewski (1886, fig. 1, Plate XVII) finds vesicles at the bottom of the furrows in the early stages of the goldfish. Agassiz and Whitman (1889) figure, in surface views of blastoderms of *Otenolabrus*, rows of small vacuoles extending along the whole length of the cleavage planes in the two- and four-celled stages, but do not refer to them in their text. Fusari (1890, figs. 4 and 5, Plate III) shows in both surface views and sections blastoderms with vacuoles. Some of the sections show vacuoles with large dilatations at the bottom like those in figs. 35 and 36, Plate VII.

In the pipefish, the first furrow does not cut through to the yolk. (See figs. 34, 35, 36, and 37.) In this respect it agrees with *Cristiceps* (Fusari, 1890), the Herring (Brook, 1887), *Carassius* (Kowalewski, 1886), the Bass (Wilson, 1891), the Salmon and Trout (His, 1898), but is unlike *Merluccius* (Kingsley and Conn, 1882), *Gadus* (Cunningham,

1886), and others, which do cut all the way through. Agassiz and Whitman (1889) show that in *Otenolabrus* the first furrow may or may not penetrate to the yolk. There is never any such under furrow as the bass and *Otenolabrus* show in the first division.

The eggs are laid at night, as early as 10 o'clock, and probably at any hour thereafter. At any rate, by 7 o'clock the next morning, they are to be found in stages of from two to sixteen cells. Probably from four to six hours elapse before they begin to segment, since it takes this long for the germ disk to form on eggs in water, in comparison with six and one-fourth hours for the herring (Brook, 1887) and twelve to thirteen for the salmon (Hoffmann, 1888).

FOUR-CELLED STAGE.

In fig. 4, Plate V, is shown a normal four-celled blastoderm. The second furrow is horizontal and crosses the first approximately at right angles. Thus there is formed a four-celled symmetrical blastoderm. Sections of this would in no wise differ from those for two-celled stages, save in the plane *a-b*, where the beginnings of the segmentation cavity and the central periblast would be found. Such a section is not at hand, unfortunately.

Fig. 5, Plate V, a more common form, shows slight inequalities in the size of its blastomeres. Such irregularities become more pronounced until they result in reniform blastoderms, as fig. 6, Plate V. Fig. 38, Plate VII, is a nearly horizontal section through the base of such a form as fig. 4, Plate V. The wide separation of two of the cells is an artefact. Of special interest are the segmentation cavity in the center and the remnants of protoplasmic bridges which connected the blastomeres.

EIGHT-CELLED STAGE.

Into the blastoderms of the pipefish egg of this stage, many very great and seemingly irreconcilable irregularities enter and greatly confuse the investigator. These were first noted on living eggs with four and eight cells below, two, three, and four above. Hardened eggs showed the same irregularities. Surface views of a great many of these eight- to sixteen-celled blastoderms were drawn. When a comparison of these drawings was made, they were found to conform to four general types. This was confirmed by an examination of all the eggs of this stage which had been preserved. At the close of this section, there is appended a table showing the relative numbers of these various types.

In fig. 7, Plate V, is shown the normal type of 8-celled teleost blastoderm. It is formed by two furrows nearly parallel to the first and perpendicular to the second plane of segmentation, dividing such a form as fig. 4, Plate V, into eight blastomeres. In this blasto-

derm, and in nearly all others of this and the next stage, a considerable elongation is noticeable.

Figs. 8 and 9, Plate V, show variations of this normal type, which are more common than the type itself, but are easily referable to it. Fig. 39, Plate VII, shows a section of fig. 7, Plate V, in the plane *a-b*. In it one of the two central cells is completely cut out of the protoplasm, while at the inner end of the cell wall, partly cutting out the other cell, there is a little split, which in sections nearer the center will push a short distance to the left, but on the right will extend *clear* across, completely cutting out the cell and extending the segmentation cavity (*s. c.*). The layer of protoplasm with yolk marked *c. p.* is the central periblast, and the cavity above it is the segmentation cavity. This, however, is not the first appearance of either, since a section in the plane *a-b*, in fig. 4, Plate V, would show both. I regret that I have not been able to find such a section. The outer periblast never shows the periblastic ridge figured by Wilson (1891) for *Serranus*. Fig. 40, Plate VII, is through the plane *a-b* of fig. 16, Plate VI, a normal sixteen-celled stage, but it will show the state of things in the plane *c-d* through fig. 7, Plate V. In this part of the normal blastoderm of this stage, the central cells are separated from the periblast by a large segmentation cavity, which extends for a short distance under the peripheral cells, in this case the end cells of fig. 7, Plate V.

Fig. 41, Plate VII, is a section at right angles to the long axis of a blastoderm, similar to fig. 7, Plate V. Here the two cells are separated from each other by a wide segmentation cavity (*s. c.*) roofed over by a protoplasmic bridge (*p. b.*) connecting the two blastomeres. A thin split extends for some distance under each cell and partially separates it from the central periblast (*c. p.*), which is heavily laden with yolk in its lower parts. Such protoplasmic bridges as the one shown here are not uncommon in this and the next stage. All that can be said of their origin is that they have been left behind when the cells were cut out of the protoplasm. Structures similar to this would be found by making sections at right angles to the long axes of figs. 8 and 9, Plate V. So far as I know, these protoplasmic bridges have not been figured and described before.

The periblast never comes away freely from the yolk, but is so obscured with fragments of this latter that it has in all cases been drawn semi-diagrammatically, the general course of the break only being followed.

Fig. 10, Plate V, shows a type of eight-celled blastoderm far more common in the pipefish than the preceding. In this the plane of the third furrow shifts until it becomes equatorial and cuts off four somewhat smaller blastomeres from four underlying larger ones. Henny (1888, fig. 39) shows a blastoderm for the trout which is almost

an exact counterpart of this. A section through this blastoderm in the plane *a-b* reveals the structure shown in fig. 42, Plate VII. Here the two central cells stand above the basal ones, with the line of demarkation on the right especially sharp. The segmentation cavity (*s. c.*) and the central periblast (*c. p.*) are both very much reduced.

Another very common form of eight-celled blastoderm is shown in fig. 11, Plate V. Here there are six cells below and two above. This is evidently a derivative of a six-celled stage frequently met with, in which two of the blastomeres of fig. 4, Plate V, divide by vertical furrows, the other two cells undergoing no change. Later, however, a division of these in a horizontal plane would give the structure shown in fig. 11. Variations of this type are frequently due to the shifting of this pair of upper cells. Such a divergence is shown in fig. 12, Plate V, where these two cells reduced in size are shifted to one end of the longer axis of the blastoderm. Sometimes these two cells are placed parallel to the main axis, but over one of the central lateral cells. Again they may be shifted to lie at right angles to the long axis, over one of the furrows separating two lateral cells, so that one cell is at the edge of the blastoderm. In order not to multiply figures there is given only one drawing of sections from such blastoderms. Fig. 43, Plate VIII, is a section through such a structure as fig. 12, Plate V, in the plane *a-b*. Here one central cell is very much higher than any of the other cells. The other central cell is completely cut out of the protoplasm and is roofed over by a protoplasmic bridge extending from the high cell to the left outer cell. Following the sections to one side of this, the bridge and the cell under it are found to unite. They would thus seem to have been split apart from the same mass of protoplasm.

Another eight-celled blastoderm, quite as common as either of the foregoing, is represented in fig. 13, Plate VI. Here one cell has, by an equatorial furrow, become cut out to lie slightly above the rest. The right side of the structure is normal, save that the third cell is slightly flattened at its inner edge by contact with this central cell. As in the preceding case, so here there may be variations in the position of this high level cell. It may lie in the center, at the edge, or at any intermediate position on the blastoderm. A section through the long axis of fig. 13 would give a structure essentially like that shown in fig. 43, Plate VIII, omitting the protoplasmic bridge. Klein (1872, figs. 5 and 6, Plate XVI) shows essentially the same structures in the same stage of the trout germ, as does Henneguy (1888) in his fig. 38, Plate XVII.

Fig. 14, Plate VI, is a seven-celled form, in which an unmistakable equatorial furrow has cut off three upper from four lower cells, of which three are very large. A view of this blastoderm from below is shown in the next figure (fig. 15). Here the two meridional furrows show quite clearly, but there is no trace of the third or equatorial

furrow. The segmentation cavity (*s. c.*) is so small as to be almost negligible. Unfortunately, no section of this figure can be given, but a comparison between it and fig. 42, Plate VII, will make clear its internal make-up.

These nine figures of the eight-celled stage have been introduced to show (1), the great irregularities which enter into the segmentation of the pipefish egg at this stage; (2), that these all result from the position of the third furrow, which, ordinarily meridional and parallel to the first and perpendicular to the second plane of division, here becomes equatorial, and (3), that the irregularities thus resulting may be reduced to four types, which may be traced to the very close of segmentation. In order to establish definitely these points, a table is given showing the relative numbers of the different kinds of eight-celled blastomeres which have been counted.

From these eight-celled blastomeres are derived four types of segmentation which persist to the close of segmentation. From figs. 7, 8, and 9 come two types of flat structures; from figs. 10, 11, 13 (with the eighth cell in center) there comes a high-arched type of blastoderm, and from figs. 12 and 13 (with the eighth cell at one end) a type of blastoderm thick at one end and tapering toward the other. These structures will be more clearly shown in the next section.

Table showing relative numbers of blastoderms for each type of the eight-celled stage of the Pipefish egg.

[Types referable to figures on Plates V and VI.]

Killed in—	Lot.	VII, VIII, IX.	X.	XI.	XIII.	XIV.
Perenyi	1	0	2	5	2	6
Formalin	2	4	5	6	4	8
Perenyi	3	0	3	1	4	1
Formalin	4	0	7	3	3	0.
Do	5	^a 2	8	3	3	0
Sub-acetic	6	0	0	2	4	0
Perenyi	7	2	1	0	2	0
Total	7	8	26	20	22	15

^aSix-celled.

SIXTEEN-CELLED STAGE.

Intermediate between the eight and sixteen-celled stages are found many blastoderms with twelve, fourteen, and fifteen cells. These are in fact more abundant than blastoderms with exactly sixteen cells.

Figs. 16 and 17, Plate VI, show the two most regular sixteen-celled stages that have been found, yet they do not have the regular structure of the corresponding stages shown for *Serranus* by Wilson (1891) and for *Cristiceps* by Fusari (1890). These blastoderms have been

formed by each of the cells in figs. 7, 8, or 9, Plate V, dividing into two. In fig. 16 all the cells save one are practically on the same level, or at most with a gentle curve across the upper surface. In fig. 17, the blastomeres are arranged more irregularly. Fig. 40, Plate VII, is a section in the plane $a-b$ of a blastoderm like fig. 16, Plate VI, preparing to divide into thirty-two cells. The two central cells will divide to form two surface and two interior cells, while the outer cells will each divide into two cells, both on the surface. This is shown by the position of the centrosomes. The cells form a gentle arch roofing over a considerable segmentation cavity. The planes of segmentation are dilated at their outer ends into vesicles which are covered by thin protoplasmic sheets or bridges. Fig. 44, Plate VIII, is a section of some such structure as fig. 17, Plate VI, in the plane $a-b$. Some blastoderms of this stage have been found in which the four or five cells were not cut off from the basal periblast, but these are too infrequent and too little understood to be reproduced here. Fusari (1890) has figured a section like this for *Cristiceps*, a goby.

In fig. 45, Plate VIII, there is shown a section of a flat-topped abrupt-edged sixteen-celled blastoderm of a type which persists till the preparation for invagination begins. What the appearance of such a blastoderm in surface view would be I can not say; probably it would in no wise differ from fig. 16, Plate VI. The essential difference between figs. 44 and 45, Plate VIII, is the circular groove sharply marking off the outer periblast (*o. p.*) in the latter. Possibly these figures are derivatives of the one-celled stages shown in figs. 28 and 32, Plate VII. In fig. 45, Plate VIII, there is a large segmentation cavity and a yolk-laden periblast. The dotted lines show where the outer periblast has been torn away. Note the large dilatation at the outer end of the right furrow and the protoplasmic bridge covering it. Fig. 18, Plate VI, is a derivative of some such forms as figs. 10, 11, 13, and 14. It is arched, but the crest of the arch is not in the center but to one side, and the cells lie in two if not three levels. A section through an almost identical form (in the plane $a-b$) is shown in fig. 46, Plate VIII, and makes clear its sloping outline and its two excentrically placed high cells. It has one interior cell, which in the next section is clear of the central periblast (*c. p.*), and has probably originated by the horizontal division of an outer cell.

Fig. 19, Plate VI, shows a modification of the arched type. Its sixteen cells are in two layers and the seven upper ones are on an approximate level. Fig. 47, Plate VIII, is a section through some such blastoderm as the above. Its surface slopes gently and the left peripheral cell projects over the outer periblast (*o. p.*). This latter phenomenon will be found frequently in later stages. Vacuoles are found in two of the division walls.

The high-arched type of sixteen-celled blastoderm is shown in

fig. 20, Plate VI. This is probably a descendant of a blastoderm like fig. 14, on the same plate. No description of it is needed, beyond calling attention to the fact that the five upper cells are cut out by an equatorial furrow. This is seen by referring to fig. 21, which is a ventral view of the same blastoderm. Here only five of the vertical planes seen from above cut all the way through. The ones marked *o* in fig. 20 have not reached the base. The small segmentation cavity (*s. c.*) recalls that of fig. 15. Let us compare with this the next, fig. 22, which is a view from below of a similar high-piled sixteen-celled stage. Here there are nine basal cells resting on the yolk, six in the second tier, and a central one forming the keystone of the arch, the whole inclosing a spacious segmentation cavity. Barring the fact that the segmentation cavity (*s. c.*) extends under the marginal cells, fig. 48, Plate VIII, may be given as a section through fig. 22 in any vertical plane passing through the keystone cell. The central cell has not yet completely cut itself off from its neighbor to the right, and the cell to the left has a resting nucleus curiously elongated.

There have now been figured and described in surface views and sections, such sixteen-celled structures as may be considered typical for the pipefish. Of these, two are sufficiently like the usual teleost form as to be called normal, but a great majority, fully 90 per cent of those studied, are like figs. 18, 19, and 20, Plate VI. In this connection Hertwig's statement (Handbuch, pp. 645-646), with reference to the fourth segmentation and formation of the sixteen-celled stage, is of interest. He says: "The end result is everywhere the same, a 'checkerboard-like' arrangement of sixteen blastomeres, four in the center, and a circle of twelve marginal cells." How untrue this is for the pipefish, a glance at the figures given and at the table shown on page 478, will demonstrate.

EQUATORIAL PLANE OF SEGMENTATION.

All investigators are agreed as to the homology between the first and second furrows in teleost and amphibian eggs, but whether or not the third furrows correspond is a very debated question.

Hoffmann (1881) figures and describes in pelagic fish eggs the first segmentation as equatorial, dividing germ from periblast; but later (1888), he acknowledges his error and declares that in *Salmo* the third furrow is equatorial. Ziegler says that the third furrow in the salmon and trout is equatorial and divides eight upper from eight lower cells, the latter not being as yet marked off from a periblast. Rauber (1883) made a careful study of the subject based on the well-known fact that the fourth amphibian furrow in a great many cases is not truly meridional but avoids the pole and forms many structures like figs. 7 and 9, Plate V. He concludes that the first *equatorial* furrow of the frog has been lost in the Teleost, and homologizes the third

teleostean with the fourth (pole-avoiding, meridional) furrow of the frog. For this interpretation of Rauber see Wilson (1891, pp. 214–215).

Agassiz and Whitman (1885) think that the amphibian equatorial furrow has become vertical in the Teleost, and that the horizontal division of the four central cells of the sixteen-celled stage into four outer and four inner lying cells is the first equatorial segmentation. With this latter statement Kopsch (1901), from his work on *Belone*, is in full accord. Brook (1887) describes, from sections of herring eggs (Plate XIII, fig. 9), an equatorial segmentation separating the four blastomeres from the periblast. List (1887, Plate XXXI, figs. 4 and 5) finds the second furrow in *Orenilabrus* to be equatorial, and says that Kupffer found the same in the herring. In *Cristiceps*, Fusari (1890, figs. 4 and 5, Plates I and III) finds that in the sixteen-celled stage, all the cells are united at the base, but the next division sets sixteen central cells free from the yolk and from sixteen peripheral cells. This he calls the equatorial division. Wilson (1891, p. 215) agrees with Rauber (see above). Samassa (1896), in the segmentation of Salmonoids, finds as a rule that an equatorial division follows the eight-celled stage, although it sometimes comes earlier.

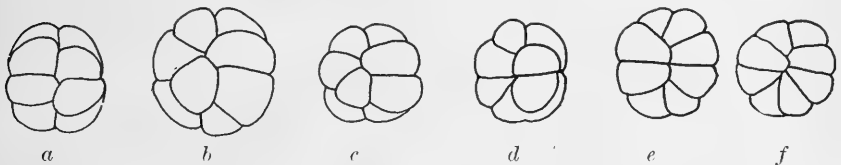


FIG. 2.—EGGS OF THE TRITONS IN THE EIGHT-CELLED STAGE. (AFTER GRÖNRÖSS.)

An equatorial segmentation has been pointed out in certain eight-celled blastoderms of *Siphostoma*, and this gives them a very decided resemblance to the upper surface of dividing amphibian eggs. Grönross (1890) (see Hertwig's Handbuch) gives a series of figures for the eggs of Tritons to which the figures above noted show very striking resemblances. The Tritons have eggs with relatively large amounts of yolk and in them the segmentation approaches the meroblastic condition. The text figure reproduces some of the more striking forms to which reference will be made. The resemblance is so striking that no extended comparison is called for. With Grönross's fig. *a*, compare fig. 10, Plate V, and also Henneguy's (1888) fig. 39. They are almost identical. For a figure which almost duplicates his figs. *b* and *c*, see fig. 13 on the next plate. Among drawings not included in the plates is one almost identical with his fig. *d*. Again, figs. *e* and *f* are very similar to fig. 9. The comparison might be extended further, but this is sufficient to show the very striking similarity between these two forms. That we have here an analogous segmentation is beyond question. The segmentation in the pipefish

egg in the blastoderms in question is equatorial or at least approaches very close thereto, and it seems hardly going too far to say that such pipefish blastoderms as figs. 10, 11, 14, 18, 20, there is a reversion to a type of segmentation essentially like that of Amphibia.

THIRTY-TWO-CELLED STAGE.

Normal types of this stage, as shown in fig. 23, Plate VI, were found to make up about 30 per cent of one lot of eggs, and were noted sparingly in all others. Fig. 23 is plainly a derivative of forms like figs. 16 and 17, and, while it may be called normal, is noticeably different from Wilson's figures of the same stage for *Serranus* (figs. 6, 8, 9, and 10). No section of this stage will be given. Its internal structure will be made clear by reference to fig. 40, Plate VII, a sixteen-celled blastoderm ready to divide into thirty-two. The two central cells will divide horizontally, the two lateral ones by an oblique plane resulting in six surface and two interior cells. (Compare Wilson's fig. 18.)

Fig. 49, Plate VIII, is a section from a flat-topped abrupt-edged blastoderm, drawn with the same magnification as the others. It serves to show the inequalities in the size of the blastoderms. The peripheral cells are very much flattened above, though retaining their rounded forms below. To the right the section cuts the point of a sixth cell. The segmentation cavity (*s. c.*) is partially filled with cells. The larger and lower cell seems to have been cut off from the central periblast (*c. p.*), from which it is separated by a cell wall so delicate that the oil immersion only will detect it. It is like the periblast in that its periphery contains many yolk granules.

Fig. 24, Plate VI, is an arched type, with the highest point rather nearer the lower side. The twenty-seven outer cells are in three tiers, and while the second is pretty sharply marked off from the first there is but little difference in level between it and the third tier. There is here noticeable a symmetry comparable to that in figs. 7 and 8. The plane 1—1 in all probability represents the first, 2—2 the second line of division referable to fig. 4.

A central section through fig. 24 in the plane *a—b* is shown in fig. 50, Plate VIII. The peripheral cells form an arch with the highest point slightly to one side, and inclose a segmentation cavity which is almost filled with cells. The two smaller cells have been cut off from the peripheral ones, the larger probably from one of its fellows. The periblast is thick and yolky. A more pronounced large-ended type is fig. 51. Here the segmentation cavity is somewhat eccentric, and, as in the preceding, the thick end overhangs the base. The spacious segmentation cavity (*s. c.*) contains one cell which abuts on a curious tongue of protoplasm from a partially segmented region on the left.

Fig. 25, Plate VI, is a typical high-piled blastoderm, whose cells are

arranged in three layers. Its highest cell is slightly eccentrically placed, and one of the axes of the blastoderm is somewhat longer than the other. Fig. 52, Plate VIII, is a central section through a similar but slightly older blastoderm. The marginal cells are sharply marked off from the outer periblast (*o. p.*). The arch is high and round. On the left, two cells are imperfectly separated, and a tongue of protoplasm, from which a cell has been cut off, projects into the large segmentation cavity. The periblast, torn off at the right, is in the center reduced to a mere film of protoplasm with much yolk adherent below, thus giving it the breadth as drawn.

Fig. 53 shows a structure by no means uncommon in the egg of *Siphostoma*. It is a thirty-two-celled stage in which no periblast has yet been formed. The cells are in two layers, the long cell on the upper right is nearly ready to divide, and underneath the whole is a thick layer of protoplasm in which three vertical cell walls extend downward and are lost. Later transverse walls will appear and cut these cells out of the syncytium, finally leaving a periblast layer below. There is a very small segmentation cavity (*s. c.*) and the large cell to the right has a vacuole (*v.*). Ziegler (1882, fig. 2) figures an almost identical structure for the salmon. Kowalewski (1886, figs. 1 and 2) portrays essentially the same conditions in the goldfish. Hoffmann (1888, figs. 6 and 9, especially) describes a similar structure in the salmon germ. And latest of all His (1898, figs. 7 and 10) confirms the figures and descriptions of the earlier workers on the Salmonoids.

Fig. 26, Plate VI, is a very interesting divided blastoderm of this stage with eighteen cells in one division and fourteen in the other. Such structures have been met with occasionally in stages of from sixteen to sixty-four cells, but especially abound in the eggs from one fish. Out of twenty of these eggs killed in micro-acetic, five were like the one figured. That these were not artefacts is shown by the fact that eggs of the same lot killed in formalin also contained divided blastoderms, the numbers of which were unfortunately not noted. In each division a segmentation cavity exists, and the line of separation is broad and definite down to the periblast. These points are brought out very definitely in fig. 54, Plate VIII, a section through a similar but older blastoderm. In the left half there is a small segmentation cavity (*s. c.*); on the right, however, there is none. There is no periblast. Cells have been cut out of the mass of protoplasm, leaving a thick germ basis in which are found vertical cell walls and a number of vacuoles (*v.*), and which is filled below with fragments of yolk. Fig. 55, Plate IX, is a divided sixty-four-celled stage of the thick-ended type. The furrow between the two parts is here not so wide. In other blastoderms this may swell out to a vesicle at the bottom or be reduced to a mere line, as in the two-celled stages above. There is a segmentation cavity in each portion, but there is no distinct

periblast, the basal layer of protoplasm being thick with a large vacuole and full of yolk in its lower part. In some cases, where the plane of separation is reduced to a line, the cells are drawn out into long points toward the base as if a fine thread, used to separate the parts, had elongated the cells downward.

The only reference to such peculiar conditions as shown in these figures is found in a short section on *Coregonus* in Eycleshymer's paper on *Amblystoma* (1895, fig. 35 and others). This writer thinks, however, that these divided blastoderms do not result in double embryos. The same seems to hold true for the pipefishes of Beaufort, for although thousands of eggs and larvæ and hundreds of adults, alive or preserved, have been examined, only two apparent cases of deformation have been found by the writer. The literature of these fishes contains but few references to abnormalities. M. Malm (1862) describes a *Syngnathus* with two caudals. Ryder (1884) reports a *Syngnathus* with two anals. However, Rathke (1837) reports in the *Syngnathidæ* of the Black Sea many abnormalities of the snout, eyes, and tail, due, he thinks, to retardation of development.

A fair example of the late stages of segmentation is shown in fig. 27, Plate VI. Here the thirty-eight cells are in three tiers, with one cell high above all. There is an elongation in one axis, possibly a derivation of the condition found in the eight-celled stage, and a curiously regular arrangement of certain cells. On the whole, however, the segmentation is very irregular, and it becomes more so later; finally all trace of symmetry is lost, and the blastoderms become almost circular in outline. No surface views of later stages will be given, since, as the cells grow smaller, the blastoderms approach more and more the ordinary teleostean form.

STAGE OF SIXTY-FOUR CELLS.

Artificial fertilization being impossible in *Siphostoma*, one can not divide late material into stages by hours, and the greatly varying shapes of the blastoderms make it impracticable to classify sections by the number of rows of cells in each, as some writers do, so it becomes necessary to devise an arbitrary scheme. This scheme is to count the peripheral cells in the central section of a blastoderm, then, assuming a like number in a section at right angles to this, by squaring this number the approximate number of surface cells is found. The size of the cells serves as a check to this.

Fig. 56, Plate IX, with eight peripheral cells, is from a normal type of the sixty-four celled stage. The central periblast (*c. p.*) is thick and yolky, and at the right is a cell not yet cut off from it. The segmentation cavity (*s. c.*) is filled with cells, some of which are ready to divide.

Fig. 57 is derived from a flat blastoderm of the preceding stage, and, by comparison with figs. 45 and 47, Plate VIII, is seen to have

undergone considerable division in horizontal planes, as is shown by the number of cells filling the segmentation cavity. The large nuclei are in the spireme stage, and in the left marginal cell there are two large vacuoles.

The high-arched type of this stage is shown in fig. 58, a derivative of a structure like fig. 53, Plate VIII. The surface falls steeply into the outer periblast (*o. p.*), the cells are all rounded and have small nuclei. Very interesting are the two cells which are incompletely cut off from the central periblast (*c. p.*). Scattered yolk granules are found in some of the cells. The mitotic figures indicate that division into the next stage has begun.

In fig. 59 we have an example of the thick-ended type. The section is slightly to one side of the center, and shows one cell just free and another not yet cut out from the thick yolky periblast. Note the vacuoles which help to delimit cells. In the central section the small segmentation cavity (*s. c.*) becomes somewhat larger. The outer cells are flattened on the exterior, and the whole structure is very like fig. 55.

STAGE OF ONE-HUNDRED-TWENTY-EIGHT SURFACE CELLS.

The normal gently arched type is represented in fig. 60, a nearly central section of a blastoderm of this stage. The central periblast (*c. p.*) is here thick and fairly well delimited from the yolk below. Of especial interest are the cells in the act of being cut out of it into the segmentation cavity. Very notable is the agency of vacuoles (*v.*) in this process. The cell next to the right marginal cell has in its lower part a nucleus, the first met with in the periblast region.

Fig. 61 is an example of the flat-arched type. The central peripheral cells, like those of the preceding stage, have undergone more division than their fellows. The periblast at the left is reduced to a mere line; at the right it is thicker and so filled with yolk that one can find no line of separation save where the whole has come away from the yolk.

The round-arched type finds a good illustration in fig. 62. There are three points of interest in this section: the presence of vacuoles, which help to separate the right marginal cell from the "Rand;" the cell near the center still adherent to the central periblast, and, with its neighbors, having some yolk particles in it; and two pairs of neighboring cells with spindles at right angles to each other. These last illustrate the exceedingly irregular segmentation in the pipefish egg.

Fig. 63 is a nearly central section through a blastoderm intermediate between the normal and the thick-ended types. It is sharply marked off from the outer periblast, which it overhangs on the right. The segmentation cavity is reduced to the interstices between the cells. All along the germ basis, in all the sections, cells are being cut out and the periblast layer left behind. An especially interesting

case of this is found in the very center. Some cells show mitotic figures, and in others there are beside the nuclei small solidly staining round bodies of unknown function.

Fig. 64, derived from fig. 59, is a fine example of its type. It is very flat and the segmentation cavity is very much reduced. The periblast, perfectly free from yolk and as distinct below as above, has a layer of cells cut out of it and at the left a nucleus under the marginal cell and clearly derived from it. At one point near the center the periblast is reduced to a mere line. This figure, which is typical for the whole blastoderm, is remarkably like His's (1898) fig. 10 for the brook trout.

STAGE OF TWO-HUNDRED-FIFTY-SIX SURFACE CELLS.

The normal type blastoderm of this stage is shown in fig. 65. The cells lying near the upper surface are considerably smaller than those in the lower parts nearer the periblast. To right and left are furrows with dilatations helping to cut cells out of the periblast, and at the center are cells nearly free from it.

Fig. 66 is plainly a derivative of fig. 63 in its general outline and in the reentrant angles which separate its outer periblast (*o. p.*) from the marginal cells. The periblast is somewhat sunken in the yolk and free from cells throughout the whole blastoderm. The segmentation cavity is, because of this depression, large and is only partly filled with cells. Neighboring sections show the upper surface to be as flat as that in fig. 61.

The third type is shown in fig. 67 from a nearly central section. There is a very noticeable difference in the size of the blastomeres, some being fully three times as large as others. Here again are cells being cut out of the basal periblast. They are in all stages from rounded buds to a completely cut-out cell. Neighboring sections show nuclei in each of these. At the right are two cells connected by a stout protoplasmic bridge.

Fig. 68, Plate X, is a good example of the rounded type. The spacious segmentation cavity is loosely filled with rounded cells. The periblast is throughout the blastoderm in the form of two thick pads in the "*Rand*" region, but in the center it is very thin and obscured with yolk. Nowhere in the whole blastoderm are cells being budded off from it. In the peripheral cells there are, even in this advanced stage, two cases of protoplasmic bridges.

A nearly horizontal section through such a blastoderm as fig. 68 is shown in fig. 69. This is introduced to show the arrangement of cells in horizontal plane. There is here a closer aggregation of cells to the periphery, the inner row being a derivative of the outer, while in the center the cells are more scattering.

Fig. 70 is from a blastoderm intermediate between those from which figs. 65 and 67, Plate IX, are taken. Neighboring sections are more

like fig. 65. Some of the outer cells show a tendency to elongate and are somewhat smaller than the interior ones. Both marginal pads are nucleated, and in one a cell wall is cutting downward. While the periblast has cells resting on it and even depressing it, nowhere in the blastoderm is there any evidence that they have been budded off.

STAGE WITH FIVE-HUNDRED-TWELVE CELLS ON THE SURFACE.

Fig. 71, the normal type, is very similar to the preceding figure. Here the cells are pretty uniform in size, and those on the surface are noticeably elongated, some being drawn out in fine thread-like connections—the beginning of the "*Deckschicht*" of the Germans. Some of the nuclei are in process of division by mitosis, but the majority stain solidly. The outer thickenings of the periblast are nucleated, the basal portion is thin, yolky, and totally devoid of either nuclei or cells.

The rounded type is finely shown in fig. 72. The surface cells are slightly flattened and only occasionally pointed, and one on the right is binucleate. The blastomeres are by no means uniform in size, and on the right is a giant cell with a proportionate nucleus. All the nuclei stain solidly. The periblast is very thick, and, while laden with yolk fragments, is fairly distinct below. There are two nuclei in the periblast. One is in a thickening out of which a cell will probably be formed. Near by are cells which seem to have been recently cut out.

Fig. 73 is an excellent illustration of the flat type. The blastomeres are very uniform in size and distribution, and are especially noteworthy for the large number of dividing nuclei, with spindles at all angles. The chief interest, however, centers in the periblast, which is thick and possesses many yolk granules, but is perfectly distinct. In it to the right is a nucleus dividing by mitosis with a spindle considerably longer than those in the blastomeres. On the left the section cuts through a chromatin bundle at right angles to the spindle. At the extreme left is found, for the first time, a nucleus in the outer periblast. The central periblast in this blastoderm is very rich in nuclei dividing by mitosis. A cursory examination showed one vertical and eight horizontal ones. Another blastoderm, of the same lot and stage, contains, in its periblast, thirty-three oblique spindles at all angles from nearly vertical to nearly horizontal, twenty-nine lying horizontally, and seven standing in a vertical position. In all, sixty-nine spindles were counted (none twice). There are a very few solidly staining nuclei, but a great number are cut, as above, through the chromatin masses, and these are not counted. There can be no doubt that the spindles stand in all positions.

The last type of this stage is fig. 74. The cells are not uniform in size, and many are twice as large as the small ones. Most of the nuclei stain solidly, but some contain spindles. Two binucleate cells

are present, the one in the periphery being very large. This condition is far from rare in this and later stages. Some thirty cases have been particularly noted. The periblast is very thick, yolky, and distinct. It contains several nuclei, and a cell is either being cut out of or is in process of uniting with the periblast. In other sections similar conditions are found. The reentrant angle, between the outer periblast and the "*Rand*" in this and fig. 73, recalls the like in figs. 63 and 66, Plate IX, and fig. 47, Plate VIII, and in His's figures for the Salmonoids referred to above.

STAGE OF ONE THOUSAND-TWENTY-FOUR SURFACE CELLS.

Fig. 75 represents the normal type and presents several points of interest. The surface cells show a considerable flattening, and adjacent to them are other cells with their bases generally at right angles to the former, making the outer layer in places two cells thick. The inner cells show a tendency to run together in threes and fours. The chief interest, however, centers in the periblast. This is notably free from yolk and is drawn exactly as it appears. Nuclei are scattered very freely throughout its entire extent in all sections, and nearly surround the large vacuole to the right of the center. At the left a large cell, which has recently been cut out of the "*Rand*," is dividing by mitosis. A large number of cells rest on and *indent* the periblast, and are either being cut out of or added to this layer. The close juxtaposition of these cells to nuclei in the periblast would seem to lead to the former conclusion.

The second type is represented in fig. 76, which, judging by the number of cells in the periphery and by their size, is from a blastoderm slightly younger than the preceding. The periblast is sunken deeply into the yolk, and has thus nearly doubled the segmentation cavity, which is sparingly filled with scattered cells. The thick periblast is so obscured with yolk that no nuclei could be found. It is here free from cells, but nearby sections show a condition in this respect like the preceding figure. In the "*Deckschicht*," near the center, is a binucleate cell, while its neighbor has a spindle.

Fig. 77 is from a rounded blastoderm of about the same stage as the preceding. A "*Deckschicht*" can hardly be spoken of here, for the outer cells are nearly all round. The segmentation cavity is reduced to the small interstices between the cells. The greatly thickened periblast is full of large vacuoles, and abounds in nuclei in all the sections, and near the center seems to be budding off cells. In the left "*Rand*" there is a mitotic figure fully twice as large as any in the blastomeres.

No better illustration of the lens-shaped blastoderm so characteristic of late Teleost segmentation than fig. 78 can be given. It probably has been derived from a form like the preceding by the pressure of the cells against the eggshell, causing the periblast to be depressed.

Thus the segmentation cavity has been enlarged and the cells are more scattered than in the preceding. The cells are grouped in twos, threes, and fours. The thick periblast has several nuclei in the resting condition. There is a well defined "epidermic stratum," as the English writers term the outer layer of cells.

Fig. 79 represents the last type of this stage, and need detain us but for a few moments. Its outer cells are flattened and unequal in size, and the interior cells are the largest of all. The periblast is very thick, yolky, and indented from below by large vacuoles. On the left a large cell has been cut out of the "*Rand*," and at the right a cell indents the periblast, while in the center cells seem to be in process of formation from the basal layer. This blastoderm is closely related to that illustrated in section by fig. 74.

Fig. 80 is a horizontal section through some such blastoderm as that illustrated in vertical section in fig. 78, Plate X. It shows the loose arrangement of the interior cells, and the drawn out cells of the "*Deckschicht*." This was broken at several points in the process of sectioning.

LATEST STAGES OF SEGMENTATION.

From this time on it is not profitable and is hardly possible to follow the segmentation, but some figures may be introduced to show the course of development.

Fig. 81, Plate XI, is probably a descendant of a form like fig. 70, Plate X. There is an "epidermic stratum," the cells are loosely scattered in the large segmentation cavity. The periblast is quite distinct, free from yolk, and has a good many nuclei. Just across the border from one of these nuclei is a cell, in another place a cell lies in a depression in the periblast.

Fig. 82 is another type with "*Deckschicht*," with cells fairly closely crowded in the segmentation cavity, and with a very thin periblast out of which cells are being budded or into which they lose themselves. At one or two places the periblast is reduced to the thickness of a cell wall, and in neighboring sections nuclei abound in it. In the left outer periblast two tripolar spindles are found. These have been noticed occasionally in other sections.

Fig. 83 is the typical Teleost late lens-shaped blastoderm. It closely resembles Fusari's (1890) fig. 9 for *Cristiceps*, and is almost a duplicate of Samassa's (1896) fig. 3 for the salmon in corresponding stages. The depression of the blastoderm into the yolk is probably due to pressure against the eggshell. In the highest part of the epidermic stratum is a very large cell, and in the right "*Rand*" a giant nucleus, which is separated from the neighboring cell by hardly more than the cell wall. At the left a cell has been cut out of the "*Rand*." The thin periblast has resting on it many cells, neither the origin nor the fate of which can safely be passed upon.

EARLY STAGES PREPARATORY TO INVAGINATION.

Fig. 84 is a normal type in which the cells are beginning to move away from the periblast, to crowd together in the upper part of the blastoderm, and to leave a subgerminal cavity (*s. g. c.*) between them and the periblast. The line marked *x* is, in this and the following sections, the lower limit of the cells. The outermost cells of the blastoderm have flattened until they make a very thin skin-like layer. The periblast is comparatively free from yolk granules and is here drawn after nature instead of semi-diagrammatically.

The second type is represented in fig. 85. The cells are densely crowded, the periblast depressed, and the subgerminal cavity (*s. g. c.*) is very large. The periblast is very thick and yolk-laden, and so heavily stained that only one nucleus could be made out.

Fig. 86 illustrates the thick-ended type. In this section the cells are not so closely crowded as in the preceding, but a distinct subgerminal cavity is formed. The very distinct periblast contains many large nuclei, and on the left is separated from the blastoderm by a sharp reentrant angle. A very large binucleate cell is shown, and nearby two others are found. On the left is shown a cell of ordinary size.

Fig. 87 represents the high-arched type like fig. 83, which has begun to flatten out in preparation for the next stage. This flattening is probably responsible for the small subgerminal cavity. The periblast has many large nuclei. Two blastomeres shown indicate the size of the cells at this stage.

LATE STAGES PREPARATORY TO INVAGINATION.

Of these only two will be shown. Fig. 88 is the normal teleost structure for this stage. The cells are all closely crowded into a high-arched band, having a large subgerminal cavity (*s. g. c.*) below. The periblast is here filled with yolk and contains many flattened nuclei. The blastoderm has begun to spread out over the yolk, and the section in fig. 88 is 25 per cent longer than that in fig. 84.

Whether the slight difference in shape of fig. 89 in comparison with fig. 88 is due to contraction caused by the killing fluid or whether it is due to descent from a form like fig. 86 would be hard to decide. Possibly the latter idea is correct. The periblast is filled with yolk fragments, and the nuclei are very much flattened.

VII. THE PERIBLAST.

The origin of this layer, together with many of its peculiarities of structure, has been noted in the descriptions of the plates. It is not my intention to go now into any extended discussion of its formation and fate. However, it will be well to describe briefly the various

modes of its formation in other Teleosts, and to show under which of these classes the pipefish egg falls, and finally to give references to a few of the more valuable papers on this subject.

In Teleosts the periblast layer seems to be formed after three types:

(1). In eggs, in which the first furrow cuts through to the yolk, the periblast is formed by a thin protoplasmic sheet extending inward from the "*Rand*." Henneguy (1888, fig. 63) shows this very plainly for the trout.

(2). In eggs, in which there is no layer of oil drops under the germ-disk, or those in which the protoplasmic mass separates sharply from the yolk, the periblast is formed when the inner ends of the cells in the four and eight celled stages are cut out and lifted from the underlying thin protoplasmic sheet. This is the mode of formation in *Serranus* (Wilson, 1891), *Utenolabrus* (Agassiz and Whitman, 1885), and *Belone* (Kopsch, 1901).

(3). In eggs in which there is an imperfect separation of germ disk and yolk, or in which there is a layer of oil drops under the blastodisk, the central periblast has a very peculiar mode of origin. Cells are cut out of the protoplasmic disk in successive layers from above downward and the central periblast is the remnant of blastodisk left when this process has ended. The explanation for this is that the protoplasm continues to flow out of the yolk into the germ disk until segmentation has progressed some distance. Kupffer (1868) noticed that the germ disk was not fully formed in a European *Syngnathus* until after the four-celled stage. This formation for the central periblast is described by most workers on the Salmonoids, notably by Zeigler (1882), and Hoffmann (1888), for the salmon, and latest of all by His (1898) for the salmon and trout. Kowalewski (1886) found essentially the same formation in *Carassius* and *Polyacanthus*.

The central periblast nuclei, in types 1 and 2, originate by division of the "*Rand*" nuclei and migrate centralwards in this layer. In Type 3 they are the direct descendants of the segmentation cells.

In *Siphostoma floridae* there are found the two methods of central periblast formation described in Types 2 and 3 above. In figs. 40, 45, 46, 47, 48, and 52 for the eight and sixteen-celled stages, there is shown a mode of formation for the periblast which negatives the idea that from it there could ever come any "after-segmentation." On the other hand, in figs. 53, 54, 55, 58, 59, 60, 61, and 62, the central periblast is the protoplasmic remnant of the primary germ disk, left after all the blastoderm cells have been cut out of it. It is well to note here that a migration of nuclei into the marginal region and the formation of a "wreath" by the disappearance of cell walls has, because of the opacity of the egg, not been seen in the pipefish. Whether it takes place or not I can not say.

The difficult question, whether, in the egg of the pipefish, cells are budded off from the central periblast and added to the blastomeres, can not here be taken up. However, this would seem to be a legitimate consequence of such a mode of cell formation as that shown in Type 3 above, and apparently finds confirmation in figs. 75, 77, 79, and 82, in which a perfectly definite periblast layer has been formed. If these figures are compared with His's (1898) figs. 10 and 12, this matter will be made clearer.

For a fuller discussion of the origin of the periblast and its nuclei, and of the fate of the latter, the reader is referred to Brook (1887), Kowalewski (1886), Hoffmann (1888), Fusari (1890), Berent (1896), Zeigler (1887 and 1896), His (1898), and Hertwig (1903).

At this point, the work on the development of the pipefish will have to rest. It has been the intention of the writer to carry it further, at least to the closure of the blastopore, and for this purpose the sections have been cut, but the difficulties met with have caused so many delays that it has been impossible to complete it.

The egg of the pipefish is very different from most other teleostean eggs in the form of its segmentation and the dual origin of its periblast, together with the "after-segmentation" of cells therefrom. So marked are these differences that it seems proper to say that the figures in this paper are representative of the sections of a thousand or more eggs, obtained from thirty-three fishes during three summers.

The slides containing the sections from which these figures were drawn have been presented to the U. S. National Museum.

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EXPLANATION OF PLATES.

MAGNIFICATION.

Fig. 1, Plate V, $\times 38$; all other surface views $\times 73$.
All sections $\times 114$.

REFERENCE LETTERS USED IN THE FIGURES.

a-b, c-d. Planes in which were cut sections shown in Plates VII and VIII.

b. Bud.

c. p. Central periblast.

d. h. "*Disque huileux.*"

o. In fig. 20, furrows not visible in fig. 21.

o. p. Outer periblast.

p. b. Protoplasmic bridge.

s. c. Segmentation cavity.

s. g. c. Sub-germinal cavity.

v. Vacuole.

ves. Vesicle.

x. Lower limit of cells in figs. 84-88.

PLATE V.

FIG. 1. Egg in shell, blastodisc resting on "*disque huileux*" which covers the upper third of the yolk.

2. Two-celled stage, blastomeres equal.
3. Two-celled stage, blastomeres unequal, vacuole in plane of division.
4. Four-celled stage, regular, segmentation cavity present.
5. Irregular 4-blastomere stage.
6. Four-blastomere stage, reniform, segmentation cavity absent.
7. Normal 8-celled blastoderm.
8. Eight-blastomere stage, slightly irregular.
9. Irregular 8-celled blastoderm.
10. Eight-celled blastoderm formed by equatorial furrow. Cells 4-4.
11. Irregular 8-celled blastoderm with equatorial furrow. Cells 2-6.
12. As above. Two upper cells smaller and shifted to one end.

PLATE VI.

13. Irregular 8-celled blastoderm, with one cell in center.
14. Seven-celled blastoderm, equatorial furrow cutting off 3 upper cells.
15. View of same from below, vertical furrows only visible.
16. Normal 16-celled stage, cells on one level.
17. Normal 16-celled stage, central cells slightly raised.
18. Irregular 16-celled stage. Cells in two layers, blastoderm thicker at lower edge.
19. Irregular 16-celled blastoderm. Cells in two layers, blastoderm highest in center.
20. Irregular 12-celled stage, derived from a form like fig. 14.
21. View of same blastoderm from below, showing small segmentation cavity.

- FIG. 22. View from below of a high-arched 16-celled stage, showing 9 cells in the first tier, 6 in the second, and 1 keystone, together with the large segmentation cavity.
23. Nearly normal 32-celled blastoderm.
 24. Irregular 27-celled blastoderm. Cells in three tiers, blastoderm thickest at lower edge.
 25. Irregular 28-celled stage. Cells in three tiers, blastoderm highest in center.
 26. Divided 32-celled blastoderm, 14 cells in smaller, 18 in larger division, both resting on a common protoplasmic basis.
 27. Later stage, with 38 cells, showing the growing irregularity of the segmentation.

PLATE VII.

28. Section through germ disc, 5 hours in water. Below the dotted line yolk and protoplasm are mixed.
29. Section through germ disc, 11 hours and 20 minutes in water, showing formation of buds.
30. Section through germ disc 26½ hours in water.
31. Section through germ disc 36-48 hours in pouch.
32. Section through center of 1-celled stage like fig. 1, Plate V.
33. Section through 2-celled stage. Protoplasmic fibrils at right angles to the plane of the furrow.
34. Stage of 2 cells, section through *a-b* of fig. 2.
35. Irregular 2-celled stage, section through *a-b* of fig. 3, showing vesicle at base of furrow.
36. Two-celled stage, furrow taking form of narrow cleft.
37. Furrow of 2-celled stage formed by breaking down of walls of vesicles lying in a vertical series.
38. Horizontal section through 4-blastomere stage of fig. 4.
39. Stage of 8 cells, section through plane *a-b* of fig. 7.
40. Stage of 8 into 16 cells, section through *c-d* of fig. 7.
41. Eight-celled stage, section at right angles to long axis of such stages as figs. 7 and 8, showing protoplasmic bridge.
42. Stage of 8 cells, section in plane *a-b* of fig. 10.

PLATE VIII.

43. Eight-celled stage, section through *a-b* of fig. 12 showing a protoplasmic bridge.
44. Sixteen-celled stage, section in plane *a-b* of fig. 17.
45. Stage of 16 cells, section through plane *a-b* of fig. 16.
46. Stage of 16 cells, section in plane *a-b* of fig. 18.
47. Sixteen-celled stage, section through blastoderm like fig. 19.
48. High-arched 16-celled stage, section through blastoderm like fig. 22, with large segmentation cavity.
49. Stage of 32 cells, section through a blastoderm like fig. 23.
50. Stage of 32 cells, high-arched type, section is through *a-b* of fig. 24.
51. Stage of 32 cells, thick-ended type with large segmentation cavity and thin central periblast.
52. Stage of 32 cells, section through a high-arched blastoderm similar to fig. 25.
53. Thirty-two-celled stage. *No periblast*; two tiers of cells cut out of a solid mass of protoplasm.
54. Divided 32 to 64-celled stage. *No periblast*; basal protoplasm thick, with many vacuoles, and having cell walls cutting down into it.

PLATE IX.

- FIG. 55. Divided thick-ended 32 to 64-celled type of blastoderm. The split is here a narrow vertical cleft. Cell walls are pushing into the basal layer which has large vacuoles.
56. Stage of 64 cells. Section through a normal or gently arched type. One cell not yet free from central periblast.
57. Stage of 64 cells. Type with flat surface and abrupt edges. Nuclei are very large and in spireme stage.
58. Same stage. High-arched type. Cells still connected to periblast layer.
59. Section through thick-ended blastoderm of 64-celled stage. No distinct central periblast.
60. Stage of 128 surface cells. Normal type with 7 cells in process of formation from basal layer of protoplasm.
61. Second type of 128-celled stage. Central periblast laden with yolk.
62. High-arched type of this stage. Mitotic spindles stand at all angles to each other, and vacuoles aid in cutting out the cell to right.
63. Fourth type of 128-celled stage. Cells are being cut out of the basal syncytium, the "Rand" is separated from the outer periblast by a sharp re-entrant angle. Many of the darkly stained nuclei have beside them solidly stained bodies of unknown function.
64. A section through another thick-ended blastoderm of this stage. There is no central periblast; cells have been cut out of the syncytium.
65. Normal type of 256-celled stage. The nuclei all stain solidly, cells are being cut off from the periblast, the "Rand" is nucleated. This is the earliest stage with nuclei in central periblast.
66. Stage of 256 surface cells, second type. "Rand" sharply marked off from the outer periblast.
67. Same stage, third type, showing cells in process of formation in the basal syncytium.

PLATE X.

68. High-arched type of this stage, with solidly stained nuclei—periblast wholly free from cells.
69. Horizontal section through blastoderm of same stage as that of which fig. 68 is a vertical section.
70. Vertical section through blastoderm intermediate between figs. 65 and 67.
71. Stage of 512 surface cells, normal type. Surface cells show a notable elongation, some forming "bridges."
72. High-arched type of this stage. The cells are of unequal sizes, the nuclei stain solidly, the periblast is nucleated and in process of budding off cells.
73. Same stage, flat-topped, abrupt-edged type. The "Rand" is of peculiar form. At the left a spindle in the periblast is cut through in the chromatin mass while on the right a whole spindle is shown.
74. 512-celled stage, fourth type. "Rand" and thick periblast nucleated. Some cells with mitotic figures, but most nuclei stain solidly.
75. Stage of 1,024 cells on surface, normal type. Outer cells flattening to form an epidermic stratum which is at places two-layered. Many nuclei and vacuoles are found in the periblast, out of which a number of cells are being cut.
76. Same stage, second type. The periblast is sunken in the yolk, and the blastomeres only sparingly fill the segmentation cavity thus enlarged. The nuclei are in the spireme stage and a "Deckschicht" is present.
77. High-arched type of this stage. The thick periblast is vacuolated and has a giant spindle at the left

- FIG. 78. Section from a blastoderm like fig. 77, but with periblast deeply sunk in the yolk, thus greatly enlarging the segmentation cavity.
79. 1,024-blastomere stage, fourth type. A "*Deckschicht*" is forming and the periblast is giving rise to cells.

PLATE XI.

80. Horizontal section through a blastoderm of the same stage as fig. 78. Epidermic stratum very definite and in part two-layered.
81. Late stage of segmentation. Section from a blastoderm intermediate between the gently arched and the thick-ended types. Blastomeres scattered in the large segmentation cavity caused by the down-sunken periblast.
82. Late segmentation stage, round-arched type. Epidermic layer present. Many cells resting on periblast and probably formed from it. The left outer periblast shows two multipolar spindles.
83. Section through late lens-shaped blastula. The "*Deckschicht*" is two-layered, and the periblast, which has no forming cells, is deeply sunken.
84. Outline section of normal type late blastoderm. The cells have moved upward, forming a compact mass, the lower limit of which is marked x x, and having a large subgerminal cavity. Giant nuclei in periblast.
85. Late blastoderm, second type, showing same structures as fig. 84. Periblast much sunken.
86. Same stage, thick-ended type. Periblast is thin and multinucleate. A large binucleate cell is shown.
87. Same stage and structures as above from a blastoderm like fig. 83. Many resting nuclei in periblast.
88. Normal type blastoderm spreading over yolk preparatory to the beginning of invagination.
89. Section from a blastoderm similar to the above save for a slight variation in shape.

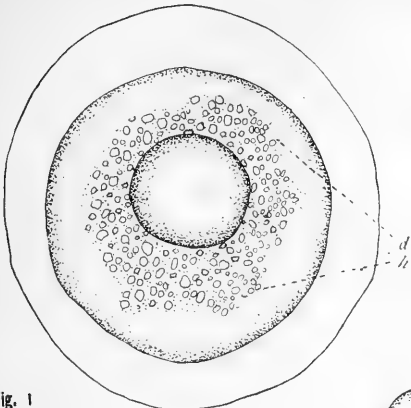


Fig. 1

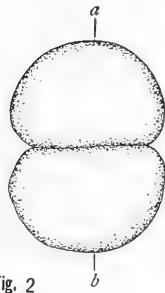


Fig. 2

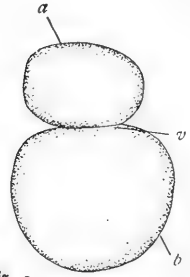


Fig. 3

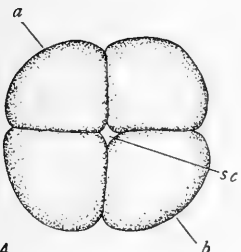


Fig. 4

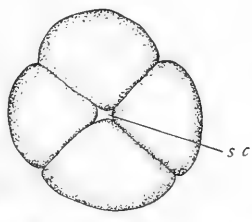


Fig. 5

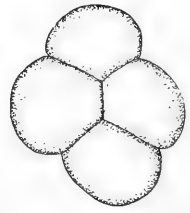


Fig. 6

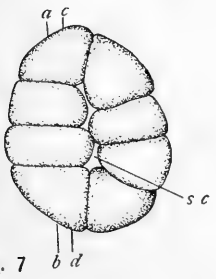


Fig. 7

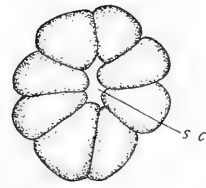


Fig. 8

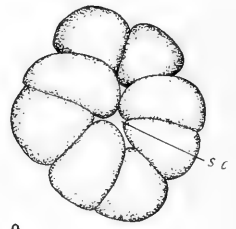


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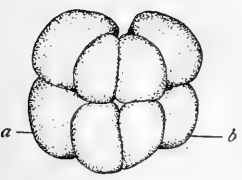


Fig. 10

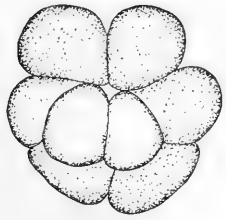


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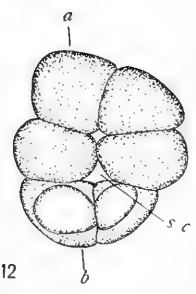
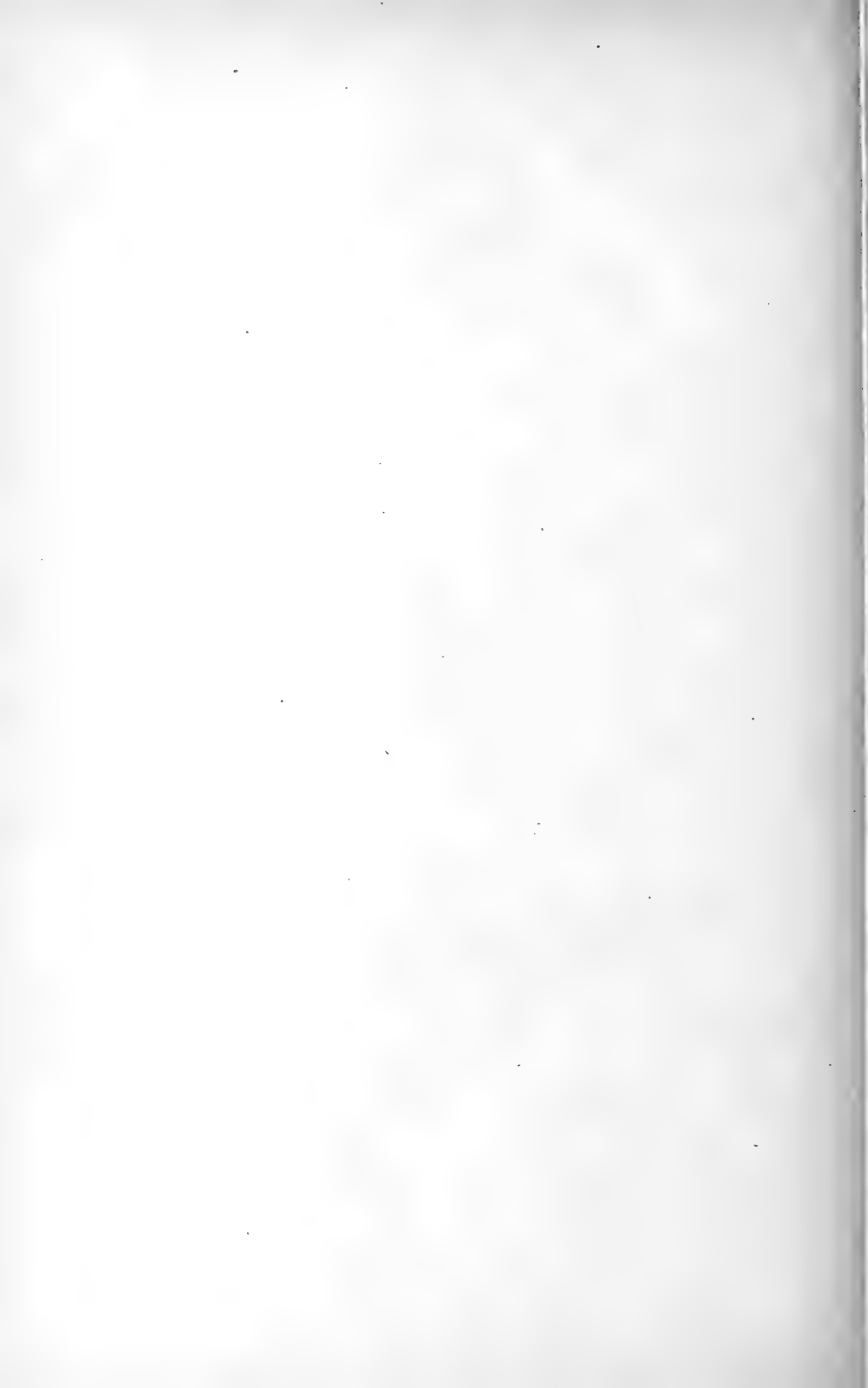


Fig. 12

SEGMENTATION OF PIPEFISH EGGS.

FOR EXPLANATION OF PLATE SEE PAGE 497.



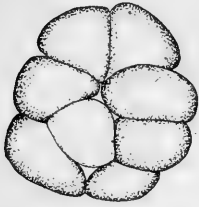


Fig. 13



Fig. 14

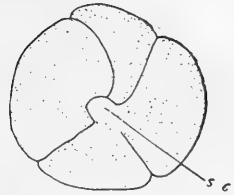


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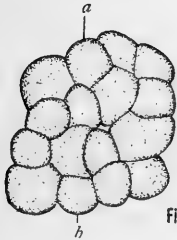


Fig. 16

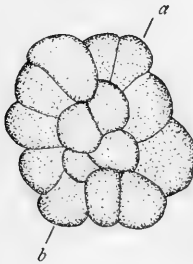


Fig. 17

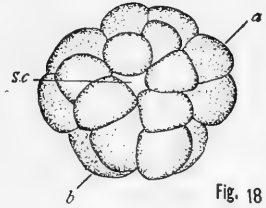


Fig. 18

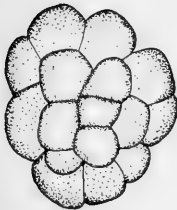


Fig. 19

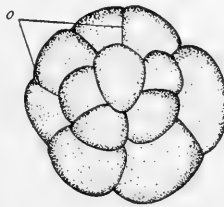


Fig. 20

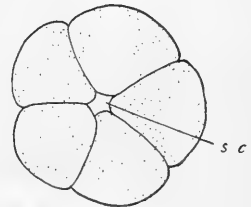


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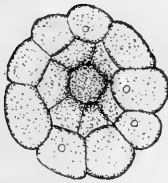


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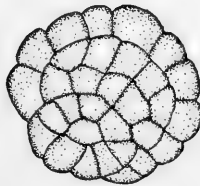


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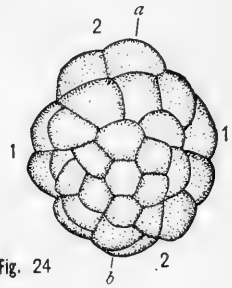


Fig. 24

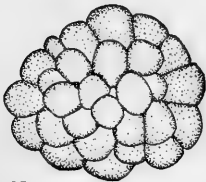


Fig. 25

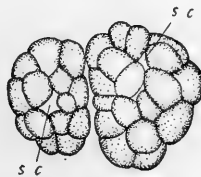


Fig. 26

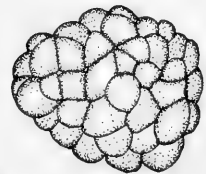
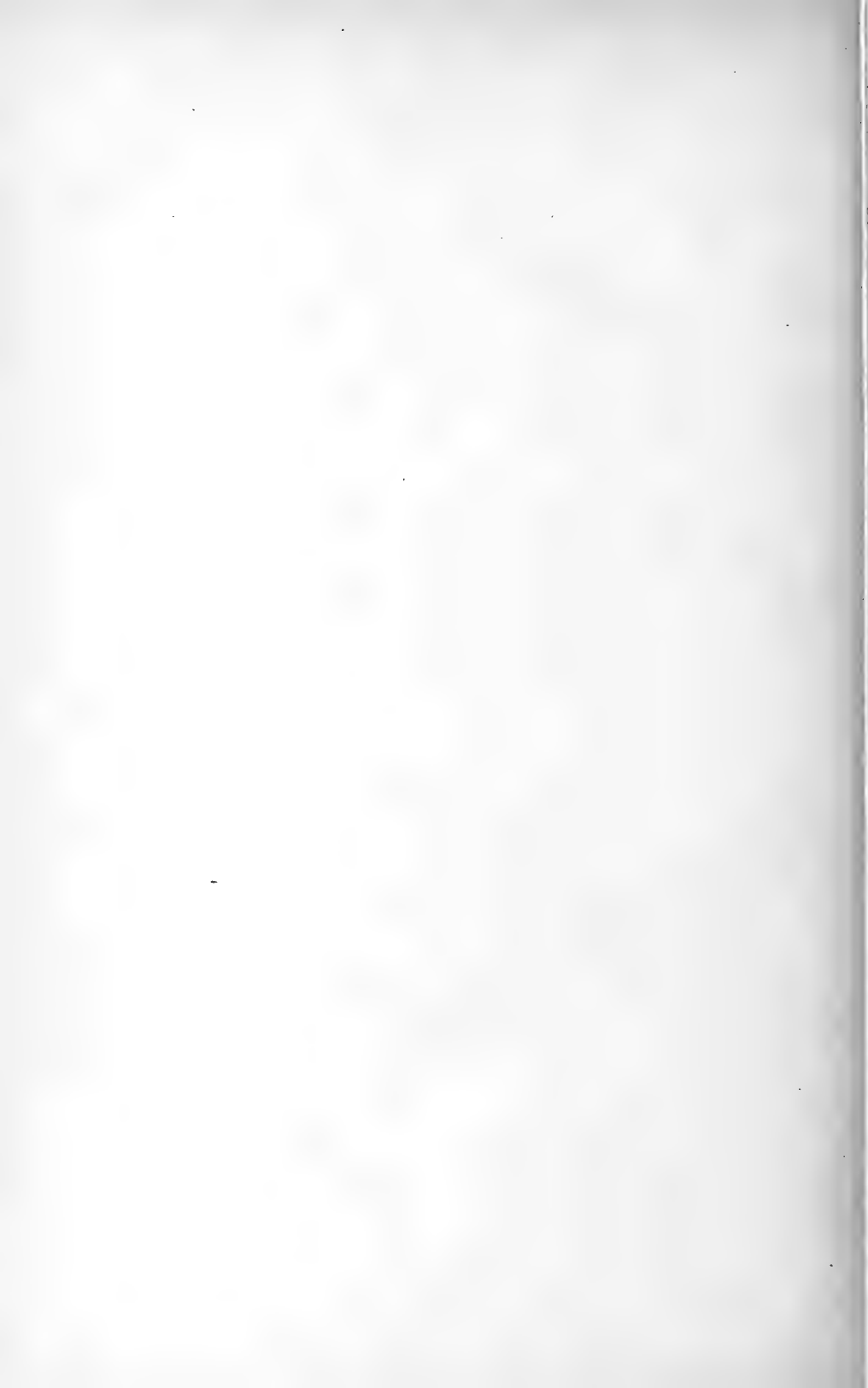
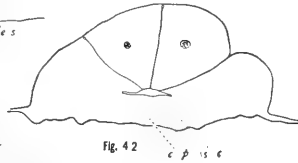
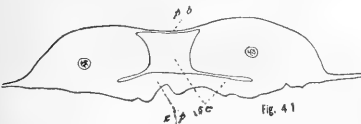
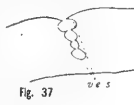
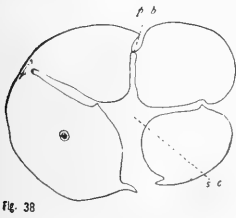
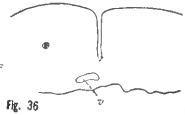
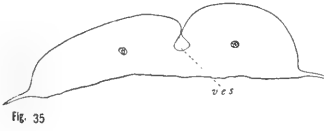
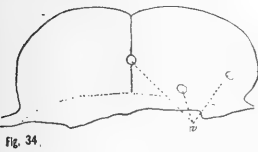
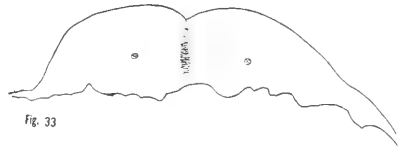
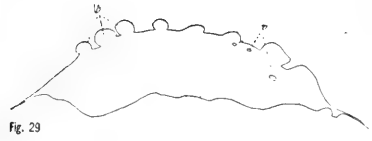


Fig. 27

SEGMENTATION OF PIPEFISH EGGS.

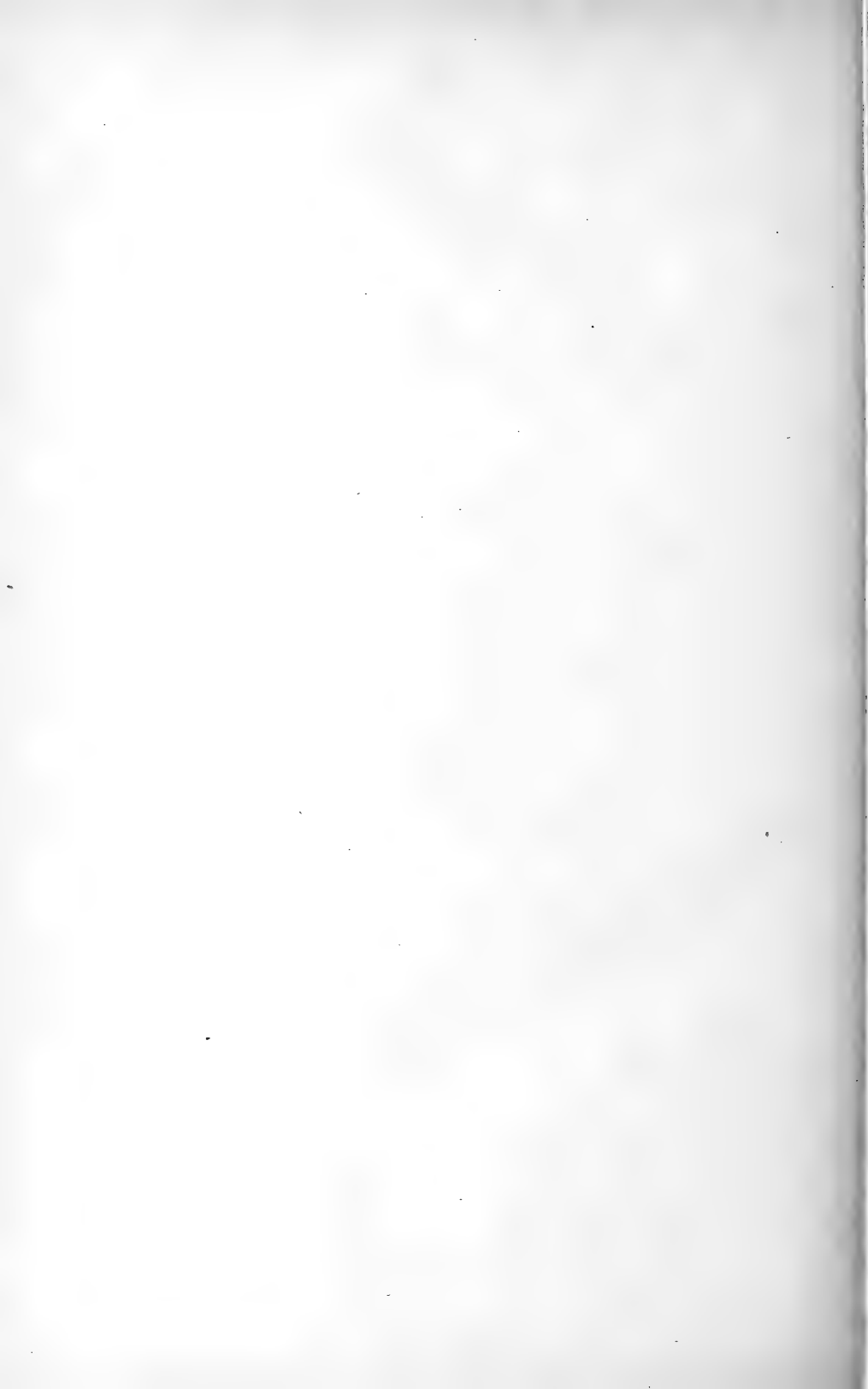
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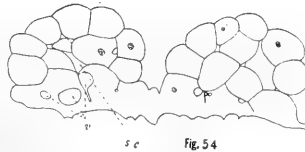
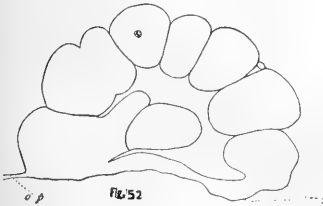
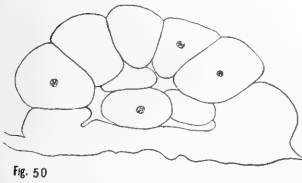
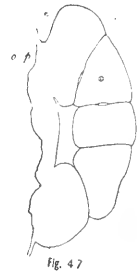
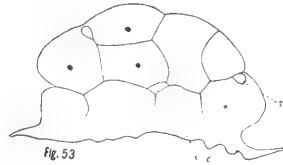
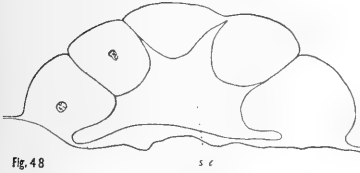
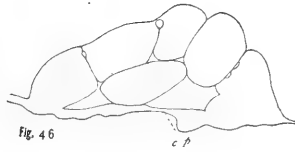
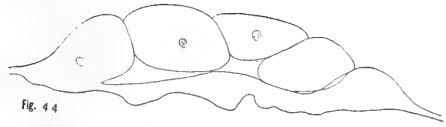




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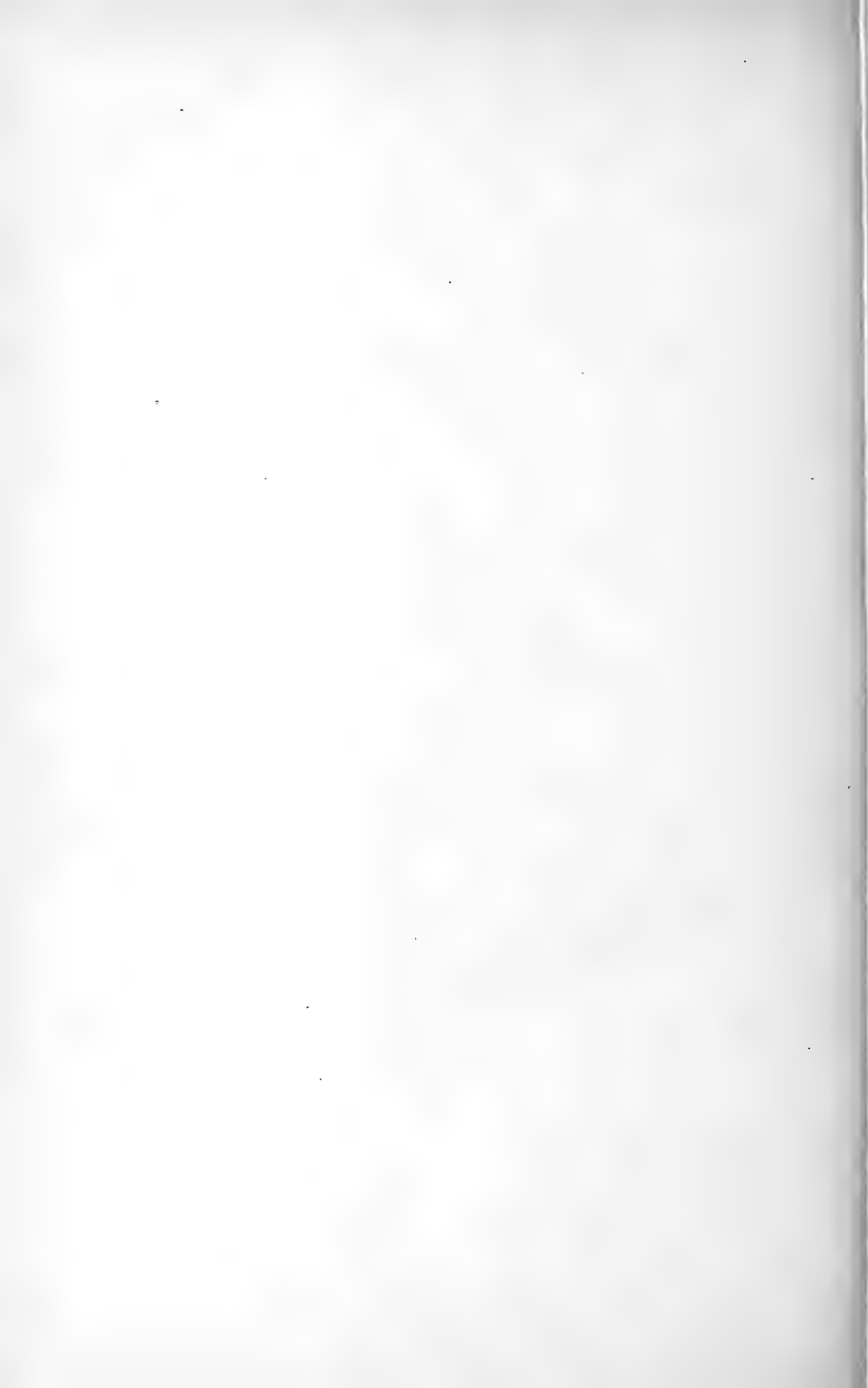
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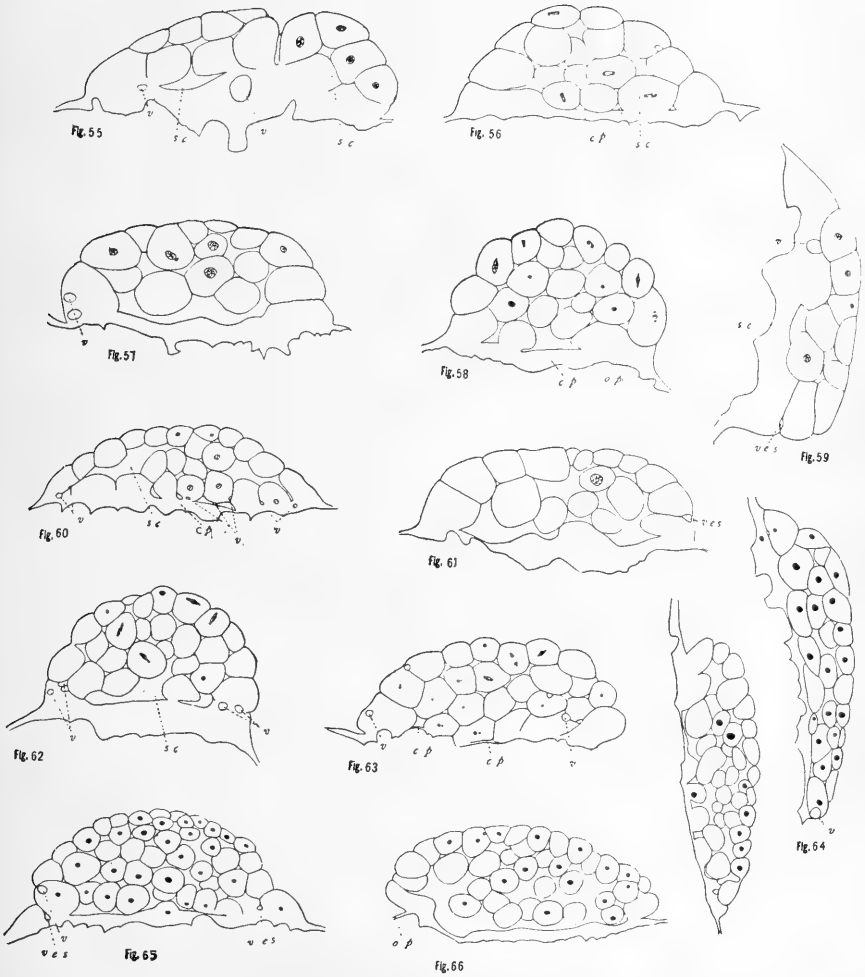




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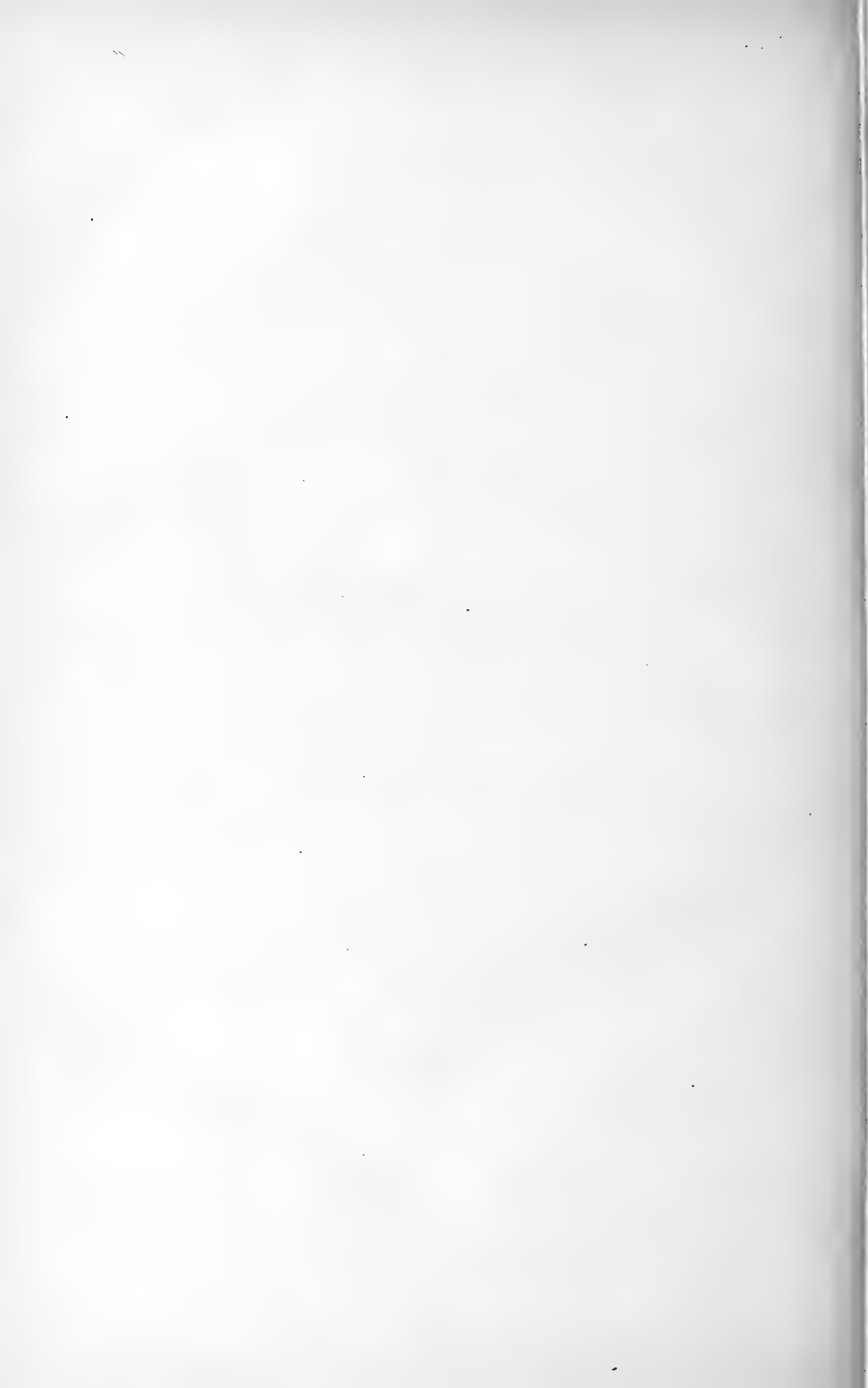
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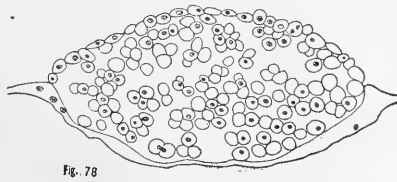
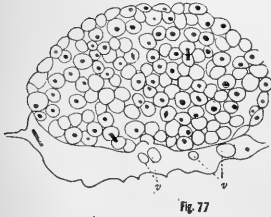
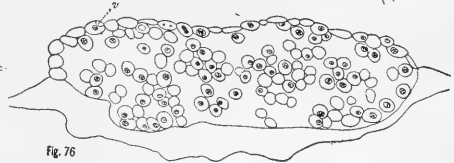
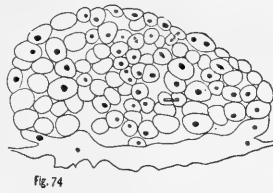
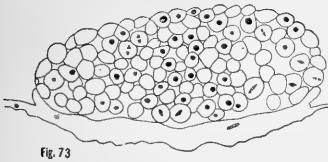
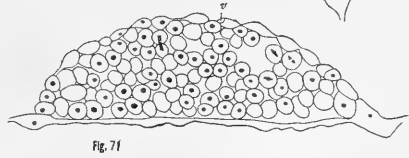
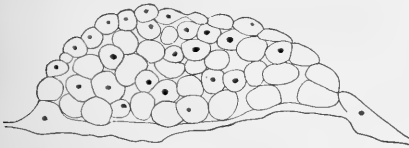
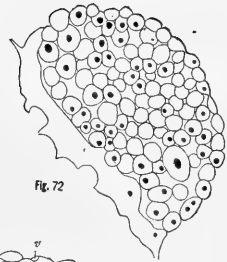
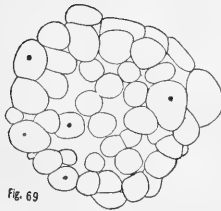
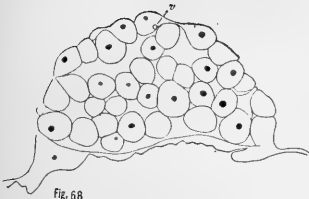




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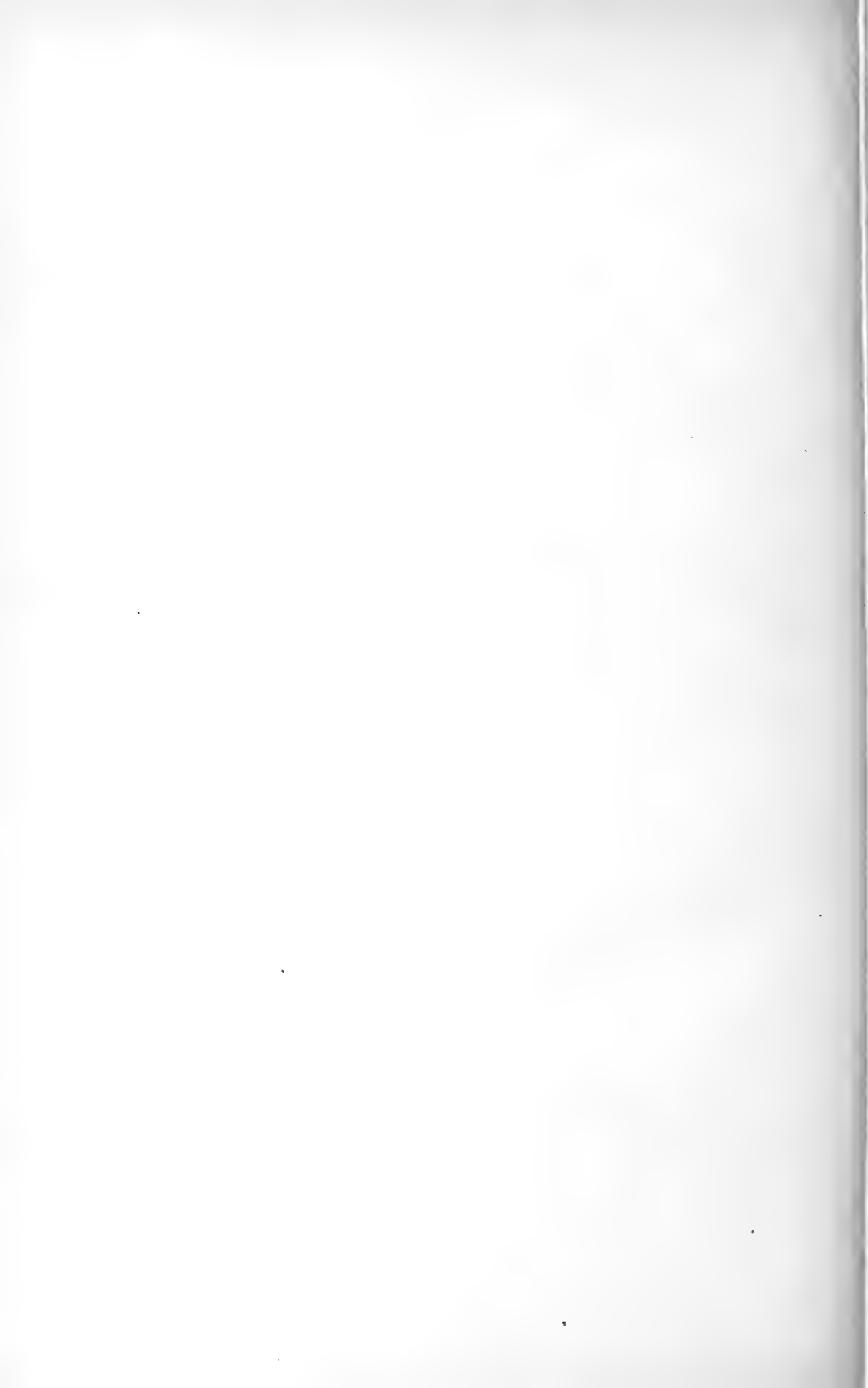
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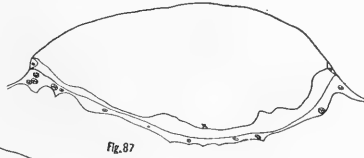
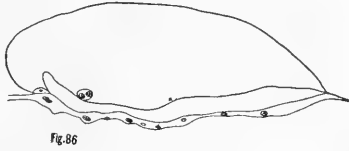
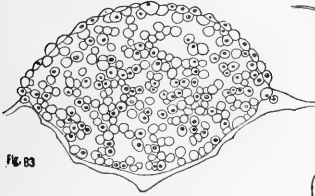
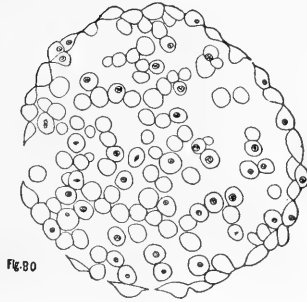




SEGMENTATION OF PIPEFISH EGGS.

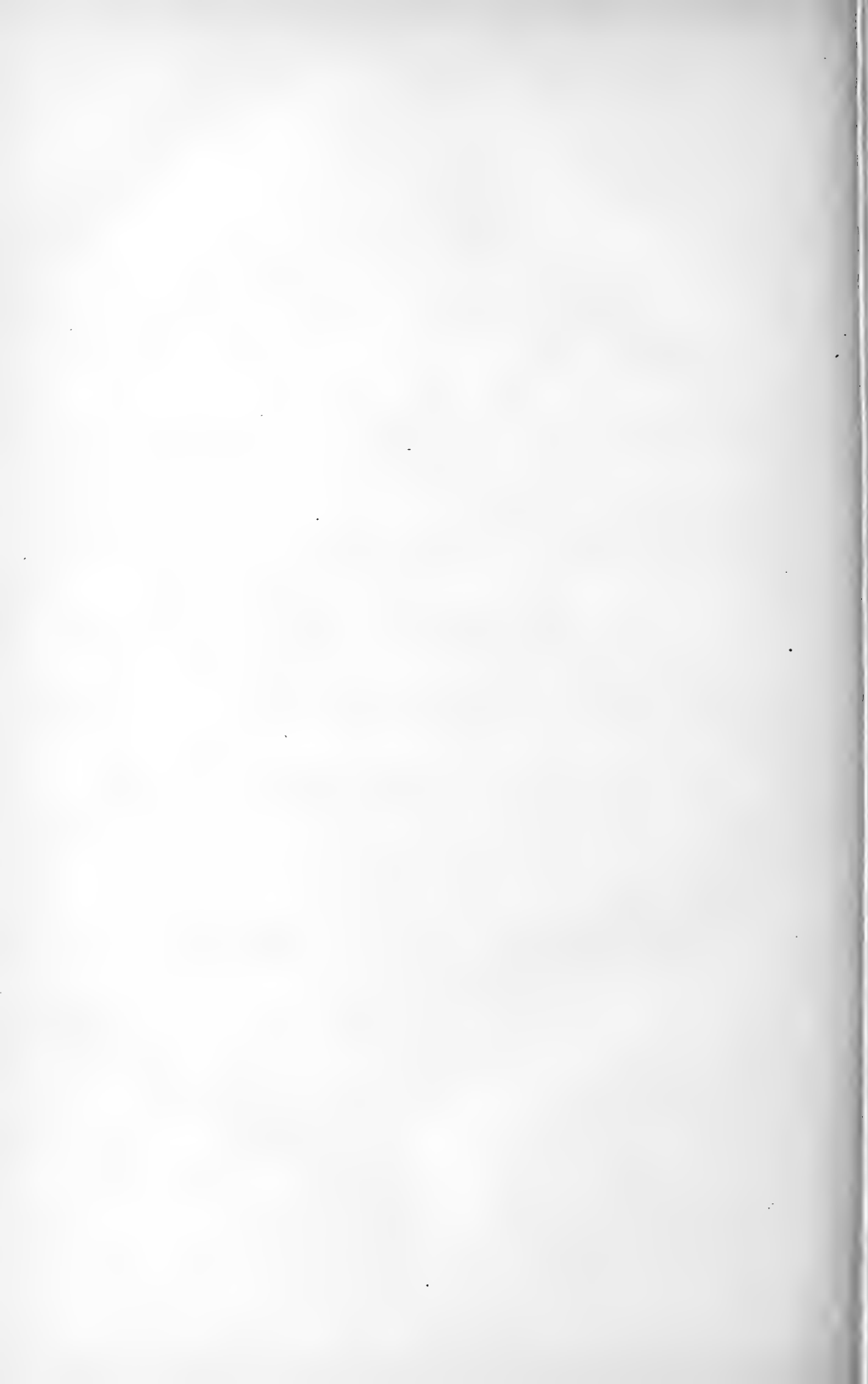
FOR EXPLANATION OF PLATE SEE PAGES 499, 500.





SEGMENTATION OF PIPEFISH EGGS.

FOR EXPLANATION OF PLATE SEE PAGE 500.



NOTES ON EXOTIC FORFICULIDS OR EARWIGS, WITH DESCRIPTIONS OF NEW SPECIES.

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The following records and notes have been made almost wholly from the United States National Museum collections, a few specimens from other collections having been studied and noted when of interest for comparative or faunistic reasons.

My thanks are extended to Dr. Richard Rathbun and other officials of the Museum for the privilege of studying this and other collections.

Genus PYGIDICRANA Serville.

1831. *Pygidicrana* SERVILLE, Ann. Sci. Nat., XXII, p. 30.

Type.—*P. V-nigrum* Serville.

PYGIDICRANA PERUVIANA, new species.

Type.—Female; Piches and Perene valleys, 2,000–3,000 feet, Peru. (Soc. Geogr. de Lima.) [Cat. No. 8171, U.S.N.M.]

Apparently a very distinct species of the genus.

Size rather large; form depressed, subequal; surface minutely tuberculate and supplied with fine stiff hairs, which are longest on the head and shortest on the abdomen. Head trigonal, deplanate, caudolateral angles of the head subrectangulate; eyes distinctly though moderately projecting laterad; antennæ with eighteen joints present (terminals missing), the proximal joint large, moderately long, cylindrical, second joint short, third joint about equal to the first in length, but slenderer, cylindrical, remaining joints increasing in size distad from the subspherical fourth joint. Pronotum slightly longer than broad, somewhat produced meso-cephalad, rounded caudad, lateral margins subparallel, angles rounded; longitudinal lateral depressions distinct, transverse depression much shallower and caudad of the middle; a very faint and shallow precurrent, median sulcus is present. Tegmina about twice the length of the pronotum, the "shoulder" angles broadly rounded, the caudal margins obliquely trimmed toward the median line. Exposed portions of the wings not quite equal to

the pronotum in length, rounded with the tips squarely truncate. Abdomen with the sides parallel; anal segment large, equal to the pronotum in length and very slightly wider than the other segments, with extremely faint traces of a median depression and the caudal margin truncato-emarginate; subgenital plate arcuate with the apex subtruncate and slightly emarginate mesad. Forceps moderately long, depressed, carinate above, the tips rather bluntly hooked, the internal margins crenulato-dentate. Femora considerably inflated, particularly the cephalic. Tarsi compressed, the second not depressed, the terminal joint on all the limbs at least as long as the basal.

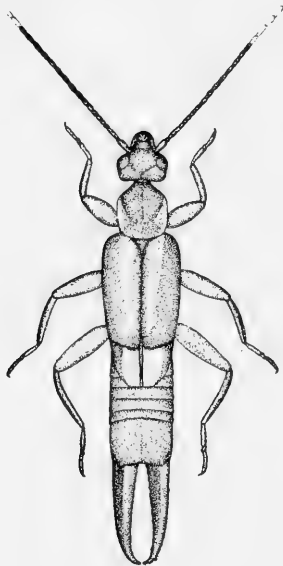


FIG. 1.—PYGIDICRANA PERUVIANA.
× 2.

Forceps dark liver brown, ventral surface of the same and the subgenital plate burnt sienna. Limbs tawny ochraceous, the tibiae marked dorsad with blackish.

Measurements.

	mm.
Length of body (excluding forceps)	18.5
Length of pronotum	3.5
Length of tegmen	7.2
Length of exposed portion of wing	2.0
Length of anal segment.....	3.2
Breadth of anal segment.....	3.2
Length of forceps	6.5

Genus LABIDURA Leach.

LABIDURA RIPARIA (Pallas).

1773. *Forficula riparia* PALLAS, Reise Russ. Reichs, II, buch 2, p. 727. ["Habitat in ripis præruptis, arenosis, præcipue ad Irten copiosissima, canalibus horizontalibus latens."]

Luebo, Kongo. (D. W. Snyder.) [U.S.N.M.] Three females.

I am unable to separate these individuals from a female from Morocco determined by Saussure and fully representing true *riparia*.

LABIDURA MONGOLICA new species.

Type.—Female; Pekin, Chi-li, China. April, 1901. (M. L. Robb.) [Cat. No. 8164, U.S.N.M.]

A large form of the *riparia* type and apparently allied to *L. bidens* of the West Indies. It does not appear to fit any of the numerous forms previously described, though it is possibly the one to which Motschulsky applied the *nomen nudum* of *Forficula amurensis*.^a

Size very large; form as usual in the genus. Head rather deplinate, the impressed lines distinct but faint; eyes hardly projecting; antennæ with the basal joint large, subcylindrical, the second subspherical, the third slightly more than twice the length of the second, equal in width. Pronotum quadrate, the margins very slightly arcuate, the cephalic angles very narrowly, the caudal angles moderately rounded; lateral, longitudinal, and median transverse depressions marked, a slight median longitudinal sulcus present on the cephalic half. Tegmina half again as long as the pronotum; "shoulder" angles rounded, caudal margins slightly arcuate; the deflected lateral portions separated from the dorsum by a distinct angle cephalad, which becomes subobsolete caudad. Exposed portion of the wings short, rounded. Abdomen very slightly depressed, gradually but slightly expanding caudad; anal segment over twice as broad as long, lateral margins subparallel, the caudal margin subtruncate with a blunt tubercle at the base of each arm of the forceps, between which are two parallel spiniform processes, as in *L. bidens*; subgenital plate transverse trigonal, the apex sinuato-truncate; pygidium cuneiform, the apex truncate. Forceps rather long, equal to the exposed portion of the abdomen and anal segment united, gently bowed, tips rather blunt, an internal tooth placed slightly before the apical third. Limbs, with the femora slightly inflated; proximal and distal segments of the tarsi equal in the cephalic and median pair, the proximal much exceeding the distal in the caudal pair.

General color tawny ochraceous, marked with blackish. Head suffused above, the eyes clear black; pronotum black, except for lateral and median longitudinal lines of the lighter color; tegmina with the same color pattern as the pronotum, but the dorso-lateral angle is also

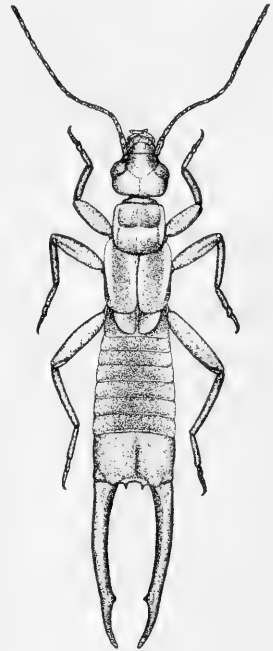


FIG. 2.—LABIDURA MONGOLICA.
× 2.

^aBull. Soc. Imp. Nat. Moscou, XXXII, p. 499.

marked with blackish; abdomen with all the segments except the anal suffused above with blackish, below with very dark brown; caudal margin of the anal segment marked with reddish-brown; forceps with the apical half suffused with reddish-brown, becoming blackish toward the tips; limbs tawny ochraceous.

Measurements.

	mm.
Length of body (exclusive of the forceps).....	22.0
Length of pronotum.....	3.5
Length of tegmen.....	5.2
Length of anal segment.....	3.0
Breadth of anal segment.....	5.5
Length of forceps.....	11.5

Genus BORMANSIA Verhoeff.

1902. *Bormansia* VERHOEFF, Zool. Anzeiger, XXV, p. 184.

Included *B. africana* and *impressicollis* Verhoeff, of which the former may be considered the type.

BORMANSIA MERIDIONALIS Burr.

1904. *Bormansia meridionalis* BURR, Insecta Transvaaliensia, V, p. 97, fig. 13. [Zoutpansberg, Transvaal.]

Luebo, Kongo. (D. W. Snyder.) [U.S.N.M.] One female.

This specimen appears to be closer related to this species than to either *B. africana* and *impressicollis* Verhoeff, from German East Africa, which, in addition to other characters, are of much greater size.

Genus LABIDURODES Dubrony.

1879. *Labidurodes* DUBRONY, Ann. Mus. Civ. Stor. Nat. Genova, XIV, p. 355.

Type.—*L. robustus* Dubrony.

LABIDURODES MAGNIFICUS, new species.

Type.—Male; Khow Sai Dow, Trong, Lower Siam, 1,000 feet elevation. January–February, 1899. (W. L. Abbott.) [Cat. No. 8167, U.S.N.M.]

Allied to *L. robustus*, but differing in the transverse pronotum, longer tegmina and wings, the fewer antennal joints, and the absence of lateral plicæ on the abdomen.

This species is very close to *Labidura*, and may be an annectant type. The resemblance to *Psalis* is also very great.

Size large; form subequal, slightly constricted mesad, considerably depressed; surface of the head, pronotum, tegmina, and wings glabrous, of the abdomen and forceps punctate, particularly on the segments of the abdomen other than the anal. Head elongate trigonal, truncate caudad; deplanate dorsad, impressed lines very faint; eyes

very slightly projecting; antennæ with fourteen joints present, proximal one large, constricted proximad, second joint small and subspherical, third joint cylindrical, not quite half the length of the proximal, fourth and fifth joints slightly smaller than the third, from this point the segments gradually increase in length toward the apex. Pronotum slightly transverse, the margins all very slightly arcuate, the caudal angles more rounded than the cephalic, the latter each supplied with several long, stiff bristles; lateral depressions not deep, a transverse depression caudad of the middle is faint and incomplete mesad; median longitudinal sulcus very faint but precurrent. Tegmina slightly more than twice the length of the pronotum; "shoulder" angles rounded, a distinct lateral carina present; caudal margins subtruncate; the tegmina when in normal position narrower caudad than cephalad. Exposed portion of the wings less than a third the length of the tegmina, rounded with the tips abruptly truncate. Abdomen narrow cephalad, increasing in breadth caudad, the margins of the segments supplied more or less regularly with long, stiff bristles; anal segment subquadrate, the caudal margin truncate, a distinct but shallow longitudinal median depression present; subgenital plate trigonal, a moderately elevated medio-longitudinal area subglabrous, flanked by subovate areas of linear irregular rugosities; pygidium with the proximal portion subtrigonal, the distal portion longitudinal, subequal, the apical section expanded into a narrow lamellate structure. Forceps almost equal to the tegmina in length, somewhat depressed, gently curved except in the distal fourth of the right arm, which is strongly hooked, and the distal half of the left arm which is regularly but not strongly curved; internal margins with several crenulations on the proximal third, otherwise unarmed. Limbs with the femora distinctly inflated; tarsi of the cephalic pair with the distal joint distinctly longer than the proximal, of the median pair slightly longer, of the caudal pair distinctly shorter, second joint depressed, cordiform; arolia present, minute.

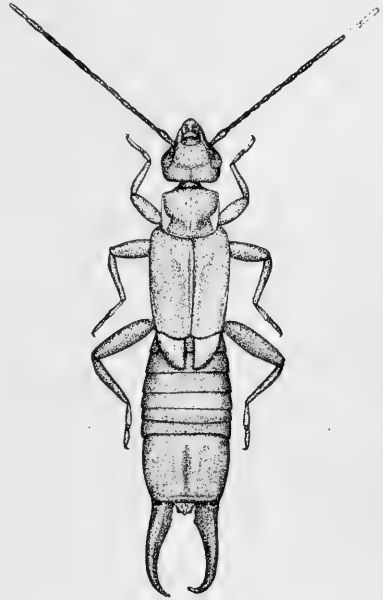


FIG. 3.—LABIDURODES MAGNIFICUS. $\times 2$.

General color blackish bay, brighter cephalad; exposed portions of the wings ocher yellow with the lateral margins dark; feet paler, inclined toward yellowish, with the hairs golden brown.

Measurements.

	mm.
Length of body (excluding forceps)	24.0
Length of pronotum.....	3.3
Length of tegmen	7.9
Length of anal segment.....	4.5
Length of forceps.....	6.5

The type is unique.

Genus GONOLABIS Burr.

1900. *Gonolabis* BURR, Ann. Soc. Entom. Belg., XLIV, p. 48.

Type.—*Anisolabis javana* Bormans.

GONOLABIS LATIVENTRIS (Philippi).

1863. *Forficula lativentris* PHILIPPI, Zeitschr. Gesam. Naturwissen., XXI, p. 217.
[Province of Valdivia, Chile.]

Concepcion, Chili. December, 1903. (Carlos S. Reed.) [A. N. S. Phila.] Two males. Penco, Chili, December, 1903. (Carlos S. Reed.) [A. N. S. Phila.] One female.

Genus ANISOLABIS Fieber.

ANISOLABIS MARITIMA (Gené).

1832. *Forficula maritima* GENÉ, Saggio di una Monografia delli Forficule Indigene, p. 9. [Genoa, Italy; Nice, France; Mount Lebanon, Syria.]

Nara, Yamato, Hondo, Japan. (Y. Hirase.) Fifty-eight males, fifty-eight females. [A. N. S. Phila.]

Kyoto, Yamashiro, Hondo, Japan. (Y. Hirase, No. 64.) Eleven males, eleven females. [Hebard Collection.]

New Zealand. (Koebele.) Two females. [U.S.N.M.]

The above large series exhibits an enormous amount of individual variation in size, females ranging from 16.5 to 26 millimeters in total length, and males from 16.7 to 25.

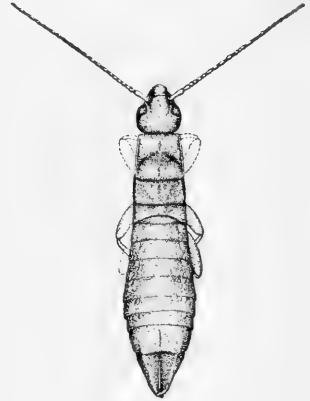
ANISOLABIS PLUTO, new species.

Type.—Female; Mount Coffee, Liberia. (O. F. Cook.) [Cat. No. 8165, U.S.N.M.]

Allied to *A. maritima*, *mauritanica*, and *rufescens*, but differing from the first in the heavier forceps, from *mauritanica* in the weak teeth on the internal margin of the same as well as the absence of distinct pubescence, and from *rufescens* in the blackish head and pronotum.

Size medium; form elongate subfusiform, greatest width across the caudal portion of the abdomen, moderately depressed; surface finely punctate. Head slightly narrower caudad than across the eyes, deplinate, usual impressed lines obsolete; eyes not projecting; antennæ

diminishing in thickness toward the apex, basal joint large, cylindrical, strongly constricted proximad, second small, much narrower than the basal, third joint nearly twice the length of the second, fourth and fifth bead-like, the remainder gradually increasing in length distad. Pronotum subquadrate, slightly broader caudad than cephalad, angles hardly rounded, transverse impression slightly behind the middle broad and moderately impressed, longitudinal median sulcus subobsolete. Mesonotum transverse, about twice as wide as long, a very faint median sulcus present. Metanotum transverse, almost as long laterad as the mesonotum, caudal margin arcuato-emarginate. Abdomen with the lateral plicæ on the three fully exposed proximal segments weak and hardly perceptible except on the third segment; anal segment transverse, more than half as long as broad, the cephalic margin slightly emarginate, the median longitudinal sulcus distinct; subgenital plate transverse trigonal. Forceps short, heavy, recurved in the distal half, the tips with blunt hooks, the internal margins crenulate. Caudal limbs with the proximal joint of the tarsi slightly longer than the distal.

FIG. 4.—ANISOLABIS PLUTO. $\times 2$.

General color, seal brown; palpi, antennæ, and limbs tawny-olive.

Measurements.

	mm.
Length of body (exclusive of forceps)	16.2
Length of pronotum	2.9
Length of mesonotum	1.5
Length of anal segment	2.0
Length of forceps	3.0

A paratypic female of this species has also been examined.

Genus *LABIA* Leach.

LABIA BRUNNEA Scudder

1876. [*Labia*] *brunnea* SCUDDER, Bull. U. S. Geol. Surv. Terr., II, pp. 257, 258.
[Cuba.]

Cayamas, Santiago Province, Cuba. March 3 and 8. (E. A. Schwarz.)
[U.S.N.M.] Two males.

LABIA NIGROFLAVIDA, new species.

Type.—Female; Cairns, Queensland, Australia. (Koebele.) [Cat. No. 8168, U.S.N.M.]

Allied to *L. grandis* Bormans, from Australia, New Guinea, and the Aru Islands, but differing in the lesser number of antennal joints,

the almost uniform color of the same appendages, and the longer, slenderer, and less dentate forceps.

Size medium (for the genus); form elongate fusiform, slightly depressed; surface finely punctate on the abdomen and forceps; glabrous elsewhere. Head equal in width in the caudal half, gently rounded; antennæ composed of thirteen joints, the proximal sub-conic, the second small, third slightly longer than the fourth or fifth, the latter two subequal, the remaining joints regularly increasing in length. Pronotum slightly larger than broad, the lateral margins very slightly expanding caudad; caudal angles and caudal margin rotundato-arcuate; transverse impression broad and shallow, caudad of the middle, the whole caudal half being lower than the cephalic half, which is slightly inflated; a faint median longitudinal sulcus present. Tegmina slightly more than half the length of the pronotum; "shoulder" angles rounded, projecting but little beyond the pronotum; caudal margins obliquely truncate toward the median line. Ex-



FIG. 5.—*LABIA NIGROFLAVIDA*. $\times 24$.

posed portions of the wings about two-thirds the length of the pronotum, rounded, with the tips sharply truncate. Abdomen with lateral plicæ present on two segments, the distal of the two segments with them more marked than on the other; anal segment but little longer than the next segment proximad, gradually narrowed caudad, bearing along the truncate caudal margin a number of distinct rasp-like tubercles; subgenital plate transverse, the distal margin broadly arcuate. Forceps about as long as the tegmina, parallel, moderately slender, gently curved in the distal third and overlapping, the internal margins crenulate. Femora distinctly though moderately inflated.

General color, seal brown, with a very faint blue-black sheen to the abdomen; caudo-lateral margins of the pronotum and exposed portions of the wings buffy; the limbs are of the general color, touched with claret brown.

Measurements.

	mm.
Length of body (excluding the forceps).....	8.2
Length of pronotum.....	1.5
Length of tegmen.....	2.5
Length of forceps.....	2.6

The type is unique.

Genus *CHELISOCHES* Scudder.

1876. *Chelisoche* SCUDDER, Proc. Boston Soc. Nat. Hist., XVIII, p. 295.

Type.—*Lobophora rufitarsis* Serville.

CHELISOCHES STRATIOTICUS, new species.

Type.—Female; Trong, Lower Siam. (Dr. W. L. Abbott.) [Cat. No. 8170, U.S.N.M.]

A member of the group comprising *pulehripennis* and *glaucopterus*, but apparently closer to the last-mentioned species. It can be readily distinguished by the shorter pygidium, the more depressed and less distinctly dentate forceps, and several other characters.

Size large; form subfusiform, greatest width abdominal, depressed; surface subglabrous, the abdomen finely punctate. Head longer than broad, strongly depressed with a pair of converging depressions extending back from the eyes; lateral margins slightly and gradually constricted caudad of the eyes; caudo-lateral angles moderately rounded; caudal margin with a median rotundate emargination; eyes small, hardly projecting beyond the head; antennæ composed of fourteen segments, the proximal large, cylindrical, strongly constricted toward the head; second joint small, short; third joint about half the length of the first; fourth joint small, but larger than the second, remaining joints gradually increasing in length distad. Pronotum subquadrate, lateral margins slightly expanding caudad, cephalic margin subtruncate with a median low rounded protuberance, caudo-lateral angles rounded, caudal margin rotundato-angulate; cephalic half with a crescentic depressed area on each side extending from the antero-lateral angles to the median line, a shallow and rather indistinct longitudinal median sulcus present on the cephalic half. Tegmina almost twice the length of the pronotum; "shoulder" angles projecting little beyond the sides of the pronotum; caudal margins truncate. Exposed portions of the wings extending a distance beyond the tegmina less than the length of the pronotum, rounded, tips narrowly truncate. Abdomen with the dorsal margins of the distal segments with numerous short plicæ, strong lateral plicæ present on the third segment; anal segment strongly transverse, caudal margin truncate, thickened and supplied with rasp-like tubercles except on the median section, which is depressed with a median sulcus between two small tuberculate ridges; subgenital plate transverse, the margin arcuate; pygidium longitudinal, reversed cuneiform, the distal portion not more than half the proximal width, apex roundly emarginate. Forceps about equal to the head, pronotum, and tegmina in length, distinctly depressed, very gently arcuate, except the distal fourth which

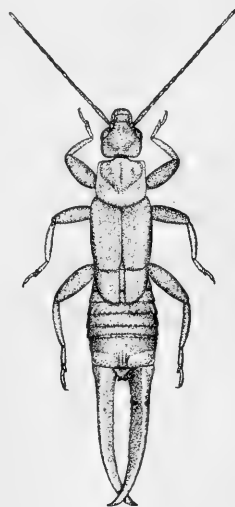


FIG. 6.—CHELISOCHES STRATIOTICUS. $\times 2$.

is distinctly curved; internal margins irregularly serrato-dentate. Femora short, strongly inflated, particularly the cephalic and median pairs; tarsi with narrow transverse arolia present.

General color burnt umber, pale on the tarsi and very dark, almost blackish, on the abdomen; antennæ rather pale at the tips.

Measurements.

	mm.
Length of body (exclusive of forceps)	15.5
Length of pronotum.....	3.1
Length of tegmen.....	5
Length of anal segment.....	2
Greatest width of anal segment.....	4.5
Length of forceps.....	9.5

The type is unique.

Genus ANCISTROGASTER Stål.

ANCISTROGASTER FALCIFERA, new species.

Type.—Male; Piches and Perene valleys, Peru, 2,000–3,000 feet. (Soc. Geog. de Lima.) [Cat. No. 8172, U.S.N.M.]

Allied to *A. variegata* Dohrn from Venezuela, but differing in the brownish-black color of the terminal abdominal segments and the reddish lateral margins of the pronotum.

Size medium; form, as usual in the genus, depressed; surface supplied with short closely placed hairs. Head distinctly but moderately inflated between the eyes and bearing a pair of deep median punctures, caudal section depressed; caudal margin truncato-emarginate, caudo-lateral angles rounded; eyes rather large, considerably projecting; antennæ with nine joints present, the proximal joint long, slender, tapering proximad, second joint minute, third joint slightly more than half the length of the first, fourth subequal to the third, fifth joint nearly as long as the first, the remaining joints similar to the fifth, but each slightly increasing in length over the next proximal one. Pronotum subquadrate, small, slightly narrower than the width of the head across the eyes, lateral and caudal margins arcuate, the caudo-lateral angles broadly rounded, cephalo-lateral angles narrowly rounded; lateral portions of the pronotum with depressed longitudinal areas near the lateral margins and slightly converging caudad, median transverse depression shallow, broad, present between these lateral areas, longitudinal median sulcus distinct only cephalad. Tegmina about two and a half times the length of the pronotum, broad, the "shoulder" angles moderately rounded, caudal margins truncate.



FIG. 7.—ANCISTROGASTER FALCIFERA. $\times 2$.

Exposed portion of the wings slightly more than half the length of the tegmina, the lateral margins rather tapering, the tips narrowly truncate. Abdomen strongly constricted cephalad and narrowed caudad at the anal segment; lateral plicæ present on the proximal segments; depressed lateral unguicular processes present on three segments, adpressed and recurved, the two segments cephalad of the anal unarmed; anal segment transverse, the caudal margin very slightly arcuate, slightly depressed, median longitudinal sulcus very faint; subgenital plate transverse, caudal margin rotundato-emarginate, the angles projecting; pygidium cuneiform, the apex slightly expanded, truncate. Forceps of the type usual in the genus, bent arcuate, the apex spiniform, the thickened pre-apical portion moderate in size and armed proximad with a spine similar to the apical but smaller and blunter. Limbs slender; tarsi with the second joint strongly depressed, cordiform, no arolia present.

General color dull brownish black; head orange-rufous, eyes black, antennæ chestnut becoming blackish distad; pronotum with the lateral portions ferruginous; forceps ferruginous; limbs inclined toward cinnamon.

Measurements.

	mm.
Length of body (excluding forceps)	11.0
Length of pronotum.....	1.7
Length of tegmen	3.6
Greatest abdominal width	4.6
Width of anal segment.....	2.5
Length of forceps.....	5.0

The type is unique.

Genus OPISTHOCOSMIA Dohrn.

OPISTHOCOSMIA BOGOTENSIS, new species.

Type.—Male; Bogota, Colombia. (Coll. Henry G. Klages.) [Cat. No. 8166, U.S.N.M.]

Apparently allied to *O. brahma* Burr from northern India, but differing in the greater size, the different coloration, and the peculiar sculpture of the dorsal surface of the last abdominal segment. Like that species it appears to be quite distinct from any of the other forms of the genus.

Size large; form strongly depressed; surface smooth, dull, on the abdomen and forceps supplied with numerous points as detailed in the following. Head subtrigonal, slightly elongate, slightly inflated; caudal margin truncate; eyes rather large and prominent; antennæ rather thick, strongly compressed proximad. Pronotum very slightly transverse, the cephalic and lateral margins straight, the cephalo-lateral angles very slightly rounded; caudal margin arcuate, caudo-lateral angles obtusely rounded; transverse median depressed area

very distinct, the cephalic half distinctly inflated, lateral margins distinctly elevated, and mesad with distinct subparallel depressions; longitudinal median sulcus faintly impressed on cephalic half, absent on caudal. Tegmina about two and a half times the length of the pronotum, broad, the "shoulder" angles narrowly rounded; caudal margins obliquely rotundato-emarginate toward the median line. Exposed portions of the wings about equal to the length of the pronotum proximal, as broad as caudal margin of the tegmina, evenly rounded, with the tips rather narrowly truncate. Abdomen distinctly expanded mesad; three proximal segments with continuous lateral plicæ, which are very faint on the first and increase gradually in size distad, terminating abruptly in a large thickened mass on the third segment; dorsal

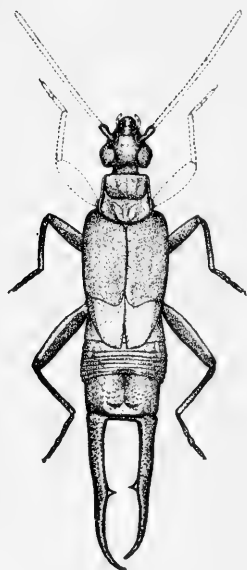


FIG. 8.—*OPISTHOCOSMIA BOGOTENSIS*. $\times 2$.

and lateral margins of all segments except the proximal one supplied with series of small, bead-like tubercles, which are subobsolete on the median portions of the distal segments but quite distinct laterad; anal segment transverse, twice as broad as long, strongly depressed mesad with a distinct longitudinal sulcus at the bottom of the depression, which is anchor shaped, spreading out distad, and embracing two distinct prominences, caudal margin truncate, surface of the plate with numerous rasp-like tubercles; subgenital plate transverse, about twice as wide as long, the caudal margin moderately arcuate; pygidium rectangulate, the distal margin truncate, a distinct median longitudinal sulcus present. Forceps elongate, but slightly shorter than the combined length of the pronotum, tegmina, and exposed portions of the wings, rounded dorsad, flattened ventrad, moderately straight in the basal half or slightly less (the left arm considerably exceeding the right in length), armed at this point

with a short thick tooth on the ventral portion of the internal face, distal section of the forceps evenly arcuate, the longer left arm slightly hooked distad; surface of the forceps covered with evenly distributed asperities, those of the ventral surface minute. Limbs rather slender; femora hardly inflated; second and third joints of the caudal tibiae together hardly exceeding the proximal in length; second joint strongly compressed proximal, third joint strongly depressed, elliptical, no arolia present.

General color seal brown, becoming burnt umber on the forceps and touched with ochraceous on the limbs; exposed portions of the wings ochraceous, with the lateral margins marked with the general color.

Measurements.

	mm.
Length of body (exclusive of forceps).....	16.5
Length of pronotum	2.9
Length of tegmen	6.5
Length of anal segment	2.3
Breadth of anal segment.....	5.0
Length of forceps (left arm)	10.6

The type is unique.

Genus *APTERYGIDA* Westwood.*APTERYGIDA 'ARACHIDIS* (Yersin).

1860. *Forficula arachidis* YERSIN, Ann. Soc. Ent. France (3), VIII, p. 509, pl. x, figs. 33, 34 and 35. [Marseilles, France].

Jamaica. [U.S.N.M.] One male.

This specimen is somewhat larger than specimens from Aguadilla, Porto Rico, recorded as *Apterygida gravidula*.^a

APTERYGIDA ERYTHROCEPHALA (Olivier).

1791. *Forficula erythrocephala* OLIVIER, Encyc. Method., Ins., VI, Pt. 2, p. 468. [Cape of Good Hope.]

Luebo, Kongo. (D. W. Snyder.) [U.S.N.M.] One male. Congo. [U.S.N.M.] Two males, one female. Mount Coffee, Liberia. (G. P. Goll.) [U.S.N.M.] One male, one female.

Genus *FORFICULA* Linnæus.*FORFICULA AURICULARIA* Linnæus.

1758. [*Forficula auricularia* LINNÆUS, Syst. Nat., 10th ed.; p. 423. [Europe.]

Flores, Azores. (Wm. Trelease.) [U.S.N.M.] Two males, two females.

FORFICULA SCHWARZI, new species.

Type.—Female; Cayamas, Santiago Province, Cuba. March 4. (E. A. Schwarz.) [Cat. No. 8169, U.S.N.M.]

This species appears to be quite distinct from any other member of the genus, principally on account of the peculiar forceps and coloration.

Size medium; forceps elongate, depressed; surface glabrous. Head about as broad as long, distinctly broader across the eyes than cephalad, caudal angles rather evenly rounded; above subdeplanate, impressed lines distinct; eyes roundly protuberant; antennæ with nine joints, proximal elongate cylindrical, second joint narrower than the proximal and about a third the length, third joint slightly longer than

^aTrans. Amer. Entom. Soc., XXIX, p. 129.

the second, from this joint the succeeding articles regularly increase in length distad. Pronotum as broad as long; cephalic margin truncate, lateral and caudal margins and caudo-lateral angles arcuate, cephalo-lateral angles slightly obtuse; transverse median depressed area slight, lateral regions with slight longitudinal depressions, longitudinal median sulcus present, slight, very faint caudad. Tegmina slightly more than twice the length of the pronotum, moderately expanded, "shoulder" angles rather narrowly rounded; caudal margin of each tegmen arcuato-emarginate. Exposed portions of the wings nearly half as long as the tegmina, rounded on the distal half. Abdomen slightly inflated mesad, the segments armed laterad, and the distal one (excluding anal segment) dorsad with marginal series

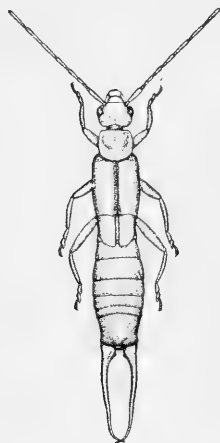


FIG. 9.—FORFICULA SCHWARZI.
× 2.

of bead-like prominences, two proximal segments with lateral plicæ; anal segment slightly broader than long, slightly constricted caudad, caudal margin slightly produced, thickened, truncate between the centers of the arms of the forceps; subgenital plate transverse, caudal margin broadly arcuate; pygidium subcuneiform, constricted mesad, the base trigonal. Forceps equal to the pronotum, tegmina and exposed portions of the wings in length, moderately depressed, expanded at the base with a short internal lamellate ridge, which bears a distinct distal tooth and crenulations on the remainder of the edge; arms subparallel, very slightly caudad of the middle, tips evenly curved mesad, acute, crossed; internal surface of the arms without a distinct ridge and unarmed. Limbs of moderate size, cephalic femora slightly inflated; tarsi strongly depressed, the second joint distinct cordiform and extending considerably beneath the third joint; arolia absent.

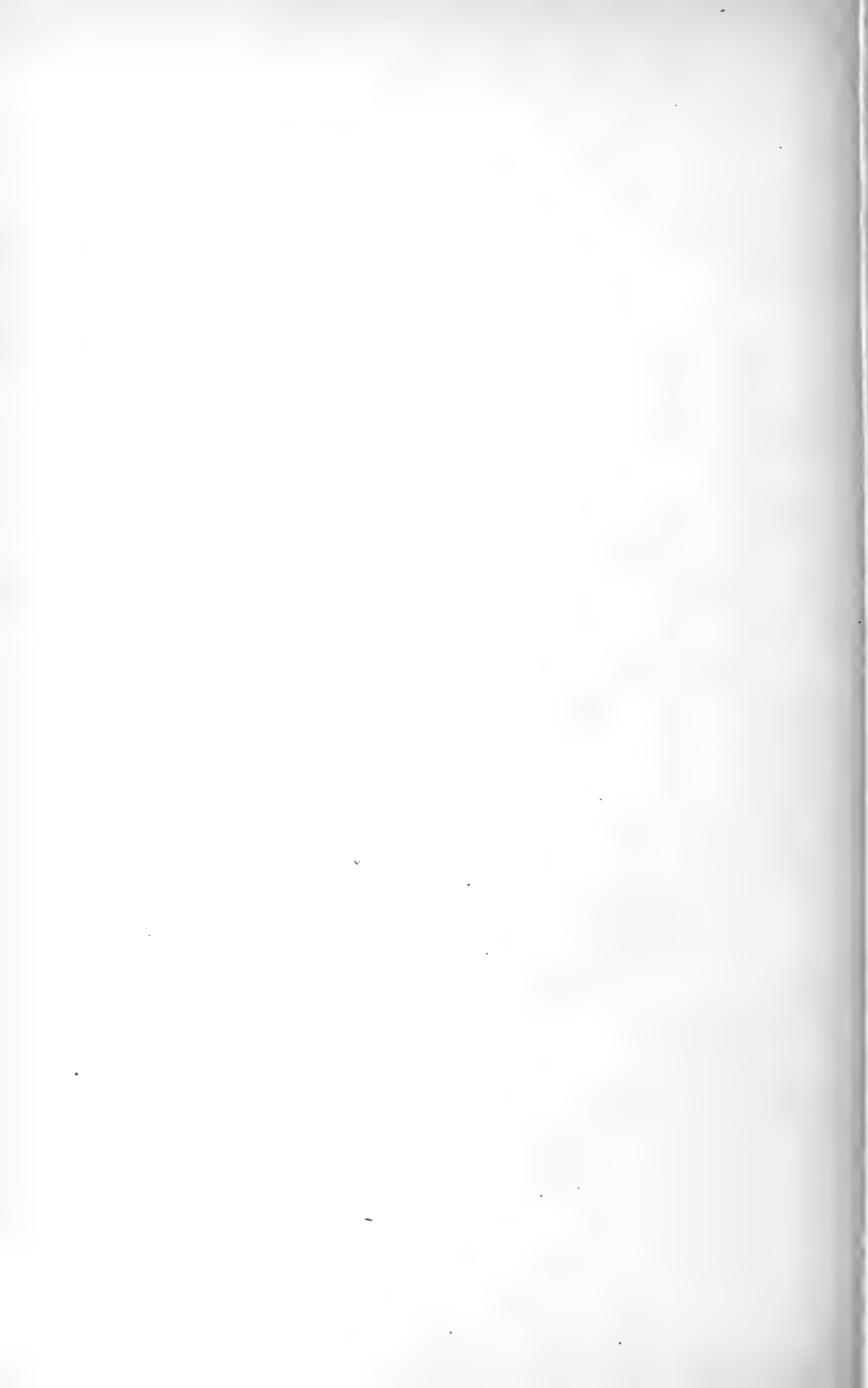
General color of the head, pronotum, tegmina and exposed portions of the wings buff, rather diluted and weak on the head and pronotum; eyes blackish-brown; antennæ slightly obscured distad; tegmina with all the margins except the caudal lined with seal brown, the lateral margins very broadly marked; exposed portions of the wings buff margined laterad with seal brown, the bar narrowing and becoming evanescent caudad. General color of abdomen tawny-olive, more reddish, the ventrad margins of the segments broadly marked with blackish laterad; anal segment ferruginous, margined caudad with blackish; pygidium blackish. Forceps rather pale ochraceous, becoming ferruginous distad, the margins of the basal expansions blackish. Cephalic limbs buff; median and caudal limbs tawny-olive, the median touched with ferruginous.

Measurements.

	mm.
Length of body (exclusive of forceps)	14.5
Length of pronotum.....	1.9
Length of tegmen	4
Length of anal segment.....	2
Length of forceps	6.2

The type is unique.

I take pleasure in dedicating this striking species to Mr. E. A. Schwarz, the eminent coleopterist, who collected the type.



LIST OF FISHES COLLECTED IN 1882-83 BY PIERRE
LOUIS JOUY AT SHANGHAI AND HONGKONG, CHINA.

By DAVID STARR JORDAN and ALVIN SEALE,
Of Stanford University.

During the winter of 1882-83, the late Mr. Pierre Louis Jouy, then assistant to the United States National Museum, made a collection of fishes at Shanghai and Hongkong, in connection with a visit to Japan. He was accompanied and assisted by Dr. Frank C. Dale, U. S. N. In the present paper is given a list of the species contained in the collection with descriptions of the new species. Fifteen additional species, none of them new, are omitted from the list on account of the loss of the record of locality. The plates accompanying the paper are the work of Mrs. Chloe Lesley Starks and William Sackston Atkinson. The new species are the following: *Coilia ectenes*, *Zezera rathbuni*, *Fistularia starksi*, *Collichthys fragilis*, *Prosopodasys lewrynnis*, and *Eleotris balia*.

For the opportunity of studying this collection we are indebted to the courtesy of Mr. Richard Rathbun, Assistant Secretary of the Smithsonian Institution.

Family ENGRAULIDÆ.

COILIA ECTENES Jordan and Seale, new species.

Head, 5.75 in length; depth, 6.10; maxillary reaching to base of pectoral; D. I, 13; A. 123; six pectoral filaments greatly prolonged, 2.70 in length of fish without caudal; snout, 3.75 in head; eye, 5.10 in head; interorbital width, 3.50 in head; scales, 65 to 70.

Body elongate, compressed, tapering evenly from dorsal and ventral fins to a point at caudal; tip of snout prolonged into a short projection; upper edge of the greatly prolonged maxillary serrated; a single row of small sharp teeth in jaws and on palatines, none on vomer; gill-rakers long and slender, 26 on lower limb of outer arch; ventral surface of abdomen sharp and serrated; origin of dorsal directly in line with origin of ventrals, its base, 3 in head, its longest ray, about

1.25 in head; base of anal extending from anterior third of fish to caudal, its rays short, about 3 in head; ventrals short and small, 2.50 in head; pectorals (not pectoral filaments) about equal to head, and about half the length of the filaments; caudal pointed, 3 in head.

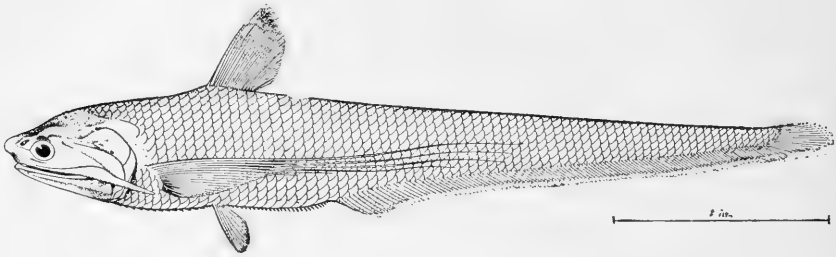


FIG. 1.—*COILIA ECTENES*.

Color in spirits, uniform silvery white; fins unmarked.

Two specimens from Shanghai, China. Length 2.30 to 3.75 inches. Type is Cat. No. 52077, U.S.N.M. Length 3.75 inches.

Family CYPRINIDÆ.

RHODEUS OCELLATUS Kner.

Head, 4 in length; depth, 2; D. 14; A. I, 13; scales, 2-33; lateral line showing only on the anterior three scales.

Color in spirits, uniform silvery, with no trace of ocellus.

Four specimens from Shanghai. Length, 2 to 2.20 inches.

ZEZERA RATHBUNI Jordan and Seale, new species.

Head, 4.50 in length; depth, 4.20; eye, 6 in head; D. I, 8; A. II, 7; scales about 7-57-6; snout, 3 in head, equal to interorbital width; a single long barbel at posterior end of maxillary, this barbel reaching to angle of opercle.

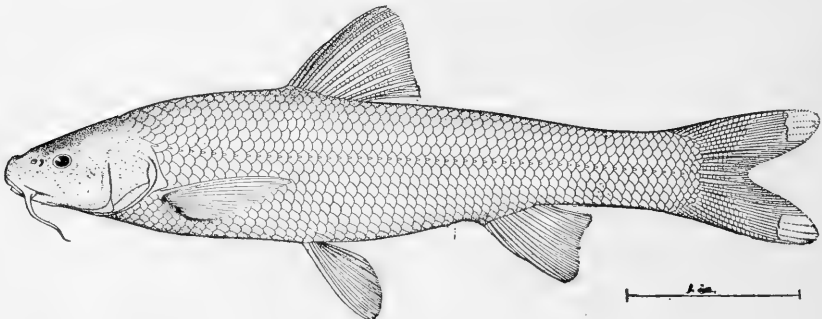


FIG. 2.—*ZEZERA RATHBUNI*.

Body elongate, compressed, not deep; depth of caudal peduncle, 2 in head; head naked, rather blunt, the upper lip thick and somewhat projecting; depth of head, 1.50 in its length; pharyngeal teeth 5 + 5

short and blunt, rather rounded on top, with but little grinding surface; gill-rakers short and blunt, 10 on lower limb of outer arch; about 17 series of scales between head and origin of dorsal; base of dorsal, 1.75 in its length, its longest ray, 1.10 in head; ventrals inserted directly below the first to fourth rays of dorsal, their length, 1.50 in head; origin of anal midway between tip of pectorals and base of caudal; base of anal, 1.50 in its longest ray; pectorals, 1.10 in head.

Color in spirits, yellowish white with some silvery reflections; dorsal with three anterior rays dusky; pectorals with slight wash of dusky on their middle portion; caudal grayish, anal and ventral uniform yellowish white.

One specimen (Cat. No. 52078, U.S.N.M.) from Shanghai, China. Length, 4.50 inches.

CARASSIUS AURATUS (Linnæus).

One small specimen of the common gold-fish from Hongkong. Length, 3 inches.

Family COBITIDÆ.

MISGURNUS ANGUILLICAUDATUS (Cantor).

Head, 5.50 in length; barbels, 10, three on upper and two on lower jaw of each side.

Color in spirits, yellowish brown, some indistinct darker markings on upper half of body, usually a black spot on upper half of base of caudal, the spot sometimes extending to lower base of fin also. Two specimens from Shanghai. Length, 5-5.75 inches. These seem fully identical with our specimens from Japan.

Family SILURIDÆ.

FLUVIDRACO FULVIDRACO (Richardson).

Head, 3.50 in length; depth, 4.50; D. I, 6; A. 20; pectoral spine serrated on both edges; barbels, 8; caudal deeply forked.

Color in spirits, brownish, with a wash of yellowish on under parts.

One specimen from Shanghai. Length, 6.25 inches.

LIOCASSIS LONGIROSTRIS Günther.

Head, 3.50 in length; depth, 4.75; D. I, 7; A. 15; P. I, 9; caudal deeply forked; barbels, four on upper jaw, four on lower jaw; numerous sharp teeth in jaws, vomer, and palatines; a roughened bony plate on nuchal region and at origin of dorsal; pectoral and dorsal spines very strong and armed with barbs; upper jaw projecting.

One specimen from China, "probably Hongkong." Length, 10 inches. This species was described from a specimen from Jamrach's collection, said to come from "Japan." It is doubtless Chinese, and should be omitted from Japanese lists.

Family FISTULARIIDÆ.

FISTULARIA STARKSI Jordan and Seale, new species.

Head, 2.50 in length; snout, 3.15; depth much less than width of body; mandible, 5.20 in snout; eye, 9 in snout, 1.45 in postocular portion of head; maxillary, 2 in mandible; the depth of head at nuchal region is greater than its width. The ridges on top of head are as in *Fistularia petimba (depressa)*, as described by Günther, the median ridges being at all points farther apart than their distance from upper lateral ridge; lower lateral ridges scarcely roughened; the posterior two-thirds of lateral ridges strongly spinous; D. 15; A. 14; about 23 minute separate spinelets in front of dorsal.

Body very elongate, flattened, the anterior bones of head projected into a long beak; thoracic portion of body formed of large plates, the upper with 3 smooth longitudinal raised lines; postorbital bones promi-

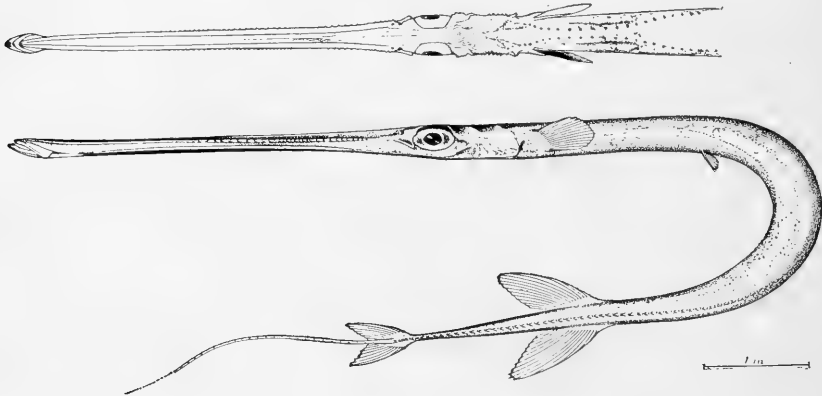


FIG. 3.—FISTULARIA STARKSI.

nent, strongly denticulate; interorbital space concave, equal to width of pupil; a prominent, strongly serrated, bony ridge at upper margin of opercles; a row of lateral spines or barbs along the sides of body from head to caudal; these are very strong and barb-like on posterior third of body, much larger and stronger than in any other known species of *Fistularia*, the longest barb being about one-half width of pupil; other portions of body smooth, unscathed. Insertion of dorsal directly over anal, the two fins being similar and about equal in size, the distance between their origin and base of caudal, 2 in length of snout; pectorals, 7.20 in snout; ventrals small, 1.50 in eye; caudal small, deeply forked with one median projecting filament which is about 2 in length of snout.

Color in spirits, uniform yellow, with wash of red; fins unmarked.

One specimen from Hongkong. Cat. No. 52079, U.S.N.M. Length, 14.50 inches.

Family SYNGNATHIDÆ.

SYNGNATHUS SCHLEGELI Kaup.

Head, 7.50 in length; snout rather long and slender, its length one-half greater than postorbital part of head; rings 20 + 34; D. 37; interorbital space concave, narrow, equaling one-half of eye; eye, 4 in snout; top of head and snout smooth; a small rounded caudal fin equal in length to postorbital part of head; body, about 1.30 in tail; opercle without a distinct ridge; width of body greater than depth.

One specimen from Shanghai, identical with this common Japanese species.

Family MUGILIDÆ.

MUGIL CEPHALUS Linnæus.

Mugil aur FORSKÅL.

Head, 4 in length; depth, 4.30; eye, 4 in head, a very broad adipose eyelid; lips thin, the upper with a single row of small fringes. D. IV-9; A. III, 8; scales 37.

One specimen from Hongkong, China, 10 inches long; another from Shanghai, 5.50 inches long.

Family SERRANIDÆ.

LATEOLABRAX JAPONICUS (Cuvier and Valenciennes).

Head, 3 in length; depth, 3.40; eye, 5 in head; D. X, 12; A. III, 7; scales about 80 in lateral series; maxillary extending to below posterior border of eye; villiform teeth in jaws, vomer, and palatines.

Color in spirits, silvery, slightly darker above, with scattered black spots above the lateral line.

One specimen from Shanghai. Length, 8 inches.

DIPLOPRION BIFASCIATUS (Kuhl and Van Hasselt).

Head, 3 in length; depth, 2.20; D. VIII, 14; A. II, 12.

One specimen of this well-marked species from Hongkong. Length, 7.50 inches.

Family PRIACANTHIDÆ.

PRIACANTHUS TAYENUS Richardson.

Head, 3 in length; depth, 3; D. X, 12; A. III, 13.

Color in spirits, yellowish white, ventral membrane with round black spots, the one nearest the body very much larger than the others.

One specimen, length, 2.50 inches, from Hongkong, China.

Family LUTIANIDÆ.

LUTIANUS ERYTHROPTERUS (Bloch).

Head, 2.50 in length; depth, 2.25; D. XI, 13; A. III, 8; scales about 46; sharp pointed fixed teeth in jaws, a single row with a patch in front in lower jaw, two or three rows in upper jaw with one or more curved canines in front; posterior limb of preopercle strongly denticulate, with a stronger spine at angle; opercle with a single sharp spine at posterior tip; maxillary reaching to below anterior margin of pupil.

Color in spirits, yellow, about 12 narrow longitudinal brown bands; a large dark brown white-edged ocellus occupying the entire caudal peduncle; a brown stripe from dorsal to eye; caudal white, ventrals black.

One young specimen from Hongkong. Length, 1.55 inches.

LUTIANUS JOHNII (Bloch).

Head, 2.75 in length; depth, 2.50; eye, 4.50 in head; D. XI, 14; A. III, 8, scales, 48.

Color in spirits, yellowish white, a large oval black spot under anterior portion of soft dorsal; notch of preopercle shallow.

One specimen from China, probably Shanghai. Length, 8.50 inches.

Family SCIÆNIDÆ.

PSEUDOSCIÆNA POLYACTIS Bleeker.

D. X, 35. Second anal spine very short, less than eye. Color in spirits, uniform yellowish white. One specimen from China, probably Shanghai. Length, 10.50 inches.

The species is notable for the great length of the dorsal fin.

COLLICHTHYS FRAGILIS Jordan and Seale, new species.

Head, 3.75 in length; depth, 3.50; D. IX, 28; A. II, 13; scales of moderate size, very deciduous; eye small, 6 in head; snout, 4 in head; interorbital space, 3 in head; three spines on middle of nuchal region, one directed forward, one directed back. A broad fringed flap on shoulders above posterior portion of opercles.

Body moderately elongate, compressed, the fish becoming rather abruptly slender at origin of anal; caudal peduncle slender, its depth about equal to orbit; head large, scaled, roughened with ridges; mouth large, oblique, only the distal portion of maxillary exposed; end of maxillary under the posterior margin of eye, a notch at symphysis of upper jaw; teeth in villiform bands in jaws, with a cluster of slightly larger ones along front of lower jaw; opercles and preopercles apparently entire, several small bony ridges extending

from vertical limb of preopercle; origin of dorsal directly above origin of pectorals; longest dorsal spine, 2 in head; the longest ray, about 2.50 in head; base of anal, 1.25 in head, its longest ray, 1.75 in head; ventrals, 1.50 in head; pectorals, 1.50 in head; caudal rounded, about 1.25 in head.

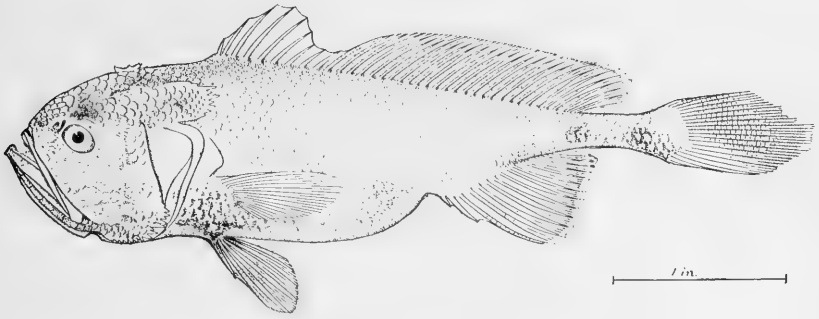


FIG. 4.—*COLLICHTHYS FRAGILIS*.

Color in spirits, uniform, dull yellowish white, with slight wash of brown on back and caudal peduncle; fins uniform.

One mutilated specimen, Cat. No. 52080, U.S.N.M., from Shanghai. Length, 4.75 inches.

Family OPHICEPHALIDÆ.

OPHICEPHALUS PEKINENSIS Basilewsky.

? *Ophicephalus miliaris* CUVIER and VALENCIENNES.

Head, 2.80 in length; depth, 6.30; eye, 4.50 in head; ventral fins small. D. 49; A. 32; scales about 64; villiform teeth in jaws, vomer, and palatines with larger teeth among them; cheeks and head scaled; maxillary reaching to posterior part of eye; three distinct mucous pores on under part of jaw and three on lower limb of subopercle. Color in spirits brownish, with 12 or 13 indistinct darker stripes or bands on sides and back, taking the form of dusky blotches, two indistinct longitudinal lines on sides of head.

Two specimens from Shanghai. Length, 2.75–3 inches.

This fish may be identical with *O. miliaris* Cuvier and Valenciennes, but as the fins and teeth are not described, it is impossible to make a certain identification.

Family POMACENTRIDÆ.

AMPHIPRION POLYMNUS (Linnæus).

Amphiprion Japonicus (SCHLEGEL).

One fine specimen, probably from Hongkong, corresponding fully to the account of *Amphiprion japonicus*. It is very closely allied to *Amphiprion snyderi* Ishikawa, lately described from the Bonin Islands.^a

^aProc. Nat. Hist., Imp. Mus., Tokyo, I, 1904, p. 11.

The nuchal band is, however, narrower and more deeply defined than in *A. snyderi*. It is less directed backward and does not involve the bases of the first two dorsal spines. The second band is also narrower and sharper, and the third forms a sharp pearly streak in front of the yellow of the tail and caudal fin. The ventrals and anal are yellow, both with a black edge.

The figure of *Prochilus polymnus* in Bleeker's Atlas fits our Hongkong specimen perfectly. We give a colored figure of the latter specimen in another paper, On the fishes collected at Hongkong by William Finch.^a

Family LABRIDÆ.

THALASSOMA LUNARE (Linnæus).

Head, 3.75 in length; depth, 3.50; eye, 6.50 in head; caudal lunate, the lobes prolonged.

Color in spirits yellowish; head blue, with several bands; pectorals with a blue-black area running parallel with rays on the upper third of fin.

One specimen from China, probably Shanghai. Length, 8.25 inches.

STETHOJULIS INTERRUPTA (Bleeker).

Head, 2.75 in length; depth, 3.25; D. IX, 12; A. III, 11; scales, 27.

Color in spirits yellowish; the position of lines and markings are as in Bleeker's figure, but the lines are whitish in spirits, doubtless red in life.

One specimen in the Jouy Collection labeled China (probably from Hongkong).

Family CHÆTODONTIDÆ.

CHÆTODON COLLARIS Bloch.

Head, 3.75 in length; depth, 1.50; D. XI, 23; A. III, 20.

One fine specimen from Hongkong; length, 5.20 inches. This example agrees perfectly with the specimen from Japan, described and figured by Jordan and Fowler.^b

Family MONACANTHIDÆ.

MONACANTHUS CHINENSIS (Bloch).

Head, 3.50 in length; depth, 2; D. 28; A. 29.

Two specimens from Hongkong. Length, 3.25-7.75. The small specimen has the barbs on the dorsal spine stronger than on the large example.

^a Proc. Davenport Acad. Sci. 1905.

^b Proc. U. S. Nat. Mus., XXV, p. 534.

MONACANTHUS JAPONICUS (Tilesius).

Head, 3.50 in length; depth, 1.50; D. I, 27; A. 27; spine barbed, rather strong; color in spirits brownish, with two indistinct dusky bands from base of dorsal and anal.

One specimen from Shanghai. Length, 1.50, similar to others from Japan.

Family TETRAODONTIDÆ.

SPHEROIDES RUBRIPES (Schlegel).

Head, 2.80 in length; interorbital width, 2.50 in head; caudal truncate. Color in spirits yellowish, a brownish wash on back with some indistinct cross-bands, a large blackish ocellus with a white ring on anal and one on base of dorsal, also a dusky or brownish blotch under posterior portion of pectorals.

One young specimen from Shanghai. Length, 1.50 inches.

Family SCORPÆNIDÆ.

PROSOPODASYS LEURYNNIS Jordan and Seale, new species.

Head, 3 in length; depth, 3; D. III-IX, 8; A. I, 7; snout equal to eye; interorbital space, two-thirds width of eye; preorbital with two very large spines directed backward; preopercle with four large spines

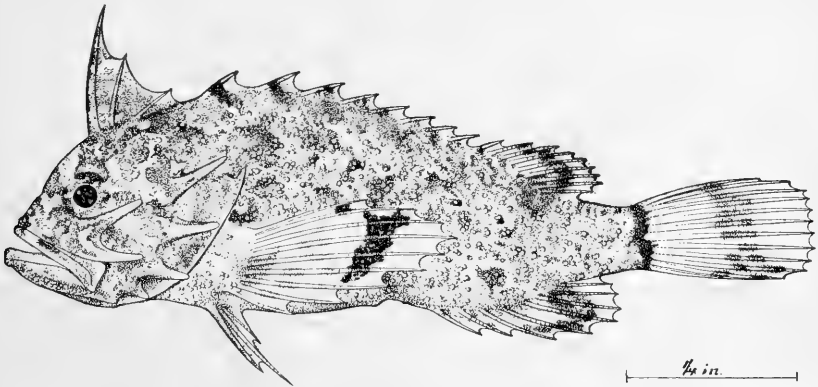


FIG. 5.—*PROSOPODASYS LEURYNNIS*.

directed backward, the upper one the largest; head without tubercles; no teeth on palatines.

Body oblong, compressed, the snout almost straight in profile, the lower jaw slightly the longer; depth of caudal peduncle 3.20 in head; body apparently naked; mouth moderate, the maxillary reaching to below posterior margin of pupil; small teeth on jaws and vomer, no teeth on palatines; gill-rakers consisting of small prickly clusters, 7 of these on lower limb; the first dorsal spine long and strong, situated

directly over posterior margin of orbit, its length equal to postorbital part of head; the three anterior spines graduated, connected by membrane, but separated from the fourth spine; the last two dorsal spines also somewhat separated from the others; anal fin rather short, its longest ray, 3.50 in head; ventrals small, short, 2.20 in head; pectorals entire, equal to length of head; caudal rounded, 1.20 in head.

Color in spirits, mottled everywhere with yellowish brown; anterior half of caudal white, posterior portion of pectorals brown with a dusky blotch on posterior third; other fins mottled with brown.

Two specimens from Hongkong, China. Length, 0.85–1.15 inches. The type is Cat. No. 52081, U.S.N.M. From the absence of palatine teeth it is perhaps a representative of a subgenus distinct from *Prosopodusys*.

Family GOBIIDÆ.

BOSTRYCHUS SINENSIS Lacépède.

Head, 3.75 in length; depth, 6.05; eye, 6.50 in head; villiform teeth on jaws, vomer, and palatines; D. VI–I, 12; A. I, 9; a brown ocellus on upper base of the caudal fin; brownish in spirits.

Two specimens of the widely diffused species, from Shanghai. Length 4.75–5.50 inches.

MOGURNDA OBSCURA (Schlegel).

Head, 2.80 in length; depth, 6; eye, 6 in head; D. VII–9; A. 9; scales, 38; bands of small teeth in jaws, none on vomer or palatines; head scaled; maxillary reaching to below middle of eye.

Color in spirits, brownish, with blotches and black dots; fins with brown bands.

One specimen from Shanghai, China. Length, 5 inches. It is identical with Japanese specimens. We can not separate the Asiatic genus called *Odontobutis* Bleeker from the Australian *Mogurnda*, of Gill.

ELEOTRIS BALIA Jordan and Seale, new species.

Head, 3.20 in length; depth, 4.50; D. VI–9; A. 9; scales, about 47 to end of last caudal vertebra; 48 scales between origin of dorsal and snout; eye, 6.50 in head, 1.75 in snout, 2 in interorbital space; maxillary extending to below middle of eye.

Body moderately elongate, slightly compressed; caudal peduncle deep, 2.90 in head; head rather flat, depressed, the interorbital space almost flat; scales very small on top of head and on cheeks, minute on belly and thorax, larger on sides and largest on caudal peduncle; bands of small teeth in jaws, none on vomer or palatines; a rather distinct spine directed downward on the posterior margin of preopercle; origin of spinous dorsal over the posterior third of ventrals, the longest dorsal spine, 2.75 in head; six series of scales between base of

spinous and soft dorsal; base of soft dorsal, 2 in head, its longest ray 2.90 in head; origin of anal about one ray posterior to origin of soft dorsal, its base, 2.50 in head; pectorals, 1.20 in head; ventrals 1.75, in head; caudal rounded, 1.20 in head.

Color in spirits, brown, a wide black stripe, made up of small black dots, extending from opercle to caudal; a distinct narrow black line through eye from snout to origin of dark stripe on body; another short black line from posterior margin of orbit to posterior margin of preopercle; some small scattered black dots below the anterior half of the dark body stripe; the centers of the scales a little lighter in color, this giving an indistinct striped appearance to the body; some white

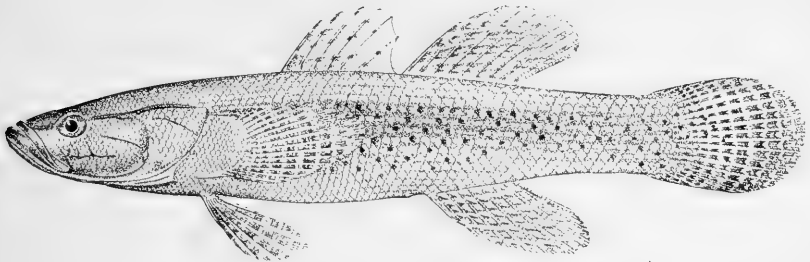


FIG. 6.—ELEOTRIS BALIA.

spots on under side of head; dorsal fins each with four longitudinal brown lines, darkest on the soft rays, the one at base of spinous dorsal indistinct; pectorals with several narrow irregular brown lines; ventrals with four or five brown bands; anal banded with brown; caudal with irregular lines or blotches of brown.

One specimen from China, probably from Hongkong; Cat. No. 52082, U.S.N.M.

PERIOPHTHALMUS CANTONENSIS (Osbeck).

Head, 4 in length; depth, 5.50; D. XIV, 12; A. 12; scales, about 75.

Color in spirits, grayish with a wash of brown on upper part; small dark specks scattered over body; dorsal grayish dusky at top; the soft dorsal with dark specks at base and a dark submarginal band.

Eighteen specimens from Shanghai. Length, 0.75–2.50 inches.

RHINOGOBIUS PLATYCEPHALUS (Peters).

Head, 3.20 in length; depth, 5.25; eye, 6.50 in head; D. VI–9; A. 6; scales, about 29; teeth in villiform bands in jaws.

Color in spirits, yellowish white; a small black opercular spot.

Six specimens. Length, 1–3 inches. From Shanghai.

ACANTHOGOBIUS OMMATURUS (Richardson).

Head, 3.50 in length; depth, 6.10; eye, 5.10 in head; D. IX-20; A. 16; scales, about 77; head naked except nuchal region, upper half of opercles and the cheeks which bear a few small scales near upper margin of preopercle; in lower jaw a single irregular row of rather large sharp-pointed teeth, upper jaw with two or three rows, with some larger curved teeth intermingled.

Color in spirits, uniform yellowish white; dorsal with brownish oblique stripes; caudal with a dusky shade.

Two specimens from Shanghai. Length, 4-4.50 inches.

GOBIICHTHYS MICROLEPIS (Bleeker).

Head, 4 in length; depth, 6; interorbital width one-half pupil; D. VI-13; A. 14; scales, about 55, larger on posterior part of body; head naked; opercles and preopercles entire; a single row of sharp curved teeth in upper jaw, two rows of slightly smaller ones in lower jaw; maxillary extending to below anterior third of eye; lower jaw the longer; anterior dorsal ray longest; caudal elongate.

Color in spirits, yellowish, a tint of dusky on tip of posterior rays of spinous dorsal.

Five specimens from Hongkong. Length, 4.50-5 inches.

PARACHÆTURICHTHYS POLYNEMUS (Bleeker).

Head, 3.95 in length; depth, 5.20; D. VI-11; A. 10; scales, 27; head and cheeks scaled; teeth in several rows, with some enlarged outer ones; caudal elongate, sharp; dorsal not elongate; numerous barbels on lower margin of subopercles, isthmus and lower jaw.

Color in spirits, yellowish brown; the fins all have a wash of dusky; a large black, white-edged ocellus on upper rays of caudal, not extending on caudal peduncle or on base of fin; scales on top of head rather large.

Three specimens from Hongkong. Length, 2.20-3 inches.

Family **PLEURONECTIDÆ**.**ARNOGLOSSUS TENUIS** Günther.

Head, 4 in length; depth, 2.75; D. 90; A. 70; small sharp teeth on each jaw; eyes close together on left side.

Two small specimens of this most fragile of flounders, from Hongkong. Length 2.50 inches. They agree well with Günther's description.^a

^aShore Fishes, Challenger, p. 55.

PSEUDORHOMBUS ARSIUS (Hamilton-Buchanan).

Head on left side; head, 3.85 in length; depth, 2.05; interorbital narrow, less than pupil. D. 71; A. 55; scales about 75; curved portion of lateral line 3 in the straight portion; maxillary reaching to anterior margin of pupil.

Color in spirits, yellowish, with numerous lighter spots and dots, an indistinct dusky blotch on lateral line; scales ctenoid on both sides.

One specimen from Hongkong. Length, 8.50 inches.

Family **SOLEIDÆ**.**CYNOGLOSSUS AREL** (Bloch and Schneider).

Head, 4.50 in length; depth, 4.25; eye, 3.20 in snout; D. 120; scales 96.

One specimen from Hongkong. Length, 10.50 inches.

Family **CALLIONYMIDÆ**.**CALLIONYMUS OLIDUS** Günther.

Head, 2.75 in length; depth, 11; D. IV-10; A. 9; three anterior dorsal spines elongate, filiform, the fourth short; preopercular spine strong, equal to length of eye, with four hooked barbs on the posterior arm and one spine directed forward at base.

One small specimen. Length, 2.50 inches, from Shanghai. It agrees very well with the account given by Günther



ON THE SYNTOMID MOTHS OF SOUTHERN VENEZUELA
COLLECTED IN 1898-1900.

By EDWARD A. KLAGES,

Of Crafton, Pennsylvania.

Having recently studied the Syntomidae remaining in my collections brought from Venezuela, as well as some received later, and finding a comparatively large percentage new to science, it was deemed advisable to undertake a thorough study of the species.

As the U. S. National Museum acquired a complete representation of the moths taken by me in Venezuela after the first year's collecting,^a arrangements were made with its officials whereby I have been enabled to undertake the study of almost all the accessible species of Syntomidae^b taken by me during my entire trip in Venezuela. The present paper is therefore based primarily upon specimens in the U. S. National Museum and, solely, upon species collected by the author. The arrangement followed is in accordance with that in Hampson's admirable work on the family,^c with such minor changes as are warranted by the present study and the writer's knowledge of their habits.

PSEUDOSPHEX AURIFERA, new species.

Female.—Head, and thorax beneath, dark brown; antennae fulvous with dilated portion purple; two outer joints of palpi, the frons, and head behind eyes with some grey hair; neck, tegulae, and thorax above, clothed with golden hair; legs fulvous, the front pair dark; abdomen

^a The Tring Museum received the specimens taken during the first year in the field.

^b Some of the species taken the first year were not found in duplicate, and such of them as were not taken later are necessarily omitted. Of the species taken after the first year two are not included because it was impossible to study the venation without some injury to the specimens, which, being uniques, it would be unadvisable to mar. At least two other species were not found in time to be studied.

^c Catalogue of the Syntomidae in the Collection of the British Museum, by Sir George F. Hampson, Bart

fulvous-brown; the sides and ventral surface of second segment and lateral patches and ventral fringe on third segment silvery; wings yellow-hyaline, the veins and cilia brown. Fore wing with the area in front of the median nervure and vein 5 brown, the cell with the scales less dense toward base; the inner area with brown fascia expanded to vein 1 except on outer third. Hind wing with fulvous costal fascia, and the front of cell rather thinly clothed with brownish scales.

Expanse.—28–30 mm.

Habitat.—Suapure, Venezuela.

Types.—Cat. No. 8403, U.S.N.M., and in collection of the author.

This species, as well as the next, belongs to the same generic section as *P. polistes* Hübner.

PSEUDOSPHEX CAURENSIS, new species.

Male.—Head fulvous-yellow; antennæ, tegulæ, thorax, and legs fulvous; lower part of frons and line behind eyes white; vertex with black patch; mesothorax clothed rather thinly between dorsal line and patagia; fore coxæ, and streaks on fore and middle femoræ silvery; abdomen with the first three segments and ventral valve fulvous, the fourth segment with the ventral surface light fulvous, the upper surface and following segments black; the first segment with subdorsal black lines, the second and third dorsal segments narrowly edged, and the fourth dorsal segment irrorated and broadly edged with fulvous-yellow; the ventral valve and the third ventral segment fringed with white; wings fulvous-hyaline, the veins fulvous. Fore wing with costal and inner fascia fulvous and the outer end of cell and area forward of vein 5 somewhat irrorated. Hind wing with fulvous costal fascia.

Expanse.—30–32 mm.

Habitat.—Suapure, Venezuela.

Types.—Cat. No. 8404, U.S.N.M., and in collection of the author.

PSEUDOSPHEX POLISTES, Hübner.

Habitat.—Suapure, Venezuela.

SPHECOSOMA GRACILIS, new species.

Male.—Head, thorax, and legs orange; palpi in front with some whitish scales; antennæ with the shaft reddish and the branches dark; spot on vertex, band on back of head, patches on tegulæ, stripes on patagia, and large patches on meso- and meta-thorax black; pectus with white spots; fore coxæ whitish at base; abdomen fulvous above and lighter below, the segments fringed with fulvous-yellow; the front of first segment with a black bar expanded at middle into a short dorsal stripe not reaching second segment; the tubercles with a few

silver-green scales; wings yellow-hyaline, the veins, and margins very narrowly, brown. Fore wing with fulvous inner fascia.

Female.—Other than in the antennæ, there are no definite secondary characters.

Expanse.—26–30 mm.

Habitat.—Suapure, and the upper Caura, Venezuela.

Types.—Cat. No. 8405, U.S.N.M., and in collection of the author.

Allied to *S. angustatum* Möschler.

POMPILODES ALIENA Walker.

Habitat.—Suapure, Venezuela.

ISANTHRENE CRABRONIFORMIS Staudinger.

This differs a little from the typical form, of which it seems to be a variation due to locality.

Habitat.—Suapure, Venezuela.

HYDA BASILUTEA Walker.

Habitat.—Ciudad Bolívar and Suapure, Venezuela.

PHÆNICOPROCTA VACILLANS Walker.

Habitat.—Suapure, Venezuela.

PHEIA LATERALIS, new species.

Female.—Head, body, and legs brown-black; frons with lateral white spots; antennæ with minute streaks at base, and stripes near tips white; patches on tegulæ, shoulders, meso and metathorax, and stripes on patagia crimson; coxæ with white spots; abdomen with two dorsal white stripes on first segment, followed by two dorsal series of golden green spots, smallest at beginning, and subdorsal broad crimson stripes which beyond the sixth segment are abruptly narrowed (forming lateral stripes) and of a lighter or orange hue; the first three segments with ventral broad white stripe; wings hyaline, the veins and margins brown-black. Fore wing with a small basal patch below cell expanding into a short streak along front of vein 1, a long subcostal streak, and a short streak on inner fascia crimson; a brown-black discoidal spot conjoined to the costal fascia, the terminal band wide on apical area and below vein 2. Hind wing with the terminal band wide on apical area and expanded at tornus.

Expanse.—30 mm.

Habitat.—Suapure, Venezuela.

Types.—Cat. No. 8406, U.S.N.M., and in collection of the author.

Allied to *P. daphæna* Hampson and *P. utica* Druce.

PHEIA UTICA Druce.

Habitat.—Ciudad Bolivar and Suapure, Venezuela.

PHEIA ALBISIGNA Walker.

Habitat.—Suapure, Venezuela.

MIMAGYRTA PULCHELLA, new species.

Female.—Head, thorax, and abdomen above, brown-black; pectus, legs, and abdomen beneath, white; streaks on front of palpi, the frons, streaks behind eyes, spots below tegulae, subdorsal spots on mesothorax, and subdorsal patches of hair on meso and metathorax white; tegulae dorsally tipped with white and with some metallic blue scales; patagia with small patch of whitish scales; legs streaked with brown; abdomen with subdorsal lines and interrupted lateral streaks whitish; the anal tufts and sublateral stripes on terminal segments brown-black; wings brown-black. Fore wing with white point at base of costal nervure, a broad yellow streak below base of cell, an oblique yellow patch in end of cell and extending to vein 1, an oblique hyaline band beyond the cell between veins 3 and 7, and some brilliant blue scales at base of inner margin; the underside as above, but without the brilliant blue and with whitish streaks on base. Hind wing with yellow fascia from base below the cell and vein 2 extending above vein 4 and between 3 and 4 to near termen; a few brilliant blue scales along vein 1, the cilia on inner margin white; underneath as above, but with whitish streak on base of costal area, a yellowish splash below the yellow fascia, and without any brilliant blue scales.

Expanse.—32 mm.

Habitat.—Suapure, Venezuela.

Types.—Cat. No. 8407, U.S.N.M., and in collection of the author.

This species bears a striking resemblance to *Chrostosoma tricolor* Felder and, as the venation is but slightly different, it seems that the two genera should be placed closer together than has been done.

LOXOPHLEBIA TRIANGULIFERA Felder.

Habitat.—Suapure, Venezuela.

COSMOSOMA HAMPSONI, new species.

Male.—Head and body above, dark orange; below, orange-yellow; palpi orange-yellow or orange; frons paler below; antennae black with the inner part of basal joint orange; paired spots on vertex, meso and metathorax, and spots on tegulae black with metallic blue patches; patagia with black border, the inner margin usually with slight metallic blue streak, the shoulders with metallic blue spots, pectus

with metallic blue patches; fore coxæ whitish; tibiæ with basal black stripes usually streaked with metallic blue, the stripes on fore and middle tibiæ short; abdomen with ventral valve; the front of first four dorsal segments narrowly whitish; the hind part of dorsal segments with subdorsal black patches (small or absent beyond sixth segment) usually (in types the first six pairs) enclosing metallic blue spots; usually the first five or six (in types five) pairs of patches connected dorsally, and the first three to five pairs rather extended laterally; underneath with silvery band (often hidden by ventral valve) on front of fourth segment, and the medial segments with or without lateral black spots, often enclosing metallic blue patches; wings yellow hyaline, the veins, and margins narrowly brown-black. Fore wing with metallic blue points at base, the terminal band wide on apical area, the inner fascia black. Hind wing with the terminal band wide at vein 1, the inner fascia orange.

Female.—The whitish fascia on fore coxæ and the silvery band on underside of fourth segment are absent; fore wing with basal orange streak on inner fascia. The ventral valve is of course absent.

Expanse.—Males 34-42 mm.; females 34-48 mm.

Habitat.—Suapure, Venezuela.

Types.—Cat. No. 8408, U.S.N.M., and in collection of the author.

Remarkable for the great variation in size. In rare instances the metallic markings are blue-green.

Allied to *C. nigricornis* Fabricius.

Named after Sir George F. Hampson in recognition of his lepidopterological writings, which, although of wonderful magnitude, are unexcelled in system and accuracy.

COSMOSOMA GEMMATUM Butler.

The form taken has the legs brown-black, and the abdomen with sublateral series of metallic blue spots (as in *C. xanthocera* Hampson). The male has the fore coxæ and streaks on legs brownish yellow, and the abdomen beneath without yellow spots on third segment. This form is evidently due to the locality.

Habitat.—Suapure, Venezuela.

COSMOSOMA GEMMATUM Butler var. XANTHOCERA Hampson.

In the form taken the antennæ are black, with the branches orange, and the shaft very rarely streaked. The abdomen frequently with orange spot or band on front of sixth segment, and the band on fifth segment not reduced in the male.

While the ground color of the head and body in this form is orange and in *gemmatum* black, the two forms are identical in habits, were observed to commingle sexually, and are undoubtedly varieties of

each other. They should be listed as given above, though the discovery of the new form of *xanthocera* makes the latter name no longer appropriate.

Habitat.—Suapure, Venezuela.

COSMOSOMA TEUTHRAS Walker.

In one specimen the discocellular spot was entirely absent, whereas in all other individuals it was quite prominent.

Habitat.—Ciudad Bolivar, Venezuela.

COSMOSOMA ACHEMON Fabricius.

In this species the male has the terminal band of forewing expanded between veins 2 and 3 to cell and along it to vein 4, the expanded portion being entirely black or with more or less broad orange-red streaks between the veins, the latter form agreeing with the description of the type.

Habitat.—Ciudad Bolivar, Venezuela.

COSMOSOMA ACHEMON Fabricius.

Variety.—In this rare form the usual red of the underside of the body is superseded by black, thus conforming to the coloration of the male.

Expanse.—28 mm.

Habitat.—Ciudad Bolivar, Venezuela.

COSMOSOMA ACHEMON Fabricius var. BOLIVARENSIS, new variety.

Male.—Head and body black; antennæ with some white on tips; patch on frons, spot between and spots behind antennæ, spots on tegulae and thorax, patches on pectus, fore coxæ below, and slight basal streaks on tibiae metallic blue; patagia with or without red stripe (in types without stripe in males, with stripe in females); abdomen with subdorsal series of metallic blue spots; the ventral surface with sublateral series of metallic blue spots which are very large on basal segment, and usually obsolete beyond (as in types); wings hyaline, the veins and margins black. Fore wing with metallic blue point at base of subcostal nervure, a black basal patch, a narrow black discoidal lunule; the terminal band very wide on apical area and expanded between veins 2 and 3 to cell and along it to vein 4. Hind wing with the terminal band wide at apex and expanded at tornus.

Female.—With the terminal band of fore wing not expanded between veins 2 and 4.

Expanse.—26–30 mm.

Habitat.—Ciudad Bolivar and Suapure, Venezuela, though only one specimen was met with at the latter place.

Types.—Cat. No. 8409, U.S.N.M., and in collection of the author.

The orange-red of the body and wings in *achemon* is, in this form, almost if not entirely superseded by black. It is closely allied to *C. remotum* Walker, and it is very likely that the latter and, perhaps, one or two more of the related "species," may yet be added to the list of varieties. The three forms herein listed were found together and are exactly alike in habits.

MYCETROCNEME VARIPES Walker.

The only specimen taken is a female in which the hyaline area of the fore wing is reduced to a small spot below the cell, and another between veins 3 and 4.

Habitat.—Suapure, Venezuela.

SAURITA CRYPTOLEUCA Walker.

Habitat.—Suapure, Venezuela.

SAURITA CASSANDRA Linnæus.

Habitat.—Ciudad Bolivar and Suapure, Venezuela.

SAURITA VITRISTRIGA Druce.

As the male of this species was evidently unknown when Mr. Hampson monographed the family, the following description is given:

Male.—Abdomen with ventral valve covering the basal segments, the valve black-brown broadly fringed with white; the last four ventral segments yellowish, and the preceding two with sublateral white spots.

In this species the wings show considerable variation; the hyaline area in some individuals being inconspicuous, though it is usually prominent and occasionally occupies about one-fourth of the whole area.

The male having a ventral valve would place this species in the same group as *S. cassandra* Linnæus.

Habitat.—Suapure, Venezuela.

SAURITA ANTHRACINA, new species.

Female.—Body black: frons and vertex with bluish metallic spots and some whitish scales; spots on tegulæ, shoulders, pectus, mesothorax, and spot on metathorax metallic blue with some whitish scales; legs brown-black; abdomen with dorsal and lateral lines, and sublateral series of spots metallic green merging into blue at base; wings brown-black. Fore wing above slightly suffused with brilliant blue; underneath with short metallic blue streak on base of costal nervure, and a suffused brilliant blue streak on median nervure with branches on

veins 2, 3, and 4. Hind wing beneath with a suffused brilliant blue streak on median nervure.

Expanse.—42 mm.

Habitat.—Suapure, Venezuela.

Type.—Cat. No. 8410, U.S.N.M.

SAURITA VENEZUELENSIS, new species.

Male.—Black; tegulae, patagia, and thorax above orange; the head, body, and base of fore wings with some metallic blue scales. Fore wing with hyaline streaks in interspaces of basal half. Hind wing with the interspaces hyaline.

Female.—The orange on tegulae obsolete in type, the interspaces of both wings hyaline, and the veins and margins black.

Expanse.—22–25 mm.

Habitat.—Ciudad Bolivar, Suapure, and the Caura Valley, Venezuela.

Types.—In collection of the author.

This and the next form are closely related to *S. temenus* Stoll, and the present form seems intermediate. Possibly these three may prove to be varieties of one species?

SAURITA VENEZUELENSIS E. A. Klages, var. OBSCURA, new variety.

Like the preceding, but without orange markings in males or females.

Habitat.—The same as preceding form.

Types.—Cat. No. 8411, U.S.N.M., and in collection of the author.

SAURITA THORACICA, new species.

Male.—Dark fuscous; frons whitish; thorax and pectus orange-red; fore coxae below with long whitish scales, the fore tibiae with white streaks; wings orange-red at base.

Female.—No markings on fore coxae and legs.

Expanse.—Male, 20 mm.; female, 25 mm.

Habitat.—Suapure, Venezuela.

Types.—Cat. No. 8412, U.S.N.M.

PSOLOPTERA LEUCOSTICTA Hübner.

Habitat.—Suapure, Venezuela.

HISTIÆA BELLATRIX Walker.

Habitat.—Suapure, Venezuela.

HISTIÆA MONTICOLA, new species.

Female.—Brown-black; frons yellowish below; shoulders with yellowish spots mixed with brown scales; points behind antennae, points on tegulae, dorsal streak on metathorax, and patches on pectus metal-

lie blue; legs brown, the fore coxæ with yellow patches. Abdomen with two dorsal and subdorsal brownish-yellow patches on front of first segment; the front of the second and third dorsal segments with lateral yellowish fasciæ nearly meeting above; the second, third, and fourth segments with ventral broad yellow bands; a dorsal spot on second segment, lateral series of spots beginning on same segment, and incomplete sublateral series of spots metallic blue. Fore wing with metallic-blue spots at base; a subcostal basal streak, a basal streak below cell, a patch in end of cell, and streaks below base of vein 2 crimson, slightly irrorated with brown scales; the discocellulars with metallic-blue streaks; an oblique postmedian series of yellowish spots between veins 3 and 7, the lower two being displaced outwardly; underside marked about as above, but with a metallic-blue streak in median part of cell, the lower discocellular streak expanded, and the crimson markings without brown scales and outlined clearly. Hind wing with basal large crimson patch below the cell, and an oblique postmedian series of crimson spots between veins 2 and 6; underside marked as above.

Expanse.—62–66 mm.

Habitat.—Suapure Mountains, Venezuela.

Types.—Cat. No. 8413, U.S.N.M., and in collection of the author.

MACROCNEME THYRIDIA Hampson.

The coloration in this species is subject to considerable variation, the metallic color varying from bronze-green to topaz and dark cupreous. The fore wing above often with medial metallic streaks which are sometimes expanded and conjoined into a more or less prominent central band.

Habitat.—Ciudad Bolivar and Suapure, Venezuela.

MACROCNEME AFFINIS, new species.

Female.—Black; basal spots on palpi, lateral spots on frons, and antennæ near tips white; tegulæ with white tips and some metallic-blue scales; subdorsal stripes on thorax, and streaks on patagia metallic blue; spots on trochanters, basal spots on fore coxæ, and tips of hind tarsi white; tibiæ and fore coxæ usually with metallic-blue streaks. Abdomen with subdorsal and lateral white spots on first segment, lateral and sublateral spots on second, and ventral points on the other segments; the dorsal surface beyond the subdorsal spots, and the sides of medial ventral segments suffused more or less with dark cupreous green. Fore wing with white point at base of costa; some metallic blue on base and streaks of same in and below end of cell and above inner margin; underneath with a subcostal streak, and large fasciæ in and below cell metallic blue. Hind wing underneath

with large metallic-blue fasciæ on front half to beyond end of cell, and sometimes with fascia on inner area.

Expanse.—36 mm.

Habitat.—Suapure, Venezuela.

Types.—Cat. No. 8414, U.S.N.M., and in collection of the author. This species is allied to *M. thyridia* Hampson.

MACROCNEME CHRYSOTARSIA Hampson.

In one specimen the hind tarsi are entirely black.

Habitat.—Ciudad Bolivar, Venezuela.

MACROCNEME CAURENSIS, new species.

Male.—Black; palpi with the basal joint and front of second joint white, the third joint sometimes streaked; lower part of frons with the sides white and some bluish scales between; vertex with some metallic-blue scales; points fore and aft on basal joint of antennæ, streaks behind eyes, and spots on neck white; patches on tegulæ, spots on shoulders, subdorsal spots on mesothorax, spot on metathorax, streaks on patagia, fore coxæ below, and streaks on tibiæ white suffused with metallic blue; spots on trochanters, and tips of hind tarsi white. Abdomen with metallic green dorsal and lateral stripes; the ventral valve metallic green broadly edged with white; the exposed ventral segments with sublateral series of white spots, sometimes connected ventrally. Fore wing with white point at base of subcostal nervure, some metallic green at base, and streaks in and in front of cell; underneath with subcostal streak, and large fasciæ in and below cell metallic green. Hind wing underneath with large metallic-green fasciæ in and in front of cell. The metallic green on the body and wings is blue in oblique light.

Expanse.—30 mm.

Habitat.—Suapure and Ciudad Bolivar, Venezuela, though only one specimen was met with at the latter place.

Types.—Cat. No. 8415, U.S.N.M., and in collection of the author. Allied to *M. alesa* Druce.

MACROCNEME VITTATA Walker.

Habitat.—Suapure, Venezuela.

CALONOTOS TIBURTUS Cramer?

Habitat.—Suapure, Venezuela.

Most if not all the species in this genus show considerable variation in the markings of the wings, and without the types before me it has been found impracticable to make definite determinations save in one instance. Two or three species of the genus were taken at Ciudad Bolivar.

CALONOTOS sp.

Habitat.—Suapure, Venezuela.

CALONOTOS sp.

Differs chiefly from the former in that the male has the fore coxæ clothed with rather long hair.

Habitat.—Suapure, Venezuela.

CALONOTOS PLUMULATUS, new species.

Male.—Brown-black; frons with lateral brown-mixed whitish patches; antennæ with some white on tips; points on tegulæ, spots on pectus, fore coxæ, and trochanters, and the tips of middle and hind femoræ white; abdomen above with white subdorsal lines and lateral spots on first segment, followed by dorsal and lateral broad golden green stripes; underneath with sublateral golden green stripes on first seven segments, and a ventral series of white spots. Fore wing with metallic blue-green basal streak below costa, and broad basal streak below median nervure; underneath with a subcostal short metallic blue-green streak at base, another beyond the middle, and a short streak in front part of cell. Hind wing underneath with broad metallic blue-green basal streaks in and in front of cell. Antennæ with the branches very long.

Expense.—50 mm.

Habitat.—Suapure, Venezuela.

Type.—Cat. No. 8416, U.S.N.M.

POLIOPASTEA VERDIVITTATA, new species.

Female.—Black; frons, streaks below eyes, spots on neck, median spots on patagia, and spots on pectus and trochanters white; spots on tegulæ and shoulders, dorsal streak on mesothorax, and patch on metathorax golden green; abdomen with broad golden green dorsal, lateral, and sublateral stripes, the lateral stripes beginning on second segment and in line with white stripes on first segment. Fore wing with white speck at base of costa, a subcostal short hyaline streak near base, and a broad golden green streak below base of cell; underneath with golden green streaks in cell. Hind wing underneath with basal short golden green streak below costa, and broad streak in cell.

Expense.—44 mm.

Habitat.—Suapure, Venezuela.

Type.—Cat. No. 8417, U.S.N.M.

POLIOPASTEA VERDIVITTATA E. A. Klages, var. FENESTRATA,
new variety.

Female.—Like the former, but with these additional characters: Fore wing with a median hyaline spot below the cell, and a postmedian series between veins 3 and 7 with the intervening portions of veins streaked with white. Hind wing with a hyaline spot beyond the cell.

Expansion.—44 mm.

Habitat.—Ciudad Bolivar and Suapure, Venezuela, the latter being the type locality.

Types.—Cat. No. 8418, U.S.N.M., and in collection of the author.

POLIOPASTEA PLUMBEA Hampson.

Habitat.—Suapure, Venezuela.

TRICHURA MONSTRABILIS, new species.

Male.—Head and body black; palpi in front, and streaks on neck white; frons, vertex, cheeks, tegulae, shoulders, patagia, thorax, and legs with patches of metallic blue (sometimes blue-green) scales; coxae with white patches; abdomen suffused with dark bronze-green, the constricted segment white at sides and beneath; wings hyaline, the veins and margins black. Fore wing with the base black with or without metallic blue point; a discoidal black bar conjoined to the costal fascia; the terminal band wider on apical half, underneath with basal white streak on subcostal nervure. Hind wing with apical black patch diminishing to vein 2, and the lobe on inner margin black, underneath with subcostal long white streak. Abdomen with or without (in types with) appendage on terminal segment.

Female.—Palpi, neck, and coxae without white; the white on underside of wings absent or inconspicuous. The abdomen, of course, is without the terminal appendage.

Expansion.—32-38 mm.

Habitat.—Suapure and the upper Caura, Venezuela.

Types.—Cat. No. 8405, U.S.N.M., and in collection of the author. Belongs between *T. esmeralda* and *T. latifascia* Walker.

TRICHURA COARCTATA Drury.

Habitat.—Suapure, Venezuela.

TRICHURA AURIFERA Butler.

Habitat.—Suapure, Venezuela.

TRICHURA MATHINA Druce.

Habitat.—Suapure, Venezuela.

ÆTHRIA ANDROMACHA Fabricius.

The form taken has the extremity of abdomen crimson.

Habitat.—Suapure, Venezuela.

ÆTHRIA CARNICAUDA Butler.

Habitat.—Suapure, Venezuela.

ÆTHRIA LANGLEYI, new species.

Female.—Head and body black; sides of frons white; cheeks, patches on tegulae and shoulders, streaks on patagia, dorsal spots on mesothorax and metathorax, and spots on pectus golden green; fore coxæ with silvery patches, and hind femoræ with white spots on tips; abdomen with the dorsal surface somewhat shot with brilliant blue, becoming obsolete toward tip; dorsal and moderately long lateral series of golden green spots inclosing patches of whitish scales; the terminal tufts and sides of preceding segment crimson, and the underside with short series of sublateral white patches; wings hyaline, the veins and margins black. Fore wing with the basal area black with golden green patch at base; a black discoidal bar conjoined to the costal fascia; the terminal band slightly expanded toward apex and at tornus. Hind wing with the terminal band expanding to costa and into a short streak below vein 1.

Expanse.—30 mm.

Habitat.—Suapure, Venezuela.

Type.—Cat. No. 8420, U.S.N.M.

This species belongs in the same generic section as the former two, as indicated by the venation of the fore wing.

Named after Dr. S. P. Langley, Secretary of the Smithsonian Institution.

ÆTHRIA ELIZA, new species.

Male.—Head and body deep black; palpi with the base and streaks on front white; head with white streaks behind eyes; shoulders with spots, the lower part being white and the upper part metallic blue-green; patches on tegulae, stripes on patagia, dorsal patches on meso and metathorax, and patches on pectus metallic blue-green; patches on coxæ and spots on tips of middle and hind femora white; abdomen above with the first three segments and patch on fourth segment brilliant blue; the first six segments with dorsal, and excepting first segment, lateral, and sublateral series of white spots, the sublateral spots being the largest; the second segment with sublateral metallic blue-green spots in front of the white spots, which on this and the next two segments are connected ventrally by a few white scales; the terminal tufts crimson; wings hyaline, the veins, and margins rather broadly deep black. Fore wing with the basal area black with metallic

blue-green patch at base; a discoidal deep black bar conjoined to the costal fascia; the terminal band slightly expanded toward apex and at tornus; underneath with subcostal short basal streak, and front half of basal patch metallic blue-green. Hind wing with base of cell brilliant blue, and a similar basal patch below it, the patches shortened toward front; the terminal band expanding widely toward apex and inclosing small hyaline spots above and below vein 6, and wide and somewhat dentate between veins 1 and 2; underneath with basal short metallic blue-green streak below costa; the basal patches black. The metallic blue-green markings change to blue or green, according to the direction of the light.

Expanse.—45-47 mm.

Habitat.—Suapure, Venezuela.

Types.—Cat. No. 8421, U.S.N.M., and in collection of the author.

As indicated by the venation of the fore wing, this species also belongs to the same generic section as the latter. Superficially it bears considerable resemblance to the species described by Druce under the name of *daltha*, a species belonging to a different generic section.

Of this splendid family this is the most beautiful species known to me, and I therefore name it after my mother.

ARGYRÆIDES CERES Druce.

Habitat.—Suapure, Venezuela.

It has been found advisable to place this species of *Argyræides* at the head of those taken, owing to the discovery of a species belonging to a new generic section.

ARGYRÆIDES AURANTICINCTA, new species.

Male.—Head, palpi, pectus, and legs orange; antennæ, tegulæ, and thorax above, black; antennæ with the basal joint orange in front; vertex with subdorsal black spots behind, and with or without black patch on front; edges of tegulæ, borders of patagia, and patch on metathorax orange; coxæ orange-yellow, and legs with black streaks; abdomen black above and orange-yellow below; the first dorsal segment with tuft at middle and some hair on sides and edge orange; the hind part of second dorsal segment and the front two-thirds of third dorsal segment naked (the exposed skin brownish yellow), the third and following dorsal segments with orange bands behind, the bands on third and seventh segments narrow; the terminal tufts crimson; wings yellow-hyaline, the veins black with yellowish splashes, and the margins narrowly black. Fore wing with basal orange spot, with or without crimson point; a long orange streak on edge of costa; a narrow discoidal black bar conjoined to the costal fascia, which is wider on outer half; the terminal band slightly expanded toward apex and below vein 2. Hind wing with the terminal band slightly expanded at apex, and the lobe on inner margin clothed with orange hair.

Expanse.—24 mm.

Habitat.—Suapure, Venezuela.

Types.—Cat. No. 8422, U.S.N.M., and in collection of the author.

The partial nakedness of the constricted dorsal segments seems to be a natural character which might easily escape notice or be attributed to accidental denudation, and likely does not occur outside of this genus, in which it seems limited to a few or possibly, though not likely, two species.

ARGYRÆIDES SUAPURENSIS, new species.

Male.—Head and body brown-black; palpi in front, edge, and sometimes lower part of frons, and spots fore and aft on basal joint of antennæ brownish white; lines behind eyes white; vertex with some grayish hair; tegulae and patagia with grayish or yellowish edges; shoulders and thorax with some grayish or yellowish hair; pectus with whitish patches; fore coxæ below, and patches on middle and hind coxæ whitish; hind tibiæ fringed with rough hair on outer half of inner edge; abdomen with the back part of second dorsal segment, and the front half or two-thirds of third dorsal segment naked (the exposed skin brownish yellow); the third dorsal segment with or without (in types with) yellow on edge; the next four dorsal segments edged with yellow, but very narrowly on seventh segment; the third segment ventrally whitish behind, and the next four ventral segments with narrow yellow or whitish fringes; wings yellow hyaline, the veins brown-black with some yellowish splashes, and the margins very narrowly brown-black. Hind wing with the lobe on inner margin clothed with black hair.

Female.—The whitish patches on fore coxæ are absent.

Expanse.—23–26 mm.

Habitat.—Suapure, Venezuela.

Types.—Cat. No. 8423, U.S.N.M., and in collection of the author.

The partial nakedness of the constricted dorsal segments in this species is a constant and natural character discovered from a critical examination of quite a number of specimens, nearly all of which are in excellent condition. The underside of the third segment is normally more or less bared in front, the denudation most likely being caused by some action of the legs.

This species constitutes a new generic section on account of the hind tibiæ being fringed.

DIPTILON HALTERATA Fabricius.

Habitat.—Suapure, Venezuela.

It is strange that this species, whose hind wings are of little if any use in its flight, should be taken so far north of its first-known habitat.

SYNTRICHURA VIRENS Butler var. REBA Druce.

Habitat.—Suapure, Venezuela.

EUMENOGASTER NOTABILIS Walker var. CAURENSIS, new variety.

Male.—Head, thorax, and legs brown-black; palpi in front, some hair on frons, streaks behind eyes, spots on basal joint of antennæ, patches on fore and hind coxæ, and on outer end of fore femoræ white; vertex and tegulæ with some yellowish hair; patagia with streak of yellow hair, and the inner edge and posterior part fringed with yellow and brown hair which are long behind; metathorax with similar long hair; hind tarsi yellow beneath; abdomen with the first three segments brown-black, and the others dark red becoming brown at extremity; the first segment with slight dorsal yellow tufts; subdorsal spots on front of second segment, and the front half of third dorsal segment silvery; the fourth dorsal segment with or without silvery line on front; the anterior two-thirds of third segment, and the front of fourth segment silvery beneath; wings yellowish hyaline, the veins and margins brown. Fore wing with very long scarlet subcostal streak; some yellow scales below base of cell; the area between discocellulars and apex clouded by being sparsely irrorated with black and crimson scales; the terminal band rather broad and slightly expanded toward apex. The veins on underside of both wings yellowish.

Expanse.—30-32 mm.

Habitat.—Suapure, Venezuela.

Types.—Cat. No. 8424, U.S.N.M., and in collection of the author.

This form is very much like *notabilis* Walker, and should be regarded as a variety of it as herein considered.

EUMENOGASTER HÆMACERA Hampson.

Habitat.—Suapure, Venezuela.

SESIURA SMARAGDINA Walker.

Habitat.—Suapure, Venezuela.

CHRYSOSTOLA MELLINA Herrick-Schäffer.

Habitat.—Suapure, Venezuela.

CHRYSOSTOLA ÆQUALIS Walker.

Habitat.—Suapure, Venezuela.

PSEUDARGYROEIDES, new genus.

Proboscis well developed; palpi upturned, not reaching vertex of head; antennæ bipectinate, with short branches, the shaft dilated at middle; tibæ with the spurs moderate, the fore and middle tibæ

fringed with rough hair; abdomen with the second and third segments constricted, the third segment quite narrow at middle. Fore wing with vein 2 from near middle of cell; 3 from well before angle; 4 from angle; 5 from above angle; 6 from below upper angle; 7, 8, 9, and 10, stalked; 11 from the cell near end. Hind wing with the cell long, the front part being the longer; vein 2 from long before angle; 3 from angle; 4 absent; 5 from well above angle; 6 from well below upper angle.

Type.—*P. caurensis*.

PSEUDARGYROEIDES CAURENSIS, new species.

Female.—Head and body brown-black; palpi with the tips orange in front; frons with lateral dark yellow spots; antennæ with yellow point on front of basal joint; some hair on vertex, and streaks on neck dark yellow; streaks behind eyes metallic green; tegulae sprinkled with dark yellow scales; mesothorax with subdorsal dark yellow stripes; metathorax with patch of some metallic blue scales, and some brown and dark yellow hair; patagia fringed with dark yellow, the hind part with brown and dark yellow hair; pectus with large dark metallic blue fascia and median yellowish patch; abdomen with dorsal point on front of first segment, and dorsal spot on front of second segment yellow; the first segment with a few dark yellow hair; the third segment beneath, and the front half above, yellowish, as are ventral fringes on the next three segments; the third, fourth, and fifth dorsal segments edged with dark yellow scales; wings yellow hyaline, the veins brown-black and yellowish above, yellowish below, and the margins narrowly brown-black. Fore wing with a discoidal bar; the terminal band expanded between vein 4 and apex; underneath with the discoidal bar yellowish. Hind wing with the terminal band expanded slightly at apex, and the lobe on inner margin clothed with black hair.

Expanse.—29 mm.

Habitat.—Suapure, Venezuela.

Type.—Cat. No. 8425, U.S.N.M.

This species bears a strong resemblance to *Argyrocydes suapurensis* E. A. Klages. The genus belongs next to *Chrysostola*.

EPANYCLES IMPERIALIS Walker.

Habitat.—Suapure, Venezuela.

ANDROCHARTA MEONES Stoll.

Habitat.—Ciudad Bolivar, Venezuela.

ANDROCHARTA DIVERSIPENNIS Walker var. **BRAZILIENSIS** Butler.

Habitat.—Suapure, Venezuela.

CERAMIDIA CAURENSIS, new species.

Male.—Brown-black shot with dark cupreous green; antennæ metallic blue above; patagia fringed behind with brown-black hair; four coxæ with white patches; abdomen with the first three ventral segments white. Fore wing underneath with the inner area white as far as covered normally by the hind wing. Hind wing above with the costal area and a streak on median nervure to end of cell white.

Males.

Expanse.—40–44 mm.

Habitat.—Suapure, Venezuela.

Types.—Cat. No. 8426, U.S.N.M., and in collection of the author.

In occasional specimens the metallic hue is dark blue-green.

Allied to *C. butleri* Möschler.

CERAMIDIA PHEMONOIDES Möschler.

Habitat.—Suapure, Venezuela.

AMYCLES ANTHRACINA Walker.

In two specimens the neck has prominent lateral crimson-tipped tufts, while the other examples have the tufts more or less obsolete and, with few exceptions, without a trace of crimson.

Habitat.—Suapure, Venezuela.

AMYCLES DOLOSA Walker.

Habitat.—Suapure, Venezuela.

ANTICHLORIS ERYPHIA Fabricius.

Habitat.—Suapure, Venezuela.

ANTICHLORIS QUARTZI, new species.

Male.—Head and body brown-black; palpi with some white on outer side; antennæ above, and patches on frons and vertex suffused with metallic blue; eyes with some white behind; patches on tegulæ and shoulders metallic blue or blue-green slightly suffused with white; meso and metathorax with dorsal metallic-blue patches; patagia with metallic-blue or blue-green stripes and fringed with brown-black hair longer behind; legs suffused with metallic blue or blue-green; patches on fore coxæ and streaks on legs white; abdomen with dorsal and lateral metallic blue-green or cupreous-green stripes, and a slight suffusion between; the second segment with white lateral spots on front; the ventral surface with sublateral white stripes narrowing distally, the intermediate area suffused with metallic blue or blue-green; wings brown-black diffused above with metallic blue-green and below with metallic blue, the diffusion on upper surface appearing stronger on

the nervures. Fore wing with metallic blue or blue-green spot at base of subcostal nervure; underneath with the inner area silvery as far as covered normally by the hind wing. Hind wing with the costal area silvery as far as covered normally by the fore wing.

Female.—The patches on fore coxæ are reduced to spots and the legs without white streaks; the inner area on underside of fore wing, and the costal area on upper side of hind wing grayish brown.

Expanse.—38–42 mm.

Habitat.—Suapure, Venezuela.

Types.—Cat. No. 8427, U.S.N.M., and in collection of the author.

The metallic hues are subject to variation, a few specimens having the upperside of the wings diffused with dark cupreous green, and the underside, as well as the markings on head and body, shows a corresponding change.

This species bears a striking resemblance to *A. cryphia* Fabricius, but, as the hind wing has vein 2 given off from toward angle of cell while the discocellulars are as in *A. panacea* Druce, it constitutes a new generic section forming a connection between the sections of which the former and latter species are representative. The former species should be placed after *A. scudderi* Butler.

Named after my neighbor, Mr. William B. Quartz.

SCIOPSYCHE AURANTICAUDA, new species.

Female.—Head, thorax, and legs black; abdomen with the first four segments above, and the first three below black; the underside of third segment with ventral patch and some scales along edge brownish white; the last ventral segment and anal tufts yellow; the other segments, and lateral spots on fourth dorsal segment orange; wings with the veins, and margins very narrowly, brown-black. Fore wing with the interspaces rather thinly clothed with brown-black scales. Hind wing semihyaline, the terminal and inner areas irregularly suffused with brown-black.

Expanse.—32 mm.

Habitat.—Suapure, Venezuela.

Types.—Cat. No. 8428, U.S.N.M., and in collection of the author.

While the venation in this species does not agree exactly with the genus *Sciopsyche*, yet the writer does not regard it as differing enough to warrant the founding of another new genus.

NAPATA VENEZUELENSIS, new species.

Male.—Brown-black; palpi in front, frons, and front of basal joint of antennæ white; head back of eyes with metallic blue stripes edged behind with white; some scales on vertex, patches on tegulæ, meso and metathorax, shoulders and pectus, the inner edge of patagia, and suffused streaks on legs metallic blue, the patches on shoulders with

some white below; coxæ, and streaks on underside of femoræ and fore tibiæ white. Abdomen with dorsal whitish line and lateral series of metallic spots blue at base and blue-green behind; the first six segments with broad ventral white stripe. Fore wing with a long narrow whitish streak on costal edge; a basal spot, and a short streak on base of vein 1 metallic blue; hyaline streaks in cell and below it to angle; ciliæ white at apex and, partly, at tornus. Hind wing with the ciliæ whitish toward tornus; the inner area white below.

Female.—Frons metallic blue; coxæ without white except at tips, the fore coxæ with metallic-blue patches; legs without white streaks; antennæ, shoulders, costal edge of fore wing, and inner area of underside of hind wing without white; abdomen with the ventral stripe present (as in types), or very rarely obsolete, the stripe clouded (usually slightly, as in types) by being irrorated with brown-black scales; palpi with or without (in types with) white on front and the white mixed with brown, the white usually (as in types) present as a small streak; the front of palpi also with or without (in types with) some metallic-blue scales toward outer end.

Expanse.—25–27 mm.

Habitat.—Ciudad Bolívar and Suapure, Venezuela.

Types.—Cat. No. 8429, U.S.N.M., and in collection of the author.

In rare instances the metallic markings are blue-green, but the metallic blue of ordinary specimens changes to blue-green in oblique light.

Allied to *N. terminalis* Walker and *N. leucotelus* Butler.

NAPATA QUADRIMACULATA Möscher.

Habitat.—Suapure, Venezuela.

IXYLASIA KELLERI, new species.

Male.—Head, thorax, and abdomen black; basal joint of palpi and points behind eyes white; spots on tegulæ, shoulders, and patagia, subdorsal points on mesothorax and dorsal point on hind margin of metathorax white and metallic blue; coxæ with white patches; abdomen with the tufts of hair brown and white; the dorsal surface with white and blue point on first segment, the terminal segment and band on preceding segment scarlet; underneath with short lateral series and longer sublateral series of white spots, the latter series followed by white-mixed dark orange patches on last two segments; wings hyaline, the veins and margins black. Fore wing with the base black, with two basal bluish-white points, a broad discoidal black bar conjoined to the costal fascia and extended and widened between veins 3 and 4, the terminal band expanding toward apex and widened below vein 2, the inner fascia rather broad and with a short metallic green streak on

basal half; underneath with a basal white and blue streak on costal fascia. Hind wing with a narrow discoidal black bar, the terminal band broad and irregular; underneath with a broad white and blue basal streak on costal fascia.

Female.—Head with the markings as in the male and with white patch on frons; tegulae, body, and wings without blue and white, or bluish-white markings; spots on shoulders, and dorsal spots fore and aft on thorax white; abdomen with dorsal and lateral white spots on first segment, the lateral and sublateral series absent, the terminal segment (excepting anterior subdorsal areas) and some scales on preceding dorsal segment scarlet. Fore wing without metallic green streak on inner fascia. The abdomen, of course, is without the basal tufts of long hair.

Expanse.—44-48 mm.

Habitat.—Suapure and the upper Caura, Venezuela.

Types.—Cat. No. 8430, U.S.N.M., and in collection of the author. Allied to *I. trogonoides* Walker.

Named in memory of the late Prof. Edward Keller, of Pittsburgh, Pennsylvania, whose knowledge of music, philology, and botany, and familiarity with most branches of natural history made him most attractive.

CACOSTATIA UMBRATICOLA, new species.

Male.—Black, shot with brilliant blue; some scales on front of palpi, the frons, cheeks, small patches of scales on tegulae and shoulders, and some scales on patagia and thorax white; legs fuscous with coxae and stripes white; abdomen with subdorsal whitish stripes; a broad ventral stripe and sublateral lines white. Fore wing with patch of scales on base of vein 1, and a short streak in front of outer end of patch, white; a large triangular hyaline patch in and below cell and between veins 2 and 3, and an oblique band beyond the cell between veins 3 and 7. Hind wing hyaline, the veins, and a terminal band expanding at apex and tornus and extending on inner margin to near base, black, shot with brilliant blue; ciliae partly white at tornus.

Expanse.—30-32 mm.

Habitat.—Suapure, Venezuela.

Types.—Cat. No. 8431, U.S.N.M., and in collection of the author. Allied to *C. discalis* Walker.

CYANOPEPLA GLAUPOIDES Walker.

Habitat.—Suapure Mountains, Venezuela.

AGYRTA PORPHYRIA Stoll.

Habitat.—Suapure, Venezuela.

CORREBIDIA CALOPTERIDIA Butler.

Habitat.—Suapure, Venezuela.

HYALEUCEREA ERYTHROTELUS Walker.

Habitat.—Suapure, Venezuela.

HYALEUCEREA CHAPMANI, new species.

Male.—Head, body, and legs fuscous; abdomen with subdorsal series of large patches beginning on fourth segment, and lateral anal tufts scarlet; wings hyaline, the veins and margins rather widely fuscous. Fore wing with a discoidal fuscous patch conjoined to the costal fascia and extending below angle of cell; the terminal band wide on apical area and expanded at vein 1. Hind wing with the terminal band wide at apex and the inner fascia rather broad.

Expanse.—26 mm.

Habitat.—Suapure, Venezuela.

Types.—Cat. No. 8432, U.S.N.M., and in collection of the author. Belongs in the same generic section as the former species.

Named after Prof. Thomas J. Chapman,^a author of *The French in the Allegheny Valley, Old Pittsburgh Days, etc.*

While the species included in this paper are all day-fliers it is likely that nearly all of them possess some characteristic habits which, in a number of cases, the writer was able to discover, but in other instances could not, owing to the paucity of specimens or from being too difficult to ascertain with exactness. Although it has been impossible to record these observations in the present paper, yet, without the knowledge gained in the field, it would have been impossible definitely to determine the relationship of some of the forms herein listed.

^a Professor Chapman died suddenly before this paper could be printed. A sketch of his life will be found in *The Chartiers Valley Mirror* of February 25, 1905, and in the current volume of *The Pennsylvania School Journal*.

A FOSSIL RACCOON FROM A CALIFORNIA PLEISTOCENE
CAVE DEPOSIT.

By JAMES WILLIAMS GIDLEY,
Of the Department of Geology.

While engaged in the work of cataloguing fossil vertebrate material in the United States National Museum, the writer recently brought to light a small collection of fossils from "Cave Bear" Cave, McCloud River, California, in which were some fragmentary bones and well-preserved upper and lower jaws of an apparently new species of *Procyon*, which is described below. The remainder of the lot consists principally of limb bones and vertebrae of a very large carnivore, probably a species of *Amphicyon*. These last-mentioned bones are comparatively free from matrix, being only lightly coated with a reddish deposit, characteristic of the decomposition of limestone, but the bones and teeth of the *Procyon* specimen were heavily incrustated with stalactitic and crystalline calcite, suggesting that they may have come from a different part of the cave. The specimens, however, are probably contemporary and of Pleistocene age.

This interesting little collection was procured and presented to the Museum by Mr. L. Stone, in 1881.

PROCYON SIMUS, new species.

The type specimen (Cat. No. 2634, U.S.N.M.) represents an adult male, as indicated by the relatively large canines, and consists of both jaws, containing a complete series of upper and lower teeth, a portion of the palate, both otic bullae, and a few other skull fragments. Associated with it and probably belonging to the same individual are the distal half of a humerus and the nearly complete half of a pelvis.

This species most closely resembles the California variety of the living *Procyon lotor*, with which it is here compared, but besides its somewhat greater size the following important differences are observable:

(1) The lower jaw has relatively a much greater depth, especially anteriorly, the molar premolar series of teeth standing at a relatively

higher elevation above the base of the canine. (2) Both upper and lower canines are comparatively larger, straighter, and placed more nearly vertical in the jaw. This, together with (3) the relatively wider separation, especially of the upper canines, and (4) the somewhat more prominent and more squarely set incisors, gives to the muzzle a massive and more pug-nosed appearance than is observed in *P. lotor*.

The second molars, upper and lower, are relatively larger, and the premolars are more closely crowded than is usual in the specimens of *P. lotor* examined, but these differences are perhaps not more marked than would be seen in the extreme of individual variation in this direction.

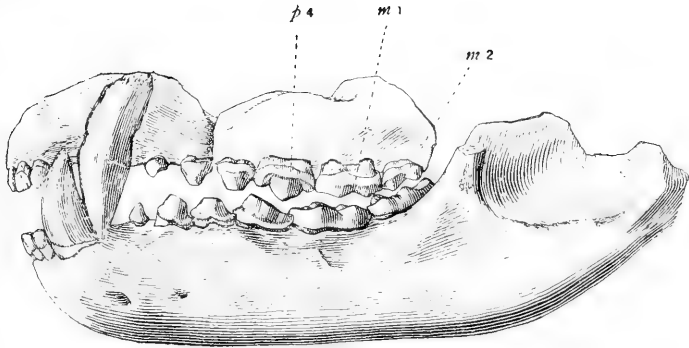
The following is a table of comparative measurements of the type specimen and an adult male of *P. lotor* from California. The two specimens represent as nearly as possible individuals of equal age, as indicated by a like degree of wear in the teeth.

Measurements.	<i>P. simus</i>	<i>P. lotor</i>
	(No. 2634, U.S.N.M.).	(No. 70948, U.S.N.M.).
	<i>mm.</i>	<i>mm.</i>
Total length of lower jaw	90.0	80.0
Total length of lower dental series	53.5	51.0
Depth of jaw at m_1	16.0	12.0
Depth of jaw at p_2	17.5	13.0
Width across upper incisors	18.5	16.0
Total width across upper canines	31.5	25.5
Anteroposterior diameter of canine at base	8.0	6.3
Diameters of p_4 :		
Anteroposterior	8.5	8.5
Transverse	8.5	8.0
Diameters of m_1 :		
Anteroposterior	9.0	9.0
Transverse	10.0	9.5
Diameters of m_2 :		
Anteroposterior	7.0	6.0
Transverse	8.5	8.0

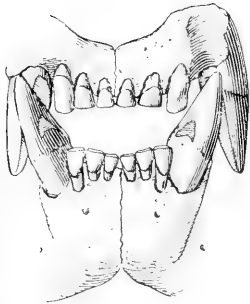
EXPLANATION OF PLATE XII.

Procyon simus.

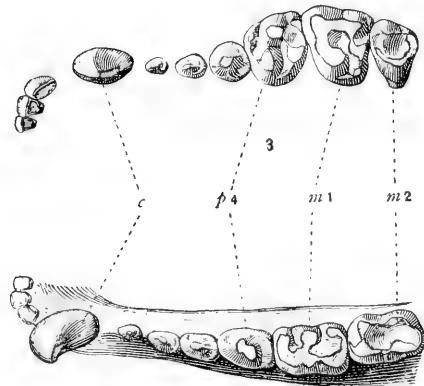
- FIG. 1. Upper and lower jaws, side view.
2. Upper and lower jaws, anterior view.
3. Superior dentition, crown view.
4. Inferior dentition, crown view.



1



2



4

PROCYON SIMUS, NEW SPECIES.

FOR EXPLANATION OF PLATE SEE PAGE 554.

THE MONKEYS OF THE MACACA NEMESTRINA GROUP.

By GERRIT S. MILLER, Jr.,
Assistant Curator, Division of Mammals.

The United States National Museum contains seventeen skins of monkeys of the *Macaca*^a *nemestrina* group, all but one of them collected and presented by Dr. W. L. Abbott. In this series are represented no less than five well characterized species, one each from Sumatra, Borneo, the Pagi Islands, the Malay Peninsula, and Chance Island, Mergui Archipelago. The specimens show no individual variations worthy of special note or which tend in any way to connect the different forms. The species may be distinguished as follows:

SYNOPSIS OF THE MONKEYS OF THE MACACA NEMESTRINA GROUP.

Hairs of back, underparts, arms, and legs indistinctly or not annulated; median and posterior area of back so dark that the blackish tail forms no noticeable contrast; buttocks not noticeably paler than sides and thighs; canines of males (so far as known) excessively heavy.

A dwarf animal with skull of adult female (male not known) only 110 mm. in greatest length.....*M. pagensis*, p. 557

Large animals with skull of female 130 mm. or more in greatest length, that of adult male 140-160 mm.

Skull elongated, the zygomatic breadth scarcely or not greater than distance from lower rim of orbit to most posterior point of occiput.

M. nemestrina, p. 556

Skull widened, the zygomatic breadth considerably greater than distance from lower rim of orbit to most posterior point of occiput.....*M. broca*, p. 558

Hairs of back, underparts, arms, and legs distinctly annulated; median and posterior area of back so little darkened that the blackish tail forms a conspicuous contrast; buttocks noticeably paler than sides and thighs; canines of males not excessively heavy.

A noticeable contrast in length between hair of shoulders and neck and that of back; least distance from orbit to gnathion scarcely greater than width of rostrum at base of zygomata.....*M. insulana*, p. 560

No noticeable contrast in length between hair of shoulders and neck and that of back; least distance from orbit to gnathion conspicuously greater than width of rostrum at base of zygomata.....*M. adusta*, p. 559

^a *Macaca* Lecépède, Tabl. Mamm., 1799, p. 4. *Macacus* Desmarest, Mammalogie, I, 1820, p. 63.

MACACA NEMESTRINA (Linnæus).

1766. [*Simia*] *nemestrina* LINNÆUS, Syst. Nat., I, 12th ed., p. 35 (Sumatra).

1822. *Simia carpolegus* RAFFLES, Trans. Linn. Soc. London, XIII, p. 243 (Bencoolen, Sumatra).

Type locality.—Sumatra.

Geographic distribution.—So far as is at present known this species is confined to the island of Sumatra, where it appears to be very generally distributed.

General characters.—A large animal with greatest length of skull 130 mm. or more in females, 140–160 mm. in males; zygomatic breadth of skull scarcely or not greater than distance from lower rim of orbit to most posterior point of occiput; fur nowhere distinctly grizzled; a noticeable blackish median dorsal area.

Color.—General color a light, dull, russet or wood-brown, fading to ecru-drab on underparts and inner surface of limbs, and becoming blackish on crown, neck, and median area of back. Across shoulders the blackish and brown are distinctly mingled, though without producing any grizzled effect. Long hairs beneath and in front of ear blackish at tip. Tail sharply bicolor; blackish above, dull ochraceous-buff below. Hands and feet not darker than arms and legs. Throughout the brown area of the body and limbs the fur is ecru-drab beneath surface, this color appearing when hairs are disarranged, particularly on sides of body, on lower half of legs, and on hairy portions of buttocks, though nowhere producing contrasted lighter areas. Many of the hairs on arms and legs are dark-tipped, but this is only noticeable on close inspection.

Skull and teeth.—Skull (Plate XV, fig. 1) rather elongate, the zygomatic breadth about equal to distance from anterior rim of orbit to most posterior point of occiput, the least distance from orbit to gnathion distinctly greater than breadth of rostrum at anterior base of zygomata; brain case low, the depth from posterior point of frontal to lower edge of occipital condyle very noticeably less than width above posterior base of zygomata; palate highly arched. Canine teeth very large, the greatest diameter of the upper tooth at alveolus about one and one-half times length of crown of third molar; cheek teeth not peculiar in form, but their size relatively somewhat less than in the other species.

Measurements.—See tables, pages 561–562.

Specimens examined.—Eight, from the following localities: Kateman River, east Sumatra, 4; Tapanuli Bay, west Sumatra, 2; Tarussan Bay, west Sumatra, 2.

MACACA PAGENSIS Miller.

1903. *Macacus pagensis* MILLER, Smithsonian Miscellaneous Collections, XLV, p. 61. November 6, 1903.

Type locality.—South Pagi Island, east Sumatra.

Geographic distribution.—This animal is probably confined to the Pagi Islands.

General characters.—Like *Macaca nemestrina*, but size much less (skull of female only 110 mm. in greatest length), and color much darker.

Color.—Dorsal surface from forehead to base of tail clear bistre, darker than that of Ridgway, the drab underfur appearing irregularly at surface when hair is disarranged. Sides of body and inner surface of arms and legs isabella-color. Belly isabella-color, fading to light fawn-color on chest and throat. Outer surface of arms light russet, that of legs dark isabella-color, except on thighs, which are mostly covered by an extension of the brown area of back. A similar but less extensive wash covers proximal half of upper arm. Sides of neck grayish cream-buff, in striking contrast with upper surface. Cheeks and chin brown like that of back, but not quite as dark. Hands and feet dusky brownish. Tail sprinkled with isabella-colored hairs. "Callosities fleshy brown. Palms and soles light fleshy brown."^a

Skull.—The skull (Plate XVIII, fig. 2) is very much smaller than that of a slightly younger female of *Macaca nemestrina* (Plate XVIII, fig. 1) from Tapanuli Bay, Sumatra. In general form, however, the two do not appreciably differ. The bony palate is concave laterally (when viewed from below), but to a less degree than in the larger animal. Its median line is nearly straight, and shows only a trace of the deep longitudinal concavity so conspicuous in *M. nemestrina* in region between premolars. Audital bullæ a little more swollen anterolaterally than in *M. nemestrina*, but this character may be purely individual. Teeth as in *Macaca nemestrina*, but smaller throughout.

Measurements.—See tables, pages 561–562.

Specimens examined.—The type of this species remains unique.

Remarks.—*Macaca pagensis* is a well-marked insular species characterized by its small size and dark color. The peculiarities of the posterior molars of the type prove to be individual only, as they are exactly reproduced in some of the specimens of *M. nemestrina* now at hand.

^aCollector's note on label.

MACACA BROCA, new species.

1893. *Macacus nemestrinus* HOSE, Mammals of Borneo, p. 6. (Not *Simia nemestrina* Linnæus.)

Type specimen.—Adult male (skin and skull) No. $\frac{1}{3}\frac{2}{3}\frac{1}{3}\frac{1}{3}$ United States National Museum. Collected at Sapagaya River, northeast Borneo, November 21, 1887, by C. F. Adams.

Geographic distribution.—Borneo.

General characters.—Similar to *Macaca nemestrina*, but skull so broadened that zygomatic breadth is considerably greater than distance from lower rim of orbit to most posterior point of occiput.

Color.—The color of the type is much like that of *Macaca nemestrina*, except that the brown areas have a dull, drabby cast. This dullness may be due to the fact that the specimen was brought from Borneo in an acid preservative fluid, which may have injured the color. There is no distinct trace of annulation on any part of the fur. Dark dorsal area well developed, extending from forehead to base of tail. In his 'Mammals of Borneo' Mr. Charles Hose describes the color of this animal as follows:

The general color is a decided olive, tending in some animals to brown, the variation in color being due to the relative development of the yellow and black rings on the hair. The rings occur on the exposed portion of the hair, the hidden part of which is gray. The upper surface of the head, the mesial line of the back, and the upper surface of the tail near its base are deep brown or even blackish, more especially on the head and over the hind quarters. The extremities pale toward the hands and feet, which are light olive brown. The outsides of the thighs have an olive-gray tint. Some animals, however, especially the fully grown ones, are almost uniformly colored deep olive brown, except on the blackish head and the middle line of the back. The sides of the face and the under surfaces generally are grayish, tending to white, but on the sides of the face the hair is washed with a dark, almost blackish gray. The face is nude, of a dusky flesh color, which is the tint also pervading the almost naked ears and the callosities.

From this it appears that there is some annulation of the hairs in certain regions, but that it is slight and variable. It is not present to any noticeable degree in any of the three skins that I have examined.

Skull and teeth.—The skull differs conspicuously from that of *Macaca nemestrina* in its much greater relative breadth and depth. The zygomatic breadth is conspicuously greater than the distance from anterior rim of orbit to most posterior point of occiput; the distance from orbit to gnathion is not noticeably greater than width of rostrum at anterior base of zygomata, and the depth of brain case from posterior point of frontal to lower edge of occipital condyle is nearly equal to width above posterior roots of zygomata. Palate broader and less highly arched than in *N. nemestrina*. Teeth as in the Sumatran animal, the canines similarly large.

Measurements.—See tables, pages 561–562.

Specimens examined.—Three, the type in the United States National Museum, and two specimens in the British Museum.

Remarks.—This species is readily distinguishable from *Macaca nemestrina* by its much broadened and deepened skull.

MACACA ADUSTA, new species.

Type specimen.—Adult male (skin and skull), No. 124023, United States National Museum. Collected at Champang, Tenasserim, December 22, 1903, by Dr. W. L. Abbott. Original number, 2929.

Geographic distribution.—Malay Peninsula. Limits of range unknown.

General characters.—Like *Macaca nemestrina*, but with hairs of back, underparts, arms, and legs distinctly annulated, median area of back very slightly darkened, and canines of males much less enlarged; least distance from orbit to gnathion conspicuously greater than width of rostrum at base of zygomata.

Color.—The ground color of neck, shoulders, and back is a bright russet, everywhere distinctly speckled by blackish annulations about 3 mm. in length, of which there are from three to five to a hair, according as the fur is longer or shorter. In lumbar region and on uppermost part of thighs the russet fades abruptly to a light ochraceous-buff, which becomes clear and unspeckled in area near callosities, forming a noticeable contrast with surrounding parts. Crown blackish. A faint, narrow, blackish shade along middle of back. Tail as in *Macaca nemestrina*, but its dark upper surface strongly contrasted with back. Underparts a light, indefinite drabby gray, distinctly darkened and grizzled across belly. Arms and legs grizzled blackish and drabby gray, with a very slight suffusion of russet, their color noticeably contrasted with that of back. Feet and hands slightly darker than arms and legs.

Skull and teeth.—The skull (Plate XIV, fig. 2) is less elongate than that of *Macaca nemestrina*, but not as widened as that of *M. broca*. Bony palate, less arched than in the Sumatran animal. The teeth differ from those of *Macaca nemestrina* in the much less enlargement of the canines in the male, the diameter of the upper tooth at alveolus being about equal to length of crown of posterior molar. The anterior lower premolar has the same peculiarity.

Measurements.—For measurements, see tables, pages 561–562.

Specimens examined. Four, from the following localities in Tenasserim: Red Point, 1; Champang, 2; Telok Besar, 1.

MACACA INSULANA, new species.

Type specimen.—Adult male (skin and skull), No. 104441, United States National Museum. Collected on Chance Island, Mergui Archipelago, January 1, 1900, by Dr. W. L. Abbott. Original number, 199.

General characters.—Like *Macaca adusta*, but with hair of shoulders noticeably longer than that of back; least distance from orbit to gnathion scarcely greater than width of rostrum at base of zygomata.

Color.—The color does not differ appreciably from that of *Macaca adusta*, except that the chest and belly are more heavily grizzled and the hands and feet are noticeably darker than the arms and legs.

Skull and teeth.—The skull differs from that of *Macaca adusta* in smaller general size, relatively greater width, and in the shorter rostrum. In fact it suggests a miniature of the Bornean *M. broca*, except that the rostrum is less broad anteriorly. Audital bullæ less inflated than in any of the other forms. Teeth as in *M. adusta*.

Measurements.—For measurements, see tables, pages 561–562.

Specimens examined.—Three, all from Chance Island.

External measurements of monkeys of the Macaca nemestrina group.

Name.	Locality.	Date.	Catalogue No. U.S.N.M.	Sex.	Total length.	Head and body.	Tail.	Foot.	Weight.
					mm.	mm.	mm.	mm.	Pounds.
<i>Macaca nemestrina</i>	Sumatra: Kateman River.....	Aug. 15, 1903	123143	Male adult.....	780	550	230	180	24 ^a
Do .....	.....do	Aug. 23, 1903	123145	.....do	740	545	195	174	27
Do	Sumatra: Tarussan Bay.....	Dec. 31, 1904	141143	.....do	805	590	215	180	30
Do .....	.....do .....	.....do	141144	Female adult ..	700	490	210	155	16
Do	Sumatra: Tapanuli Bay.....	Feb. 19, 1902	114502	.....do	690	480	210	152	10 ³ / ₄
<i>Macaca pagensis</i>	Sumatra: South Pagi Island....	Nov. 17, 1902	b 121653	.....do	580	435	145	125	.....
<i>Macaca broca</i>	Borneo: Sapagaya River.....	Nov. 21, 1887	b 34930	Male adult.....	.....	.....	.....	175	.....
<i>Macaca adusta</i>	Tenasserim: Champaung	Dec. 22, 1903	b 124023	.....do	785	555	230	163	20
Do	Tenasserim: Red Point.....	Feb. 20, 1904	124230	.....do	680	500	180	155	14
<i>Macaca insulana</i>	Tenasserim: Chance Island	Dec. 30, 1899	104439	.....do	685	520	165	147	.....
Do .....	.....do	Jan. 1, 1900	104440	.....do	666	508	158	148	13 ³ / ₄
Do .....	.....do .....	.....do	b 104441	.....do	697	520	177	143	13 ³ / ₄

^a Half starved.

^b Type.

Cranial measurements of monkeys of the *Macaca nemestrina* group.

Name.	Catalogue No., U.S.N.M.	Sex.	Condylo-basilar length.	Basilar length.	Greatest length.	Palat-ilar length.	Orbit to gnathion.	Front of orbit to posterior point of brain case.	Zygomatic breadth.	Breadth of brain case above roots of zygomatic.	Depth of brain from posterior extremity of frontal to lower edge of occipital condyle.	Maxillary tooth row (alveoli).	Diameter of upper canine (alveoli).	Crown of last upper molar.	Mandibular tooth row (alveoli).	
																mm.
<i>Macaca nemestrina</i>	123143	Male adult	116.0	108.0	154.0	63.5	66.0	99.0	93.0	67.5	56.0	49.6	13.0	9.8×8.0	109.0	55.0
Do	123145	do	111.0	103.0	151.0	60.4	65.6	98.0	96.0	68.8	62.0	47.8	13.0	8.8×8.8	108.6	55.4
Do	141143	do	113.4	105.4	154.4	64.8	66.2	100.0	103.0	72.6	62.0	49.0	14.0	9.8×8.6	111.0	60.0
Do	141144	Female adult	91.0	82.0	130.0	48.8	49.6	89.0	82.6	69.6	58.8	41.4	7.2	8.8×8.0	89.0	47.8
Do	114502	do	96.2	87.0	134.4	52.6	54.0	92.6	83.8	67.8	55.0	41.4	7.0	9.7×7.4	93.4	46.6
<i>Macaca pagensis</i>	α 121653	do	77.8	70.0	111.0	38.0	38.6	79.0	70.8	60.6	54.0	35.8	5.4	7.8×7.0	80.0	40.4
<i>Macaca brachy</i>	α 34930	Male adult	111.0	100.0	145.6	60.0	59.0	96.0	104.0	71.0	63.0	47.4	12.4	9.4×8.6	110.4	54.4
<i>Macaca atlasa</i>	α 124023	do	104.0	96.0	136.0	54.0	53.8	89.6	91.0	64.4	59.0	46.8	10.0	9.6×9.0	100.0	53.0
Do	124230	do	98.0	89.0	130.0	49.4	49.0	87.6	88.0	63.0	57.8	43.0	9.0	9.8×8.4	94.0	49.0
<i>Macaca fusulana</i>	104439	do	96.0	88.0	128.0	50.4	52.2	86.6	94.0	65.0	53.0	41.0	9.4	8.2×8.0	93.6	47.0
Do	104440	do	93.4	86.0	125.4	48.4	47.6	88.4	89.6	61.2	52.0	41.0	9.6	8.8×8.0	92.0	48.6
Do	α 104441	do	101.0	91.0	133.0	52.6	53.0	90.0	94.6	63.6	53.0	41.4	10.2	7.8×7.8	97.0	49.4

α Type.

EXPLANATION OF PLATES.

PLATE XIII.

(Greatly reduced.)

- Fig. 1. *Macaca nemestrina* (Linnaeus), male, Cat. No. 123143, U.S.N.M., Kateman River, east Sumatra.
 2. *Macaca adusta* Miller, type.

PLATE XIV.

(Greatly reduced.)

- Fig. 1. *Macaca nemestrina* (Linnaeus), male, Cat. No. 123143, U.S.N.M., Kateman River, east Sumatra.
 2. *Macaca adusta* Miller, type.

PLATE XV.

(Two-thirds natural size.)

- Fig. 1. *Macaca nemestrina* (Linnaeus), male, Cat. No. 123143, U.S.N.M., Kateman River, east Sumatra.
 2. *Macaca adusta* Miller, type.

PLATE XVI.

(Two-thirds natural size.)

- Fig. 1. *Macaca nemestrina* (Linnaeus), male, Cat. No. 123143, U.S.N.M., Kateman River, east Sumatra.
 2. *Macaca adusta* Miller, type.

PLATE XVII.

(Two-thirds natural size.)

- Fig. 1. *Macaca nemestrina* (Linnaeus), male, Cat. No. 123143, U.S.N.M., Kateman River, east Sumatra.
 2. *Macaca adusta* Miller, type.

PLATE XVIII.

(Two-thirds natural size.)

- Fig. 1. *Macaca nemestrina* (Linnaeus), female, Cat. No. 114502, U.S.N.M., Tapanuli Bay, west Sumatra.
 2. *Macaca pagensis* Miller, type.

PLATE XIX.

(Two-thirds natural size.)

- Fig. 1. *Macaca nemestrina* (Linnaeus), female, Cat. No. 114502, U.S.N.M., Tapanuli Bay, west Sumatra.
 2. *Macaca pagensis* Miller, type.

PLATE XX.

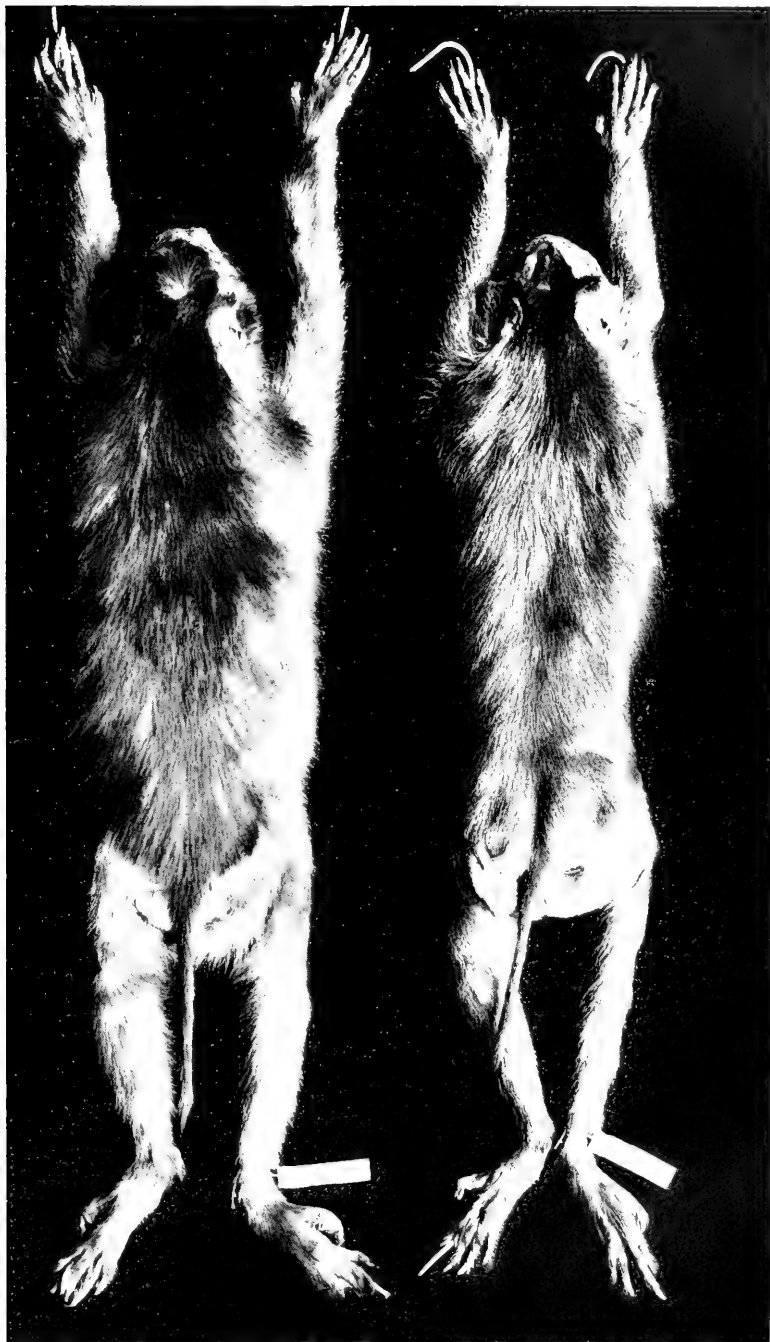
(Two-thirds natural size.)

- Fig. 1. *Macaca nemestrina* (Linnaeus), female, Cat. No. 114502, U.S.N.M., Tapanuli Bay, west Sumatra.
 2. *Macaca pagensis* Miller, type.



1

2



SKINS OF *MACACA NEMESTRINA* (1) AND *M. ADUSTA* (2).

FOR EXPLANATION OF PLATE SEE PAGE 563.



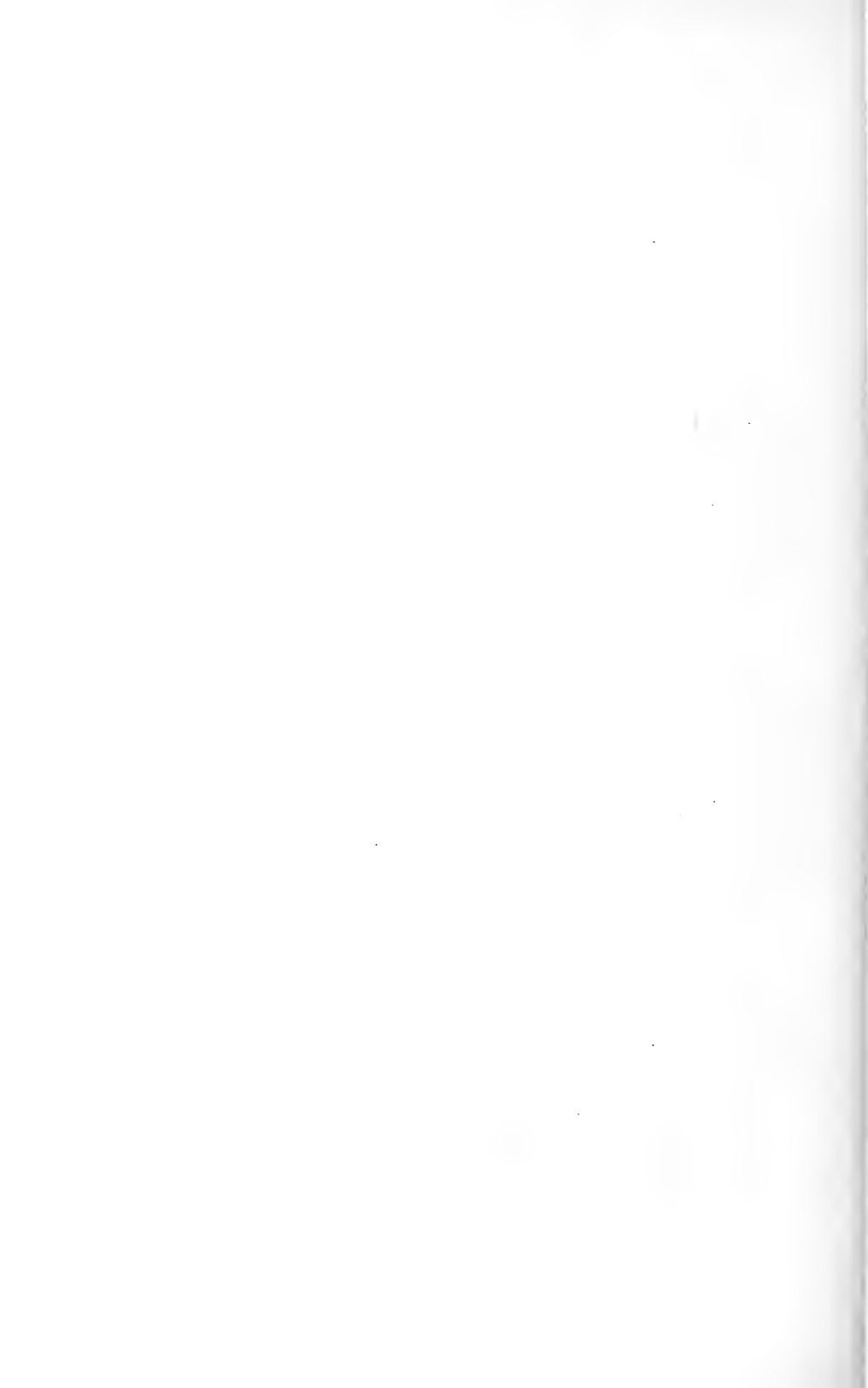
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2



SKINS OF *MACACA NEMESTRINA* (1) AND *M. ADUSTA* (2).

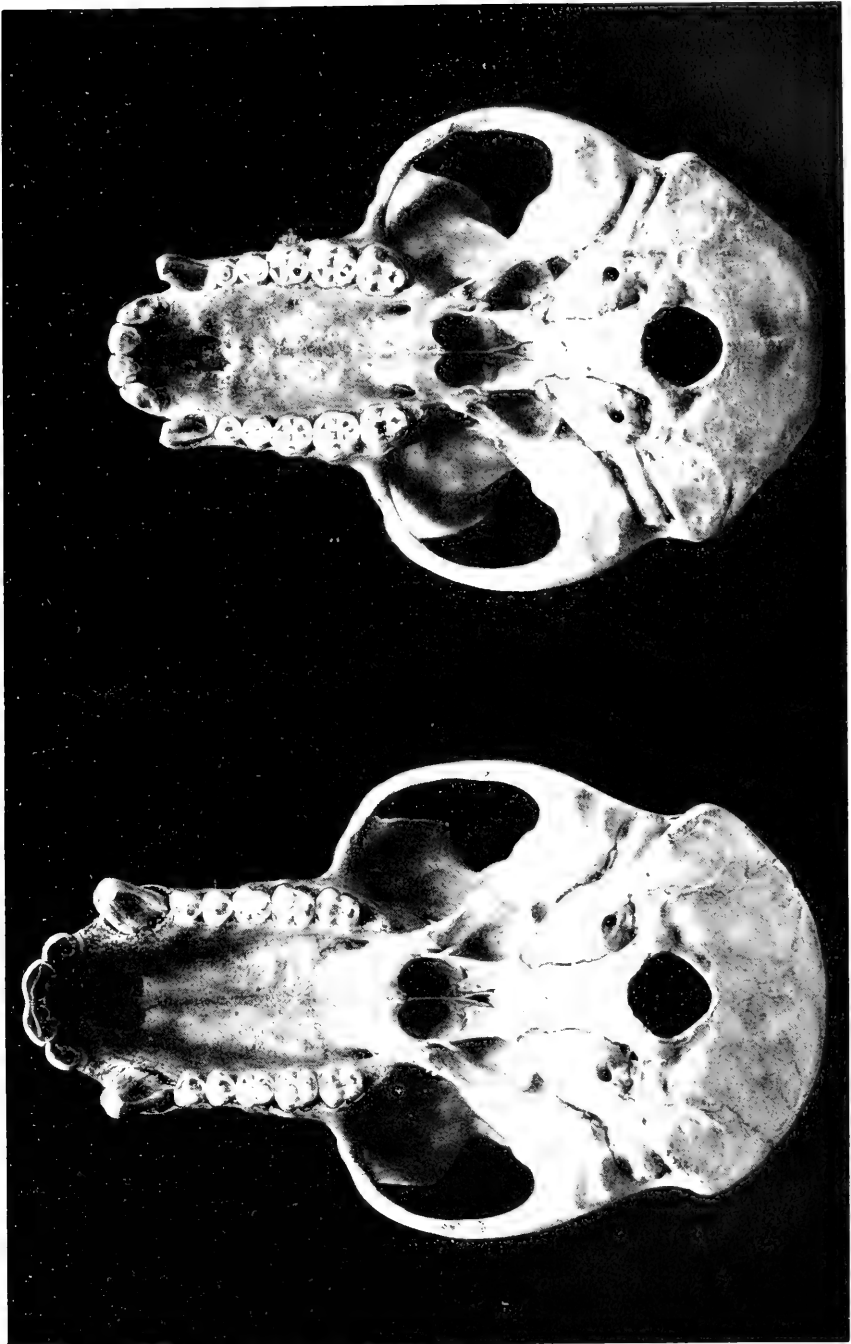
FOR EXPLANATION OF PLATE SEE PAGE 563.





SKULLS OF *MACACA NEMESTRINA* (1) AND *M. ADUSTA* (2).

FOR EXPLANATION OF PLATE SEE PAGE 563.



SKULLS OF *MACACA NEMESTRINA* (1) AND *M. ADUSTA* (2).

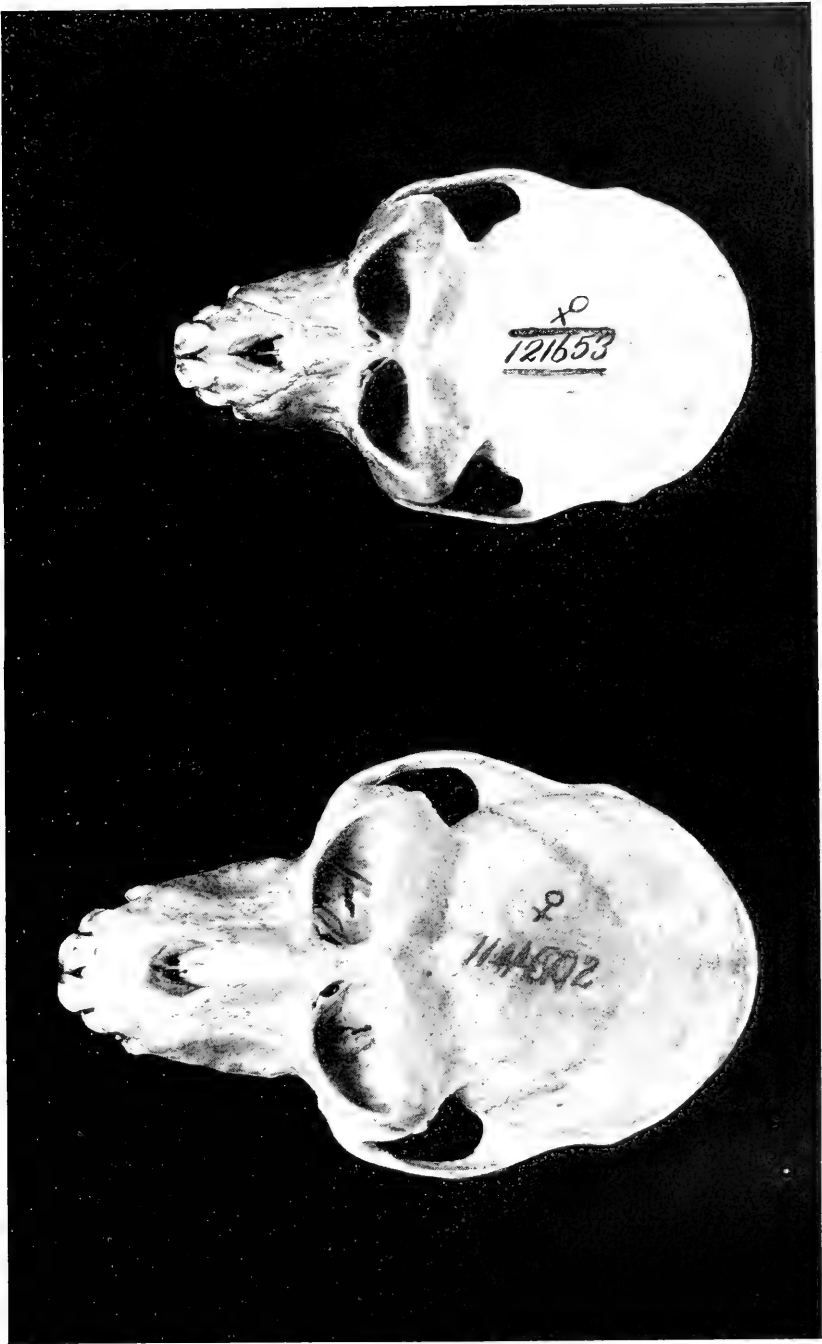
FOR EXPLANATION OF PLATE SEE PAGE 563.



SKULLS OF *MACACA NEMESTRINA* (1) AND *M. ADUSTA* (2).

FOR EXPLANATION OF PLATE SEE PAGE 563.

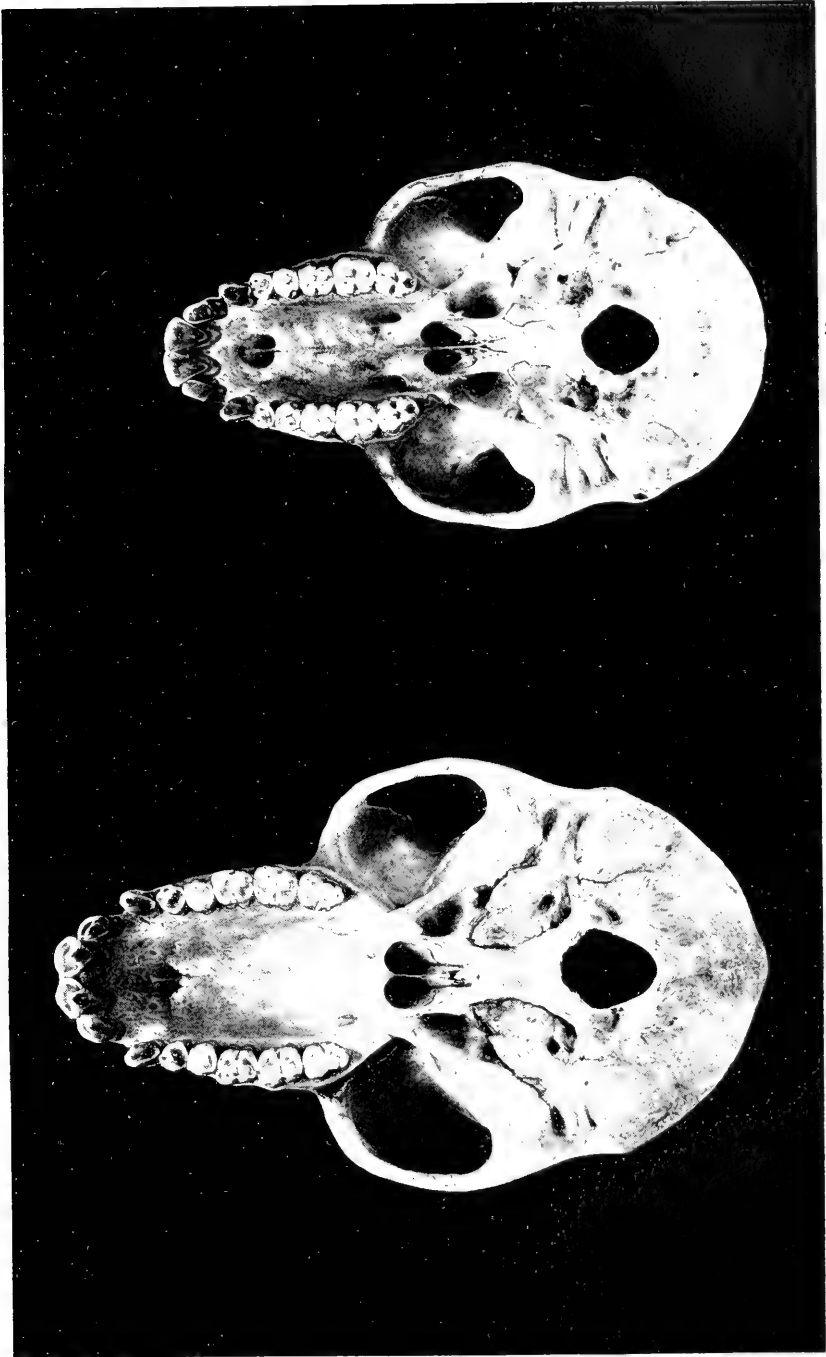




SKULLS OF MACACA NEMESTRINA (1) AND M. PAGENSIS (2).

FOR EXPLANATION OF PLATE SEE PAGE 563.

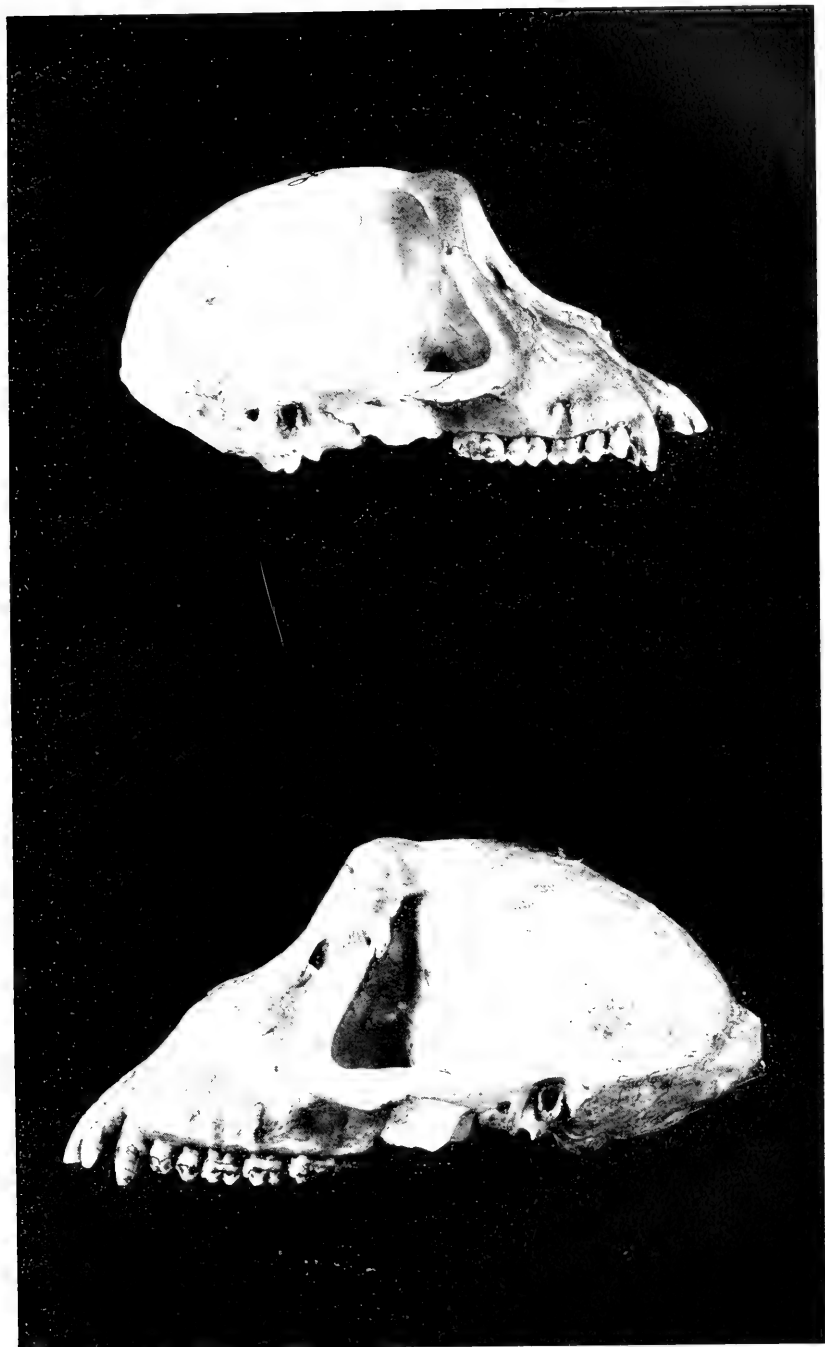




SKULLS OF *MACACA NEMESTRINA* (1) AND *M. PAGENSIS* (2).

FOR EXPLANATION OF PLATE SEE PAGE 563.





SKULLS OF *MACACA NEMESTRINA* (1) AND *M. PAGENSIS* (2).

FOR EXPLANATION OF PLATE SEE PAGE 563.



A NEW LIZARD OF THE GENUS PHRYNOSOMA, FROM
MEXICO.

By LEONHARD STEJNEGER,
Curator, Division of Reptiles and Batrachians.

A short time ago Mr. Raymond L. Ditmars, curator of reptiles in the New York Zoological Park, sent me, from his private collection, two small Phrynosomas, one of which he had kept alive for some time and which had attracted his attention by its peculiar habits. They were given to him in 1897, by a Mr. Eustace, according to whose statement they were taken "a short distance over the border of Arizona, in old Mexico, State of Sonora."

The most cursory examination of the specimens showed them to belong to an undescribed species of "horned toad," if indeed a Phrynosoma practically without horns can be so designated. Mr. Ditmars has kindly presented the specimens to the U. S. National Museum, and I take great pleasure in naming this very interesting species after him.

PHRYNOSOMA DITMARSII, new species.

Diagnosis.—Tymp. naked; nostril in the line of canthus rostralis; one series of marginal abdominal scales; a single series of enlarged gular scales; submandibulars larger than lower labials; no horns; a prominent ridge from tip of postorbital boss to outer enlarged temporals; ventrals strongly keeled; lower jaw enormously developed posteriorly, with 5 to 7 rows of keeled scales between the lower labials and the submandibulars.

Habitat.—Mexico.

Type.—Cat. No. 36022, U.S.N.M.; State of Sonora, Mexico, not far from boundary of Arizona; Ditmars collection.

Description of type.—Adult male. Head much broader than long; nostril in the line of canthus rostralis; tympanum entirely posterior, vertical to the axis of the body, concealed in the anterior neck fold, naked; no horns, the scales which in the other species form more or less

projecting spines being only low bosses or protuberances; the postocular boss, a broad triangular pyramid, its three edges being continuations of the superciliary, the supraocular, and the orbito-temporal ridges; an abruptly raised orbito-temporal ridge from tip of postorbital boss to the outer edge of the supratemporal expansion at the base of the scale corresponding to the outer temporal horn in other species, two scales corresponding to temporal horns slightly enlarged, depressed, the posterior, or inner, slightly pointed; below the scale row forming the upper posterior edge of the supratemporal expansion on each side a small conical spine; supratemporal expansion very wide, nearly straight behind, with a very deep and narrow occipital notch; no temporal ridge; on the edge of the fold in front of the ear a vertical series of 4 small spines; rostral very low; supralabials very small, scarcely differentiated from the scale row above, about 15 in number; about 15 small lower labials, the posterior ones gradually increasing in size, though not larger than the scutes forming the orbito-temporal ridge, and with a raised keel; a small spine behind the last lower labial, separated from it by a single scale; along the edge of the lower mandible a series of enlarged, strongly keeled submandibulars, increasing in size backward, the keels of the posterior ones slightly produced and pointed behind; mandible exceedingly deep, the distance between angle of mouth and base of submandibular shields being greater than the diameter of the orbit; the large flat space between the lower labials and the submandibulars covered with polygonal scales of varying sizes, similar to those covering the upper surfaces of the head, about 5 in a row; all head scales keeled and wrinkled; gular scales small, keeled; a series of spines on each side of the posterior half of the throat near the submandibulars and parallel with them; gular fold with a transverse series of spines and a few isolated clusters of spines; a very heavy angular fold on each side of the neck, both the vertical and horizontal portion armored with clusters of large spines; back and upper surface of hind legs and tail with scattered larger, bluntly keeled scales, the largest with their base surrounded by a "rosette" of smaller scales, which are larger than those forming the general dorsal lepidosis; a single series of marginal scales, which are enlarged and bluntly pyramidal, set between 2 basal rows of slightly enlarged scales; scales of fore legs and lower surfaces strongly keeled, the former pointed behind; a series of 13 (14) femoral pores on each side, separated on the middle of the belly by 4 scales, the pores piercing the scales near the posterior margin; base of tail strongly swollen, with 2 enlarged postanals; tail once and a third longer than head. Color (in life) "reddish—the color of dry building sand, with very obscure markings," according to Mr. Ditmars; in alcohol, pale yellowish gray, with 2 faint, narrow, brownish bands across the lower back; underside whitish with very obscure dusky spots.

Dimensions.

	mm.
Total length	104
Tip of snout to vent	76
Vent to tip of tail	28
Tip of snout to tip of postorbital boss	16
Tip of snout to tip of extreme temporal scale	25
Greatest width of head	28
Fore leg	40
Hind leg	53

The *female* (No. 36013; same locality and origin) is smaller (snout to vent 64 mm.), but agrees in all particulars with the male, except that the tail is shorter and not swollen at base and without postanal shields. The number of scales in a row between lower labials and submandibulars 6 or 7; about 9 poorly differentiated femoral pores on each side.

Remarks.—It is difficult to say to which of the formerly known *Phrynosomas* the present species is most nearly related. It has no special affinity to any of them. Of course, the absence of "horns" proper may not be a point of great moment, although the corresponding scutes do not have the appearance of retrograded horns such as in some forms of *Phrynosoma douglassii*. With the latter our new species has the greatly expanded supratemporal region in common, but otherwise they show no relationship. The position of the nostrils is nearly exactly the same as in *Phrynosoma orbiculare*, but there the similarity ends. The scutellation of the throat reminds one of *Phrynosoma cornutum*, and as this also is the only other species which has an orbito-temporal, or postorbital, ridge, though much less developed, it may be that it is to this highly spinous and many-horned species that our hornless and nearly spineless novelty has any real affinity.

The most unique feature of our species is the enormous vertical expansion of the lower jaw, to which there is not even a faint approximation in any of the hitherto known species.

A STUDY OF THE WINGS OF THE TENTHREDINOIDEA. A SUPERFAMILY OF HYMENOPTERA.

By ALEXANDER DYER MACGILLIVRAY,
Instructor in Entomology, Cornell University.

INTRODUCTION.

This is a study in the phylogeny of a group of animals based on a study of the modifications of a single organ. It is an attempt to trace the course of the changes wrought by natural selection, an effort to apply the principles of descent to taxonomy.

Classifications based on the modifications of a single organ are generally imperfect. But on no single organ of any group of animals or plants has the effects of natural selection been written so clearly as on the wings of insects. The record is spread out as on a printed page and only awaits the translator. The taxonomy of several groups of insects based on a genetic study of their wings has been published, and in every case where phylogenies based on other sets of organs have been made it has been found that they confirm the conclusions derived from a study of the wings.

The Tenthredinoidea have been carefully studied by many investigators. Several classifications have been proposed, but no attempt has been made hitherto to work out an arrangement along the lines here proposed. In previous groupings a character common to a large number of forms and not common to others has been taken as of high value, while those common to a smaller number of forms as of subordinate value. No account has been taken of the question as to whether these characters include forms of one or of many lines of descent.

At the outset I wish to express my obligations to Prof. J. H. Comstock and Dr. W. A. Riley for constant advice throughout the preparation of this paper; to the authorities of the United States National Museum for the loan of specimens from their collections not otherwise accessible to me, and to Mr. J. Chester Bradley for the privilege of examining a number of species and for looking over the manuscript.

I.—HISTORICAL.^a

Students of wing-venation in the past almost invariably made the mistake of considering the few-veined wing as the starting point and the many-veined wing as the acquired condition. In the Lepidoptera a wing-type like that occurring in the Noctuidæ or Arctiidæ was considered the generalized condition, while the many-veined wings of the Hepialidæ and Micropterygidæ were looked upon as being at the summit of specialization in that order. In the Diptera the wing of the Muscidæ was taken as the starting point, and the extra veins found in the Tabanidæ and Leptidæ were considered as entirely new developments and were given special names. The same view was held by writers on the Hymenoptera, where a wing type similar to that found in the Sphecidæ was made use of.

Our knowledge of the homology of the wing veins of insects is due to the work of several investigators. The first one to consider this subject was Hermann Hagen.^b He published a paper *Ueber rationelle Benennung des Geaders in den Flügeln der Insekten*, but this had little more effect than to call attention to the importance of the subject. The first serious attempt to homologize the wing veins of insects of all orders was not undertaken until sixteen years later when Josef Redtenbacher^c published a paper on a *Vergleichende Studien über das Flügelgeader der Insekten*, which was an epoch-making work. Unfortunately he made the serious mistake at the beginning of his investigations of adopting the conclusions of Adolph;^d who, from a study of the development of wing veins, had concluded that the veins were of two distinct kinds, concave and convex. The concave veins had been produced by a thinning and the convex veins by a thickening of the wing membrane; the former by a pushing in of the trachea, the latter by the formation of chitinous lines and occupied by tracheæ only secondarily. Redtenbacher believed further that the wing was longitudinally plaited, consisting of alternate ridges and grooves, the concave or primary veins being situated at the bottom of the grooves and the convex or secondary veins along the top of the ridges. He considered that in the primitive insect the two wings of each side were fan-like in form and similar in venation, like the wings of the Saltatorial Orthoptera and Ephemeriidæ. Starting with such a many-veined type, he was successful in homologizing the main stems of the principal veins, but through his efforts to apply the theory of Adolph,

^a For extended bibliographies of papers dealing with the wing veins of insects the following should be consulted:

H. J. Kolbe. *Einführung in die Kenntniss der Insecten*. 1893. Pp. 269-271.

A. S. Packard. *Text-book of Entomology*. 1898. Pp. 147-148.

^b Hermann Hagen. *Stett. Ent. Zeit.*, XXXI, 1870, pp. 316-320.

^c Josef Redtenbacher. *Ann. k. k. Naturh. Hofmus.*, I, 1886, pp. 153-232.

^d G. Ernst Adolph. *Ueber Insectenflügel*. 1879.

he was led into serious errors in homologizing the tips of the veins. In comparing the few veined wings of the Lepidoptera, Diptera, and Hymenoptera, where practically all the concave veins are wanting, with his primitive fan-type of wing, he concluded that fully one-half of the veins had been lost. He was the first to devise a uniform nomenclature and to apply it to all the orders of winged insects. Beginning with the front margin of the wing, the veins were named *costa*, *subcosta*, *radius*, *media*, *cubitus*, and *anal*. The convex veins were designated by odd Roman numerals, *costa* by I, *radius* by III, *media* by V, *cubitus* by VII, and the convex anal veins by IX, XI, XIII, etc., the concave veins by even Roman numerals, *subcosta* by II, the concave anal veins by VIII, X, XII, etc., the concave veins IV and VI being left unnamed. The branches of the veins were designated by Arabic numerals appended as indices to the Roman numerals the Arabic indices being odd or even in accordance with whether the veins were convex or concave.

Redtenbacher in conjunction with Brauer in *Ein Beitrag zur Entwicklung des Flügelgeaders der Insekten*,^a from a study of the development of the veins in the wing of a nymph of an *Æschnid*, proved that both concave and convex veins are preceded by tracheæ and are therefore similar in origin and consequently completely upset the conclusions of Adolph.

Spuler in 1892 in a paper, *Zür Phylogenie und Ontogenie des Flügelgeaders der Schmetterlinge*,^b gave the results of an investigation of the tracheæ that precede the wing veins, determined the type of the lepidopterous wing, and was the first to recognize that *radius* in the hind wings of this order has only two branches. A modified form of the Redtenbacher notation was adopted, the veins being numbered consecutively with Roman numerals and Arabic indices regardless of their origin, Redtenbacher's veins IV and VI being entirely disregarded. Unfortunately, however, he overlooked the trachea of *costa*, vein I, and began his numbers with the second of the principal veins.

The following year Comstock^c published the results of a general investigation of wing veins, with special reference to the Lepidoptera. From a comparative study of the wings of carboniferous insects he showed that the two pairs of wings were similar in form and venation, the most generalized forms being found among the carboniferous cockroaches, where, with one exception—the anal furrow, vein VIII—all of the veins are convex, while none of the wings are plaited. He further showed that the fan-type of wing assumed by Redtenbacher as the primitive type was an extreme type of specialization for a particular kind of flight, and that instead of regularly alternating concave

^a F. Brauer and J. Redtenbacher. *Zool. Anz.*, XI, 1888, pp. 444-447.

^b A. Spuler. *Zeit. Wiss. Zool.*, LIII, 1892, pp. 597-646.

^c J. H. Comstock. *Wilder Quarter-Century Book*, 1893, pp. 37-113.

and convex veins the concave veins are secondary in origin, being either modified convex veins or veins that have arisen *de novo*. The concave veins having arisen to meet two distinct needs—first, in those insects where the wings are broadly expanded so as to fit them for a sliding flight there is a necessity for a plaiting of the wings when not in use so as not to impede locomotion on foot; and second, where the width of the wings has been greatly reduced to fit them for a rapid vigorous flight and the wings have been corrugated so as to strengthen them. The concave veins IV and VI, here named “premedia” and “postmedia,” respectively, were considered as wanting not only in the Lepidoptera, but also in the primitive insect’s wing. They were considered to be present only in those highly specialized wings of modern insects where a corrugation of the wing has arisen. The nomenclature of Redtenbacher was adopted in all details, except that the branches of the veins were numbered consecutively with Arabic indices regardless as to whether they were convex or concave.

Packard,^a in 1895, gave an abstract of Spuler’s paper mentioned above, in which the nomenclature of Spuler is followed. Apparently, if we may judge from his labeling of a notodontid wing, he has overlooked one of the most important facts discovered by Spuler, namely, that the radius of the hind wings of the Lepidoptera consists of two branches.

In a Manual for the Study of Insects,^b published during the same year, the homology of the wing veins in the orders Lepidoptera, Diptera, and Hymenoptera was carefully determined and named in accordance with the modified Redtenbacher notation. The concave veins IV and VI were shown to be wanting in these orders, but were supposed to be present as secondary developments in those orders where the fan-type of wing existed.

In 1897 Comstock and Needham^c began jointly the publication of a series of articles on the wings of insects of all orders. This investigation was developed along two distinct lines and all the accessible material of all the orders of winged insects was examined. First, wherever possible, a careful study was made of the tracheæ which precede the veins in the wings of immature insects; and, second, there was made a morphological comparison of the veins in the wings of adult insects. The following important results were reached:

First. That the concave veins IV and VI are wanting in the wings of all insects.

Second. That the primitive insect’s wings had comparatively few veins. These veins were eight in number. Beginning with the front

^a A. S. Packard. *Psyche*, VII, 1895, pp. 235–241.

^b J. H. and A. B. Comstock. Ithaca, N. Y., 1895.

^c J. H. Comstock and J. G. Needham. *The Wings of Insects*, Amer. Nat., XXXII and XXXIII, 1898 and 1899.

margin of the wing, they are costa unbranched, subcosta with two branches, radius with five branches, media with four branches, cubitus with two branches, and three unbranched anal veins.

Third. That the modification in the number of wing veins of insects has proceeded along two distinct lines, the specialization of wing veins by reduction and the specialization of wing veins by addition. The former is illustrated by the wings of the orders Lepidoptera, Diptera, and Hymenoptera; and the latter by the wings of the orders Orthoptera, Ephemera, and Neuroptera.

Fourth. The development of a hypothetical wing type, which was believed to represent the maximum number, the arrangement, and the method of branching of the veins of the primitive insect's wing. This hypothetical type was shown to be of primary importance in determining the homology of the wing veins of insects of all orders.

The terminology of Redtenbacher had been applied in so many different ways by previous investigators that these writers made use of a different system of notation. They adopted the names of the stems of the veins as used by Redtenbacher and used abbreviations of these names to designate the veins, Arabic numerals being added as indices to the abbreviations for designating the branches of the veins. The abbreviations used were the following: costa, C; subcosta, Sc; radius, R; media, M; cubitus, Cu; and the anal veins as 1st A, 2d A, and 3d A.

In 1902^a Enderlein, in a discussion of an abnormal specimen of *Telea polyphemus* gives the results of an extended investigation of the interrelation of the wing and body tracheæ. The tracheæ of each wing is divided into two systems, the radial and the medial, the former including the costa, subcosta, and radius; the latter, media, cubitus, anal, and axillary veins. It is unfortunate that this writer did not study some of the generalized Lepidoptera, such as the Hepialidæ. It has been amply proven that in certain of the lower orders of insects, as the Plecoptera, there are two tracheal trunks, the anterior giving rise to costa, subcosta, radius, and media; the posterior, to cubitus and the anal veins. That this was probably the primitive condition in the Lepidoptera is shown by the adult wings of certain species of *Hepialus* in which media anastomoses with cubitus for a short distance, bends abruptly toward the radius, joins it, and coalesces with it to the base of the wing. In most Lepidoptera this basal connection between media and radius has been lost, but the condition found in *Hepialus* would seem to indicate that the arrangement of the veins into systems as shown by Enderlein was probably an acquired one. He has shown conclusively that costa of both wings is

^aDr. G. Enderlein. Eine einseitige Hemmungsbildung bei *Telea polyphemus* vom ontogenetischen Standpunkt. Ein Beitrag zur Kenntniss der Entwicklung der Schmetterlinge. Zool. Jahrb., XVI, 1902. Part 4.

always preceded by a trachea and that in certain cases this is the most prominent trachea in the wing. The tracheal trunks behind cubitus are divided into two groups. The anterior he has called the anal group and the posterior the axillary group. The modified Redtenbacher nomenclature used by Comstock and Needham is adopted.

From a study, extending over a period of several years, of the wing-veins of the superfamily Tenthredinoidea, which contains all the generalized wings found in the order Hymenoptera, I am convinced that the homologies established for the Hymenoptera by Comstock in his *Manual for the Study of Insects*, and farther elaborated by Comstock and Needham, are correct, and they are accepted and followed in this paper. An attempt will be made here to explain some details of the Hymenopterous wing as exemplified by the Tenthredinoidea and not discussed by these investigators.

II.—GENERAL CONSIDERATIONS.

In determining the homology of the wing-veins of insects, conclusions are reached by two different methods. First, by a study of the ontogeny of the wing-veins, which consists of a careful examination of the tracheation that precedes the veins and a comparison of it with the wing-veins of the pupa and adult. As a rule, cross-veins are not preceded by tracheæ, so that this method, where it can be applied, is of the greatest importance in determining the course and extent of the principal veins and their branches. Second, by a study of the phylogeny of the wing-veins, which consists of a careful comparison of the progressive modifications found in the wings of adult insects. By this method, the accuracy of the results depend on the skill of the investigator in deciphering the record.

It has been shown by Comstock and Needham^a that an ontogenetic study of the wings of the Hymenoptera is not of any value in determining the homology of the veins, and I can not do better than quote their account:

The importance of this method of study has been well shown by the results we have obtained. But we also found that in the Trichoptera there is little correlation between the venation and the tracheation of the wings, a remarkable reduction of the wing tracheæ having taken place. A similar reduction of the tracheæ of the wings exists in most families of Diptera; and even when a large proportion of the tracheæ are retained, as in certain Asilids, they afford little aid in the determining of the homologies of the wing-veins. For this reason we omitted a discussion of the tracheation of the wings of Diptera. Again, in the Hymenoptera we find that the courses of the tracheæ can not be depended upon for determining the homologies of the wing-veins. But here, in the more generalized members of the order, we find a very complete system of wing-tracheæ, and it is, therefore, incumbent on us either to point out the correspondence between the tracheæ and the wing-veins, or to demonstrate that such a correspondence does not exist.

^aJ. H. Comstock and J. G. Needham. *Amer. Nat.*, XXXII, 1898, pp. 421-422.

In the Hymenoptera, as we have shown, the courses of the branches of the forked veins, in those forms where they have been preserved, have been so modified that these branches extend more or less transversely, making sharp angles with the main stems. It is not strange, therefore, that the tracheæ of the wings of the pupa lying free within the wing-sac, have not followed these changes.

It was found, however, that this is not the explanation of the change. An examination of the wings of young pupæ of the honey-bee revealed the fact that in this insect the laying out of the wing-venation precedes the tracheation of the wing. After the wing-veins reach that stage of development in which they appear as pale bands, the tracheæ grow out from the base of the wing into them.

It is obvious that tracheæ developed in this way will follow the paths offering the least resistance to their progress; and that it is not to be expected that the tracheæ will preserve their primitive arrangement under these conditions. This brings us to the conclusion, already announced, that in determining the homologies of the wing-veins in the Hymenoptera we are forced to base our conclusions on a study of the veins themselves, and that a method of study which is of the highest importance in determining the homologies of the wing-veins in many other insects, is of little use here for this special purpose.

From the results just given it is evident that we must depend entirely on a careful comparison of the wing-veins of the Tenthredinoidea, part by part, for a determination of their homology. Before considering the special modifications of wing-veins, some discussion is necessary of the manner in which the veins may be modified or reduced in number and the resultant reduction or combination of cells.

A reduction in the number of wing-veins may take place in two ways—first, by the coalescence of two or more adjacent veins; and second, by the atrophy of a whole or a part of a vein. The first method of reduction, coalescence, may proceed in three ways—first, by the coalescence of principal veins or branches from the base of the wing toward the margin; second, by the coalescence of the tips of veins or branches from the margin of the wing toward the base; and third, by the coming together of two veins at some point more or less remote from the margin of the wing and their coalescence for a greater or less distance. This third type of coalescence is generally spoken of as anastomosis. The modern hymenopterous type of wing has been produced, as will be described later, by a combination of all three of these methods.

The second method of reduction, atrophy, or the fading out of the whole or a part of a vein, is the means by which most of the changes found in the modern hymenopterous wing are brought about.

When two or more branches or any of the principal veins coalesce, this fact is indicated by placing a plus sign (+) between the abbreviations of the veins that have combined. If, for example, R_2 and R_3 coalesce, the legend would be R_{2+3} ; while if any of the principal veins combine, as R, M, and Cu, it would be written thus: $R+M+Cu$. This implies that not only the branches of the same vein, but that the stems of the different veins, as well as the branches of different veins, may coalesce.

The cells of the wing are named by applying to them the abbreviations of the vein forming its front margin, the group of cells at the base of the wing (fig. 1), being designated by the abbreviations of the principal veins, while the group of cells at the apex of the wing are designated by the branches of the veins. It should be borne in mind that when the vein forming the front margin of a cell is a composite one, as R_{2+3} , the cell behind this vein is not R_{2+3} , but R_3 , the cell R_2 having been obliterated by the coalescence of the veins R_2 and R_3 . When cells are divided by a cross-vein, as cell M_2 , the basal portion is spoken of as 1st M_2 and the marginal portion as 2d M_2 . In labeling the figures of entire wings, the names of the veins are put either on the veins or near them, and an arrow placed to indicate the vein to which the name applies, or at their apices around the wing margin, while the names of the cells are placed within the cells to which they apply.

All that portion of a vein that does not coalesce with any other vein is spoken of as the free part of that vein. If *media* be taken as an example, then all that portion of M_1 between the point where it separates from M_2 and the margin of the wing would be the free part of M_1 . In the following pages the origin of particular veins is frequently spoken of. By this is meant the point or place where they separate or fork and does not refer to the actual point of origin. If *media* be taken again as an example, the point where M_1 separates from M_2 would be considered as the origin of the free part of M_1 .

Although there are no facts in support of the method here given, and although it implies a condition much more generalized than is found in the hypothetical type, yet I have always found it easier in working out the homology of veins myself, and also in explaining venational problems to others, to consider each of the branches of any vein as extending from the base to the margin of the wing. If *radius* and its five branches be taken as an example, the stem part, always designated as R , would be considered as being a combination of all the branches of *radius*, or as $R_{1+2+3+4+5}$, which divides into R_1 and R_s . In like manner the stem of the radial sector would be considered as being a combination of all the branches of the radial sector, or as $R_{2+3+4+5}$, which divides into R_{2+3} and R_{4+5} , and these in turn into R_2 and R_3 , and R_4 and R_5 , respectively. So that in tracing out the course of any of the branches of *radius* by drawing a pencil along them, as R_4 , beginning at the base of the wing, we would pass first over the stem of R , then over the stem of the radial sector, then over R_{4+5} , and finally over the free part of R_4 .

III.—THE ORIGIN OF THE HYMENOPTEROUS TYPE.

In order that the reader can follow more intelligently the later discussions, the following general description of the origin of the wing of the Hymenoptera is introduced at this point. Use has been made of the following series of hypothetical figures to show how the existing arrangement of wing-veins was in all probability developed from a wing similar to that of the Comstock and Needham hypothetical type. This series begins, therefore, with this hypothetical type and concludes with a typical generalized hymenopterous wing, which is the wing of *Macroxyela ferruginea* to which has been added the free part of Cu_2 . To the hypothetical type I have added the cross-veins which are present in hymenopterous wings. These cross-veins are as follows:

The radial cross-vein r , situated between R_1 and R_3 ; this is wanting in the Hymenoptera only in certain genera of the Tenthredinoidea.

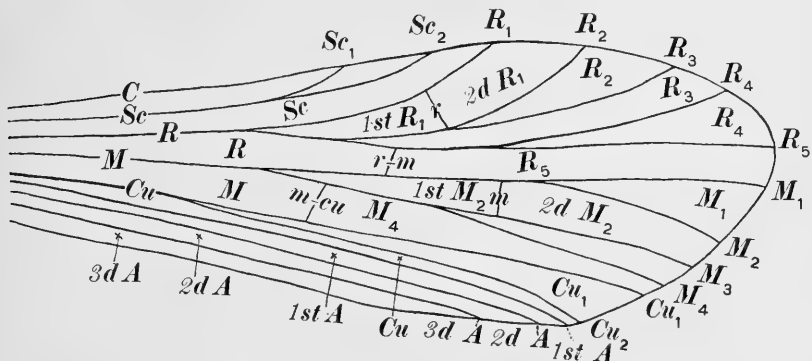


FIG. 1.—HYPOTHETICAL WING TYPE.

The radio-medial cross-vein $r-m$, situated between radius and media.

The medial cross-vein m , situated between M_2 and M_3 .

The medio-cubital cross-vein $m-cu$, situated between media and cubitus.

Beginning with the anal veins, the veins will be taken up in order, proceeding from the hind to the front margin of the wing.

The anal veins are three in number, simple, fill the anal portion of the wing, and are known as 1st A, 2d A, and 3d A. The first modification of the anal veins to be noted is the coalescence of the tips of 2d A and 3d A, resulting in the closing of the second anal cell at the margin of the wing (fig. 2). This coalescence proceeds farther and farther and the 1st A migrates toward the combined tip of 2d A and 3d A and combines with it, shoving the second anal cell toward the base of the wing and closing the first anal cell at the margin (figs. 3-4). Coincident with this apical coalescence, the base of 2d A migrates

forward to the base of 1st A, combines with it, and closes the first anal cell at base as well as at apex (figs. 4-5). The further modifications of the anal veins and cells are all the result of this coalescence continued at apex and base until the free part of 2d A appears as a cross vein just beyond the middle of the cell, while the apex of the cell bears an elongate, simple, spur-like vein formed by the combined

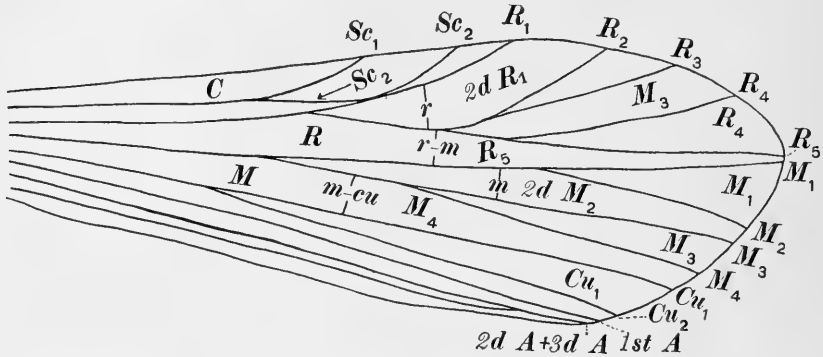


FIG. 2.—MODIFIED HYPOTHETICAL TYPE.

union of the three anal veins (figs. 7-8). We thus have formed what is known to the students of the Tenthredinoidea as the lanceolate cell, which is in reality two very different cells. The modifications of the lanceolate cell serve as excellent characters for tracing the phylogeny of the family Tenthredinidæ and for dividing it into smaller groups.

The cubitus, Cu, is a forked vein lying just in front of the three anal veins (fig. 1). The two branches of cubitus, Cu₁ and Cu₂, migrate

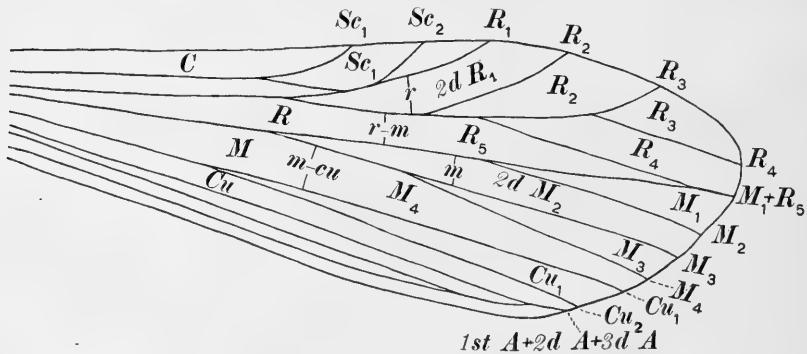


FIG. 3.—MODIFIED HYPOTHETICAL TYPE.

toward the combined tip of the anal veins (fig. 3) and coalesce with it (figs. 4-5). By this means, first, the cell Cu and then the cell Cu₁ are closed at the margin of the wing. The branches of cubitus after combining with the united tip of the anal veins, follow along the front margin of 1st A, coalescing with it more and more, and at the same time crowding the cells Cu and Cu₁ farther and farther away from the

margin of the wing (figs. 6-7). This coalescence continues until the free parts of Cu_1 and Cu_2 appear like short cross-veins near the middle of the wing. At the same time that the apices of the branches of cubitus are combining with the anal veins, the base of cubitus migrates toward the front margin of the wing, combines with the united base of radius and media (figs. 6-8), and closes the base of the cell M. With the migration forward of the base of cubitus, the combined bases of 1st A and 2d A, also migrate forward to fill the space vacated by the base of cubitus.

The media, M, lies just in front of and parallel with the cubitus (fig. 1). Near the middle of the wing it divides into two branches, each of which divides again. With the migration and coalescence of the tips of cubitus and anal veins there begins also a migration of the three posterior branches of the media (figs. 2-5). M_1 eventually combines with the combined tip of the anal veins and cubitus, closing the cell M_1 at the margin of the wing (fig. 6), migrates along this vein, and

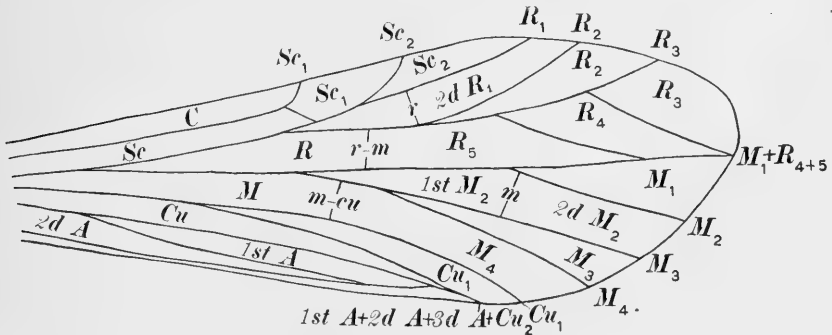


FIG. 4.—MODIFIED HYPOTHETICAL WING.

combines with the tip of the free part of Cu_1 , crowding the cell M_1 back still farther from the wing margin (figs. 7-8). M_3 , pulled along by the same force that combined M_1 with the anal veins and cubitus, migrates along the margin of the wing and combines with the tip of the spur-like vein situated at the apex of the first anal cell. In this way the cell M_3 is closed at the margin of the wing. The spur-like tip now consists of the combined anal, cubitus, and two posterior branches of media. The tip of the vein 1st A+2d A+3d A+ Cu_{1+2} + M_{3+4} has been lost, so as to permit of the folding of the posterior margin of the wing where the hooks of the hind wing are fastened. M_2 , tied to M_3 by the medial cross-vein, is also pulled around the wing margin, changing from a longitudinal to a transverse position, while the medial cross-vein is transformed from a vein extending transversely to one extending longitudinally (figs. 5-7). The first branch of media maintains its primitive position near the middle of the wing throughout the entire series. The stem of media very early migrates forward and combines with the stem of radius (figs. 4-7), thus com-

pletely closing the base of the cell R. This coalescence continues until the stem of media and the stem of radius are combined for almost their entire length, while the cell R is crowded toward the middle of the wing and is found as a small trapezoidal-shaped area near the base of the stigma (figs. 7-8).

The radius, R, lies just in front of media (fig. 1). Near the middle of the wing it breaks up into five branches. In its primitive condition radius divides by a series of characteristic dichotomies, separating first into two unequal parts, R_1 , and a large part which, together with all its branches, is known as the radial sector. The radial sector divides into two equal branches, each of which in turn divide into two more branches. This characteristic dichotomy is entirely lost in the Hymenoptera. The suppression of the dichotomy of the radius has been brought about by the coalescence of the stems R_{2+3} and R_{4+5} . This coalescence has proceeded so far that the branches of the sector now arise from a common stem (figs. 2-3). With the coalescence of

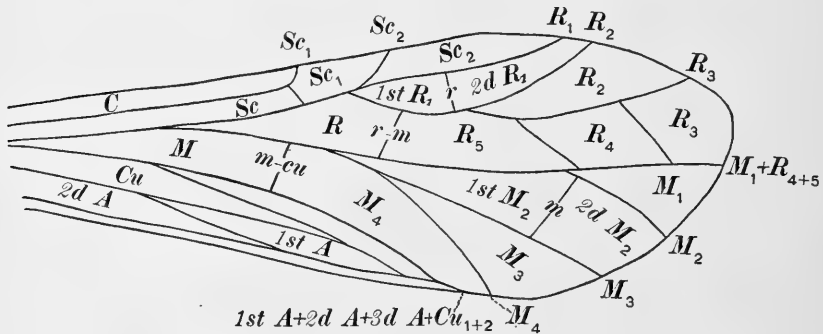


FIG. 5.—MODIFIED HYPOTHETICAL TYPE.

the stems of R_{2+3} and R_{4+5} , R_1 and R_2 begin to migrate toward the apex of the wing, to stiffen the area vacated by R_4 and R_5 , which have migrated toward the tip of M_1 (figs. 2-4). R_4 and R_5 each in turn coalesces with M_1 and closes the cells R_5 and R_4 at the margin of the wing. The coalescence proceeds farther and farther until the free parts of R_5 and R_4 appear like cross-veins extending between R_3 and M_1 , and the cells R_5 and R_4 as quadrangular areas within the disk of the wing (figs. 5-7). The primitive condition maintained by M_1 near the middle of the wing is undoubtedly due to the early coalescence of R_5 and R_4 with it and holding it in place.

The subcosta, Sc, lies just in front of the radius and parallel with it. It breaks up into two branches, Sc_1 and Sc_2 , near the margin of the wing (fig. 1). The anterior branch is preserved in practically its primitive condition throughout the series. The posterior branch bends down and touches R_1 (fig. 2), with which it anastomoses more and more (figs. 4-6), until there is only a small portion of the distal end free (fig. 7). This anastomosing of Sc_2 and R_1 divides the cell Sc into

two distinct parts, a long basal portion Sc_1 and a small area at the apex of the small free part of the vein Sc_2 , and in front of the vein R_1 . This cell in all Hymenoptera is strongly chitinized and is known as the stigma.

The costa, C, is situated on the front margin of the wing and does not undergo any marked modifications.

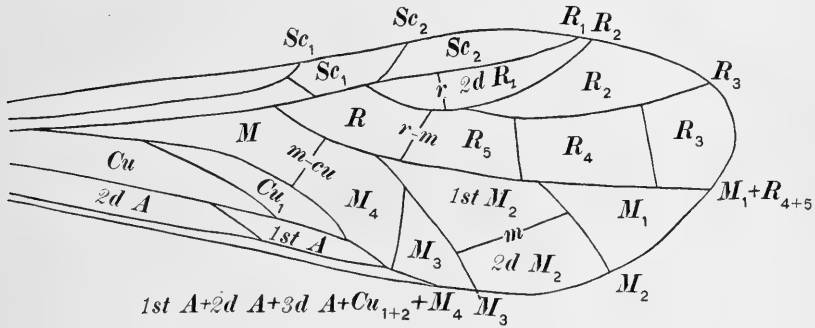


FIG. 6.—MODIFIED HYPOTHETICAL TYPE.

Thus far there has been considered only a hypothesis as to how the most generalized hymenopterous wing known could have been formed. The data upon which this hypothesis is founded is not original with the writer but is based on facts first pointed out by Prof. J. H. Comstock in his Manual for the Study of Insects and Elements of Insects Anatomy. Let us now look at a few of these facts on which this hypothesis is based. If a careful study be made of a number of wings of the Diptera, one of the most striking facts noted will be that "there is a

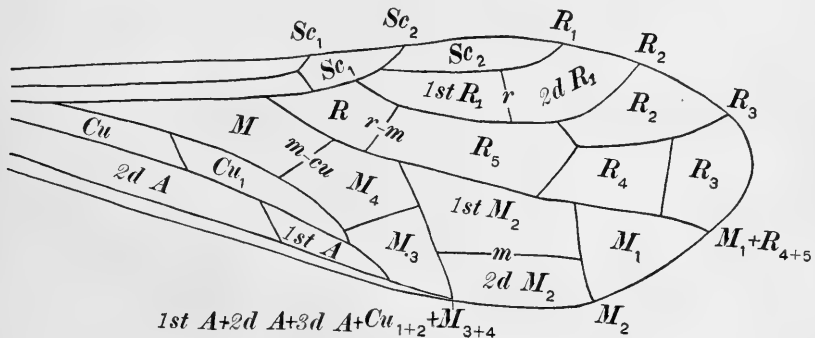


FIG. 7.—MODIFIED HYPOTHETICAL TYPE.

marked tendency for veins to coalesce from the margin of the wing toward the base." In fact, if the wing of *Midas* (fig. 28) be examined, it will be seen that a larger proportion of the veins are coalesced at apex than in any known hymenopterous wing. If Cu_2 and $1st A$ be examined in the wings of *Pantarbex* (fig. 21), *Eraw* (fig. 22), *Tabanus* (fig. 23), *Scenopinus* (fig. 24), *Rhamphomyia* (fig. 25), and *Musca* (fig. 26),

in the order named, there will be found a complete series showing how Cu_2 has combined with 1st A. It is true that only one branch of cubitus has combined with the anal vein, yet it shows how this coalescence proceeds. When the medial area of *Eratr* (fig. 22) is examined it will be noted that M_3 and Cu_1 have coalesced at apex, crowding the cell M_3 back from the margin of the wing just as cell M_4 is pushed back in the hymenopterous wing, and it does not need a long stretch of the imagination to understand what would be the result if the vein $M_3 + Cu_1$ were to migrate toward the apex of the vein 1st A, as has occurred in the Hymenoptera. The wing of *Eratr* shows also how, through the combination of the apices of the veins, the medial cross-vein has been swung around from a transverse to a longitudinal position. This same condition is also shown in the wing of *Pantarb*es (fig. 21), where the medial cross vein and the first three branches of media assume a position almost identical with that found in the Hymenoptera. It also shows how the branches of R_5 and M_1 have coalesced, the only differ-

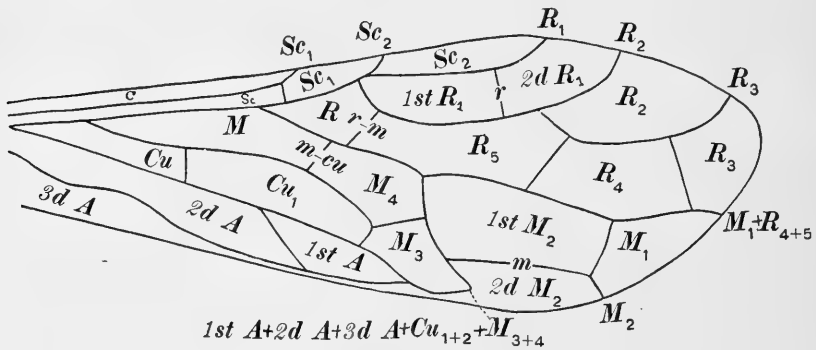


FIG. 8.—TYPICAL HYMENOPTEROUS WING.

ence in the Hymenoptera being that this condition has proceeded much farther and R_1 also has combined with M_1 . This condition found in *Pantarb*es is not peculiar to this wing, but is also found in *Pipunculus*, *Conops* (fig. 27), most Syrphidæ, and many Calyptrate Muscidæ. The wing of *Midas* (fig. 28) is an interesting example of how far this apical coalescence may proceed. In this wing the coalescence takes place in a different direction, but is just as pertinent to the point in hand. Here veins R_{2+3} , R_4 , and R_5 , have coalesced with R_1 in just the same way that R_4 and R_5 have coalesced with M_1 in the Hymenoptera, the difference being that in the Hymenoptera only two veins coalesce while in this dipterous wing three veins have coalesced and the fourth vein has migrated up to the tip of R_1 . Both branches of subcosta are preserved in but very few insects and the peculiar anastomosis of Sc_2 and R_1 and the formation of the stigma are paralleled in the wings of the Plecoptera. In the genus *Nemoura* (fig. 29), the anastomosis extends for only a short distance, while in the genus

Taeniopteryx (fig. 30), the anastomosis is for almost the entire length of Sc_2 , resulting in a condition similar to that found in the generalized Tenthredinoidea.

IV.—A STUDY OF THE WING AREAS.

As already indicated, the wings of insects may be divided into six well-marked areas, an area for each of the principal veins. It is true that these areas are closely interlocked in the Tenthredinoidea, but this seems the most logical way of approaching the subject. An attempt will be made here to describe the most important modifications found in the wings of existing genera.

1. THE FRONT WINGS.

In all insects where the wings of a side are closely fastened together for unison in flight, there is a great difference in the amount of reduction found in the two wings. It is a well-established fact that that animal whose wings approximate most nearly a triangle in outline is the most efficient flyer. For this reason it is apparent that when the wings are of this type, as in the order Hymenoptera, the hind wings are always the ones to undergo the greater amount of reduction, and consequently it has been found necessary to discuss the areas of the two wings separately.

THE COSTAL AREA.

Costa is a simple straight vein of the same width throughout in the Lydidae (figs. 36-43), Xyelidae (figs. 31-35), and Megalodontidae (fig. 92). In most genera, as *Dolerus* (fig. 49), *Pteronus* (fig. 68), *Blennocampa* (fig. 72), and *Eriocampa* (fig. 47), it is decidedly thickened at apex, spatulate in outline, while in the Cimbicinae (figs. 59-60), it is thickened throughout its entire length and lies adjacent to $Sc + R + M$, practically squeezing out the costal and subcostal cells.

A peculiar condition found in most of the Tenthredinoidea, though not occurring outside this superfamily, so far as I have been able to observe, is a hinge-like thinning out of the margin of the wing at the base of the stigma. It is present in all the genera except the large-bodied, active species of the family Siricidae (figs. 86-91), and the subfamilies Cimbicinae (figs. 59-60) and Pterygopherinae (fig. 81). It represents the space on the margin of the wing between the apex of the costa and the point where the second branch of subcosta joins the margin. In those forms where this structure is wanting it has been chitinized secondarily, and even here its position can often be detected because the band of chitin closing the space is not so broad as it is on either side of it.

The humeral cross vein, situated at the base of the wing between costa and subcosta, is one of the most constant of the cross veins found

in the other orders of insects. In the Tenthredinoidea it is present only in *Macroxyela ferruginea*, and even here is only faintly indicated. In the Lydidae, there is a broad thickening at the base of subcosta and a similar thickening in the Megalodontidae (fig. 92) between costa and Sc + R + M that may be homologous with this cross-vein.

THE SUBCOSTAL AREA.

Subcosta does not occur in the Hymenoptera outside the superfamily Tenthredinoidea, and here only in the families Xyelidae (figs. 31-35) and Lydidae (figs. 36-43). In most of the genera of these families subcosta extends midway between costa and R + M. Near its apex it divides into Sc₁, which ends in the margin of the wing, and Sc₂, which anastomoses with R + M and ends in the margin of the wing at the base of the stigma. Behind the stem of subcosta there is found the cell Sc and behind and beyond the vein Sc₁ the cell Sc₁. In *Megaxyela* (fig. 31) and *Odontophyes* (fig. 32) the cell Sc₁ is very small, due to the great length of subcosta. Subcosta divides into Sc₁ and Sc₂ midway between the origin of media and the radial sector. In *Macroxyela* (fig. 33) this separation takes place just beyond the origin of media, while in the Lydidae this separation is a considerable distance before the origin of media. These wings show that there is a progressive migration of the origin of Sc₁ and Sc₂ from near the origin of the radial sector to a position near the base of the wing. In *Xyela* (fig. 35) and *Manoxyela* (fig. 34) the stem of subcosta is closely appressed to R + M, though it is never coalesced with it, so far as I have been able to observe, almost obliterating the cell Sc and causing the branch Sc₁ to extend like an oblique cross-vein from R + M to the wing margin. In *Neurotoma* (fig. 36) the free part of Sc₁ has completely atrophied, while the remainder of the vein is normal. An interesting related condition is found in certain of the large species of Siricidae, as *Tremex columba* (fig. 91), where the area of the wing situated between costa and R + M is almost as strongly chitinized as the veins themselves. In wings mounted in balsam it is possible to trace as a pale line a condition of subcosta similar to that found in *Neurotoma*. This seems to indicate that subcosta has been suppressed in two ways, first, by the close appression of its stem to R + M and its probable later coalescence with it, and, second, by the chitinization of the area between costa and R + M, and in this manner doing away with the necessity for a vein to stiffen this area.

In all other Tenthredinoidea, where any portion of subcosta is present, other than the apex of Sc₂, it is the free part of Sc₁. It extends as a cross-vein between costa and R + M, and is usually spoken of by the investigators on this superfamily as the intercostal cross-vein. It is generally situated just in front of the radial end of the medio-cubital cross-vein, except in *Xiphodria* (fig. 85), where it is sometimes

opposite the point of origin of media, and in *Dineura* (fig. 63), where it is distinctly beyond the radial end of this cross-vein. An interesting modification is found in the subfamily Tenthredininae (figs. 56-58), where R+M is bent at a prominent angle at the point where it is joined by Sc₁, indicating a condition more closely related to the Xyelidae and Lydidæ than is found in the other members of the family Tenthredinidae. Sc₁ is best preserved in those genera where the medio-cubital cross-vein and the stem of M₃₊₄ are strongly divergent behind. In fact, there seems to be a direct correlation between the divergence of these veins, the widening of the area between costa and Sc+R+M, and the preservation of the free part of Sc₁. This is especially marked in the subfamily Nematinae (fig. 68). The free part of Sc₁ is entirely wanting in the Cephidae (figs. 93-96), Oryssidae (fig. 97), Cimbicinae (figs. 59-60), and numerous genera of other groups as *Labiduræ* (fig. 78), *Phyllotoma* (fig. 54), *Harpiphorus*, and *Blasticotoma* (fig. 44); while in many genera, as *Stromboceros* (fig. 50), *Dolerus* (fig. 49), and *Macrophya* (fig. 57) there is a marked thinning out of the costal half of the vein, while in still other genera as *Allantus* and *Athalia*, there is only a slight projection on the front margin of Sc+R+M.

If the record has been correctly interpreted, the free part of Sc₁, as represented in the genus *Dineura* (fig. 63), has undergone a double migration. First, from near the stigma to the condition found in *Xyela* (fig. 35), as shown by the wings of the Xyelidae and Lydidæ, and second, after the coalescence of the stem of subcosta with R+M, a remigration toward the stigma has resulted. -

THE RADIAL AREA.

Radius divides into R₁ and the radial sector just before the stigma, of which the vein R₁ forms the hind margin, and beyond the stigma extends along just within the wing margin to or beyond the apex of R₃.

There is only one family of Hymenoptera, the Xyelidae (figs. 31-35), in which all the branches of radius are present. In all the families except the one named the entire free part of R₃ has been obliterated.

In the genus *Macroxyela* (fig. 33) R₂ arises about midway between the radial cross-vein and the origin of the free part of the vein R₅; in *Manoxyela* (fig. 34) it usually arises near the apex of the cell R₅, though in the same species it may in some specimens arise from the cell R₅ and in others be interstitial with the free part of the vein R₅, and in *Xyela* (fig. 35), although it normally arises from the cell R₁, yet it is sometimes interstitial with the free part of the vein R₅.

The radial cross-vein is situated between the vein R₁ and the stem of the radial sector, dividing the cell R₁ into two parts. Within certain limits it is fairly constant in its position. In every case, so far as I have observed, its anterior end is joined to about the middle of

the stigma. Its posterior end in the families Xyelidæ (figs. 31-35) and Cephidæ (figs. 93-96) is attached near the middle of the cell R_5 ; in the Megalodontidæ (fig. 92) and Siricidæ (figs. 86-91), except the genera *Tremex* (fig. 91) and *Teredon* (fig. 90), where it is joined to the cell R_4 , it is attached just beyond the middle of the cell R_5 ; in the Lydidæ (figs. 36-43) it varies in position from just beyond the middle of the cell R_5 to the apex of this cell, and in some forms is interstitial with the free part of the vein R_5 , and in all other Tenthredinoidea it is attached near the middle of the cell R_4 , except in certain species of *Tenthredopsis*, *Scolioneura* (fig. 75), *Monophadnus*, *Lycaota* (fig. 55), and *Blennocampa* (fig. 72), where it is interstitial with the free part of the vein R_4 , and in certain species of the genus *Kaliosysphinga* (fig. 73), where it is attached to the cell R_3 , but this latter change is not due to a shifting of the position of the radial cross-vein, but to a migration of the free part of the vein R_4 toward the base of the wing. The radial cross-vein is present in the wings of all Hymenoptera where the base of the radial sector is present other than those of a few groups of Tenthredinidæ, Lophyrinæ (fig. 45), Nematinae (fig. 68), Perreyiinae (fig. 80), Perginae (fig. 84), and Pterygopherinae (fig. 81).

The radio-medial cross-vein is rarely wanting, though in many genera it is so completely covered by a large clear spot or bulla that it is often-difficult to determine whether it is present or not. This condition is well shown in many Nematinae, where all stages from a distinct well-marked cross-vein to its total disappearance can be found. In other genera, as *Trichiosoma* (fig. 59), *Clavellaria* (fig. 60), *Oryssus* (fig. 97), *Kaliosysphinga* (fig. 73), *Acordulecera* (fig. 83), and *Blasticotoma* (fig. 44), all trace of the cross-vein has disappeared, while in *Monoctenus* (fig. 67) only the posterior half is wanting. In those genera, where this cross-vein is retained, it always appears as a transverse vein extending between the stem of the radial sector and the stem of media. In the Xyelidæ (figs. 31-35) the medial end has swung toward the base of the wing so that it appears to be a continuation of the radial sector, while a portion of the stem of the radial sector appears to be the cross-vein. In certain genera of the Siricidæ, as *Sirex* (fig. 87-88) and *Tremex* (fig. 91), the medial end has swung around still farther toward the base of the wing so that it arises from the angle made by the transverse and longitudinal parts of the stem of media where it is joined by the medio-cubital cross-vein, and in some species arises distinctly from the transverse part of media.

The free part of R_5 is wanting in only a very few genera, as *Dolerus* (fig. 49), *Loderus*, *Eutura*, and *Tremex* (fig. 91).

The free part of R_4 so far as observed is never wanting in this superfamily. It is not so constant in position as R_5 ; in the Xyelidæ (figs.

31–35) and Lydidæ (figs. 36–43) it is an oblique transverse vein situated near the margin of the wing. In most Tenthredinidæ, as *Hoplomampa* (fig. 61), *Cladius* (fig. 66), *Tenthredo* (fig. 56), and *Dineura* (fig. 63), it is found in the apical third of the distance between the base of the stigma and the apex of the wing, while in a few genera, as *Loboceras* (fig. 82), *Acordulecera* (fig. 83), and many Hylotominæ (fig. 76), it is found near the middle of this area.

In the apex of the wing of many Tenthredinoidea, as *Sirex* and *Tremex* (fig. 10, e), there is found a prominent spur-like projection from the apex of the cell R_{1+2} . The area included in front of this spur has been termed the appendiculate cell. As there is no vein forming the front margin of this cell, and as this name is in general use by the investigators on this order, it will be used here. The origin of the appendiculate cell will be more readily understood if we examine this region first in certain genera where

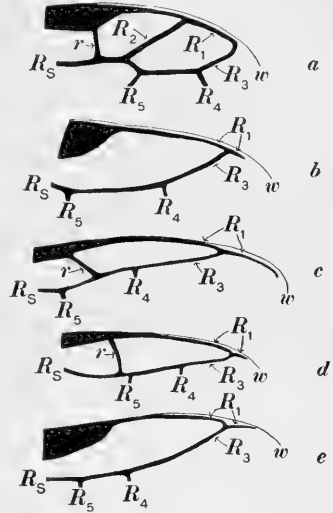


FIG. 9.—ORIGIN OF THE APPENDICULATE CELL. a, *MACROXYELA FERRUGINEA*; b, *MONOCTENUS JUNIPERI*; c, *CLAVELLARIA AMERINÆ*; d, *XIPHYDRIA CAMELUS*; e, *PERRYIA VITELLINA*.

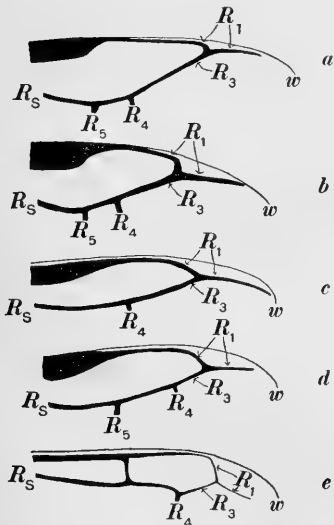


FIG. 10.—APPENDICULATE CELL. a, *DIELOCERUS FORMOSUS*; b, *PACHYLOTA AUDOUINII*; c, *PTERYGOPHORUS CINCTUS*; d, *LABIDARGE DIBAPHA*; e, *TREMEX FUSCOENIS*.

the appendiculate cell is not supposed to be present. If the front wing of almost any member of this superfamily be examined in this region, it will be noted that the portion of R_1 beyond the stigma does not form the margin of the wing but is set in a short distance from it. This is especially marked in the genera *Macroxyela* (fig. 9, a), *Tenthredo* (fig. 56), *Monoctenus* (fig. 9, b), *Cladius* (fig. 66), and *Strongylogaster* (fig. 51). It should be also noted that in all these wings R_1 extends beyond the point where it is joined by R_3 . This is especially marked in most Cimbicinæ, as *Clavellaria* (fig. 9, c), where there is also a slight curving down of R_1 at the point where R_3 joins it.

Now if this region at the apex of R_3 is examined in the following wings, it will be seen that the formation of the appendiculate cell is only a gradual modification of the condition existing in the wing of *Clavellaria*. In *Xiphydria* (fig. 9, d), the bending down is slightly more pronounced

yet not so prominent that systematists have ascribed an appendiculate cell to this genus. In the genera *Perreyia* (fig. 9, *c*), *Dielocerus* (fig. 10, *a*), *Pterygophorus* (fig. 10 *c*), *Labidarge* (fig. 10, *d*), *Sirex* (figs. 87-88), and *Tremex* (fig. 10, *e*), all of which are considered as having an appendiculate cell, there is a perfect series from the condition found in *Tenthredo* and *Clavellaria* to those genera in which the appendiculate cell is well marked. This series also shows clearly that the vein projecting from the apex of the cell $2d R_1 + R_2$ in *Tremex* is not of secondary origin but is vein R_1 , which has moved in from the margin of the wing and that vein R_3 ends at the point where it joins R_1 . The formation of the appendiculate cell has arisen through the necessity for a stiffening of the apex of the wing.

THE MEDIAL AREA.

The point of separation of the stem of media from radius and the position of the medio-cubital cross-vein are so intimately associated that they will be discussed together. Media is found in its most primitive condition in the wings of *Manoxyela* (fig. 34), where it separates from radius very nearly midway between the stigma and the base of the wing. It does not bend down at right angles, as is the case in most of the veins of the Hymenoptera, but branches off in a manner similar to that found in the branches of radius and media in the dipterous wing. This has a marked effect on the size and shape of the cell R, which is here three times as long as it is broad at its widest point. The medio-cubital cross-vein also occupies a very generalized position. It is located at the apex of the cell R, almost interstitial with the radio-medial cross-vein, while in all other Tenthredinoidea it is found at or near the base of the cell R. In *Macroxyela* (fig. 33) we find a slight modification of the condition found in *Manoxyela*. Here media has combined with radius for a greater distance, separating from radius distinctly beyond the middle of the distance between the stigma and the base of the wing, while the cell R is only about twice as long as broad. The medio-cubital cross-vein arises from near the apex of the cell R and is about the same length as the portion of media between it and radius, the two standing at about the same angle like the top of a Y. In all other Tenthredinoidea the media has coalesced with radius for a much greater distance—for at least three-fourths of that portion of radius extending between the stigma and the base of the wing. In *Xiphydria* (fig. 85) media arises very much as in the wings just described and the medio-cubital cross-vein is transverse and placed just before the middle of the cell R. The wing of *Oryssus* (fig. 97) is another interesting example. In this wing the reduction in the number of wing veins has been carried farther than in any other Tenthredinoidea, yet as regards the origin of media and the position of the medio-cubital cross-vein it is practically the

same as is found in *Xiphydria*. This is an interesting example of how very specialized a wing may be in one part while in others it may have retained a very generalized condition. In the Lydidæ (figs. 36–43) *media* arises in a manner similar to that just described, but the medio-cubital cross-vein is always many times longer than the transverse part of *media* and meets it soon after it separates from *radius* in the genera *Bactroceros* (fig. 41), *Cephaleia* (fig. 42), *Neurotoma* (fig. 36), *Lio-lyda* (fig. 43), and *Pamphilus* (fig. 39), while in the genera *Itycorsia* (fig. 40), *Cænolyda* (fig. 38), and *Lyda* (fig. 37) it arises in the angle formed between *radius* and *media*. It is of interest to note that in the case of those genera where it arises in the angle between *radius* and *media* no part of the cross-vein has migrated onto *radius*, but that it is attached to the very base of *media*. In the anomalous genus *Blasticotoma* (fig. 44) *media*, after separating from *radius*, goes off at a right angle for a short distance and then turns abruptly toward the apex of the wing, the anterior end of the cross-vein being joined to *media* at the point where the abrupt bend is made and the posterior end, instead of joining *cubitus* almost directly behind its anterior end, as in the generalized families Xyelidæ and Lydidæ, has migrated along *cubitus* toward the base of the wing and extends toward *media* at an angle of about 45°. In most Cephidæ (figs. 93–96) *media* arises as in the Lydidæ and the cross-vein is in a similar position, but on first examination it appears to be very different. This is due to the migration of the basal end of the radial sector toward the radial cross-vein and the migration of the radio-medial cross-vein toward the apex of the wing, in this way greatly increasing the size of the cell R.

The modifications found in the family Tenthredinidæ (figs. 45–84) are a continuation of those just described. The cell R instead of being a large irregular area with no two sides parallel has been transformed into a small quadrangular cell with the opposite sides parallel. *Media* has not changed its position materially from that found in the Lydidæ and *Blasticotomidæ*, but the medio-cubital cross-vein is very inconstant in its location. It is usually found in a position similar to that found in *Blasticotoma* (fig. 44), extending at an angle of about 45°. The posterior or cubital end is fairly constant in position, but the anterior end, from being attached to the base of *media*, as in *Periclista* (fig. 69), swings toward the base of the wing; in *Acordulecera* (fig. 83), *Rhadinocera* (fig. 70), *Loboceras* (fig. 82), *Monoctenus* (fig. 67), and *Perga* (fig. 84) it is attached in the angle between *radius* and *media*; in *Strongylogaster* (fig. 51), *Stromboceros* (fig. 50), *Dolerus* (fig. 49), and *Cladius* (fig. 66) it is attached to *radius* just before the angle; in *Macrophya* (fig. 57), *Pteronus* (fig. 68), *Hoplocampa* (fig. 61), and *Dineura* (fig. 63) it is attached to *radius* for a considerable distance before the angle, and, finally, in *Trichiosoma* (fig. 59) and *Clavellaria*

(fig. 60), it is attached as far distant from media as its own length, standing almost perpendicular between radius and cubitus.

In the wings just described the modifications of the origin of media and the changes in the position of the medio-cubital cross-vein marks out a distinct line of development, the changes proceeding from a generalized to a very specialized condition.

The families Megalodontidæ (fig. 92) and Siricidæ (figs. 86-91) illustrate a very different line of specialization. In those groups, when the cross-vein reaches a position similar to that found in *Xiphydria* (fig. 85), it becomes fixed in its location and all further modifications are due to the migration of the base of media. With the genus *Xeris* (fig. 89), there is a perpendicular transverse vein forming the apex of the cell M. The anterior half of this vein represents the transverse part of M and the posterior half the medio-cubital cross-vein. The peculiar condition found here has been brought about by the coalescence of the base of media with radius to a point opposite the anterior end of the medio-cubital cross-vein. This coalescence has been carried farther and farther until in the genera *Tremex* (fig. 91) and *Megalodontes* (fig. 92) the medial vein separates from radius distinctly beyond the apex of the anterior end of the medio-cubital cross-vein, while the vein forming the apex of the cell M is a fairly straight but very oblique vein with M apparently arising from its middle, as has been described.

All the branches of media are fairly constant in position and depart but little from the condition found in the typical hymenopterous wing. Only the more marked of these secondary modifications will be discussed here.

The transverse part of M_2 in many of the highly specialized genera of the Tenthredinidæ, as *Lobocerus* (fig. 82), *Acordulecera* (fig. 83), *Perreyia* (fig. 80), and *Dielocerus* (fig. 79), has migrated toward the base of the wing so that the length of the medial cross-vein is greatly reduced. In *Oryssus* (fig. 97) the transverse part of M_2 is entirely wanting, and if it were not for the presence of the first anal cell and the interrelation of the transverse part of M and the medio-cubital cross-vein, it might be easily mistaken for the wing of a Braconid.

M_{3+4} has undergone a slight modification in direction in many genera. This will be best understood if we look first at some of the genera of the Xyelidæ (figs. 31-35) and Lydidæ (figs. 36-43). In these genera it will be noted that if this vein were continued at the same angle to the margin of the wing that it would reach the margin at a point at or beyond the apex of the cell 1st A, while if the medio-cubital cross-vein be continued it would end near the free part of 2d A. If now we examine such genera as *Pteronus* (fig. 68), *Hoplocampa* (fig. 61), *Monoctenus* (fig. 67), and *Cladius* (fig. 66), we find that with the marked migration of the cubital end of the medio-cubital cross-

vein toward the base of the wing there is a corresponding migration of the posterior end of the stem of M_{3+4} toward the apex of the wing, and although this latter vein keeps relatively the same inclination, yet in these genera it would end at or a little before the apex of the cell 1st A. As was pointed out above, there seems to be a marked correlation between the divergence of these veins and the widening of the cell C, together with a usually well preserved Sc_1 ; an exception is found in the genera *Labidarge* (fig. 78) and *Blasticotoma* (fig. 44), where the free part of Sc_1 is entirely wanting and cell C is hardly more than a line, but this discrepancy is due to another cause, the different way in which the stress exerted in flight is transmitted from the stigma to the anal margin of the wing, which is shown by the angulate condition of M at the origin of the stem of M_{3+4} . If now we examine another series, as *Xiphydria* (fig. 85) and *Xeris* (fig. 89), where the medio-cubital cross-vein is transverse, we find that the posterior end of the stem of M_{3+4} has migrated slightly toward the base of the wing and is parallel with the cross-vein. In *Megalodontes* (fig. 92), where the cross-vein is oblique, the posterior end of the stem of M_{3+4} has migrated still farther, yet maintains its parallel course. While in such genera as *Strongylogaster* (fig. 51), *Cephus* (fig. 96), *Phymatocera* (fig. 71), *Blennocampa* (fig. 72), and *Tenthredo* (fig. 56), where this cross-vein is strongly inclined and if continued would approximate the base of the wing, there is a corresponding migration of the posterior end of the stem of M_{3+4} toward the base of the wing which has kept pace with the cross-vein, and if it were continued it would reach the margin some distance before the apex of the first anal cell.

THE CUBITAL AREA.

The base of cubitus in most Tenthredinoidea coalesces with the combined bases of radius and media for only a very short distance, for one-fifth to one-sixth the length of the distance between the base of the wing and the apex of the cell M. The family Lydidæ (figs. 36-43) represent a marked sidewise development as regards this coalescence, where cubitus has coalesced with $R+M$ for fully one-third of the distance between the base of the wing and the apex of the cell M.

The free part of Cu_1+M_1 is almost always found extending between the cells M_1 and 1st A. In the Lydidæ (figs. 36-43) it joins the cell M_1 at or beyond the middle and the cell 1st A on its apical third or fourth with this end always pointed toward the apex of the wing. In *Manoryela* (fig. 34) it occupies a similar position except that the end joining the anal vein points toward the base of the wing, while in *Macroryela* (fig. 33) it joins cell M_1 on its apical fifth and bends toward the base of the wing. It is found in *Paururus* (fig. 86) near the middle of the cell M_1 and on the basal third of the first anal cell; in *Xeris* (fig. 89) it joins the cell M_1 on its basal fourth and the

first anal cell as in *Paururus*; in *Xiphydria* (fig. 85) it joins M_4 at the base, being almost interstitial with the medio-cubital cross-vein, and the first anal cell at middle; and in *Tremex* (fig. 91) it joins the cell M distinctly before the medio-cubital cross-vein and the first anal cell on its basal fourth. In most other Tenthredinoidea it joins the cell M_4 just before, at, or just beyond the middle, is either transverse or inclined toward the apex of the wing, and joins the first anal cell near the middle, except in the genus *Labidarge* (fig. 78), where it joins it near the apex, a secondary modification due to the coalescence of the veins at the apex of the first anal cell. In the subfamily Tenthredininae it joins the cell M_4 at base just in front of the medio-cubital cross-vein and inclines strongly toward the apex of the wing. In the genera *Megalodontes* (fig. 92), *Oryssus* (fig. 97), *Trichiosoma* (fig. 59), and *Perga* (fig. 84), it is interstitial with the medio-cubital cross-vein and likewise inclined toward the apex of the wing. In the genus *Perreyia* (fig. 80) there is a marked convexity in the veins Cu_1 and M_4 with the convexity turned toward the anal veins, the free part of $Cu_1 + M_4$ starting off at the point of greatest convexity and inclining strongly toward the base of the wing. This condition seems to be characteristic of practically all the species of this subfamily.

All vestige of the free part of the vein Cu_2 is wanting except in certain species of the genera *Pamphilus* (fig. 39), *Cephalcia* (fig. 42), *Bactroceros* (fig. 41), *Lyda* (fig. 37), and *Cænolyda* (fig. 38) of the Lydidae, and the species of the genus *Paururus* (fig. 86). The position of the free part of this vein is represented in various other genera of Siricidae, as *Sirex californicus* (fig. 87), by a minute spur. In the remaining genera of the family Lydidae, where the free part of this vein is wanting, the prominent bend indicating the usual location of this vein is as prominent as in those genera where the vein is present, but even this bend is wanting in all other Tenthredinoidea.

THE ANAL AREA.

As already described, the wing area inclosed by the three anal veins has been named the lanceolate cell by the students of the Tenthredinoidea. This so-called lanceolate cell is in reality two cells, 1st A and 2d A. The front margin of the first anal cell is formed for the most part by the coalesced veins, 1st A, Cu_1 , Cu_2 , and M_4 ; its hind margin is formed by the combined 2d A and 3d A. The front margin of the second anal cell is formed for the most part by the coalesced 1st A and 2d A; its hind margin is formed by the 3d A. The cells 1st A and 2d A are separated by the free part of 2d A, which extends transversely and is generally spoken of as the cross-vein of the lanceolate cell.

The lanceolate cell is found under five different forms: First, open at the shoulder with an oblique or straight cross-vein; this is the form found in the typical hymenopterous wing and is of most frequent

occurrence (fig. 11, *a-d*); second, open at the shoulder without a cross-vein—that is, with the free part of 2d A wanting (fig. 11, *e*); third, contracted at middle without a cross-vein (fig. 11, *b-g*); fourth, petio- late (fig. 12, *a-c*); and fifth, with the lanceolate cell represented only by the vein forming its front margin (fig. 81).

The origin of the cells of the anal area has already been discussed, and only the origin of the different types of cells will be considered here. The anal cells are found in their simplest condition in the families Xyelidæ (figs. 31–35) and Lydidæ (figs. 36–43). In these families the important points to be noted are, that the vein forming the front margin of this area is straight, while the vein forming its hind margin is straight on its apical half and has a prominent bend or emargination on its basal half, known as the contraction of the lanceolate or second anal cell; that the anal veins have not coalesced at base; and that there is a short, oblique, transverse vein near the apex. This same type of cell is found in the genera *Dolerus* (fig. 49), *Emphytus* (fig. 46), *Pseudosiobla* (fig. 48), and *Eriocampa* (fig. 47), except that the emargination on the hind margin at base is not so deep while the cells themselves are not so broad. In *Blasticotoma* (fig. 44) these cells are narrowed, but the portion of the vein on the basal side of the emargination has been enlarged shoulder-like. Among the Siricidæ there has been a gradual but marked change; in *Xeris* (fig. 89) and *Paururus* (fig. 11, *b*) the cells have been greatly elongated, together with a corresponding elongation of the emargination, while in *Teredon* (fig. 90) and *Tremex* (fig. 91) the emargination is so gradual that it would be overlooked if it were not for its presence in the closely related forms, while there has been developed an additional spur which extends from the apical end of the emargination toward the base and margin of the wing. In *Megalodontes* (fig. 92) these cells have been much shortened, the emargination is almost entirely wanting, while the bellying out of the third anal vein just in front of the free part of the second anal, which is only slightly indicated in the Lydidæ, is well marked here. In almost all those genera where there is a prominent emargination of the third anal vein at base, there is a corresponding expansion of the wing area behind the

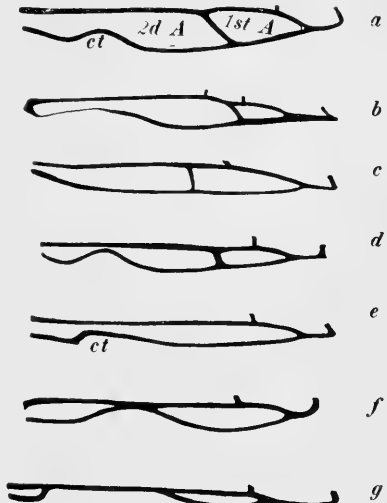


FIG. 11.—TYPES OF ANAL CELLS. *a*, MACROXYELEA FERRUGINEA; *b*, PAURURUS CYANEUS; *c*, CEPHUS PYGMEUS; *d*, KONOWIA WALSHII; *e*, STRONGYLOGASTER CINGULATUS; *f*, HOPLOCAMPA FERRUGINEA; *g*, LABIDARGE DIBAPHA.

anal veins. The Cephidae (fig. 11, *c*) are an interesting example of how far the reduction of this area may be carried; in this family the emargination of the base of the third anal is entirely wanting, the free part of the second anal is perpendicular to the other veins and opposite the medio-cubital cross-vein, while the wing area behind the third anal is so greatly reduced that this vein in some species practically forms the hind margin of the wing.

The genera *Derecyrtia*, *Brachyriphus*, and *Konowia* (fig. 11, *d*), of the family Xiphydriidae are described as having the free part of the second anal vein present and the third anal vein united with 1st A+2d A at the contraction of the third anal vein. The first two genera are unknown to me in nature, but the species of these genera, figured by Westwood^a and Kirby, show the contraction of the anal cells of the same type as found in *Xiphydria* (fig. 85). In *Xiphydria* the contraction is much deeper and the third anal approximates more closely the 1st A+2d A than in any of the other genera of the Tenthredinoidea. In *Konowia walshii*^b the contraction is still deeper, yet the two veins do not come into actual contact with each other. *Xiphydria* and *Konowia* are of interest in showing successive stages of the anterior migration of the third anal at the contraction and to prove that at least one method of the modification of the anal cells is by the anastomosing of the veins at this point.

The anal area has been reduced in two very different ways; first, by the anastomosis of the third anal with the first and second at the contraction in the second anal cell; second, by the shortening of the free part of the second anal until the third anal comes in contact with the combined first and second anals. Thus it will be seen that in both cases the reduction is due to anastomosis, but that it takes place at a different point and in a different way.

With the exception of the genera of the family Oryssidae (fig. 97), the only place where the anal area undergoes any reduction at all is in the family Tenthredinidae, and even here the great majority of the genera fall under the first class. As to whether the third anal anastomoses with the combined first and second anals before or after the atrophy of the free part of the second anal, it is impossible to tell. If we base our conclusions on the Xiphydriidae, the natural supposition would be that it took place before the atrophy of the free part of the second anal; but, from a careful study of this area, I have been led to conclude, because of the difference in the stages within the different families, that these modifications have arisen independently within

^aJ. O. Westwood. Thesaurus Ent. Oxoniensis. 1874. W. F. Kirby. List Hymen. Brit. Mus., Tenth. and Siric. I, 1882.

^bI am indebted to Mr. J. Chester Bradley for an opportunity to see a specimen of this species belonging to the U. S. National Museum Collections. The generic reference was made by Dr. W. H. Ashmead.

each family; and further believe, judging from the existing forms, that in the family Tenthredinidae, where there are closely related forms with and without the free part of the first anal, that this anastomosis took place after the loss of the free part of the second anal.

The type of cell, where the free part of the second anal is wanting, is illustrated by the genera *Selandria*, *Strongylogaster* (fig. 11, e), *Stromboceros* (fig. 50), and *Thrinax* of the subfamily Selandrinae. These genera have an anal area identical with that found in the genera *Dolerus* (fig. 49), *Lophyrus* (fig. 45), *Eriocampoides* (figs. 52-53), and *Emphytus* (fig. 46), except for the atrophy of the part named, and represent the type of lanceolate cell open at the shoulder without a cross-vein.

In the genera *Hoplocampa* (fig. 11, f), *Cladius* (fig. 66), *Monoctenus* (fig. 67), *Labidarge* (fig. 11, g), and *Hylotoma* (fig. 76), the type of cells found in the Selandrinae has been further modified by the anastomosis of the third anal vein with the combined first and second anal veins at the point where the third anal is deeply emarginate in the Selandrinae, and consequently, with the loss of all trace of the emargination. The anastomosis varies from a short distance in *Hoplocampa* and *Monoctenus* to almost the entire length of the area in *Hylotoma* and *Labidarge* and is the type of lanceolate cell considered as being contracted at middle.

The so-called petiolate type of lanceolate cell is a direct modification of the contracted type. It is brought about in two very different ways. By the atrophy of that part of the third anal vein adjacent to the basal end of the anastomosis, or by the continuation of the anastomosis of the basal part until it reaches the base of the wing. *Hylotoma* and *Labidarge* show the basal part of the second anal cell as a minute area at the extreme base of the wing while in *Pachylota* (fig. 77) this area is obliterated by the completion of the coalescence. Although there is no data available, yet from the shape of the anal cells in the Oryssidae (fig. 97) it is quite probable that the reduction has taken place here in the same manner. That the petiolate type is brought about by atrophy is readily proven by an examination of the wings of *Rhadinoceraea* (fig. 12, a), *Periclista* (fig. 12, b), and *Phymatocera* (fig. 71), in the order named. In these wings,

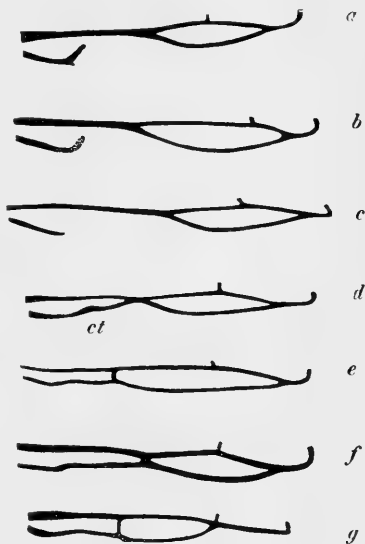


FIG. 12.—REDUCTION OF THE ANAL CELLS. a, RHADINOCERAEA REITTERI; b, PERICLISTA MELANOCEPHALA; c, PTERONUS PAVIDUS; d, MACROPHYA ALBICINCTA; e, TENTHREDO FLAVA; f, LYCAOTA SODALIS; g, CLAVELLARIA AMERINÆ.

the basal part of the third anal vein is preserved in every case, but is interrupted at the point where it should join the anastomosis. *Pteronuss* (fig. 12, *c*) and *Blennocampa* (fig. 72) show a slightly later stage in which only the longitudinal part of this vein is preserved, while many genera, as *Dineura* (fig. 63), show the complete atrophy of the entire basal part of the third anal, or at most it is represented only by a fold. In *Perreyia* (fig. 80) there is developed a peculiar spur on the posterior margin of the cell 1st A opposite the free part of $M_4 + Cu_1$.

The greatest reduction of the anal area is reached in the subfamilies Lobocerinae (fig. 82), Pterygophorinae (fig. 81), and Perginae (fig. 84), where all that remains is the simple straight vein. The members of these subfamilies, at least so far as this area is concerned, have reached the condition found in all the higher Hymenoptera. This condition has been reached by a continuation of the anastomosis found in *Labi-large* (fig. 78). As was shown above, the petiolate type of cell might be produced by the anastomosis of the basal part of the third anal, while the condition here is produced by anastomosis of both basal and apical parts. It is an interesting fact that the cell on the basal side of the anastomosis is bounded in front by 1st A + 2d A and behind by 3d A, while the apical half is bounded in front by 1st A and behind by 2d A + 3d A, so that the resulting vein is a combination of all three anal veins, which has certainly been brought about in a very round-about manner.

The second method of the modification of the anal area, namely, by the gradual shortening of the free part of 2d A and the almost complete obliteration of the emargination of the 3d A is found only in the subfamilies Lycaotinae (fig. 12, *f*), Tenthredininae (fig. 12, *d-e*), and Cimbicinae (fig. 12, *g*). When the wings of *Itycorsia* (fig. 40), *Lyda* (fig. 37), *Ctenolyda* (fig. 38), *Eriocampa* (fig. 47), and *Strongylogaster* (fig. 51) are carefully examined there will be found at the base of the emargination a prominent shoulder, which is distinctly thickened. This shoulder is present in varying degrees in all those genera where the third anal is emarginate at base, but is especially prominent in the genera named. If, now, we examine the wings of most any member of the subfamily Tenthredininae, as *Macrophya* (fig. 57), we will find near the basal side of the anastomosis a slight emargination, and just beyond it a thickening. In this emargination and thickening we find the reason for our conclusions that in these subfamilies the contracted type of cells has been produced by a shortening of the free part of the second anal. This conclusion is further confirmed by the great variation in the amount of anastomosis. In the genus *Macrophya* alone this condition varies from a well-marked perpendicular free part of the second anal to an anastomosis for some distance. The perpendicular free part of the second anal or the anastomosis in the Tenthredininae occupies a position nearer the base of the wing than the corre-

sponding parts in *Dolerus* or *Emphytus*, but this is undoubtedly due to the elongation and narrowing of the wing. That this position is due to the elongation of the wing is proven by the wing of *Lycotota* (fig. 55), which is broad and not at all elongated, while the anastomosis occupies a position similar to that of the free part of the second anal in *Dolerus* (fig. 49), and *Emphytus* (fig. 46). In the Cimbicinae most of the genera have lost the emargination found in the Tenthredininae, but in a few genera, as *Abia*, it is prominent. Even though the emargination were wanting in all the genera of this subfamily, the general contour of the anal area in the more generalized genera, as *Cimbex* and *Trichiosoma*, would show their intimate relation to the Tenthredininae and Lycototinae. In the Cimbicinae (figs. 59-60) the first anal cell is much reduced by the coalescence of the veins at its apex. In *Clarellaria* (fig. 60) this has proceeded so far that 2d A+3d A has coalesced with 1st A to just before the free part of M_1+Cu_1 .

2. THE HIND WINGS.

The hind wings of most Hymenoptera have been so greatly reduced that the primary homologies can be determined only after careful study. Once the primary homologies have been established the deter-

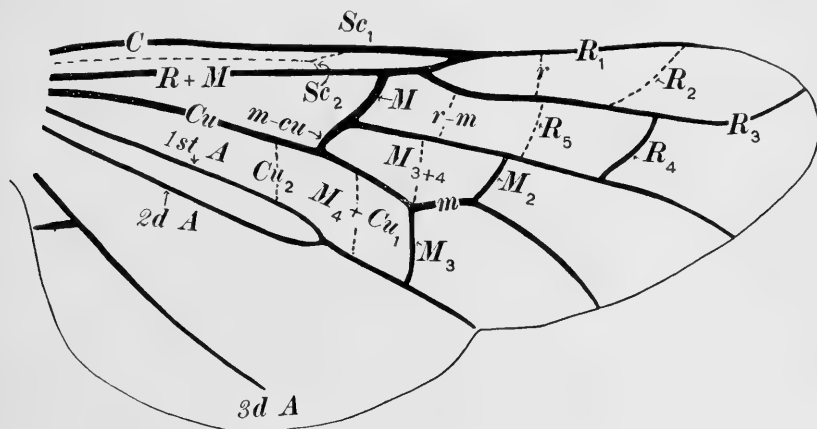


FIG. 13.—TYPICAL HIND WING WITH THE LACKING VEINS INDICATED BY DOTTED LINES.

mination of the different veins in different wings is a very simple matter. As the superfamily Tenthredinoidea contains all the hymenopterous insects in which the hind wings are at all generalized, it is apparent that a study of the wing areas of the members of this superfamily is of the first importance. Practically all the modifications found in this wing are due to the atrophy of the transverse parts of veins or to a secondary shifting of the transverse parts of veins so as to stiffen the wing more effectually. Fig. 13 represents a generalized hind wing in which the wanting veins are indicated by dotted lines.

THE COSTAL AREA.

The costal area is represented by the costa, which is present in the hind wings of practically all Tenthredinoidea as a strong vein thickened at base. So far as observed costa is wanting only in the genera *Oryssus* (fig. 97) and *Stromboceros* (fig. 50).

On the front margin of the hind wings of all Hymenoptera there is a series of hooks for fastening the two wings of a side together so that they will move as a unit during flight. These hooks are of varying extent, in the Siricidae there is a prominent group at the base and another near the apex of Sc_2 with isolated hooks between; this same condition is found in certain Lydidae while in others only the basal and apical areas are preserved. The Xyelidae and Xiphydriidae also have basal and apical areas. In the Oryssidae there is an apical area with four or five isolated hooks just before the apical area. In most Tenthredinoidea there is only the apical area, which is likewise characteristic of the higher Hymenoptera. The apical area is of about the same extent in all the groups except the Cimbicinae, where it extends from one-half to two-thirds the length of the cell R_{1+2} .

THE SUBCOSTAL AREA.

All vestige of the subcosta has disappeared except in the single family Lydidae (figs. 36-43), where in the genera *Lyda* (fig. 37) and *Bactroceros* (fig. 41) it is as fully preserved as it is in the fore wing of the Lydidae and Xyelidae. Subcosta and its continuation, Sc_1 , extend as a straight vein from the base of the wing to near the apex of the vein $Sc_2 + R_1$. The basal free part of Sc_2 is a short vein only three or four times as long as broad and in some genera, as *Bactroceros*, *Neurotoma* (fig. 36), and *Pamphilus* (fig. 39), it is only about as long as broad, while in the genus *Cænolyda* (fig. 38) it is entirely wanting. When present it is generally situated about midway of the vein R_1 , making the cells Sc and Sc_1 subequal in length. The only exception observed is in the genus *Neurotoma*, where the free part of Sc_2 is much nearer the apex of the wing, the cell Sc_1 being less than one-half the length of the cell Sc . The apical free part of Sc_2 has been obliterated by its coalescence with R_1 to the margin of the wing. In the genera *Pamphilus*, *Neurotoma*, *Cephaleia* (fig. 42), *Itycorsia* (fig. 40), and *Lyda* a considerable portion of the subcosta found between the base of the wing and the free part of Sc_2 has completely atrophied, the amount varying in the different genera. The conditions found in the genera just named go to show that the reduction of the subcosta in the hind wings has proceeded in a very different way from what it has in the fore wing, where the modification is clearly due to coalescence. The cell lying between costa and $Sc + R + M$, $C + Sc + Sc_1$, is broad and well marked in all the specialized Tenthre-

dinoidea except in the family Cephidæ (figs. 93-96), where it has been completely squeezed out by the close apposition of costa and $Sc + R + M$.

THE RADIAL AREA.

The bases of radius and media are combined in the same way as in the forewing. The single vein $R + M$ extends to near the middle of the wing, where it divides into R_1 and $R_5 + M$. In most specialized Tenthredinoidea the stem of $R + M$ is only moderately thickened, but in *Oryssus* (fig. 97), the costa being wanting, the vein $R + M$ has been excessively thickened, evidently to take up the stress that would have been transmitted along the costa.

R_1 combined with Sc_2 extends obliquely to the front margin of the wing, where it anastomosis with costa in a single point, or at most for only a very short distance, just before the apical area of hooks, then curves away from the costa and joins it again at the apex of the apical area of hooks, forming a cell Sc_2 homologous with the stigma of the front wings. This cell is prominent in such genera as *Periclista* (fig. 69), *Pteronus* (fig. 68), *Phymatocera* (fig. 71), *Strongylogaster* (fig. 51), *Dineura* (fig. 63), *Dolerus* (fig. 49), *Tenthredo* (fig. 56), and *Trichiosoma* (fig. 59), and is generally situated at the base of the cell R_{1+2} . In the Xyelidæ (figs. 31-35), Xiphydriidæ, Cephidæ (figs. 93-96), Megalodontidæ, and Blasticotomidæ (fig. 44), this stigma-like cell is entirely wanting, while the apical area of hooks is situated on an enlargement of the costa opposite the middle of the cell R_{1+2} . This cell is faintly indicated in the Lydidæ (figs. 36-43) and situated as in the Xyelidæ, while in the Tenthredinidæ it is generally distinct except in the more specialized subfamilies. This is especially true in those genera with an appendiculate cell. The course of the apex of R_1 here confirms our conclusions regarding its course around the stigma in the front wings and that the stigma is nothing more than a stronger chitinization of the wing membrane in front of R_1 than is found in the other cells.

The front margin of the cell R_{1+2} in the Siricidæ (figs. 86-91), Megalodontidæ (fig. 92), Xyelidæ, Lydidæ, and Blasticotomidæ is bounded by a vein of uniform width, R_1 , which, after joining the costa beyond the apex of the apical area of hooks, coalesce with it, the single vein extending along just within the front margin of the wing. It ends in the Xyelidæ (figs. 31-35), Lydidæ (figs. 36-43), Megalodontidæ and Blasticotomidæ (fig. 44), at or slightly beyond the apex of R_3 and a considerable distance before the apex of the wing. This results in a cell contour identical with that found in the front wings. In most genera of the family Tenthredinidæ, as *Macrophya* (fig. 56), *Blennocampa* (fig. 72), *Stromboceros* (fig. 50), *Periclista* (fig. 69), and *Pteronus* (fig. 68), R_1 likewise ends at or slightly beyond the apex of R_3 , but in these genera the veins R_1 and R_3 , coincident with the lengthening and nar-

rowing of the wing, have migrated to the apex of the wing, so as to stiffen it, while in the genera *Blennocampa* and *Periclista* R_1 extends around the apex. In the Cephidae and Cimbicinae R_3 has retained its primitive position distinctly before the apex of the wing while R_1 has been extended spur-like to the apex. The genus *Hoplocampa* (fig. 61) shows a similar condition, except that the prominent spur-like tip has not been developed. *Oryssus* (fig. 97), *Tremex* (fig. 91), *Paururus* (fig. 86), *Monoctenus* (fig. 67), *Dielocerus* (fig. 79), and *Pachylota* (fig. 77) show a modification of the condition found in *Blennocampa* and *Periclista*. In these genera R_1 and R_3 have migrated to the apex of the wing, but the apical half of the vein R_1 atrophied, causing the cell R_{1+2} to return to its original condition, open at the margin. The genera *Xeris* (fig. 89), *Hylotoma* (fig. 76), *Labidarge* (fig. 78), *Perga* (fig. 84), *Perreyia* (fig. 80), and *Loboceras* (fig. 82) show a still different type. Here R_3 ends distinctly before the margin of the wing while R_1 is continued to the apex, but in the course of its development was pulled away from the margin for a considerable distance, forming an appendiculate cell in the same way that it is formed in the front wing.

The second part of the vein $R + M$, $R_5 + M$, very soon divides into R_5 and M . In all the wings observed the free part of R_2 is wanting; also R_5 , except in the genera *Megaxyela*, *Odontophyes*, and *Macroxyela*. R_3 occupies a position similar to that found in the front wings; the only marked modification is the point at which it reaches the margin, and this was fully discussed above.

The tip of the fourth branch of radius has combined with $R_5 + M_1$ as in the forewing, while the free part of R_4 is a transverse vein extending between R_3 and $R_5 + M_1$. In the Xyelidae (figs. 31-35), Lydidae (figs. 36-43), and Megalodontidae (fig. 92), it is situated near the margin of the wing, but in most Tenthredinoidea it has migrated toward the base of the wing; while in such genera as *Loboceras* (fig. 82), *Dolerus* (fig. 49), *Pteromus* (fig. 68), and *Cladius* (fig. 66), it is situated in a line with the costal area of hooks. The free part of R_4 is entirely wanting in the subfamilies Blennocampinae (fig. 72), Phyllotominae (fig. 54), Fenusinae (fig. 74), and the genera *Tetratneura* and *Acidophora*.

The radio-medial cross vein is wanting in all the genera observed.

THE MEDIAL AREA.

In all the wings examined, except in *Sirex* (figs. 87-88), and *Manoxyela* (fig. 34), the vein M is coalesced with the radial sector for a greater or less distance. This is very different from the conditions found in the front wing, where M always arises from R some distance before the origin of the radial sector. In *Sirex* and *Manoxyela* M arises from R distinctly before the origin of the sector, but much nearer to it than is the case in the front wings of all other Tenthredinoidea. In *Paururus* (fig. 86) and *Xeris* (fig. 89) M arises from the sector at or just beyond its origin; in *Macroxyela* (fig. 33) it extends

about twice as far as in *Paururus*; in the Lydidae, Megalodontidae, and most Tenthredinidae it arises a considerable distance beyond the origin of the sector; while in *Tremex* (fig. 91), *Oryssus* (fig. 97), *Lycaota* (fig. 55), *Acidophora*, and the subfamily Blennocampinae (fig. 72), it arises at or just before the middle of the cell R_{1+2} , but the modification found in these genera is undoubtedly due to the atrophy of the free part of R_1 .

As soon as M separates from the radial sector it extends transversely until it joins the medio-cubital cross-vein, where it usually bends at about a right angle and extends longitudinally. About midway between its union with the medio-cubital cross-vein and the margin of the wing it divides into two branches, M_1 , which extends direct to the wing margin, occupying a position very similar to the same vein in the front wing, and M_2 , which extends transversely to near the middle of its length where it joins the medial cross-vein, from which point it extends longitudinally to the margin of the wing.

The medial cross-vein extends longitudinally toward the base of the wing, where it joins a vein which extends longitudinally or obliquely from the cubital end of the medio-cubital cross-vein. That portion of this vein which lies between the medio-cubital cross-vein and the medial cross-vein is the free parts of M_4 and Cu_1 , the free part of $M_4 + Cu_1$ being wanting, while that portion which lies between the medial cross-vein and the tip of the anal veins is the free part of M_3 . In the front wings there is a branch which extends from the stem of M and joins M_3 just before its union with the medial cross-vein. This is the stem of M_{3+4} and is entirely wanting in the hind wings of all Hymenoptera. If the position of M_1 , M_2 , M_3 , and the medial cross-vein be compared with the corresponding veins in the front wings it will be seen that they occupy a similar position and are in fact the most important landmarks in homologizing the veins of the hind wings.

In *Oryssus* (fig. 97), *Blennocampa* (fig. 72), *Acidophora*, *Perreyia*, *Loboceras* (fig. 82), *Acordulecera* (fig. 83), *Pterygopherus* (fig. 81), and *Perga* (fig. 84), the transverse part of M_2 has atrophied so that the cells M_1 and 1st M_2 are united.

The free part of M_3 in most Tenthredinoidea extends almost transversely to the margin of the wing, but in the Cephidae (figs. 93-96), Tenthredininae (figs. 56-58), and *Manocyeta* (fig. 34), where the anal area of the wing has been greatly reduced longitudinally, the free part of M_3 has been bent abruptly toward the base of the wing. While in most genera the free parts of M_3 and M_4 are subequal in length, yet in *Loboceras* (fig. 82) and *Perga* (fig. 84), M_4 is two or three times as long as M_3 , while in the Cephidae (figs. 93-96), *Tremex* (fig. 91), and *Pterygopherus* (fig. 81) M_3 is several times the length of M_4 . The medial cross-vein is in most genera subequal in length with the longitudinal part of M_2 , yet in *Xeris* (fig. 89), *Tremex* (fig. 91), *Scrico-*

cera, and *Diocerus* (fig. 79), the cross-vein is much shorter, one-third to one-fourth the length of this part of M_2 .

The medio-cubital cross-vein in the generalized Tenthredinoidea is transverse and subequal in length to the transverse part of M, but there is considerable variation throughout the various genera of the other groups. Its departures from the generalized condition may be divided into five groups. In the first of these the longitudinal part of M has migrated along the transverse part of M, greatly increasing the length of the cross-vein, although the cross-vein and the transverse part of M retain relatively the same position. This is shown in the genera *Trichiosoma* (fig. 59), *Labidarge* (fig. 78), *Dolerus* (fig. 49), and *Monoctenus* (fig. 67). In the second group the length of the cross-vein has been greatly increased by the migration of the transverse part of M from its position at or near the base of the cell $M_4+1st\ M_2$ to near its middle as in the genera *Tenthredo* (fig. 56), *Periclista* (fig. 69), and *Strongylogaster* (fig. 51). In the Cephidae this migration has proceeded so far that the transverse part of M is joined to the cell $M_4+1st\ M_2$ near its apex. The third group is represented by the genera *Xiphydria* (fig. 85), *Macrophya* (fig. 57), *Phymatocera* (fig. 71), *Rhadinocerea* (fig. 70), and *Lycota* (fig. 55). In these genera there has been a combined migration of the longitudinal part of M along its transverse part, together with a migration of the transverse part of M toward the apex of the wing. The fourth group is represented by the genus *Pterygophorus* (fig. 81), where the longitudinal part of M has migrated toward M_4 along the medio-cubital cross-vein, resulting in a distinct shortening of the cross-vein. In the fifth group there has been a migration of the transverse part of M toward the apex of the wing, while the free part of M_4 has swung around from a longitudinal or oblique position to a transverse one. Coordinated with the change in position of the free part of M_4 there has been a swinging forward of the part of cubitus on the basal side of the medio-cubital cross-vein until it has come into line with the base of the longitudinal part of M, so that in this group the medio-cubital cross-vein extends longitudinally instead of transversely. This is practically the same condition as is found in the higher Hymenoptera and is shown by the genera *Perya* (fig. 84), *Perreyia* (fig. 80), *Acordulecera* (fig. 83), and *Loboceras* (fig. 82).

THE CUBITAL AREA.

In the hind wings cubitus is represented by the long, straight vein extending from the base of the wing to the medio-cubital cross-vein. All trace of the free part of Cu_1 is wanting, and the same is true of Cu_2 unless we homologize the short vein found in the Xyelidae (figs. 31-35) at the base of the wing with this vein. That this spur represents the free part of Cu_2 there can not be much doubt. That it is not

a supernumerary vein is proven by its persistence throughout all the different genera of this family. Its preservation is undoubtedly due to its position at the extreme base of the wing, and also to the fact that its anal end curves toward the base of the wing, giving it a location where its liability to be obliterated would be reduced to a minimum.

THE ANAL AREA.

The anal veins of the hind wings, like those of the fore wing, have undergone marked changes but along very different lines. Here, as in the fore wings, there has been a combination of the apices of M_3 , M_4 , Cu_1 , Cu_2 , 1st A, and 2d A, the transverse free part of the first four of these, except M_3 , being wanting. The first anal vein extends directly from the base of the wing to the transverse part of M_3 , in many cases being strongly bowed in front, and from M_3 there extends an oblique vein to or nearly to the margin of the wing. This vein is wanting in the Cephidæ (figs. 93–96), Xyelidæ (figs. 31–35), *Acordulecera* (fig. 83), and *Blennocampa* (fig. 72).

The second anal vein is found in its most generalized condition in the wings of *Strongylogaster* (fig. 51), *Tenthredo* (fig. 56), *Periclista* (fig. 69), and *Stromboceros* (fig. 50), where it extends from the base of the wing as a slightly bowed vein and unites with the first anal vein distinctly beyond the transverse part of M_3 . In the genera *Dolerus* (fig. 49), *Selandria*, and *Macrophya* (fig. 57), the coalescence is only for a short distance in front of the transverse part of M_3 . The amount of coalescence increases until in the genera *Hylotoma* (fig. 76) and *Labi-darge* (fig. 78) the coalescence is for more than half the length of the anal cell. The second anal vein is entirely wanting in *Xeris* (fig. 89), *Oryssus* (fig. 97), *Loboceras* (fig. 82), *Perga*, (fig. 84), *Pterygophorus* (fig. 81), *Perreyia* (fig. 80), and *Acordulecera*, (fig. 83). The disappearance of the second anal vein is undoubtedly due to the fold in the wing just behind the line where the vein would be situated. This supposition is strengthened by the wing of *Xeris* and *Diolocerus* (fig. 79), where the transverse apical part of the stump is retained. While in *Sirex albicornis* (fig. 88), the basal half of the uncoalesced part is retained. In *Macroxyela* (fig. 33) there is a different type of modification. The second anal vein is situated just in front of the furrow, is as well developed as the other veins and extends almost to the margin of the wing, where it bends abruptly forward and joins the first anal vein just before the free part of M_3 . The transverse part in *Manoxyela* (fig. 34) is nearer the base of the wing and there has been developed in addition a secondary spur from the outer posterior angle to the margin of the wing. The Cimbicinæ (figs. 59–60) show a similar condition, except that the transverse part of the second anal is near the middle of the wing with a long spur continuous with the longitudinal part of the vein. In *Macrocephus*, (fig. 95) the spur is present

and the transverse part of the second anal is curved toward the base of the wing, while *Cephus* (fig. 96) differs only in lacking the spur.

The third anal vein is almost universally present, and extends as a slightly curved vein near the anal lobe of the wing from the base of the wing to the margin. It is represented in *Oryssus* by a fold and in *Acordulecera* by a pale band of pigment. In many of the generalized genera there is present a prominent transverse spur on its hind margin near the base of the wing, which is joined to the spiral vein, a cord-like thickening which extends along the base of the wing to the scutellum.

V.—DYNAMICAL CONTROL OF WING TYPE.

It has already been pointed out in a number of cases that certain modifications were due to mechanical causes. The wing of an adult insect is a machine purely for locomotion, and the rapidity and skill of the locomotion is directly dependent on the perfection of the machine. It is a fact that those insects are the swiftest flyers whose wings approach most nearly a triangle in outline, that is, having wings broad at base and pointed at tip. This is illustrated by the wings of the hawk-moths, the bee-flies, and the bees. The efficiency of a wing is dependent not only upon its outline but upon the arrangement and construction of its various parts. This construction consists in the arrangement of the veins in such a manner as to best fit it to withstand the stress exerted upon it in striking the air and at the same time without increasing the weight of the organ.

The different kinds of insects fly in two ways—by a soaring flight, for which a broad expanse of wing is required, and by a swift dashing flight, for which a narrow, stiff wing is necessary. It is also a fact, at least so far as insects are concerned, that those species whose wings are broad and approximate closely the arrangement of the veins found in the hypothetical type are never swift flyers, while those in which there has been a marked reduction in the number of veins, together with a trussing of that part of the wing subject to the greatest stress, are always swift flyers; that is, there is always a direct correlation between the structure of a wing and its efficiency as an organ for flight.

Where insects possess four wings, the wings of a side are generally fastened together in some manner to insure a more synchronous motion. This is accomplished in the Lepidoptera by a jugum on the hind margin of the front wing, or by a frenulum on the front margin of the hind wing, or by an expansion of the front margin of the hind wing so that the two wings overlap. These fastenings are all located at the base of the wing, and consequently can not exert much influence over the course of the veins found near the middle of the wing. With the Hymenoptera in general and the Tenthredinoidea in particular the conditions are different. The wings of the Tenthredinoidea

are fastened by a series of hooks on the costal margin of the hind wing which fasten into a fold along the hind margin of the front wing. These hooks may extend from the base of the wing to near the middle of the cell R_{1+2} , they may be arranged in two groups, one near the base of the wing and another near the base of the cell R_{1+2} , or they may be arranged in a compact group near the base of the cell R_{1+2} . In all cases this latter group is always the strongest, and being situated near the middle of the wing exerts a strong influence on the course of the veins found in this region in both wings, as will be shown later.

The path of the tip of an insect's wing during flight is that of a figure 8 (fig. 14). This has been shown by Marey and other investigators. It is a well-known fact that during flight the wings go through two distinct motions, a stroke or downward motion and a recovery or upward motion. The relation of the strike and recovery are shown on the accompanying figure copied from Marey. The up and down motion is due entirely to muscular action while the resistance of the air "effects those changes in surface obliquity which determine the formation of an S-shaped trajectory by the extremity of the wing."



FIG. 14.—WING TRAJECTORY.

From a mechanical standpoint, so far as insects are concerned, the act of flight is really a simple one. The wing is so constructed that there is a rigid front margin for striking the air and "a sort of flexible sail behind," which inclines the wing at the most favorable angle. This is usually about 45° . During the downward motion the wing is expanded to its fullest extent by the resistance of the air beneath it, while during its recovery it is contracted by being folded or corrugated along the lines of the wing furrows, which in this way reduce the amount of surface of the wing and consequently reduce the resistance during recovery.

The wings of most insects are corrugated or folded along certain lines. In many orders these furrows are so persistent that they have been named. Although they are not so constant in position as the veins, yet they occupy so nearly the same relative position that it is generally possible to homologize them. The function of the furrows in an insect's wing are twofold, to strengthen it and to make it flexible. The latter function seems to be their only use in the wings of the Tenthredinoidea. In this superfamily all the following furrows are present.

The anal furrow.—This is a longitudinal furrow extending from the base of the wing to the margin just in front of the first anal vein. It is distinct in both wings. In the front wings it separates the free parts of Cu_2 , $M_4 + Cu_1$, and M_3 from the vein behind the furrow and has undoubtedly been an important factor in causing the atrophy of the free part of these veins.

The second anal furrow.—This furrow also extends from the base to the margin of the wing. It is found only in the hind wings and is situated just behind the second anal vein. It is at the end of this furrow that there is located the emargination which eventually develops into a slit, the axillary incision, which separates off the hind angle of the wing into a lobe or alula. This alula, which always contains the third anal vein, whether it is separated or not by an incision, is always turned back under the remainder of the wing.

The medial furrow.—This is a straight furrow in many Tenthredinoidea, starting in the cell R and extending along just in front of M_1 to near the margin of the wing. It usually bends down near the middle of the cell R_3 , so that it is close to the vein. This furrow finds its greatest development in the family Tenthredinidae. In most of the genera of this family it extends along close to M_1 until near the middle of the cell R_3 , where it subdivides into two or three branches. The posterior branch crosses M_{1+2} near its origin and passes obliquely across the cells 1st M_2 and M_1 . The anterior branch passes midway between M_1 and R_3 to near the margin of the wing; in some cases the anterior branch subdivides, one branch extends just behind R_3 , while the other extends just in front of M_1 . Only a casual examination is necessary to see how important the medial furrow must be in maintaining the flexibility of this area of the wing. The so-called bullæ of many writers on the Tenthredinoidea are the clear spots in the veins where these furrows cross them.

The radial furrow.—This is a short longitudinal furrow situated just in front of the radial sector and may be a branch of the medial furrow.

The costal hinge.—This is a thin area of the front margin of the wing, situated between the apex of costa and Sc_2 at the base of the stigma.

The greatest stress on a wing is always on its front or striking margin and on that part of the margin that is most prominent. In the Hymenoptera this is the region in the neighborhood of the stigma. This stress is in a plane parallel with the wing membrane. This is due to two causes, the angle at which the wing strikes the air and to the sail area—that is, approximately the posterior two-thirds of the wing, which maintains the wing-membrane at relatively the same angle. The sail area of the wing has the same effect on the wing as the tail on a kite when it is drawn rapidly through the air near the ground, causing it to maintain practically the same angle at all times.

If we examine a simple type of truss, as fig. 15, where the sides AB and BC are equal and the distance AD is equal to the distance DC, we will find that any stress exerted at the point B in the plane of the truss and perpendicular to the line AC will be equally distributed along the sides AB and BC. But if we take such a truss as fig. 16, where the

side AB is much greater than the side BC, we will find that any stress exerted at the point B will not be equally distributed, but that a much larger part of the stress would fall on the side BC than on the side AB.

We may assume that that wing is the most perfect mechanical device which approaches the closest to some type of truss. From our previous studies of the wing topography of the Tenthredinoidea we are justified in concluding that if such a thing as a truss exists in their wings it must be of the type where one side is longer than the other, for there is no point situated near the middle of the front margin of the wing to which veins converge.

Before taking up a direct comparison of the wings of the Tenthredinoidea with the types of trusses given above, we should not overlook the fact that we have to do not with a simple but with a complex type. The front wings must in reality be trussed on both sides, for the hymenopterous wing has stress exerted upon it by the air upon both front and hind margins. The primary stress is exerted at some point on the front margin where it strikes the air, while the secondary stress is exerted on the hind margin where the hind wings are hooked

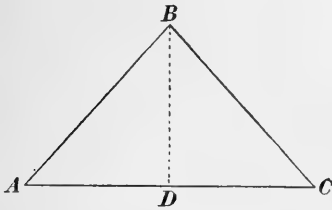


FIG. 15.—TYPE OF TRUSS.

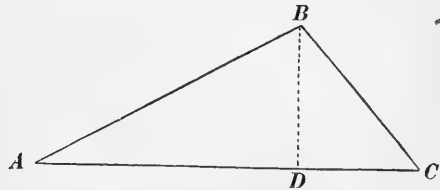


FIG. 16.—TYPE OF TRUSS.

to it. This secondary stress is due to the necessity for a synchronous motion and to the fact that the hind wing must be pulled along. The force exerted on the front margin of the front wing would be a push or a force causing retardation, while the force exerted on the hind margin of the front wing and the front margin of the hind wing would be a pull or a force causing acceleration.

A clearer conception of the arrangement of the trusses in the hymenopterous wing will be had if we study first in some detail the topography of a wing in which these structures are self-evident. For this purpose a front wing of *Blennocampa alternipes* has been selected, tracings from a photograph have been made, and the trusses found in these wings marked as triangles by means of dotted lines (fig. 17). For convenience in following the course of these triangles on the figure they have been numbered, the same number being placed on each side of the same triangle. For the sake of brevity they will be referred to in the following descriptions by these numbers.

From what has already been said, it would be expected that these trusses should arrange themselves into three groups, the first strength-

ening the stigmatal region of the front wing, the second, the apex of the first anal cell of the front wing, and the third, the stigmatal region of the hind wing. The stigma, as already shown above, is the cell Sc_2 , in which the wing membrane is almost as strongly chitinized as the veins surrounding it. In generalized genera it is a broad ovate area, which undergoes a great reduction in the highly specialized genera until it becomes a long, narrow cell, pointed at both ends. It is located at the point where the greatest stress is exerted, and is in reality a solid truss placed like a cap over this area subject to the greatest stress. So that we have in the shape of the stigma a readily observed criterion for judging the efficiency of the flight of any species, and therefore the degree of specialization to which the species has attained. Now if the stigmatal region of the front wing is examined, the following conditions are found. A large truss, truss 1, whose apex is near the middle of the stigma, with one of its basal angles at the base of the wing, and the other at the apex of R_3 . Truss 2 has its apex near the

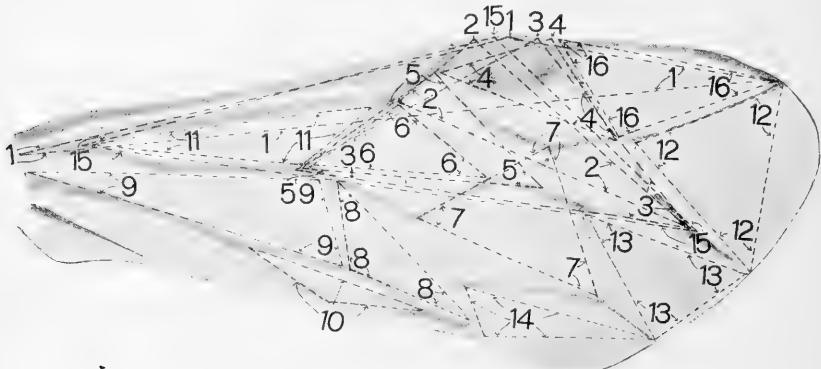


FIG. 17.—THE FRONT WING OF *BLENNOCAMPA* AND ITS TRUSSES.

base of the stigma, with one of its basal angles at the point of separation of R and M , and the other in the angle formed by R_4 and M_1 . Truss 3 has its apex near the middle of the stigma with one of its basal angles in the angle between the medio-cubital cross-vein and cubitus, and the other in the angle formed by R_4 and M_1 . Truss 4 has its apex near the apex of the stigma with one of its basal angles at the point of separation of R_1 and R_3 , and the other in the angle formed by the radial cross-vein and R_{3+4} . Truss 5 has its apex in the angle formed by R_1 and R_2 with one of its basal angles in the angle formed by the medio-cubital cross-vein and cubitus, and the other in the angle formed by R_3 and M_1 . Truss 6 has its apex in the angle formed by R and M , with one of its basal angles in the angle formed by the medio-cubital cross-vein and cubitus, and the other in the angle formed by M_{3+4} and M_{1+2} . Truss 7 has its apex at the point where the free part of R_5 arises, with one of its basal angles in the angle formed by M_3 and M_4 , and the other

in the angle formed by the medial cross-vein and M_2 . Of the seven trusses here enumerated, four of them have their apices in the stigma, while the remaining three have their apices so situated as to be a direct support to the trusses ending in the stigma. This does not take into account the thickened costa and the radio-medial cross-vein, which are also additional supports to this region, while truss 9, which is behind cubitus, is the main support of the stress transmitted by trusses 2, 5, and 6. Although each of these trusses is here described as a separate entity, yet the fact should not be overlooked that there is a direct interrelation between all the trusses. Each is dependent on the other. It is like the side of a bridge, composed of a complex of rods and beams that to the casual observer do not bear much relation to each other, but yet can be resolved by the engineer into a series of simple trusses, all directly interrelated in the same way as the trusses described here in this wing.

The anterior three-fourths of the wing being so strongly braced, there is no necessity for so perfect a bracing in the region of the first anal cell, because the stress exerted at this point can not be great, and in addition the stress is applied at a point where it can be easily disseminated. There are three of these trusses, though only two of them are directly connected with the anal area. Truss 10 occupies the first anal cell, with its apex directed toward the hind margin of the wing and opposite the point where the hooks of the hind wing fasten into the fold of the fore wing. Just in front of the apical half of truss 10, with its apex at the middle of the base of truss 10, is truss 8, with one of its basal angles at the apex of M_3 and the other at the angle formed by M_1 and $M_1 + Cu_1$. It is of interest that the stress sustained by truss 8 is not transmitted directly to the front margin of the wing, but is disseminated over its apical two-thirds. The stress transmitted by the vein $M_1 + Cu_1$ one side of truss 8, is taken up by truss 11, which has its apex almost opposite this vein. The medio-cubital cross-vein is an excellent example of the interrelation of these trusses. It is an important factor in two trusses transmitting stress from the stigmal region, and is equally important in transmitting stress from the anal region toward the base of the wing.

It is not necessary to discuss the trusses of the hind wings in any detail. A glance at the figure of a wing (fig. 81) is sufficient to show that all the principal trusses are behind the costal area of hooks. They are all arranged so as to spread the stress over as wide an area as possible and also to stiffen the wing membrane, for one of the principal functions of the hind wing is to furnish sail area.

In the preceding description no account has been taken of trusses 12, 13, and 14. They are not of primary importance, but serve to dissipate the stress transmitted from the stigmal and anal regions, and to keep the membrane or sail part of the front wing expanded.

When the conditions existing in such a wing as *Blennocampa alternipes* are compared with those found in the front wing of *Macroxyela ferruginea* the difference is very apparent. The trusses in the wing of *Macroxyela* have not been numbered. Only the most important have been indicated. From their fewness in number the reader might be led to conclude that the wing of *Macroxyela* had not been done full justice, but when the form of the cell areas is taken into consideration, all of them being either trapeziums or trapezoids in form, it is seen that this arrangement is one of the weakest possible. In such an arrangement as this each angle of each cell is the apex of a truss, which can have no other function than to stiffen the sail area. Consequently, if all the trusses found in the wing of *Macroxyela* had been indicated on the drawing, it would have resulted in this wing being apparently much more efficient, at least in number of trusses, than that of *Blennocampa*. Although there are several trusses in the wing of *Macroxyela*, yet it is a striking fact that these trusses are not nearly

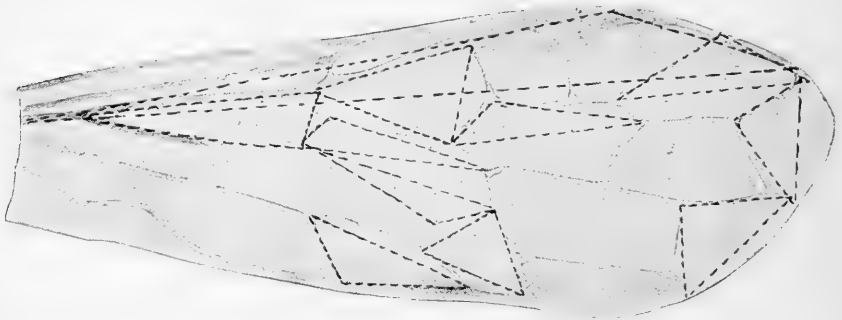


FIG. 18.—THE FRONT WING OF MACROXYELA AND ITS TRUSSES.

so efficiently placed (fig. 18). There is not so great a concentration of the stress to one region. The trusses instead of stiffening a definite area are scattered over the entire wing surface. Veins that in *Blennocampa* are constituents of important trusses are of little more value than to keep the wing membrane expanded in *Macroxyela*. Some of the most prominent differences are the position of the medio-cubital cross-vein and the origin of M_1 , the course of the veins bounding the cell M_2 , the position of the radial cross-vein, the narrowing of the cells included between the veins R_3 and M_1 , and the course of the transverse part of M_1 .

The adults of *Macroxyela ferruginea* are common at Ithaca. The larvæ feed on the leaves of the numerous elms found along the walks on the campus. The adults are very inactive, so much so, in fact, that they will lie still and allow themselves to be crushed underfoot on the walks. When they are disturbed in such a way as to be compelled to use their wings, they have a slow lumbering flight and soon alight again;—that is, the generalized condition of their wings as

regards the number and arrangement of their veins and trusses is confirmed by field observations that prove that this insect not only has wings that are poorly fitted for a rapid flight, but that in fact it is an extremely poor flyer.

If now the different groups representing families and subfamilies be examined, beginning with the more generalized, it will be found as we proceed from generalized to specialized that there is a gradual approximation to the type described for *Blennocampa*, while in other groups more specialized than *Blennocampa* that the conditions are even more perfect than in this genus. These modifications are readily traceable in the change in position of the radial cross-vein, its posterior end swinging toward the apex of the wing and forming one side of a truss behind the stigma; the moving of the medio-cubital cross-vein from a position between media and cubitus, where it is only of secondary importance in transmitting stress, to a position between radius and cubitus, where it is of primary importance; the migration of $M_4 + Cu_1$ until it is practically in line with the medio-cubital cross-vein; the shortening of the radio-medial cross-vein and the free parts of R_5 , R_4 , and R_3 , in this way greatly strengthening the area lying between the most important areas of trusses, those of the stigma and those of cell M_4 . The reduction of the anal cells of the front wings, the second anal cell being of only secondary importance, the base of the third anal vein is gradually atrophied, and the wing membrane occupied by it reduced until the petiolate type of cell is obtained, which is gradually modified further by coalescence, and the further reduction of the wing membrane until the condition existing in the higher Hymenoptera is reached by certain subfamilies of the family Tenthredinidæ. The migration of the apex of R_1 away from the margin of the wing, forming an appendiculate cell, to a position opposite the apex of the wing. Those genera in which this type of cell has been developed have their wings greatly elongated, and the migration of R_1 is to stiffen this increased sail area.

The migration of the transverse parts of the veins, due to an effort to form more efficient trusses, results in a marked modification of the position of these veins, and one of frequent occurrence. Where there is a secondary change in the position of veins, it can generally be told by a comparison with the generalized forms. This is shown in the wings of *Pachylota* (fig. 77), *Labidarge* (fig. 78), *Loboceras* (fig. 82), and *Perga* (fig. 84), where the transverse part of M_2 has migrated along $R_5 + M_{1+2}$ on one side and along the medial cross-vein on the other.

When the wings of the Lydidæ (figs. 36-43) or Xyelidæ (figs. 31-35) are compared with those of *Blennocampa*, one of the most noticeable features is the great number of veins. The greater efficiency of the truss system of the wings of *Blennocampa* over that of the many

veined wings would seem to indicate that the extra veins are a hindrance rather than an aid in stiffening the wing. This is confirmed by the fact that they have been suppressed. If these superfluous veins are a hindrance in the formation of trusses, they are also in the way in the development of wing furrows as will be seen by an examination of any of these or similar generalized forms. In the generalized wings the wing furrows are straight folds, permitting of only the minimum amount of flexibility, while in *Blennocampa* (fig. 72), *Lycaota* (fig. 55), and *Labidurga* (fig. 78), they have been developed to their full extent. These wing furrows are undoubtedly the primary factor in effecting the suppression of such veins as the radial cross-vein, the radio-medial cross-vein, and the free part of R_5 in the front wing; and the transverse part of M , the free part of R_4 , and the transverse part of M_2 in the hind wing. The way in which the radial furrow has effected the radial cross-vein is seen in the wings of *Dineura* (fig. 63), and *Rhadinoceraea* (fig. 70), where the cross-vein is gradually losing its chitinization through the prominence of this furrow. The effect of the median furrow on the radio-medial cross-vein is seen in the wings of *Eura*, *Pteronus* (fig. 68), *Cladius* (fig. 66), and *Pris-tiphora*. In this latter genus there exist all stages from a fully preserved radio-medial cross-vein to its entire disappearance. In the genera *Monoctenus* (fig. 67) and *Lophyrus* (fig. 45) an intermediate sidewise development is shown in certain species where only the posterior half of the cross-vein has atrophied, while the anterior half is fully preserved.

That the loss of the free part of Cu_2 is due to the anal furrow is seen by an examination of the wings of the following genera in the order named: *Bactroceros* (fig. 41), *Pamphilus* (fig. 39), *Cephaleia* (fig. 42), *Lyda* (fig. 37), *Cenolyda* (fig. 38), and *Itycorsia* (fig. 40). In these genera there is a complete series from a fully formed Cu_2 to a minute swelling on the side of Cu . The anal furrow is the most important as well as the most prominent and persistent furrow found in either wing. It is found in the same position throughout the entire order Hymenoptera. It is this furrow that furnishes the flexibility in movement between the two wings. Cu_2 , having been separated from the anal veins by this furrow, could be of only secondary importance in supporting this area; in fact it is more efficiently supported in the wing of *Blennocampa* without it than it is in the wing of *Bactroceros* with it. The series here named shows that we have a gradual movement toward the assumption of the condition found in *Blennocampa*. This is shown in the straightening of that part of cubitus situated between the medio-cubital cross-vein and the base of the wing, and the migration of the anterior end of the medio-cubital cross-vein from a union with media to a union with radius, by this movement coming into direct line with the subtransverse part of radius. Correlated

with these changes, though not necessarily due to the same cause, is the migration of the posterior end of the radial cross-vein toward the apex of the wing.

The costal hinge as shown above is a thin place in the membrane of the wing between the apex of costa and the tip of Sc_2 . This is undoubtedly a weak place in the wing that has been handed down from generalized progenitors which did not require such an efficient organ for flight. That it is a weak place in the wing is shown by the fact that in those forms that are especially efficient flyers this area has been bridged over. This is the case in the Cimbicinæ (figs. 59-60), the Siricidæ (figs. 86-91), the Cephidæ (figs. 93-96), and in all the higher Hymenoptera. In other forms this weakness has been overcome by a decided thickening of the apex of costa, which simply rests against R_1+Sc_2 and the stigma, but never coalesces with them. The hinge is especially prominent in those genera with a broad area between costa and $Sc+R+M$, and probably serves to make this region more flexible. That the prominence of the hinge in these genera is for flexibility is emphasized by the fact that the apex of the costa is not decidedly thickened. This causes a fold in the wing membrane between costa and $Sc+R+M$ very similar to the furrow found in this same region in the Diptera, and consequently tends to stiffen it.

In the wings of *Oryssus* (fig. 97) occurs the greatest amount of reduction found in the wings of any member of the superfamily Tenthredinoidea. It is an interesting fact that the reduction found in this genus is not amenable to any of the explanations already given. In *Oryssus* the membrane of the wing has been more strongly chitinized than in the wings of other genera, and with the increased chitinization of the wing membrane the necessity of veins for stiffening the membrane has been done away with, and consequently they have gradually disappeared, being represented only by bands of pigment.

Although it is not within the scope of the present paper, yet it may not be out of place to say something about the dynamical control of the wing type in those orders where approximately all the veins are parallel and extend lengthwise or approximately lengthwise of the wing. This is especially true of the orders Lepidoptera and Diptera.

Among the members of the order Lepidoptera the wings are broad and long. The stress exerted on the front margin of the front wings is not applied at one point as in the Hymenoptera, but is spread out along the entire front margin of the wing. Another point that must not be overlooked is the fact that there is no marked necessity for a transverse stiffening, because this is accomplished by the overlapping scales covering both surfaces, which stiffen it in the same manner that the overlapping shingles stiffen a roof. The great majority of the trusses in this order have their apices near the apex of the cell $R+M$ and their basal angles at the margin of the wing. They serve merely

as ribs for stiffening the wing membrane and keeping the sail area of the wing expanded. If the wings of such generalized families as the Hepialidæ, Pyromorphidæ, Megalopygidæ, and Eucleidæ be examined, it is found that this elongate type of truss is present not only on the hind but also on the front margin of the wing. But in the wings of the specialized families, Sphingidæ, Saturniidæ, Papilionidæ, and Nymphalidæ, which are noted as being rapid flyers, there is a very different condition. In these families all the branches in front of vein R_5 have been crowded close to the front margin of the wing, forming a compact series of five stiff braces for supporting the area subject to the greatest stress.

In the Diptera, as in the Lepidoptera, the stress is applied along the entire front margin of the wing, but in the wings of this order the covering of overlapping scales is wanting. As there is only one wing on each side of the body, and this is sub lanceolate in outline, the factor of a sailing surface is reduced to the minimum. Since the stress is applied along the entire front margin, and there is no posterior wing to exert any influence, there has not arisen any necessity for a transverse stiffening across the middle of the wing. In the generalized families the veins radiate out from the center of the wing to the margin somewhat like the spokes around the hub of a wheel. The reason for this is seen in the necessity for the stiffening of all parts of the wing. Most of the species are light bodied, and consequently the wing membrane is delicate and the wings light in weight. Those species that are predacious or hover about flowers are generally very active flyers. In these families there has been developed a marked tendency toward the coalescence of the tips of the veins, so as to prevent the fraying of the wing margin. There has also been developed along the front margin from the base to the apex of the wing a heavy vein in which the longitudinal veins terminate. This is especially marked in the families Bombyliidæ (fig. 21), Apiceridæ, and Midaidæ (fig. 28), where the tips of all the branches of radius curve forward and terminate close to the wing margin, thus accomplishing the double purpose of protecting the wing margin and at the same time stiffening that part of the wing subject to the greatest stress. The wing of *Midas*, which has been referred to before because of the great number of the tips of its veins that have migrated forward, illustrates this point well. It shows how the stress applied on the front margin of the wing is transmitted to the base along the radial stem, while that on the hind margin is transmitted along the medial stem. We find here the reason for the coalescence of the branches of the radial sector to R_1 rather than to M_1 , as happens in the Hymenoptera; namely, because the stress in this wing is applied only on its front margin, and there is a greater need for a stiffening in this direction. That this is the correct interpretation is shown by the change in the contour of the

front margin of the wing of *Midus* as compared with that of *Pantarbex* or *Eraæ* (fig. 22), *Midus* showing the highest type of efficiency, a long, narrow triangle.

VI.—THE PHYLOGENY OF THE TENTHREDINOIDEA.

It is essential in determining the phylogeny of any group to ascertain what are the most primitive forms, to compare them, and to determine the ways in which they have been modified. In making these comparisons the structure of a set of organs should be studied and the phylogeny of the group determined from this study; then other sets of organs should be examined, until all the organs of the animal have been examined, phylogenies based on these studies should be made, and then compared with the phylogeny first determined. If it is found that these successive phylogenies corroborate each other, we have a demonstration of the correctness of our conclusions. If they disagree, then there is indicated a need for a further examination of the disagreeing forms, for when correctly interpreted it will be found that the different records of the action of natural selection will not contradict but confirm each other. In the following pages the first step in such an investigation, a phylogeny based on an examination of the wings of the Tenthredinoidea, is given.

There arises, in working out the phylogeny of any group, the necessity for distinguishing between different kinds of characters.

First, characters indicating difference in *kind of specialization*; and second, characters indicating difference in *degree of specialization of the same kind*. The former will indicate dichotomous divisions of lines of descent; the latter merely indicate degrees of divergence from a primitive type. Thus, it is shown that there are two distinct ways of uniting the two wings of each side in the Lepidoptera; they may be united by a frenulum, or they may be united by a jugum. These are differences in kind of specialization, and indicate two distinct lines of descent or a dichotomous division of the order. Among those Lepidoptera in which the wings are united by a frenulum great differences occur in the degree to which this organ, or a substitute for it, is developed; such differences may merely indicate the degree of divergence from a primitive type, and may need to be correlated with other characters to indicate dichotomous divisions.^a

There is also a necessity, as is shown by Comstock, to distinguish between the characters used by systematists merely to make it possible for students to recognize the members of a group—*recognition characters* and the *essential characters* of a group. The essential characters of a group are not necessarily dependent on the presence or absence of any character or in the form of any part of the body, but on the characteristic structure of the progenitor of the group and the direction in which the descendants of this progenitor have been specialized. Recognition characters are generally those first observed and used by the systematist. They may also be essential characters,

^aJ. H. Comstock. Evolution and Taxonomy, Wilder Quarter Century Book, p. 42.

but as a rule taxonomists search only for characters indicating a difference in kind.

Specialization may take place in two very different ways—“*first*, by an addition or complication of parts, *specialization by addition*; *second*, by a reduction in the number or in the complexity of parts, *specialization by reduction*.” The specializations to be considered later are all of this latter type.

It should also be borne in mind that when an organ disappears in any phylum or line of ascent it can not reappear in the descendants of this phylum, though they might develop a substitute for it. Even if such a substitute should be developed, it is not probable that the substitute would resemble the organ so closely as to be mistaken for it.

In determining the phylogeny of any group, those characters indicating a difference in degree of specialization of the same kind are the most useful in allotting the rank of the different groups. Every large group has numerous characters indicating a difference in degree of specialization of the same kind. Certain of these characters show the ascent of the group as a whole, while others show only small lateral lines of ascent or a sidewise development. Characters indicating a sidewise development frequently arise independently several times, and do not indicate anything as to the line of ascent of the group as a whole. This is illustrated by the presence or absence of the radial cross-vein in the families Xiphydriidæ (fig. 85) and Tenthredinidæ. The presence or absence of this cross-vein is of value in indicating the line of ascent of the genera of each of these families, but is worthless so far as indicating any rank between the families themselves. Therefore care must be taken to differentiate between those characters that show the ascent of the group as a whole and those characters that show only a sidewise development.

The front wing of the original progenitor of the Hymenoptera, and therefore of the Tenthredinoidea, was undoubtedly very similar to the one already described as the typical hymenopterous wing (fig. 8). This wing contains not only all those parts that are generally wanting in the Hymenoptera, but the various parts are arranged in the most primitive condition known to us, as can readily be seen by comparing this wing with those of the Xyelidæ (figs. 31–35) and Lydidæ (figs. 36–43). No hymenopterous wing contains all the veins shown in the typical wing, but by combining the wings of the families just named the wanting parts can be readily supplied.

The characters that have been found the most useful in determining the ascent of the Tenthredinoidea are the position of the radial cross-vein, the position of the medio-cubital cross-vein, and the reduction of the anal cells of the front wings.

Hitherto the special modifications of the wing veins of the Tenthredinoidea have been considered in detail, particularly with respect to

the way in which the progressive modifications of each part has arisen. Let us now consider the interrelation of the various parts in its bearing on the phylogeny of the group as a whole, and its bearing on the relation of the Tenthredinoidea to the other superfamilies of the Hymenoptera.

The superfamily Tenthredinoidea is a homogenous group easily demarcated from all other Hymenoptera by several structural characters other than those found in the wings. The effect of natural selection on their wings has tended to modify them along so many different lines that it would be strange if we should find any single character that would circumscribe the group. This has been found to be true, though the separation of the group is readily accomplished by the employment of several coordinate characters.

As has already been pointed out several times, the superfamily Tenthredinoidea contains all those genera of the Hymenoptera that are especially generalized, as the free part of the veins R_1 , Cu_2 , 2d A, and 3d A is found only within the limits of this superfamily. The great majority of the members of this superfamily can be distinguished by the presence in the front wings of either the second or third anal cells or both.

In a few subfamilies of the family Tenthredinidæ both of these cells are wanting. But these subfamilies, Incaliinae, Acordulecerinae (fig. 83), Lobocerinae (fig. 82), Pteryogphorinae (fig. 81), and Perginae (fig. 84), of which only the second is represented in our fauna, are easily distinguished by the position of the medio-cubital cross-vein, which always extends between radius and cubitus, while in all other Hymenoptera other than the Tenthredinoidea, and even in certain members of the Tenthredinoidea, as has already been shown, this cross-vein always extends between media and cubitus. Other minor differences that should be noted are the preservation of a much greater number of veins in the radial and medial areas of the hind wings—this is true even in those subfamilies in which the anal cells of the front wings have been suppressed—and the preservation of the third anal vein

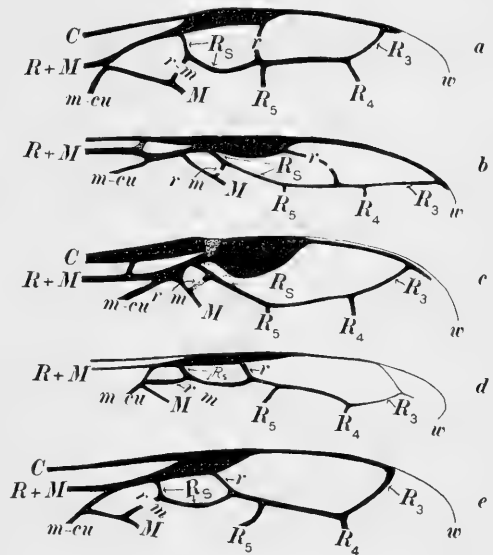


FIG. 19.—THE BASE OF THE RADIAL SECTOR. a, CENOLYDA SEMIDEA; b, TENTHREDO FLAVA; c, CLADIUS PECTINICORNIS; d, PAURURUS CYANEUS; e, MEGALODONTES SPISSI CORNIS.

of the hind wings, which appears to be wanting only in the genus *Oryssus* (fig. 97).

The most notable difference is found in the condition of the base of the radial cross-vein. The radial sector separates from R_1 at or before the base of the stigma. This is shown in the wings of *Macroxyela* (fig. 33) and *Cænolyda* (fig. 19, a), where the radial sector, after separating from R_1 , extends transversely for a considerable distance before extending longitudinally. The radial cross-vein in *Macroxyela* is a perpendicular vein extending from near the middle of the stigma to near the middle of the cell R_5 . In *Bactroceros* (fig. 41) this cross-vein joins the stigma near its apex and the cell R_5 near its apex. In the genus *Tenthredo* (fig. 19, b) the radial sector likewise arises from the base of the stigma, but differs from *Macroxyela* and *Cænolyda* in that the base of the radial sector does not extend transversely, but extends from R_1 along R_3 to the margin of the wing in a continuous regular curve. The anterior end of the radial cross-vein is beyond the middle of the stigma, as in *Bactroceros*, and the posterior end has migrated to near the middle of the cell R_4 . *Cladius* (fig. 19, c) shows a condition similar to that found in *Tenthredo*, except that the radial cross vein has atrophied, but it should be noted that in both of these genera—the one with a radial cross-vein, the other without—the radial sector arises in exactly the same manner. In *Paururus* (fig. 19, d) the radial sector arises in a similar manner to that of *Macroxyela* and *Cænolyda*, except that the transverse part is not so prominent. The radial cross-vein extends between the apical third of the stigma and the apical third of cell R_5 . It should be noted that this cross-vein is parallel with the transverse part of the radial sector and appears to be the direct continuation of that part of the radial sector beyond it. This appearance is emphasized by the position of the posterior end of the radio-medial cross-vein, which has migrated along the base of media until it has come into line with the longitudinal part of the radial sector, so that one not very familiar with the topography of this area might easily make the mistake of considering this vein as arising at the posterior end of the radio-medial cross-vein and the basal or transverse part of the radial sector, as well as the radial cross-vein, as cross-veins.

The wings of *Megalodontes* (fig. 19, e) are shorter and more compact, and there has been a crowding of the cells R , R_5 , 1st R_1 , and M_1 into the area behind the stigma, resulting in a condition similar to that found in *Paururus*. There are the following differences, however: The transverse part of the radial sector and the radial cross-vein are longer; the cross-vein is more oblique, and the appearance that it is the base of R_3 is more strongly emphasized; and the radio-medial cross-vein appears to be the continuation of the vein extending from the posterior end of the radial cross-vein to the anterior end

of the radio-medial cross-vein, the entire vein appearing as a transverse vein comparable to the free part of R_5 . In *Macrocephus satyrus* (fig. 20, a) there is a further modification of the condition found in *Megalodontes*; the cells 1st R_1 and R are about equal in length, so that the vein forming their outer ends, which extends from the posterior end of the radial cross-vein to the posterior end of the radio-medial cross-vein, is but little longer than the free part of R_5 , and is only slightly angulate. The fact should not be lost sight of that this vein is a composite one, being made up of the radio-medial cross-vein and a part of the radial sector. In this wing the cell 2d $R_1 + R_2$ is much longer, and the inclination of the radial cross-vein, together with the course of the vein forming the apices of the cells R and 1st R_1 , emphasizes the fact still more strongly that it might be the base of R_3 instead of the radial cross-vein. That part of the radial sector extending from the base of the stigma to the anterior end of the radio-medial cross-vein in this wing extends almost longitudinally. In *Janus cynosbati* (fig. 20, b), the base of that part of the vein just described has faded out for a short distance near the stigma, while in *Janus abbreviatus* (fig. 20, c) the base of this vein has faded out for over half its length. If the remainder of the basal part of the radial sector should atrophy up to the point where it is joined to the anterior end of the radio-medial cross-vein, and if it were not for the successive stages just described, then the radial sector would be considered as arising from the middle of the stigma and the entire first transverse vein, as a cross-vein. This is exactly the interpretation that has been given to these veins throughout the higher Hymenoptera, where this very condition exists. The same condition is found in the Tenthredinoidea in the genus *Oryssus* (fig. 20, d), but this genus is not so interesting in this connection, because the first transverse vein, i. e., the radio-medial cross-vein plus

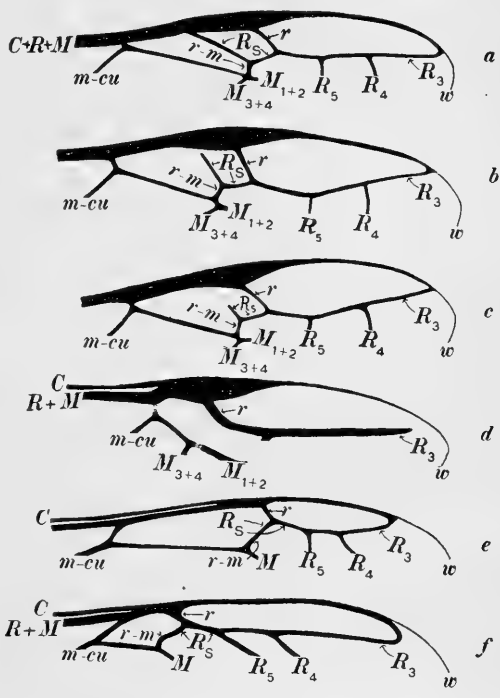


FIG. 20.—THE SWITCHING OF THE BASE OF THE RADIAL SECTOR. a, MACROCEPHUS SATYRUS; b, JANUS CYNOSBATI; c, JANUS ABBREVIATUS; d, ORYSSUS ABIETINUS; e, PELOPEUS CEMENTARIUS; f, APIS MELLIFICA.

a part of the radial sector, has also atrophied. The atrophy of the base of the radial sector results in the union of the cells R and 1st R_1 , a condition not found in any Tenthredinoidea other than *Oryssus* and *Ophrymopus*. This character is probably common to the other two genera of this family which are not known to the writer. That the above interpretation is the correct one is confirmed by the examination of the wings of the genera *Rhogas*, *Aulucus*, *Gasteruption*, *Polopæus* (fig. 20, *c*), and *Apis* (fig. 20, *f*). If the base of the vein starting off from the stigma in the first four of these genera be examined, it is found that it extends obliquely to the first transverse vein just as in *Megalodontes*, *Cephus*, and *Janus*. If this vein were the base of the radial sector, it would proceed in a regular curve, as in the genera *Tenthredo* and *Uladius*. The composite nature of the first transverse vein is shown by an examination of this vein in certain specimens of *Apis*, where it is not straight but angular, as in *Cephus*. In certain genera of Apoidea, as *Bombus*, *Psithyrus*, and *Osmia*, and of Larridae, the base of the radial sector is preserved as a fine thread-like vein, frequently entirely colorless, while in some other genera only the transparent stubs remain.

The superfamily Tenthredinoidea can be differentiated from the other superfamilies by the presence in the front wings of one or both of the anal cells, or, if both be wanting, with the medio-cubital cross-vein extending between R + M and cubitus; the cells R and 1st R_1 separated by a vein as broad as any of the others, or if not separated, with the first anal cell present.

The superfamily Tenthredinoidea is divisible into nine families. They are the Xyelidae, Lydidae, Blasticotomidae, Tenthredinidae, Xiphodriidae, Siricidae, Megalodontidae, Cephidae, Oryssidae. They are all represented in the American fauna except the Megalodontidae and the Blasticotomidae, and contain a very limited number of species except the family Tenthredinidae, which embraces several hundred species and a large number of subfamilies.

The close relation of these families is proven by characters showing a difference in degree of specialization of the same kind, but through the loss of certain of the intermediate stages those characters indicating a difference in degree of specialization of the same kind are here just as useful as characters indicating a difference in kind of specialization for marking dichotomous divisions. Although each of these families represents a period in the development of certain characters, yet the series is not a lineal one; that is, the connecting links do not lie between the various families, but behind them. They have been developed from a common progenitor which transmitted its characters to its offspring in an elementary condition, and these offspring have developed along several parallel lines. Fortunately for our study,

these offspring have all arrived at different stages in their ascent, and by a comparative study it is possible to determine the road along which they have traveled. From this it is evident that in this superfamily those characters of value as essential characters are equally valuable as recognition characters.

The relation of the families of the Tenthredinoidea can be best shown by the following synopsis.

SYNOPSIS OF THE FAMILIES OF TENTHREDINOIDEA.

The generalized Tenthredinoidea	Xyelidæ. Lydidæ.
The specialized Tenthredinoidea:	
The cell R_1 group	Blasticotomidæ. Tenthredinidæ.
The cell R_3 group	Xiphodriidæ. Siricidæ. Megalodontidæ. Cephidæ. Oryssidæ.

THE GENERALIZED TENTHREDINOIDEA.

The generalized Tenthredinoidea embraces two families, both of which are near the stem form of the original progenitor of the Hymenoptera. They are marked as generalized types by their short, broad, many-veined wings, in which the veins have not been arranged to the best advantage for stiffening the stigmatal and anal areas. They are further distinguished by the origin of the radial sector distinctly before the stigma, and by its prominent subtransverse bend away from the stigma. The course of the apex of the vein R_3 in both wings also demarcates them; this vein near the point of origin of the vein R_1 bends abruptly toward the margin of the wing, so that the cell on its front side, R_2 or $2d R_1 + R_2$ is blunt or subtruncated at apex, a condition found only in generalized genera.

This group is of particular interest to the student of phylogenies, because it approaches nearest to the typical wing in its retention of subcosta, the free part of R_2 and the free part of Cu_2 , though this latter is also found complete in one genus of Siricidæ.

Xyelidæ.—A small family embracing five genera and a limited number of species, which are confined mainly to the American fauna. It is easily separated from all other Hymenoptera by the presence in its wings of the free part of the vein R_3 . The family contains, at least so far as their wing venation is concerned, the most generalized Hymenoptera known (figs. 31-35). This is shown by the origin of media near the middle of the costal area; by the perfect transverse direction of the radial cross-vein, which is situated midway between the radio-

medial cross-vein and the origin of R_2 ; by the position of the medio-cubital cross-vein near the posterior end of the radio-medial cross-vein in *Manoxyela* (fig. 34), its location about halfway between this cross-vein and the point of separation of media in *Xyela* (fig. 35), its migration toward the base of the wing until still nearer the origin of media in *Megaxyela* (fig. 31), and *Odontophyes* (fig. 32), and finally in *Macroxyela* (fig. 33), to a position only a very short distance before the origin of media; by the progressive migration of the free part of $M_4 + Cu_1$ from just before the apex of the first anal cell in *Xyela* to just beyond the middle in *Macroxyela*; by the preservation of the radio-medial cross-vein in the hind wings of *Megaxyela*, *Odontophyes*, and *Macroxyela*; and by the location of the free part of R_4 of the hind wings near the apex of M_1 in these same genera.

It is worthy of note that the Xyelidæ have departed from the type of wing assumed for the original progenitor of the Hymenoptera only in the loss of the free part of the vein Cu_3 . It is also of interest that although their wings are distinctly generalized, yet in many ways they have undergone prominent progressive specializations, and that in each case these specializations have not proceeded in the same order. The variation in the order of specialization of the different genera will be seen in the following lists of genera which are arranged from generalized to specialized. If the modifications of the subcosta be taken they would be arranged, thus, *Odontophyes*, *Megaxyela*, *Macroxyela*, *Xyela*, *Manoxyela*; if the shape of the stigma thus, *Xyela*, *Manoxyela*, *Macroxyela*, *Megaxyela*, *Odontophyes*; if the position of the medio-cubital cross-vein, thus, *Manoxyela*, *Xyela*, *Odontophyes*, *Megaxyela*, *Macroxyela*; if the position of the free part of $M_4 + Cu_1$, thus, *Xyela*, *Odontophyes*, *Megaxyela*, *Manoxyela*, *Macroxyela*; if the origin of media thus, *Xyela*, *Macroxyela*, *Manoxyela*, *Odontophyes*, *Megaxyela*. If now the position of the five genera be tabulated for the five characters given, it is found that *Megaxyela* occupies all the positions but the first, and occupies the fourth twice, *Odontophyes* occupies each of the five places, *Macroxyela* occupies the third and fifth each twice, and does not occupy either the first or fourth, *Manoxyela* occupies each of the five places, *Xyela* occupies the first place three times, and does not occupy either the third or fifth.

This family is divisible into two subfamilies on the form of the base of the subcosta of the front wings. In one subfamily, of which *Macroxyela* (fig. 33) may be taken as the type, the subcosta extends from the base of the wing midway between costa and $R + M$ to beyond the origin of media, where it divides into two branches, one going to the costal margin, the other extending transversely coalesces with radius. In the other subfamily, of which *Xyela* (fig. 35) may be taken as the type, the base of subcosta is closely appressed to $R + M$ but does not coalesce with it, to about the middle of the distance between

the base of the wing and the stigma, where it turns abruptly toward the margin of the wing. The free part of the vein Sc_2 and the cell Sc have been suppressed by the close approximation of the stems of Sc and $R+M$.

Lydidæ.—The Lydidæ is an easily circumscribed family of ten genera and about one hundred and twenty-five species which are peculiar to the northern hemisphere. This and the Xyelidæ are the only families of Hymenoptera in which subcosta has been preserved in the hind wings (figs. 36–43). In this character the Lydidæ are more generalized than the Xyelidæ. The series of wings here shown are of value as indicating the manner in which the subcosta of the hind wings has been suppressed, namely, by atrophy from the base toward the apex. This family is noteworthy for the retention in many species of the free part of Cu_2 , though this character has been preserved in a limited number of species of the family Siricidæ (fig. 86). The Lydidæ have departed farther from the typical hymenopterous wing, and are therefore more specialized than the Xyelidæ. This is shown by the origin of media much nearer the origin of the radial sector, so that the cell R is only about as long as wide; by the position of the posterior end of the radial cross-vein, which varies from a position on the apical two-thirds of the cell R_5 to a position interstitial with the free part of the vein R_5 ; by the position of the anterior end of the medio-cubital cross-vein at or just beyond the origin of the media; by the loss of the free part of R_2 ; by the coalescence of the tip of R_4 for a greater distance from the margin of the wing; by the difference in the shape and position of the cell M_4 due to change in position of the stem of media and of the medio-cubital cross-vein; in the hind wings by the greater coalescence of the stem of media and the radial sector; and by the greater constriction of the apex of the first anal cell of the hind wings due to a coalescence of the first and second anal veins. The loss of the free part of the second branch of cubitus is a gradual one. It is complete except for the point where it is crossed by the anal furrow in *Liolyda* (fig. 43), *Pamphilus* (fig. 39), and *Bactroceros* (fig. 41); in *Lyda* (fig. 37) and *Cephalcia* (fig. 42) the posterior half is wanting; in *Cænolyda* (fig. 38) it is only a small tubercle on the posterior side of cubitus, while in *Neurotoma* (fig. 36) and *Itycorsia* (fig. 40) there is left only the convexity, indicating where the free part of Cu_2 was situated. The Lydidæ differ from the specialized Tenthredinoidea in the preservation of subcosta of both wings, the origin of media, the shape of the cell 1st R_1+R_2 and the course of the radial cross-vein.

THE SPECIALIZED TENTHREDINOIDEA.

Beginning with the families here included, there is found the first marked departure from the typical hymenopterous wing. This group is differentiated by the almost entire loss of the base of subcosta. The only exception is found in certain species of *Siricidae* (fig. 87), in which a subcosta of the type found in *Neurotoma* (fig. 36) persists. It can be traced as a pale, indistinct line through the middle of the area between costa and R+M in wings which have been cleared and mounted in Canada balsam. In addition to the loss of the base of subcosta, there is a decided shortening of cell R, due to the coalescence of radius and media to near the base of the stigma. The wings are longer, narrower, and more efficient organs of flight. The base of the radial sector has lost its prominent transverse curve, and measured along R_3 extends to the margin of the wing in a regular curve. The stigma has lost its broad quadrate outline, and, except in the genus *Blasticotoma* (fig. 44), it is narrow and diamond shaped.

The specialized Tenthredinoidea are divisible into two distinct phylogenetic groups on the position of the posterior end of the radial cross-vein, in one ending in the cell R_5 , in the other in the cell R_4 . The position of this cross-vein, together with the position of the medio-cubital cross-vein and the direction of the base of media, mark these groups as very different lines of development.

The determination of the sequence of these groups in a lineal arrangement has been a difficult one. In the answering of questions of this nature, the rule laid down by Comstock^a seems the most available one:

It seems to me that the most practicable way of meeting this difficulty is to begin with the description of the most generalized form known, and to follow this with descriptions of forms representing a single line of development, passing successively to more and more specialized forms included in this line. When the treatment of one line of development has been completed take up another line, beginning with the most generalized member of that line and clearly indicating in the text that a new start has been made.

This shows clearly the method of procedure so far as the components of each line of development are concerned, but the difficulty here to be met is the determination of the sequence of the lines of development themselves. For the sake of brevity and convenience in referring to these lines of development, they may be known as the cell R_5 group and the cell R_4 group. As is indicated above, in the former the radial cross-vein ends in the cell R_5 and in the latter in the cell R_4 . Both lines contain families that are very generalized and are consequently near the stem form. In the arrangement here adopted, it has been assumed that the group that departs farthest from the condition of the original progenitor of the group should be given the highest rank, because

^aJ. H. Comstock, Wilder Quarter-Century Book, p. 42.

they have shown by the adoption of these modifications greater ability to conform to environmental modifications.

The cell R_4 group finds its greatest modifications in the position of the radial cross-vein, the position of the medio-cubital cross-vein between $Sc+R+M$ and cubitus, and in the loss of the anal cells. The cell R_5 group finds its greatest modifications in the swinging of the base of media toward the apex of the wing, the atrophy of the base of the radial sector, and the loss of the second anal cell. It has been shown that the trend of modifications in these wings is toward the arrangement of the veins in such a way as to form supporting trusses in the stigmal area. The cell R_4 group has accomplished this by means of the medio-cubital cross-vein alone, while the cell R_5 group has employed not only the cross-vein, but combined it with the transverse part of media. The fact that this latter type is the one preserved throughout the higher Hymenoptera would seem to indicate that it is the one that has been most successful in meeting the requirements of natural selection, and consequently must be the most efficient type. The loss of the base of the radial sector, which is peculiar to the cell R_5 group, and likewise to the higher Hymenoptera, would also seem to point in this same direction. On the other hand, the cell R_4 group has exceeded the cell R_5 group in the loss of the anal cells, which is likewise peculiar to this group and the higher Hymenoptera; but even this condition is approximated by the cell R_5 group in the genus *Oryssus* (fig. 97), where the second anal cell is apparently wanting. So far as structural modifications are concerned, the weight of the evidence shows that the modifications found in the cell R_5 group have departed farthest from the primitive type, and we are therefore justified in giving it the precedence here.

Another fact that should not be overlooked, although it does not refer to structural predominance, is the number of descendants. The cell R_5 group contains five families, all of which are limited as to number of genera and species. The cell R_4 group contains two families, one containing a single species and the other many times as many genera and species as is found in all the remainder of the Tenthredinoidea together. The predominance of the cell R_4 group would seem to contradict our conclusions from structural superiority and therefore of efficiency of type, namely, that the predominance of individuals is a direct confirmation of the superiority and efficiency of the cell R_4 type. This is only an apparent contradiction, for, if structural superiority and predominance of descendants are compared in other groups of animals, it is found that in those groups where there is a marked structural superiority there are a limited number of genera and species, while in those groups where there is a marked predominance of descendants, they are as a rule only mediocre so far as structural superiority is concerned.

THE CELL R_4 GROUP.

It has been noted that there are two modifications in the stigmal region that go hand in hand. The one is the progressive coalescence of the media from the middle of the costal area to near the stigma; the other is the progressive migration of the medio-cubital cross-vein from a position near the apex of the cell R to a position in the angle between R and M . In the cell R_4 group there is found the consummation of these modifications, the base of the media moving still nearer the stigma and the cross-vein cutting loose from media and migrating along $Sc+R+M$ until in some genera it is more than its own length away from the media. It is doubtful that this moving of the radial end of the cross-vein toward the base of the wing is in every case a bona fide migration, and herein probably lies the explanation of why this character is of little value in certain subfamilies of the Tenthredinidae. If the wings of *Strongylogaster* (fig. 51), *Stromboceros* (fig. 50), and *Selandria* are examined, it is found that in the first the cross-vein arises in the angle between R and M , and that radius extends toward the stigma in a regular curve; in the second the cross-vein is farthest from M , but that beyond the cross-vein radius makes a more prominent bend toward the stigma, while in the third the cross-vein is distant from M and radius makes an abrupt bend toward the stigma. The evidence here suggests that in the case of *Selandria* this condition was reached by a coalescence of the anterior end of the cross-vein and $Sc+R+M$.

This group is noteworthy as being the only one showing the different ways in which the anal area has been modified and therefore the successive changes that have resulted in the complete reduction of the anal cells.

The position of the radial and medio-cubital cross-veins marks the group as a sidewise development, this arrangement of parts being peculiar to the group. With the exception of a single case in the cell R_5 group, it is the only place where the radial cross-vein is lost. This peculiarity has arisen independently a number of times in the family Tenthredinidae. When present, this cross-vein is always oblique to R_{3+4} and never perpendicular, as in the generalized Tenthredinoidea.

The hind wings are practically the same in venation as those of the Lydidae, except that in some forms the free part of the second anal, the free part of R_4 , and the transverse part of M_2 has atrophied.

Blasticotomidae.—A family containing a single genus and species, found only in central and eastern Europe (fig. 44). This is an isolated archaic type. It is, in certain of its characters, closely related to the Xyelidae and Lydidae; in others it approximates the Tenthredinoidea; that is, it is intermediate between these two groups. The area between costa and $Sc+R+M$ is hardly more than a line and all trace of the sub-

costa is wanting. The stigma is a broad oval area like that of the Xyelidæ. The radial sector separates from R_1 distinctly before the stigma and extends to the wing margin along R_3 in a regular curve. The apex of the cell $2d R_1+R_2$ is broadly rounded, just as in the generalized Tenthredinoidea and Megalodontidæ (fig. 92). The radial cross-vein is joined to the stigma at its apical fourth and to the vein R_{3+4} near the middle of the cell R_4 . The radio-medial cross-vein is wanting. Media separates from radius a short distance in front of the radial sector; it extends transversely for a short distance, then extends in a broad bow-like bend to the point of separation of M_{1+2} and M_{3+4} , much as in *Bactroceros* (fig. 41) and *Itycorsia* (fig. 40). The anterior end of the medio-cubital cross-vein is joined to media at the posterior end of its transverse part and the posterior end of the cross-vein to cubitus just beyond its middle, the cross-vein extending from this point to media in a prominent curve, so that the cell M_4 is in the shape of a semi-circle. The cubitus is a straight vein, closely appressed to $Sc+R+M$ at the base of the wing, but not coalesced with it. The free part of M_4+Cu_1 is situated near M_3 , as in the Lydidæ, the vein being transverse instead of oblique. The anal cell is of the form found in the typical wing. In the hind wings the cell R_{1+2} is bluntly rounded as in the fore wing and they differ from the Lydidæ only in wanting the subcostal vein and in that the transverse part of media is nearer the apex of the wing.

Almost every writer who has studied this species has located it in a different place. It has been placed in the subfamily HyloTominae (figs. 76-79), or as a separate subfamily, or as a tribe near the generalized Tenthredinoidea. It has affinities with the generalized Tenthredinoidea in the shape of the stigma, the shape of the apex of the cell R_2 , and the position of the medio-cubital cross-vein. It is allied to the family Tenthredinidæ (figs. 45-84), in the course of the base of the radial sector and in the position of the radial cross-vein. It differs from the generalized Tenthredinoidea and the generalized Tenthredinidæ in the constriction of the area between costa and $Sc+R+M$. These characters indicate it as a primitive form closely related to the family Tenthredinidæ, which finds its proper location as a distinct family just before the Tenthredinidæ.

Tenthredinidæ.—A large family with numerous subfamilies, genera, and species, found in all parts of the world. The stigma is of moderate size, ovate in outline. The costa in most of the species is distinctly thickened toward the apex. The area between costa and $Sc+R+M$ is of varying width, the subcosta is represented only by the free part of Sc_1 , and only in rare cases is all trace of this wanting. The radial cross-vein is joined to the stigma near its apex and to R_{3+4} near the apex of the cell R_4 . The radial sector extends from the base of the stigma in a regular curve. In many genera the angle between the

stigma and the base of the radial sector has been strongly chitinized secondarily, so that the radial sector appears to arise from the base of the stigma, but it is always possible to differentiate this secondary part from the stigma and the vein because of the difference in the amount of chitinization. This condition is very prominent in *Hemichroa* (fig. 62) and *Periclista* (fig. 69). *Media* separates from *radius* near the stigma. The anterior end of the medio-cubital cross-vein may be joined to it at its origin or arise from the angle between *R* and *M*, or be joined to *Sc+R+M* at various distances from the origin of *M*. The anal cells show a marked progressive modification, but this and the other modifications can be dealt with better under the discussion of the subfamilies, and will be treated there.

It has been shown that the interrelation of the medio-cubital cross-vein and the origin of *media* is one of the most useful characters in indicating the sequence of the different families. Although there is quite a little modification in this region within the family Tenthredinidæ, yet it is worthless for our present purpose, since it does not indicate anything as to the phylogeny of the group. The anal veins and cells maintain the same form and relation in all the families of the Tenthredinoidæ except the Oryssidæ and the Tenthredinidæ. In the Tenthredinidæ this area goes through a series of successive changes that are just as valuable in indicating the sequence of the subfamilies as the position of the medio-cubital cross-vein is in indicating the sequence of the families. Using, therefore, the anal area as a basis, this family can be divided into the following subfamilies, the relation of which can be best understood by means of the following synopsis:

SYNOPSIS OF THE SUBFAMILIES OF TENTHREDINIDÆ.

Generalized Tenthredinidæ	Lophyrinæ.
	Emphytinæ.
	Selandriinæ.
	Dolerinæ.
	Phyllotominæ.
Specialized Tenthredinidæ.	
Anal cell conservers.	
Second anal vein conservers	Lycaotinæ.
	Tenthredininæ.
	Cimbicinæ.
Second anal vein losers.	
Second anal cell reduced by atrophy.	
Costal area conservers.	
Radial cross-vein conservers.....	Hoplocampinæ.
	Dineurinæ.
Radial cross-vein losers.....	Monocteninæ.
	Cladiinæ.
	Nematinæ.

Costal area losers	Blennocampinae.
	Fenusinae.
	Scolioneurinae.
Second anal cell reduced by coalescence.....	Hylotominae.
	Schizocerinae.
	Perreyiinae.
Anal cell losers	Incaliinae.
	Lobocerinae.
	Acordulecerinae.
	Pterygophorinae.
	Perginae.

GENERALIZED TENTHREDINIDÆ.

The five subfamilies here included do not represent a continuous line of modification. Each subfamily is a separate entity, representing only the tip of a line of ascent. In the anal area they have retained the primitive condition of the typical wing, but in other regions they are distinctly modified. The group contains genera that have been distributed among various subfamilies. The primitive condition of the anal cells and the prominent contraction in the third anal vein shows their close relation to the generalized Tenthredinoidæ, their close affinity as a group, and furnishes ample reason for their inclusion as separate subfamilies in this place.

Lophyrinae.—The broad area between costa (fig. 45) and Sc+R+M, together with the distinct free part of Sc₁ and the origin of media from R, much as in the generalized families, denominates this group as a generalized one. It is specialized in its loss of the radial cross-vein and the open condition of the apex of the cell R₁₊₂ of the hind wings, in these ways surpassing all the subfamilies of the generalized Tenthredinidæ. The base of the radial sector bends abruptly toward the apex of the wing, but not as abruptly as this vein bends in the Xyelidæ (figs. 31–35) and Lydidæ (figs. 36–43). The apex of the cell R₁₊₂ of the front wings is moderately blunt, due to the bending of R₃ abruptly toward the wing margin at the origin of R₄, though pointed at its actual apex; the cell M₄ is about twice as long as wide; the vein M₄+Cu₁ is joined to the middle of the cell M₄; the medio-cubital cross-vein is joined to Sc+R+M just before the origin of media, the cross-vein and M₃₊₄ are slightly divergent, the free part of R₄ and the transverse part of M₂ of the hind wings is present, and the first anal cell is petiolated at apex for a short distance. An interesting modification is the loss of the posterior half of the radio-medial cross-vein in many species.

This subfamily as known to me contains only the genus *Lophyrus* (fig. 45). It is usually associated with the genus *Monoctenus* (fig. 67), and placed near the Hylotominae and its allies, but I believe that the most important modification that can be used in assigning a location

for a group in lineal arrangement in the family Tenthredinidæ is the condition of the anal cells, and judged by this criterion the Lophyrinæ must fall among the generalized Tenthredinidæ.

Emphytinæ.—The Emphytinæ have the area between costa (figs. 46-48) and $Sc+R+M$ restricted, though in some genera it is fairly broad with a distinct Sc_1 , in others it is narrow, and Sc_1 is only represented by a projection upon the front margin of $Sc+R+M$. The medio-cubital cross-vein is attached in the angle between radius and media, this cross-vein and M_{3+4} are parallel. The radio-medial cross-vein is wanting in certain genera, as *Emphytus* (fig. 46) and *Pacilostomidea*, so that the cells R and R_5 are combined. Many writers on the Tenthredinoidea content themselves with the statement that there are three or four submarginal cells present, but it is very apparent that this does not give a hint as to what vein is wanting and therefore what cells have combined. The radial cross-vein is never wanting. The cells $2d R_1+R_2$ of the fore wings and R_{1+2} of the hind wings are distinctly pointed at apex. The free part of M_4+Cu_1 varies as to the place at which it joins the cell M_4 from near the middle of the cell to a point almost interstitial with the medio-cubital cross-vein. In the hind wings the free part of R_4 is frequently wanting, while in other genera both the free part of R_4 and the transverse part of M_2 are wanting. There is considerable variation in the amount of coalescence of the first anal cell of the hind wings. In *Acidophora* the second anal vein separates from the first distinctly beyond the free part of M_4+Cu_1 , in other genera, as *Tetratneura*, the apex of the first anal is interstitial with M_4+Cu_1 , while in *Eriocampa* (fig. 47) the coalescence is for a considerable distance before M_4+Cu_1 . The following genera would be referred to this subfamily as here constituted: *Athalia*, *Eriocampa*, *Strongylogastroidea*, *Pacilostomidea*, *Pacilostoma*, *Taxonus*, *Hypotaxonus*, *Hemitaxonus*, *Emphytus*, *Harpiphorus*, *Tetratneura*, *Acidophora*, *Parasiobla*, and *Pseudosiobla*.

Selandrinæ.—A group with only a limited number of genera, but fairly rich in species. It is of especial interest, because it marks the first stage in the reduction of the anal area, the free part of the second anal vein being wanting (figs. 50-51). It is only recently that systematists have considered the loss of the free part of this vein of even generic value, but the modifications of this area are of such great phyllogenetic importance that there is not the slightest reason for not considering the loss of this vein as of subfamily value. The loss of the free part of the second anal vein marks a high specialization within the generalized Tenthredinidæ and should place this subfamily at the head of this series; but, as pointed out above, each of these subfamilies is only the tip of a line of ascent, and as the other characters of the wings ally it closely with the Emphytinæ its most natural location is after this group, where all previous systematists have placed it.

In the front wings the costal area varies from a broad prominent space to a narrow restricted area, the latter being the predominant condition. The anterior end of the medio-cubital cross-vein may arise either from the angle between radius and media or from $Sc+R+M$ distinctly before the origin of media. This shows that in certain groups at least the location of this cross-vein at or before the origin of media does not include forms belonging to the same line of ascent, but it does show the successive modifications within this line of ascent. The other wing structures are practically the same as in the Emphytinæ except that, so far as observed, the free part of R_4 and the transverse part of M_2 are never wanting in the hind wings. This subfamily includes the following genera: *Strongylogaster*, *Thrinax*, *Stromboceros*, and *Selandria*.

Dolerinæ.—A subfamily (fig. 49) with a distinct habitus, closely related to the Emphytinæ and Selandriinæ. The costal area has been greatly reduced, the free part of Sc_1 is only a projection upon the front side of $Sc+R+M$. The costa is prominently thickened at apex. This, together with the thickening of $Sc+R+M$, have undoubtedly been important factors leading to the reduction of this area. The medio-cubital cross-vein joins $Sc+R+M$ just before the origin of media. This cross-vein and the stem of M_{3+4} are slightly divergent behind. The most important characters for differentiating the group from the other subfamilies of the generalized Tenthredinidæ is the atrophy of the free part of R_{5+6} , so that the cells R_5 and R_6 are combined. The free part of M_1+Cu_1 is situated near the middle of the cell M_1 . The hind wings are of the usual form found in the generalized Tenthredinidæ. This subfamily contains two genera, *Dolerus* and *Loderus*.

Phyllostominae.—This subfamily is distinctive in the oblique course of the medio-cubital cross-vein (fig. 52-54), which is joined to $Sc+R+M$ distinctly before the origin of media and by the direction of the stem of M_{3+4} , which is strongly divergent from the cross-vein behind. The costal area is narrow, the free part of Sc_1 is represented by a mere projection on the front margin of $Sc+R+M$ in *Caliroa*, and is entirely wanting in *Phyllostoma*.

The costa is broadly expanded at apex. The radial and radio-medial cross-veins are so completely covered by furrows in certain species as to be apparently wanting. The free part of M_1+Cu_1 is joined to the cell M_1 near its middle. The hind wings have undergone the greater reduction, the free part of R_4 and the transverse part of M_2 are generally wanting, though this latter vein is sometimes present. In the males there has been a peculiar change in the direction of the veins, all of them running direct to the margin, the free part of R_4 and M_3 and the transverse part of M_2 are wanting, and in their place there has been developed secondarily a vein along the margin of the wing from the apex of the cell R_{1+2} to the apex of the first anal

cell very much like the ambient vein of the Diptera. This condition can be explained in another way by assuming that the free part of R_4 , the transverse part of M_2 , and the free part of M_3 are all present, and simply have migrated to the margin of the wing. The difficulty in the way of this explanation is that the free part of R_4 is always wanting in the females of these genera. In certain species of *Phyllotoma* the free part of the second anal vein coincides with the second anal furrow and the apex of the free part has atrophied. This subfamily contains the genera, *Caliroa*, *Phyllotoma*, and *Eriocampoides*.

THE SPECIALIZED TENTHREDINIDÆ.

A group containing the greater part of the genera and species of the family Tenthredinidæ. They are differentiated from the generalized Tenthredinidæ through the loss of the constriction near the middle of the second anal cell. The subfamilies fall into several well-marked lines of development. The *Lycaotinae* (fig. 55), *Tenthredininae* (figs. 56-58), and *Cimbicinae* (figs. 59-60) are the only members of this series in which the free part of the second anal vein of the front wings is preserved. The marked contraction of the third anal vein is represented as a slightly thickened emargination just before the free part of the second anal vein, this is found only in the *Lycaotinae* (fig. 55) and *Tenthredininae*. In the genera *Macrophya* (fig. 57) and *Tenthredo* (fig. 56) the presence or absence of a transverse vein between the second and third anal veins is not of generic value. The *Hoplocampinae*, *Dinurinae*, *Cladiinae*, *Monocteninae*, *Nematinae*, *Blennocampinae*, *Scolioneurinae*, and *Fenusinae* have the anal cells either anastomosed at middle or with the basal half of the third anal vein atrophied. In the *Hylotominae*, *Schizocerinae*, and *Perreyinae* the second anal cell has been reduced by the progressive coalescence of the anastomosis to the base of the wing. In the *Lobocerinae*, *Pterygophorinae*, and *Perreyinae* the anastomosis has proceeded both ways, so that both the first and second anal cells have been reduced.

Lycaotinae.—This subfamily contains the single genus *Lycaota* (fig. 55). Its location with the *Tenthredininae* and *Cimbicinae* is due to the form of the anal cells, which anastomose at a single point at the usual place for the location of the free part of the second anal vein. The wings are broad and their apices are blunt. The medio-cubital cross-vein arises from $Sc+R+M$, just before the origin of *media*. This cross-vein and M_{3+4} are parallel. In the hind wings the free part of R_4 is wanting and the first and second anal veins are coalesced for nearly one-half the length of the veins. This subfamily is placed as the most generalized member of the specialized Tenthredinidæ because of the form of the anal veins of the front wings and the position of the medio-cubital cross-vein.

Tenthredininæ.—The limits of this subfamily as given here is the same as that usually assigned it by systematists with the exclusion of those genera in which the free part of the second anal vein appears like an oblique cross-vein. The Tenthredininæ are generalized in the preservation of the remnant of the contraction of the typical wing (figs. 56–58), the fairly broad costal area, and in the parallel medio-cubital cross-vein and M_{3+4} . The medio-cubital cross-vein is oblique, and is joined to $Sc+R+M$ a considerable distance before the origin of media. The cells between R_1 and R_3 are broad, the radial cross-vein long and bowed. The topography of the hind wings is of the ordinary type found in the Tenthredinidæ, except that there has been a notable reduction of the anal area of the wing, so that the lobe behind the second anal vein is almost entirely wanting. In the front wings the modification of the second anal vein varies from a long vein in *Tenthredo* (fig. 56) to a broad contraction in *Pachyprotasis* (fig. 58); in the hind wings the cell R_{1+2} extends to the apex of the wing R_1 , extending beyond as a short spur. Although it is impossible to put it into words, yet the general appearance of the wings of this subfamily is distinctive and easily recognized and would never be confused with those of any other group.

Cimbicinæ.—Like the preceding group, this one has the same limits as that given it by systematists. Its distinctive characters are the narrow costal area (figs. 59–60); the long, narrow-pointed stigma; the narrow-pointed area between the veins R_1 and R_3 , which always ends a considerable distance before the apex of the wing, the vein R_1 being always extended for a considerable distance beyond the apex of this area; the radial cross-vein is straight and slightly oblique; the medio-cubital cross-vein usually joins $Sc+R+M$ more than its own length before the origin of media; the medial cross-vein is frequently oblique; the free part of the second anal vein may be present or its location represented by a broad anastomosis; the medio-cubital cross-vein and the stem of M_{3+4} are divergent before; the first anal cell has been shortened at apex by the coalescence of the first anal and the combined second and third anals; the radio-medial cross-vein is wanting, so that the cells R and R_5 are coalesced. The wing area of the hind wings has not been modified from the usual type and the vein topography is the same, except that the cell R_{1+2} ends a considerable distance before the apex of the wing, the vein R_1 being continued to near the apex of the wing. The apex of the free part of the second anal vein is transverse like a cross-vein, and there has been developed from the apex of the first anal cell on the hinder angle a long secondary spur to the wing margin. The costal area of hooks extends to or beyond the middle of the cell R_{1+2} .

Hoplocampinæ.—A small group, embracing two genera, *Hoplocampa* (fig. 61) and *Hemichroa* (fig. 62). This and the following sub-

family represents a series in which the anal veins have been modified before the loss of the radial cross-vein. In this subfamily the costal area is broad with the free part of Sc_1 distinct. The area between R_1 and R_3 is very broad, the radial cross-vein is long, straight, and slightly oblique. The area between the base of the stigma and the base of the radial sector has been chitinized so that it appears as a part of the stigma. The medio-cubital cross-vein is joined to $R+M$ distinctly before the origin of media, usually near the free part of Sc_1 . The free part of M_4+Cu_1 is joined to the cell M_4 near its middle. The anal cells are contracted for a short distance in *Hoplocampa* and for a considerable distance in *Hemichroa*. In the hind wings the anal lobe is larger, the venation is of the usual type.

Dineurinae.—This subfamily as generally limited contains the genera *Dineura* (fig. 63) and *Mesoneura* (fig. 64). To these has been added the genus *Pseudodineura* (fig. 65), which is closely allied to them. The *Dineurinae* are quite similar in wing type to the preceding subfamily, the most notable difference is in the loss of the base of the third anal vein, so that the cell included between 1st $A+2d A$, and $3d A$ has coalesced with the third anal cell. There is a notable variation in the amount of thickening of the apex of the costa, the greatest thickening being found in the genus *Mesoneura*. The free part of Sc_1 occupies a different position in each of the genera; in *Mesoneura* it is about its own length before the medio-cubital cross-vein, in *Pseudodineura* it is almost interstitial with the cross-vein, and in *Dineura* it is about its own length beyond it. The position of the free part of Sc_1 is usually of but little value systematically, at least in certain groups. This is marked in *Pteronus ventralis*, one of the *Nematinae*, where this vein is not constant within a single species, but may in different individuals occupy all three of the positions described for the genera of this subfamily. In *Pseudodineura* the apex of the free part of the second anal vein is wanting. The hind wings are of the usual type.

Monocteninae.—Beginning with this subfamily there is a series of three closely related subfamilies in which the loss of the radial cross-vein has preceded the modifications of the anal veins. The *Monocteninae* contains a single genus, *Monoctenus* (fig. 67), which all systematists have agreed hitherto in associating with the genus *Lophyrus* (fig. 45), described above. *Monoctenus* is like *Lophyrus* in lacking the radial cross-vein and in having the costal area broad, with a prominent free part of Sc_1 . In *Monoctenus* the costa is slightly thickened at apex; the medio-cubital cross-vein is joined in the angle between R and M ; this cross-vein and the stem of M_{3+4} are divergent behind; the anal cells are broadly anastomosed at middle; the free part of M_4+Cu_1 joins the cell M_4 near its middle and is strongly oblique; the cell R_{1+2} is broad and pointed at apex, and the area between the base of the stigma and the radial sector is distinctly chitinized. In the hind wings the

cell R_{1+2} is broad and open at apex; the radial sector reaches the wing margin at the actual wing apex; the remainder of the wing is of the usual type.

Cladiinæ.—The genera included in this subfamily are generally placed with the next, the Nematinae. The costa is somewhat thickened at apex (fig. 66); the medio-cubital cross-vein joins $Sc+R+M$ just before the origin of M , this cross-vein and the stem of M_{3+4} is strongly divergent behind. In the hind wings the cell R_{1+2} is broad, pointed, not open at apex, and ends on the front margin distinctly before the apex of the wing with the vein R_1 extending beyond the apex of the cell spur-like. This subfamily includes the genera *Cladius*, *Priophorus*, *Trichiocampus*, and *Camponiscus*.

Nematinae.—A large subfamily of several genera and numerous species. The genera here included are those generally included in this subfamily, in which the base of the third anal vein has atrophied so that the cells 2d A and 3d A are coalesced (fig. 68). The costa is distinctly thickened at apex, the costal area is broad; the area between the base of the stigma and the base of the radial sector is strongly chitinized; the medio-cubital cross-vein is joined to $Sc+R+M$ a considerable distance before the origin of media; the base of the free part of the third anal vein is wanting; the free part of R_5 is wanting in *Eura*; and the radio-medial cross-vein is frequently so completely covered by the radial furrow as to be partially or wholly wanting, a condition especially noticeable in the genus *Pristiphora*.

Fenusinae.—Of the genera known to me, there are two, *Fenus* (fig. 74) and *Kaliosysphinga* (fig. 73), which would fall into this subfamily as here limited. The group is indicated by the narrow costal area; the thickened apex of the costa; the loss of all trace of Sc_1 ; the broad stigma; the subtransverse bases of the radial sector and of media; the strongly bowed medio-cubital cross-vein, which is joined either in the angle between R and M , or just before the origin of media; the strong divergence of the medio-cubital cross-vein and the stem of M_{3+4} . The radio-medial cross-vein is wanting; in *Kaliosysphinga*, the base of the third anal vein is represented by a dark band of coloring matter, which in *Fenus* is completely wanting. In the hind wings there is the atrophy of the free part of R_1 and the transverse part of M_3 . The apical two-thirds of the second anal vein is wanting in *Kaliosysphinga*, and the anal area of the wings is greatly reduced. The apex of the cell R_{1+2} is open, the vein R_3 reaching the wing margin at the actual apex of the wing.

Scolioneurinae.—A small subfamily containing two genera, *Entodecta* and *Scolioneura* (fig. 75), which are closely related to the preceding subfamily. It differs from the Fenusinae in having the free part of Sc_1 preserved as a protuberance upon the front margin of $Sc+R+M$, and in having the cell R_{1+2} of the hind wings closed some distance before

the apex of the wing, the vein R_1 being continued spur-like beyond the apex of the cell. In *Scolioneura* the radial cross-vein is interstitial with the free part of R_3 , and the base of the free part of the third anal is preserved, though its connection with the other anal veins at the contraction is wanting. The radio-medial cross-vein is present, although almost entirely covered by the radial furrow. In *Entodecta* the base of the third anal vein is represented in the wing membrane as a dark, straight band.

Blennocampinae.—This and the two following subfamilies begin a series in which the costal area has been greatly reduced, and the free part of Sc_1 is represented only by a spur (figs. 69–72). The Blennocampinae is a large group rich in genera and species, in which systematists have placed a number of genera bearing no relation to the group at all, as here restricted. The costa is prominent and thickened at apex; the medio-cubital cross-vein is joined to radius in the angle between radius and media and is usually parallel with M_{3+4} , very slightly divergent in *Rhadinoceræa*; the base of the third anal vein is partly atrophied, different genera showing the successive stages in the atrofication of this vein; the free part of M_4+Cu_1 varies in position from near the middle of the cell M_4 to a position almost interstitial with the medio-cubital cross-vein. In the hind wings the free part of R_4 and the transverse part of M_2 are wanting in certain genera; the first anal cell is of varying lengths, the first and second anal veins being coalesced from a point opposite the free part of M_3 to near the middle of the distance between the base of the wing and the free part of M_3 ; the cell R_{1+2} usually ends just before the apex of the wing, but in *Perichista* R_3 ends at the actual apex, the cell being closed; in the males of certain species the apex of the wing is margined by an ambient vein as in the males of certain Phyllotomiinae.

Hylotomiinae and allies.—This group (figs. 76–80) includes three subfamilies, the Hylotomiinae, Schizocerinae, and Perreyinae. As only a very limited amount of material of the last two subfamilies is at hand for study, it will be impossible to more than point out some of the more salient characters of the group, and for this reason the groups are given the same limits in the table on another page that is generally assigned them by systematists. It seems doubtful that these groups as now arranged represent natural divisions. The Hylotomiinae and Schizocerinae are differentiated by the moderately broad costal area together with a well-marked Sc_1 , which is common to the former and wanting in the latter, while both conditions are found in the Perreyinae. The characters above given would place the genera *Hylotoma* (fig. 76) and *Pachylota* (fig. 77) in the same subfamily. In both the cell R_{1+2} of the front wings is prominently appendiculate, but in the hind wings of *Pachylota* this cell is open at the apex, the veins R_1 and R_3 extending parallel to the margin of the wing. This condition is also

found in the Schizocerinae, where this cell is appendiculate in *Labi-darge* (fig. 78), and broadly open at apex in *Scobina* and *Dielocerus* (fig. 79); in fact, in *Scobina* this cell is not appendiculate in either wing. If the results of our studies on the other groups of this family be of any value, then the variation in the characters just cited must indicate very different lines of ascent, and be of more value than for the mere differentiation of genera. The medio-cubital cross-vein is generally joined to $Sc+R+M$ at or very near the origin of media. Although it is not true of all the genera, yet in certain genera there seems to be a marked tendency for the migration of the free parts of R_1 and R_5 and the transverse part of M_2 toward the base of the wing, thus greatly increasing the size of the apical cells. The second anal cell is wanting in the Perreyinae, but according to descriptions of genera may be either present or absent in both the Hylotominae and Schizocerinae. This character is not of any phylogentic value, since, so far as it is concerned, these subfamilies are undergoing a progressive reduction of this cell. In the Hylotominae and Schizocerinae the hind margin of the cell M_1 is a fairly straight vein, the free part of M_1+Cu_1 joining it near its middle, and is either perpendicular to it or inclined toward the apex of the wing. In most Perreyinae the hind margin of the cell M_1 is deeply curved, the free part of M_1+Cu_1 is joined to it at or before the middle, and is always strongly inclined toward the base of the wing. This is the only venational character thus far discovered that is of any value in separating the Perreyinae from the other two subfamilies. In the hind wings it is only with rare exception that either the free part of R_1 or the transverse part of M_2 are wanting in the Hylotominae and Schizocerinae, and when either of them are wanting it is always the latter. In marked contrast to this is the almost entire absence of the transverse part of M_2 in the Perreyinae, the free part of R_1 being always present, so far as can be judged from figures of wings. Here, just as in the front wings, there is a marked tendency toward the migration of the free part of R_1 and the transverse part of M_2 , when it is present, toward the base of the wing. In many Tenthredinidae the transverse part of M_2 is either interstitial, or nearly so, with the free part of R_1 , but in this group it has migrated toward the base of the wing until it is near, or sometimes even before, the free part of M_3 . There is also in many Tenthredinidae a prominent angle opposite the anterior end of the free part of M_3 , but in this group this angle has been straightened out and cubitus appears to extend directly to the margin of the wing. The Perreyinae are frequently separated from all the preceding subfamilies by the loss of the free part of the second anal vein. It has been pointed out above that this vein is also wanting in the Phyllotominae and Fenusinae, and the same condition is found in certain Schizocerinae and Hylotominae. This is a character that has arisen several times in widely separated groups, and does not

appear to be of any phylogenetic value. Although the Hylotominae, Schizocerinae, and Perreyinae are so closely related in their wing characters that there is a great dearth of prominent differences for dividing them, yet the Perreyinae are readily separated from the other subfamilies on antennal characters.

The anal cell loosers.—The genera included under this heading are generally divided into three subfamilies, the Lobocerinae, Pterygophorinae, and Perginae. Such a grouping combines forms that are not closely related and they have therefore been divided into the following subfamilies: The Incaliinae, including the genera *Incalia* and *Paralypia*, which are limited to South America; the Lobocerinae, including the genera *Loboceras* (fig. 82), *Aulacomerus*, *Syzgonia*, and *Corynophilus*, which are also limited to South America; the Acordulecerinae, including the single genus *Acordulecera* (fig. 83), found in North and South America; the Pterygophorinae including the genera *Pterygophorus* (fig. 81), *Pterygophorinus*, *Lophyrotoma*, and *Philomastia*, which are limited to Australasia; and the Perginae, including the genera *Cerealecs* and *Perga* (fig. 84), and its subdivisions, which are limited to Australasia. It has been impossible to examine specimens of all these groups, and the writer has had to depend in many cases on figures, so that the characters given in the table on a later page may not be of any more value than to indicate the regions which are undergoing modifications. These subfamilies are set off from all the other Tenthredinidae by the reduction of both anal cells of the front wings. The wings are long and slender, and the anal area of the hind wings is generally greatly reduced. In the front wings the costal area is broad, and the free part of Sc_1 is preserved in the Lobocerinae, but in the other subfamilies the costal area is hardly more than a line, and the free part of Sc_1 is wanting. The radial cross-vein is wanting. The cell R_{1+2} is appendiculate in the Incaliinae, Lobocerinae, Pterygophorinae, and Perginae, ending at or before the middle of the cell R_3 , the vein R_1 being continued to the apex of the wing.

In the Acordulecerinae this cell is not appendiculate, and ends distinctly beyond the middle of the cell R_3 . The medio-cubital cross-vein joins $Sc+R+M$ at or very near the origin of M . In the Pterygophorinae the free part of R_5 is wanting, in *Acordulecera* and certain species of Perginae the radio-medial cross-vein is also wanting. The free part of M_1+Cu_1 joins the cell M_4 just before the middle in the Lobocerinae and Pterygophorinae, and interstitial with the medio-cubital cross-vein in the Perginae. In the hind wings the cell R_{1+2} is appendiculate in the Perginae and Lobocerinae, while in the Acordulecerinae and Pterygophorinae it extends as a long, pointed cell to the apex of the wing. The free part of R_4 is always present, and the transverse part of M_2 always wanting. As in the Hylotominae and its allies, the base of cubitus apparently forms a continuous vein to the

wing margin by coming into line with M_4 , the medial cross-vein, and the longitudinal part of M_2 . The medio-cubital cross-vein is longitudinal in the Incaliinæ, Lobocerinæ, and Perginæ, and transverse in the Acordulecerinæ and Pterygophorinæ. The free part of M_4 is longitudinal in the Pterygophorinæ and only about one-third the length of the free part of M_3 , while in the Lobocerinæ and Perginæ the free part of M_4 is transverse and two or three times as long as the free part of M_3 . This is due to the migration of the basal end of the medial cross-vein along the free part of M_3 . The free part of the second anal vein is wanting throughout the group, due to the great reduction of the anal lobe of the wing, while the second anal furrow and the axillary incision are near the first anal vein. The loss of the second anal is the consummation of a variation that has appeared sporadically in other subfamilies.

THE CELL R_5 GROUP.

It has been pointed out in the case of the generalized Tenthredinoidea that the radial cross-vein always ends in the cell R_5 . In the families Xiphydriidæ (fig. 85), Siricidæ (figs. 86-91), Megalodontidæ (fig. 92), and Cephidæ (figs. 93-96) this cross-vein, with rare exceptions, also ends in the cell R_5 . In the family Oryssidæ (fig. 97) this cross-vein is apparently wanting, but, as was shown above, the cross-vein is present and is represented by the transverse vein at the base of R_3 . The only modification in the course of the cross-vein is that its posterior end has migrated toward the apex of the wing, so that it is always oblique to R_{3+4} instead of being perpendicular.

The interrelation of the radio-medial cross-vein, the base of the radial sector, and the base of the media is a prominent characteristic of this group of families. In the Xiphydriidæ there is only a slight departure from the arrangement of parts existing in the typical wing, the base of the radial sector and the base of media being parallel, and the cross-vein perpendicular to them. In the other families, however, the posterior end of the cross-vein has swung around at such an angle as to form an apparently continuous vein with a part of the radial sector, while the basal part of the sector extends transversely between the cross-vein and the stigma like a cross-vein. As a result of this change in the direction of the veins, the cells R , 1st R_1 , and 2d R_1+R_2 are arranged in a row.

The position of the medio-cubital cross-vein in those families in which the posterior end of the radial cross-vein ends in the cell R_5 is also of especial interest. In the Xiphydriidæ this cross-vein occupies practically the same position that it does in the typical wing. The Oryssidæ show a stage slightly more advanced than that of the Xiphydriidæ. The cross-vein is longer than the transverse part of media, which has been brought about by a combined migration of the anterior

end of the cross-vein along media, and by a further coalescence of media with radius until it is almost opposite the anterior end of the cross-vein. A similar condition is found in certain Cephidæ, the cross-vein being about three times as long as the transverse part of media. In this family the modification has been a migration of the anterior end of the cross-vein along media until in certain species, as *Cephus pygmæus* (fig. 96) it arises in the angle between Sc+R+M and media. In the Siricidæ and Megalodontidæ the modification has been in an entirely different direction. The cross-vein and the transverse part of media in these families are subequal in length, while the origin of media is either opposite or beyond the anterior end of the cross-vein and never before it, as it is in all the forms previously described. The manner in which this arrangement of parts has arisen can be best understood if a study be made first of the condition found in the Xiphydriidæ (fig. 85). In this family the cross-vein and the transverse part of media are subequal in length, just as in the families named above. The cross-vein is distinctly bowed on the side toward the base of the wing. This bow in the cross-vein has been preserved in practically all the Siricidæ (figs. 86-91). Now, if the cross-vein maintain this same form and position, and the point of separation of media from radius be gradually changed, moving toward the apex of the wing by the coalescence of media more and more with the radius until it is opposite or beyond the anterior end of the cross vein, exactly the same condition will be had as is found in the Siricidæ. The Megalodontidæ (fig. 92) differ only in that the coalescence has proceeded farther, the transverse part of media being distinctly inclined toward the base of the wing, and the cross-vein is straight instead of being bowed.

The only other possible solution of the arrangement of veins in the stigmatal area of the Siricidæ would be that starting with a wing like that of *Cephus pygmæus*, the base of media had migrated along the cross-vein until near its middle, and that at some later time the anterior end of the combined cross-vein and media had migrated along radius toward the apex of the wing. This would give exactly the same result that has been explained above in another way. That this latter explanation can not be the correct one is proven by the relation of these veins in the Xyelidæ, Lydidæ, Cephidæ, and the Tenthredinidæ. It has been shown that in the first three of these families the tendency is for the progressive coalescence of media with radius, and coordinated with this a progressive migration of the medio-cubital cross-vein from a position near the apex of the cell R to the point of separation of media from radius. That the tendency is not for media to migrate along the cross-vein when the cross-vein reaches the angle between radius and media, as has been shown in the Tenthredinidæ, but instead that the cross-vein continues its migration toward the base

of the wing along $Sc+R+M$. This is conclusively shown in *Trichiosoma* (fig. 59), where the cross-vein has migrated more than its own length away from the origin of media. That this latter solution is untenable is further proven by the position of the posterior end of the radio-medial cross-vein, which in both the Siricidæ and Megalodontidæ is so near the posterior end of the transverse part of media as to preclude such a migration.

It has been shown that the preservation of the radial cross-vein as the base of R_3 , as in the Oryssidæ, is the same condition existing in all the higher Hymenoptera. It is of especial interest that the form of the medio-cubital cross-vein and the base of media is also the same arrangement of parts found in the other Hymenoptera. Both of these conditions go to show that the other superfamilies of the Hymenoptera were derived from a progenitor closely allied to the families Siricidæ, Megalodontidæ, and Oryssidæ.

Xiphydriidæ.—This family contains four genera and about twenty-five species, which are distributed over North and South America, Europe, and Asia. Their wing type (fig. 85) is the most generalized found in the specialized Tenthredinoidea. The front wings are long and narrow; the costal area is broad and distinct; the free part of Sc_1 is represented by a prominent transverse vein situated near the origin of media, which is a direct modification and migration of the condition found in *Xyela* (fig. 35) and *Manoxyela* (fig. 34); the anterior end of the radial cross-vein is situated near the apex of the stigma and its posterior end near the apex of the cell R_5 , or interstitial with the free part of the vein R_5 and is either perpendicular or slightly oblique; this cross-vein is wanting in the genus *Derecyrtæ*. The radial sector arises at the base of the stigma and continues along R_3 in a regular curve. The base of the sector is subtransverse; it does not make as abrupt a bend as in the generalized Tenthredinoidea, while, on the other hand, it is not so gradual a curve as in the more specialized forms. The radio-medial cross-vein is somewhat oblique and distant from the origin of media, and is wanting in the genus *Konowia*. Media separates from radius but little nearer the stigma than in the Lydidæ, while the portion before the medio-cubital cross-vein is oblique, just as in *Macroxyla* (fig. 33), though both this part of media and the cross-vein are longer than in that genus, resulting in a much wider cell M; the free part of M_4+Cu_1 is near the posterior end of the radio-medial cross-vein, almost interstitial with it. In the hind wings the origin of media is distant from the origin of the radial sector, and the first anal cell is of a type similar to that found in the Lydidæ (figs. 36-43) except in *Konowia*, where it is open at the apex.

The migration of the apex of R_1 in the front wings away from the margin of the wing in *Xiphydria camelus*, as already described, has developed into a distinct appendiculate cell in *Derecyrtæ* and *Brachyiphus*.

The venation of the wings of this family is like the typical wing in the origin of media, the location of the medio-cubital cross-vein, and the type of anal cells.

The Xiphydriidæ has generally been considered by systematists as a subfamily of the family Siricidæ. That it represents a distinct line of development is shown by the condition of the area between costa and Sc+R+M, which is broad, and the wing membrane not any thicker than that of any other part of the wing, while the remnant of subcosta retained is a modification of the type found in *Xyela*, the type found in the Siricidæ, as will be shown later, is a modification of the type found in *Neurotoma*. That the Xiphydriidæ represent a distinct line is further shown by the origin of the base of media, by the position of the radio-medial cross-vein, and by the origin of the base of media in the hind wings, which is in reality quite a specialized condition. All these characters go to show that the wings of this family are more nearly like those of the generalized Tenthredinoidea than those of the specialized Tenthredinoidea.

Siricidæ.—This family contains five genera, all of which are limited to the northern hemisphere. The Siricidæ are large, active, flying insects, and as a result their wings are long and narrow. The wings are like the typical wing (figs. 86-91) only in having homologous veins. The stigma is narrow, pointed, and eight to ten times as long as broad. The area between costa and Sc+R+M is narrow and almost as strongly chitinized as the veins themselves. The suppression of the subcosta, which is represented in some species as a pale, indistinct line, is undoubtedly due to the chitinization of the membrane of this area. In *Tremex columba* (fig. 91) the chitinization has proceeded so far that there is a large trachea unprotected by a vein ramifying through this area. The peculiar arrangement of the veins forming the apex of the cell M has already been discussed and need not be considered here. The posterior end of the radio-medial cross-vein joins the cell M_1 on its basal third; in *Tremex fuscicornis* it ends in the angle between the transverse and longitudinal parts of media, while in *Sirex californicus* (fig. 87) it ends on the posterior third of the transverse part of media. Correlated with the migration of the posterior end of this cross-vein there is a corresponding migration of its anterior end along the radial sector until, in *Tremex fuscicornis*, it arises almost at the origin of the sector, so that the cell R is hardly more than a broad line. In *Tremex* the radial cross-vein is situated near the apex of the cell R_5+R_4 , the free part of the vein R_5 is wanting. On the apex of the front wings of all the species of the family there has been developed a large appendiculate cell, with the apex of R_1 as a prominent vein extending toward the actual apex of the wing. An especially interesting feature of the wings of the Siricidæ is the preservation of the free part of Cu_2 in the genus *Paururus* (fig. 86) and a portion of it in different species

of *Sirex*. This vein is found besides in the Siricidæ only in certain species of the family Lydidæ. It is noteworthy that it is situated nearer the medio-cubital cross-vein than in the Lydidæ, and that the prominent bow in the base of cubitus, so characteristic of the Lydidæ, is wanting in the Siricidæ. The first and second anal cells approximate the type found in the typical wing, but the emargination near the base of the third anal vein, instead of being an abrupt one, as in the typical wing, is a long, continuous curve. There has also been a progressive migration of the free part of the second anal toward the apex of the wing until in *Paururus* and *Sirex californicus* it is situated midway between M_{3+4} and the medio-cubital cross-vein. In *Xeris* (fig. 89) it is just beyond the cross-vein, while in *Tremex* it is before. In the hind wings there is in certain species a well-marked appendiculate cell, but in *Tremex* and *Paururus* the transverse part of R_1 has been obliterated, leaving the cell R_{1+2} open at apex. This family is so specialized in most of its structures that it is of interest to find at least one of its characters very generalized. This is the point of origin of media, which is more primitive than the same region in the Xyelidæ (figs. 31–35). There is a progressive migration from a position distinctly before the radial sector in *Sirex californicus*, from the origin of the radial sector in *Paururus*, and finally from the radial sector distinctly beyond its origin in *Tremex*. We find a confirmation of the generalized condition of this character in its great variability, which is not constant even in the same species. The first anal cell in *Paururus* and *Sirex californicus* is of the type described for the Lydidæ and Xiphydriidæ, but in *Tremex* and *Xeris* the free part of the second anal vein is entirely wanting. The explanation of the obliteration of this vein is found in the following species: In *Sirex albicornis* the basal two-thirds and the small transverse part is preserved; in *Sirex flavicornis* only the basal two-thirds is preserved, while in *Xeris* only a part of the small transverse part remains. It should be noted that in the three species just named the longitudinal part of this vein coincides with the second anal furrow, along which this part of the wing is folded, while in *Paururus*, where the entire free part of the second anal vein is preserved, that the free part of this vein is distinctly before the furrow. There is only one solution possible for the loss of this vein, and that is that it is due to the presence and location of this furrow, which has migrated forward in certain species hand in hand with the reduction of the anal area of the wing. That there is a marked migration of this furrow and reduction of the anal area will be readily seen by an examination of the wings of the different species of *Tremex*.

The genus *Teredon*^a (fig. 90) possesses a number of interesting fea-

^aThe figure of *Teredon latitarsus* was enlarged from a photomicrograph of the wings of the type in the Collection of the American Entomological Society made and loaned the writer by Mr. J. Chester Bradley.

tures. The radial cross-vein is intermediate in its location between *Sirex* and *Tremex*, being almost interstitial with the free part of R_5 , which is fully preserved; the transverse part of the base of media has begun to disappear and the radio-medial cross-vein to function for it; the apices of the veins forming the appendiculate cell of the front wing have faded out, so that there is found exactly the same condition in both wings that exists in *Tremex*; the free part of the second anal vein is preserved and the anal area of the wing is large. All these characters ally this genus more closely with a form like *Sirex albicornis* than with *Tremex*, near which it has been placed.

The Siricidæ are a well-circumscribed group, defined by the condition of the area between costa and $Sc+R+M$, by the relation of media and the medio-cubital cross-vein, by the position of the radio-medial cross-vein, and by the prominent appendiculate cell at the apex of the front wing.

Megalodontidæ.—This family (fig. 92) contains four genera and about twenty-five species, and is peculiar to Europe, Asia, and northern Africa. It represents a line of specialization very similar to that found in the Siricidæ. This is shown by the condition of the base of media and the medio-cubital cross-vein. The cells R , $1st R_1$, and $2d R_1+R_2$ are arranged in a row. The base of the radial sector is transverse, as in the Lydidæ, but that portion of the sector between the anterior end of the radio-medial cross-vein and the posterior end of the radial cross-vein is not so strongly curved, so that the cell $1st R_1$ is almost a parallelogram. The Megalodontidæ differ from the Siricidæ in that the cells R and $1st R_1$ are subequal in size, the cell M_1 is proportionately much smaller, the cell $2d R_1+R_2$ is of about the same length, but is much broader, while the apex of the cell is like that of the Xyelidæ and Lydidæ, and is not appendiculate. The anal cells are like those of the typical wing. The area between costa and $Sc+R+M$ is broad, and all trace of the subcosta is wanting. The vein forming the apex of the cell M is a straight one; each of the components of this vein is not separately bowed on the basal side with an emargination between them, as is so characteristic of this vein in the Siricidæ, while it is more strongly inclined than in this latter family. The hind wings are just like those of the Lydidæ, except that the subcosta is wanting. The generalized condition of the apex of the cell R_{1+2} , obliquely truncated and not pointed, is notable.

The forms considered here as constituting the family Megalodontidæ are invariably classified by systematists as a subfamily of the Lydidæ. That they do not have any affinities with this family is shown by the difference in the position of the medio-cubital cross-vein, by the difference in the position of the cells R and $1st R_1$, by the entire loss of the subcosta in both wings, by the loss of the free part of Cu_2 , by the straightening of the cubital vein, so that the curve so characteristic of

this vein in the Lydidæ is wanting, by the lack of coalescence between cubitus and Sc+R+M, which extends for almost one-half the length of the vein Sc+R+M in the Lydidæ, and by the difference in the shape of the cell M_4 . The facts just given show conclusively that the Megalodontidæ are more closely allied to the Siricidæ than to any other family, while there are an abundance of characters for retaining them as a distinct family.

Cephidæ.—A family of about a dozen genera and moderately numerous in species of intercontinental distribution. It is not closely related to any of the families described hitherto. The front wings (figs. 93–96) are long and narrow, the hind wings have been remarkably reduced in the anal region, and the insects are very rapid fliers. The area between costa and Sc+R+M has been eliminated in both wings. Media separates from radius distant from the stigma, in about the same region as in the Xyelidæ. The cell R is long, subequal in length to the cell R_3 , and is in line with the cells 1st R_1 and 2d R_1+R_2 , as in the Siricidæ and Megalodontidæ, but differs from these families in that the apex of the cell R is almost opposite the apex of the cell 1st R_1 . The radio-medial cross-vein is transverse. The portion of the radial sector between this cross-vein and the stigma is longitudinal, while the portion of the sector between the radio-medial cross-vein and the radial cross-vein is subtransverse, and might readily be mistaken for a part of the radio-medial cross-vein if it were not for the angle at its anterior end. The radial cross-vein is oblique and appears to be the base of R_3 . The cell 2d R_1+R_2 is very long, as in the Siricidæ, but is pointed at tip. The anterior end of the medio-cubital cross-vein is joined to media in certain species distinctly beyond its origin, while in others it arises from the angle between R and M. The cell M_4 is as long as or longer than the cell R. The cubitus coalesces with Sc+R+M for only a very short distance at base. The cells 1st A and 2d A are subequal in width, and the free part of the second anal vein is situated just beyond the middle of cubitus and is perpendicular to the first and third anal veins, while the contraction of the third anal vein is wanting. The hind wings are just as distinctive as the front wings. With the exception of the subcostal area, costa being coalesced with R+M, the number of veins is the same as in the Xiphydriidæ. The most distinctive character is in the arrangement of the cells. Beginning at the base of the wing (fig. 95) the cells 1st A, $M_3+Cu+Cu_1$, $M_4+1st M_2$, $R+R_3+R_4$, and R_3 are arranged in an oblique row from the base to the apex of the wing.

Practically all systematists are agreed in considering the Cephidæ as a distinct group worthy of family rank. So far as the wings are concerned, they are the most distinctive of any group of the Tenthredinoidea, and are only indirectly related to any of the other families. They are generalized, so far as the origin of media is concerned, but

are very specialized in the region of the radial and radio-medial cross-veins and in the arrangement of the cells of the hind wings in an oblique row.

Oryssidae.—A small family consisting of four genera and a very limited number of species found in all parts of the world. The family is known to the writer only in the genera *Oryssus* (fig. 97), *Ophrynopus*, and the notes given here refer only to these genera. It has been found that as a rule the figures of wings given by writers who have not made an especial study of wing venation can not be depended upon, but, judging from such figures of species not accessible to the writer, they would seem to indicate more generalized conditions than those existing in *Oryssus*. The costal area is narrow; the costa is a delicate vein quite strongly thickened at base; Sc+R+M is a strong vein which functions for the costa, and at the origin of media it bends abruptly toward the stigma; cubitus and Sc+R+M are coalesced for a short distance at the base of the wing; the veins beyond and behind the stigma are nothing more than dark bands of color; the transverse part of media is almost entirely wanting; the radio-medial cross-vein, the base of the radial sector, the free part of R₅, and the transverse part of M₄ are entirely wanting. The weakening of these veins is undoubtedly due to the thickening of the wing membrane. The second anal cell has been reduced, probably by the coalescence of the third anal with the combined first and second anal. The base of R₃ is joined to the stigma by means of the radial cross-vein, as was fully described in the preceding pages. In the hind wings the costa is entirely wanting, R+M is thickened and takes the place of costa; the cubitus and the remainder of the veins are only lines of color; the second anal is entirely wanting; the third anal is preserved as a very delicate line.

So far as their wings are concerned the presence of the second anal cell in the front wings is the only structure that would place the genus *Oryssus* in the superfamily Tenthredinoidea. In their form and topography they are much more like the higher Hymenoptera than the other Tenthredinoidea. It stands at the summit of specialization, so far as this group is concerned, as an extreme isolated line of development.

VII.—SUMMARY.

In the course of the study presented in the preceding pages the following topics have been discussed:

1. An historical consideration of those investigations that have had to do with the development of a uniform nomenclature for the wing veins of all orders.

2. It has been shown how the complex hymenopterous wing has been developed from a wing of the simplest type.

3. How the apex of vein R₁ has been gradually pulled away from the wing margin to form an appendiculate cell.

4. The progressive coalescence of the base of media and radius toward the middle of the wing and, coordinated with this, the progressive migration of the medio-cubital cross-vein toward the point of separation of radius and media to form a transverse support for the stigma.

5. How all the types of anal cells found in the superfamily Tenthredinoidea have been developed from the form of this area found in the generalized families.

6. The veins of the hind wing have been homologized with those of the front wing and all the marked modifications occurring in the superfamily discussed.

7. An attempt has been made to show that all the modifications in wing topography are directly dependent on the efficiency of the wing as an organ of flight, and that this efficiency is due to the arrangement of the veins in such a manner as to stiffen the areas of the wing subject to the greatest stress.

8. The venational distinction of the Tenthredinoidea from the other superfamilies of the Hymenoptera has been pointed out.

9. The distinctive characters of the families of the Tenthredinoidea have been considered in detail and their phylogenetic importance indicated.

10. The loss of the base of the radial sector and its bearing on the homology of the veins of the wings of the higher Hymenoptera has been discussed.

11. A classification of the superfamily Tenthredinoidea is given. The sequence of the families and subfamilies, whether generalized or specialized, has been determined by a genealogical study of the different structural modifications of the wings.

12. Analytical tables are given for separating the families of the superfamily Tenthredinoidea and of the subfamilies of the family Tenthredinidæ. These tables are based on venational characters alone, and are examples of the value of such studies as the one given in the preceding pages.

13. Front and hind wings of all the generalized genera and examples selected from the numerous other groups are figured and their wing veins homologized.

14. All previous classifications have been based on recognition characters and are therefore likely to be artificial. Great use has been made of the form of the antennæ and claws, modifications that have arisen independently several times. The foregoing investigation is only a beginning of what needs to be done. Phylogenetic studies should be made of all those structural parts that will indicate anything as to the complete genealogy of the group. Two such regions are the mouth parts and the structure of the thorax.

TABLE FOR SEPARATING THE FAMILIES OF THE TENTHREDINOIDEA.

- a.* Front wings with the free part of vein R_2 presentXYELIDÆ
- aa.* Front wings with the free part of vein R_2 always wanting.
- b.* Front wings with the base of subcosta present as a distinct vein.....LYDIDÆ
- bb.* Front wings with the base of subcosta wanting, if present, only as a pale indistinct line; the subcosta is represented only by the free part of the vein Sc_1 , which is like a cross-vein near the apex of the costal area, and even this is sometimes wanting.
- c.* Front wings with the radial cross-vein ending in the cell R_4 , very rarely in the cell R_3 ; the medio-cubital cross-vein joined to the vein $Sc+R+M$ or to the vein M ; if joined to the vein M , the transverse part of the vein M not more than one-sixth the length of the cross-vein.
- d.* Front wings with the medio-cubital cross-vein joining media distinctly beyond the point of separation of radius and media; the cell 1st R_1+R_2 blunt at apex; the veins surrounding the front margin of the cell M_1 in the form of a semicircleBLASTICOTOMIDÆ
- dd.* Front wings with the medio-cubital cross-vein either joined to the vein $Sc+R+M$ or to the vein M in the angle between radius and media; the cell 1st R_1+R_2 always pointed at apex; the veins surrounding the front margin of the cell M_1 never semicircular but always with prominent angles beforeTENTHREDINIDÆ
- ec.* Front wings with the radial cross-vein ending in the cell R_5 , rarely in the cell R_4 ; and, if so, with the medio-cubital cross-vein joining media distinctly beyond the radius and subequal in length to the transverse part of media.
- d.* Front wings with the transverse part of the vein M_2 present.
- e.* Front wings with the medio-cubital cross-vein subequal in length with the transverse part of media; the portion of the radial sector between the stigma and the anterior end of the radio-medial cross-vein always distinctly less than the portion between this cross-vein and the posterior end of the radial cross-vein, or when the radial cross-vein is wanting, less than the portion between the radio-medial cross-vein and the anterior end of the free part of the vein R_5 , resulting in the apex of the cell R extending but little beyond the base of the cell 1st R_1 , or if the radio-medial cross-vein be wanting, the cell $R+R_5$ extending but little beyond the apex of the cell 1st R_1 .
- f.* Front wings with the free part of the vein Sc_1 present and situated near the point of the separation of radius and media; the base of media extending longitudinally and separating from radius distinctly before the anterior end of the medio-cubital cross-vein; the radio-medial cross-vein, when present, transverse and not appearing as the base of the radial sectorXIPHYDRIDÆ
- ff.* Front wings with the free part of the vein Sc_1 wanting; the base of media extending transversely and separating from radius either opposite or beyond the anterior end of the medio-cubital cross-vein; the radio-medial cross-vein oblique and appearing as the base of the radial sector.
- g.* Front wings with the area between costa and the vein $Sc+R+M$ hardly more than a line; the cell 2d R_1+R_2 of both wings either appendiculate or extending to the apex of the wing; the free part of the vein M_1+Cu_1 joined to the cell 1st A near its base, never more than twice the length of the free part of the second anal vein from its baseSIRICIDÆ

gg. Front wings with the area between costa and the vein Sc+R+M broad and distinct; the cell 2d R_1+R_2 of the front wings and cell R_{1+2} of the hind wings never appendiculate, never reaching the apex of the wing, and bluntly rounded at apex; the free part of the vein M_4+Cu_1 joined to the cell 1st A near its apex, over three times the length of the free part of the vein 2d A from its base.

MEGALODONTIDÆ

ee. Front wings with the medio-cubital cross-vein joined to media at or near its point of separation from radius, never less than three and usually four or five times the length of the transverse part of media; the portion of the radial sector between the stigma and the anterior end of the radio-medial cross-vein subequal to or greater, usually greater, than the portion between this cross-vein and the posterior end of the radial cross-vein, resulting in the apex of the cell R extending to near the apex of cell 1st R_1CEPHIDÆ

dd. Front wings with the transverse part of the vein M_2 wanting...ORYSSIDÆ

TABLE FOR SEPARATING THE SUBFAMILIES OF THE TENTHREDINIDÆ.

- a.* Front wings always with the first and frequently with both first and second anal cells present.
- b.* Front wings with the second anal cell contracted at middle.
- c.* Front wings with the free part of the second anal vein present.
 - d.* Radial cross-vein present.
 - e.* Front wings with the free part of the vein R_5 present and the cells R_5 and R_4 therefore separate.
 - f.* Front wings with the medio-cubital cross-vein and the vein M_{3+4} parallel.....EMPHYTINÆ
 - ff.* Front wings with the medio-cubital cross-vein and the vein M_{3+4} strongly divergent behind.....PHYLLOTOMINÆ
 - ee.* Front wings with the free part of the vein R_5 wanting, so that the cells R_5 and R_4 are united.....DOLERINÆ
 - dd.* Radial cross-vein wanting.....LOPHYRINÆ
 - cc.* Front wings with the free part of the second anal vein wanting...SELANDRINÆ
- bb.* Front wings with the second anal cell not contracted at middle.
 - c.* Radial cross-vein present.
 - d.* Front wings with the medio-cubital cross-vein joined to the vein Sc+R+M at or near the origin of media, its distance from media always less than one-half the length of the cross-vein.
 - e.* Front wings with the medio-cubital cross-vein and the vein M_{3+4} parallel.
 - f.* Front wings with the base of the third anal vein present and the second anal cell therefore not combined with the third...LYCAOTINÆ
 - ff.* Front wings with the base of the third anal vein atrophied or at least in part so that the second and third anal cells are combined.
 - BLENNOCAMPINÆ
 - e.* Front wings with the medio-cubital cross-vein and the vein M_{3+4} strongly divergent behind.
 - f.* Hind wings with the vein R_3 reaching the margin distinctly before the apex of the wing; the cell R_{1+2} pointed at apex and closed.
 - SCOLIONEURINÆ
 - ff.* Hind wings with the vein R_3 reaching the margin at or beyond the apex of the wing; the cell R_{1+2} round at apex and open...FENUSINÆ
 - dd.* Front wings with the medio-cubital cross-vein joined to the vein Sc+R+M distant from the origin of media; its distance from media always one-half or more of the length of the cross-vein.

- e. Front wings with the base of the third anal vein present and the second anal cell therefore not combined with the third.
- f. Front wings with the medio-cubital cross-vein and the vein M_{3+4} parallel, or at least not divergent behind.
- g. Front wings with the medio-cubital cross-vein and the vein M_{3+4} parallel; media separating from radius at the base of the cell M_4 ; the radio-medial cross-vein rarely, if ever, wanting; hind wings with the cell R_{1+2} extending to the apex of the wing....TENTHREDININÆ
- gg. Front wings with the medio-cubital cross-vein and the vein M_{3+4} strongly divergent before; media separating from radius at or near the middle of the cell M_4 ; the radio-medial cross-vein always wanting; hind wings with the cell R_{1+2} ending a considerable distance before the apex of the wing.....CLMBCININÆ
- ff. Front wings with the medio-cubital cross-vein and the vein M_{3+4} strongly divergent behind.....HOPLOCAMPININÆ
- ee. Front wings with the base of the third anal vein atrophied and the second and third anal cells therefore united.....DINEURININÆ
- cc. Radial cross-vein wanting.
- d. Front wings with the third and combined first and second anal veins anastomosed at middle for a short distance, the length of the coalescence always being less than the length of the second anal cell.
- e. Hind wings with the vein R_3 reaching the margin before the apex of the wing; the cell R_{1+2} pointed at apex and closed.....CLADIININÆ
- ee. Hind wings with the vein R_3 reaching the margin at the apex of the wing; the cell R_{1+2} broad at apex and open.....MONOCTENININÆ
- dd. Front wings with the third and combined first and second anal veins anastomosed at middle for a considerable distance, the coalescence being two or three times the length of the second anal cell or the second anal cell wanting or combined with the third anal cell.
- e. Front wings with the portion of the free part of M_3 situated between the apex of the vein M_{3+4} and the basal end of the medial cross-vein always more than one-half, usually subequal, and frequently greater in length than the free part of the vein M_4 , causing the cell M_4 to appear distinctly longer longitudinally than transversely; the free part of the vein M_4+Cu_1 perpendicular to the first anal vein, if oblique, inclined toward the apex of the wing.
- f. Front wings with the free part of the vein Sc_1 present.
- g. Front wings with the cell R_{1+2} never appendiculate, closed at apex and not reaching the apex of the wing.....NEMATININÆ
- gg. Front wings with the cell R_{1+2} appendiculate at apex or open, never closed at the wing margin before the apex of the wing.
HYLOTOMININÆ
- ff. Front wings with the free part of the vein Sc_1 always wanting.
SCHIZOCERININÆ
- ee. Front wings with the portion of the free part of the vein M_3 and the basal end of the medial cross-vein always less than one-half and generally not more than one-fourth or one-fifth the length of the free part of the vein M_4 , causing the cell M_4 to appear longer transversely than longitudinally; the free part of the vein M_4+Cu_1 oblique and always inclined toward the base of the wing.....PERREYININÆ
- aa. Front wings always with both the first and second anal cells wanting.
- b. Front wings with the free part of the vein M_4+Cu_1 distinctly beyond the posterior end of the medio-cubital cross-vein.
- c. Hind wings with the cell R_{1+2} distinctly appendiculate.

- d. Hind wings with the free part of the vein M_1 subequal in length with the free part of the vein M_3 INCALINÆ
- dd. Hind wings with the free part of the vein M_4 three or four times the length of the free part of the vein M_3 LOBOCERINÆ
- cc. Hind wings with the cell R_{1+2} never appendiculate, but open at apex.
- d. Front wings with the cell R_{1+2} not appendiculate; hind wings with the portion of the vein R_{s+M} forming the base of the cell R_{1+2} transverse. ACORDULACERINÆ
- dd. Front wings with the cell R_{1+2} appendiculate; hind wings with the portion of the vein R_{s+M} forming the base of the cell R_{1+2} longitudinal. PTERYGOPHORINÆ
- bb. Front wings with the free part of the vein M_4+Cu_1 interstitial with the medio-cubital cross-vein, at most not more than the width of the vein beyond the cross-vein PERGINÆ

LIST OF ABBREVIATIONS.

1st A	=First anal vein.	m-cu	=Medio-cubital cross-vein.
2d A	=Second anal vein.	R	=Stem of radius.
3d A	=Third anal vein.	r	=Radial cross-vein.
C	=Costa.	R_1	=First branch of radius.
ct	=Contraction in second anal cell.	R_2	=Second branch of radius.
Cu	=Stem of cubitus.	R_3	=Third branch of radius.
Cu_1	=First branch of cubitus.	R_4	=Fourth branch of radius.
Cu_2	=Second branch of cubitus.	R_5	=Fifth branch of radius.
M	=Stem of media.	ri	=Radial furrow.
m	=Medial cross-vein.	Rs	=Radial sector.
M_1	=First branch of media.	$R+M$	=Combined stems of radius and media.
M_2	=Second branch of media.	r-m	=Radio-medial cross-vein.
M_3	=Third branch of media.	$R+Sc_2$	=Combined radial stem and second branch of subcosta.
M_4	=Fourth branch of media.	S	=Stigma.
M_{1+2}	=Stem of the first and second branches of media.	Se	=Stem of subcosta.
M_{3+4}	=Stem of the third and fourth branches of media.	Sc_1	=First branch of subcosta.
M_4+Cu_1	=Combined fourth medial and first cubital branches.	Sc_2	=Second branch of subcosta.
M_1+R_{4+5}	=Combined first medial and fourth and fifth radial branches.	$Sc+R+M$	=Combined stems of subcosta, radius, and media.
		sp	=Secondary spur.
		sv	=Spring vein.

EXPLANATION OF PLATES.

PLATE XXI.

- FIG. 21. Wing of *Pantarbes capito*.
- 22. Wing of *Erax furax*.
- 23. Wing of *Tabanus lineola*.
- 24. Wing of *Scenopinus fenestralis*.
- 25. Wing of *Rhamphomyia* sp.

PLATE XXII.

- FIG. 26. Wing of *Musca domestica*.
27. Wing of *Conops affinis*.
28. Wing of *Midas militaris*.
29. Front wing of *Nemoura completa*.
30. Front wing of *Teniopteryx frigida*.

PLATE XXIII.

- FIG. 31. Wings of *Megaxyela major*.
32. Wings of *Odontophyes avinigrata*.
33. Wings of *Macroxyela ferruginea*.

PLATE XXIV.

- FIG. 34. Wings of *Manoxyela* sp.
35. Wings of *Xyela julii*.
36. Wings of *Neurotoma fasciata*.

PLATE XXV.

- FIG. 37. Wings of *Lyda erythrocephala*.
38. Wings of *Cenolyda semidea*.
39. Wings of *Pamphilius pallimacula*.

PLATE XXVI.

- FIG. 40. Wings of *Itycorsia hieroglyphica*.
41. Wings of *Bactrocera depressus*.
42. Wings of *Cephaleia abietis*.

PLATE XXVII.

- FIG. 43. Wings of *Liolyda frontalis*.
44. Wings of *Blasticotoma filiceti*.
45. Wings of *Lophyrus* sp.

PLATE XXVIII.

- FIG. 46. Wings of *Emphytus balteatus*.
47. Wings of *Eriocampa ovata*.
48. Wings of *Pseudosiobla excavata*.

PLATE XXIX.

- FIG. 49. Wings of *Dolerus thomsoni*.
50. Wings of *Stromboceros signarius*.
51. Wings of *Strongylogaster cingulatus*.

PLATE XXX.

- FIG. 52. Wings of *Eriocampoides æthiops* female.
53. Wings of *Eriocampoides varipes* male.
54. Wings of *Phyllotoma vagans*.

PLATE XXXI.

- FIG. 55. Wings of *Lycaota sodalis*.
 56. Wings of *Tenthredo flava*.
 57. Wings of *Macrophya albicincta*.

PLATE XXXII.

- FIG. 58. Wings of *Pachyprotasis rapæ*.
 59. Wings of *Trichiosoma lucorum*.
 60. Wings of *Clavellaria amerina*.

PLATE XXXIII.

- FIG. 61. Wings of *Hoplocampa ferruginea*.
 62. Wings of *Hemichroa americana*.
 63. Wings of *Dineura geeri*.

PLATE XXXIV.

- FIG. 64. Wings of *Mesoneura opaca*.
 65. Wings of *Pseudodineura hepaticæ*.
 66. Wings of *Cladius pectinicornis*.

PLATE XXXV.

- FIG. 67. Wings of *Monoctenus juniperi*.
 68. Wings of *Pteronus pavidus*.
 69. Wings of *Periclista melanocephala*.

PLATE XXXVI.

- FIG. 70. Wings of *Rhadinocera reitteri*.
 71. Wings of *Phymatocera aterrima*.
 72. Wings of *Blennocampa alternipes*.

PLATE XXXVII.

- FIG. 73. Wings of *Kaliosysphinga dohrnii*.
 74. Wings of *Fenusa pygmaea*.
 75. Wings of *Scolioneura betuleti*.

PLATE XXXVIII.

- FIG. 76. Wings of *Hylotoma virescens*.
 77. Wings of *Pachylota audouinii*.
 78. Wings of *Labidarge dibapha*.

PLATE XXXIX.

- FIG. 79. Wings of *Dielocerus formosus*.
 80. Wings of *Perreyia vitellina*.
 81. Wings of *Pterygophorus cinctus*.

PLATE XL.

- FIG. 82. Wings of *Loboceras frater*.
 83. Wings of *Acordulecera* sp.
 84. Wings of *Perga* sp.

PLATE XLI.

- FIG. 85. Wings of *Xiphydria maculata*.
86. Wings of *Paururus cyaneus*.
87. Wings of *Sirex californicus*.

PLATE XLII

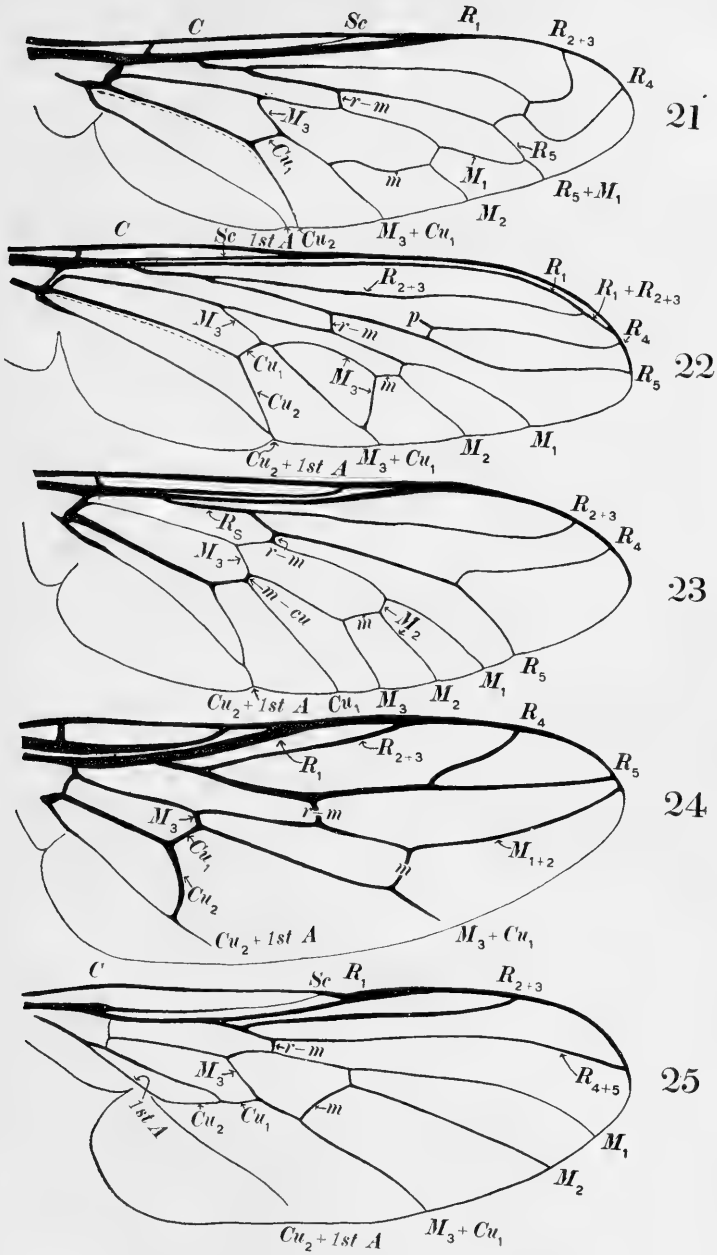
- FIG. 88. Wings of *Sirex albicornis*.
89. Wings of *Xeris spectrum*.
90. Wings of *Teredon latitarsis*.
91. Wings of *Tremex columba*.

PLATE XLIII.

- FIG. 92. Wings of *Megalodontes spissicornis*.
93. Wings of *Janus integer*.
94. Wings of *Janus abbreviatus*.

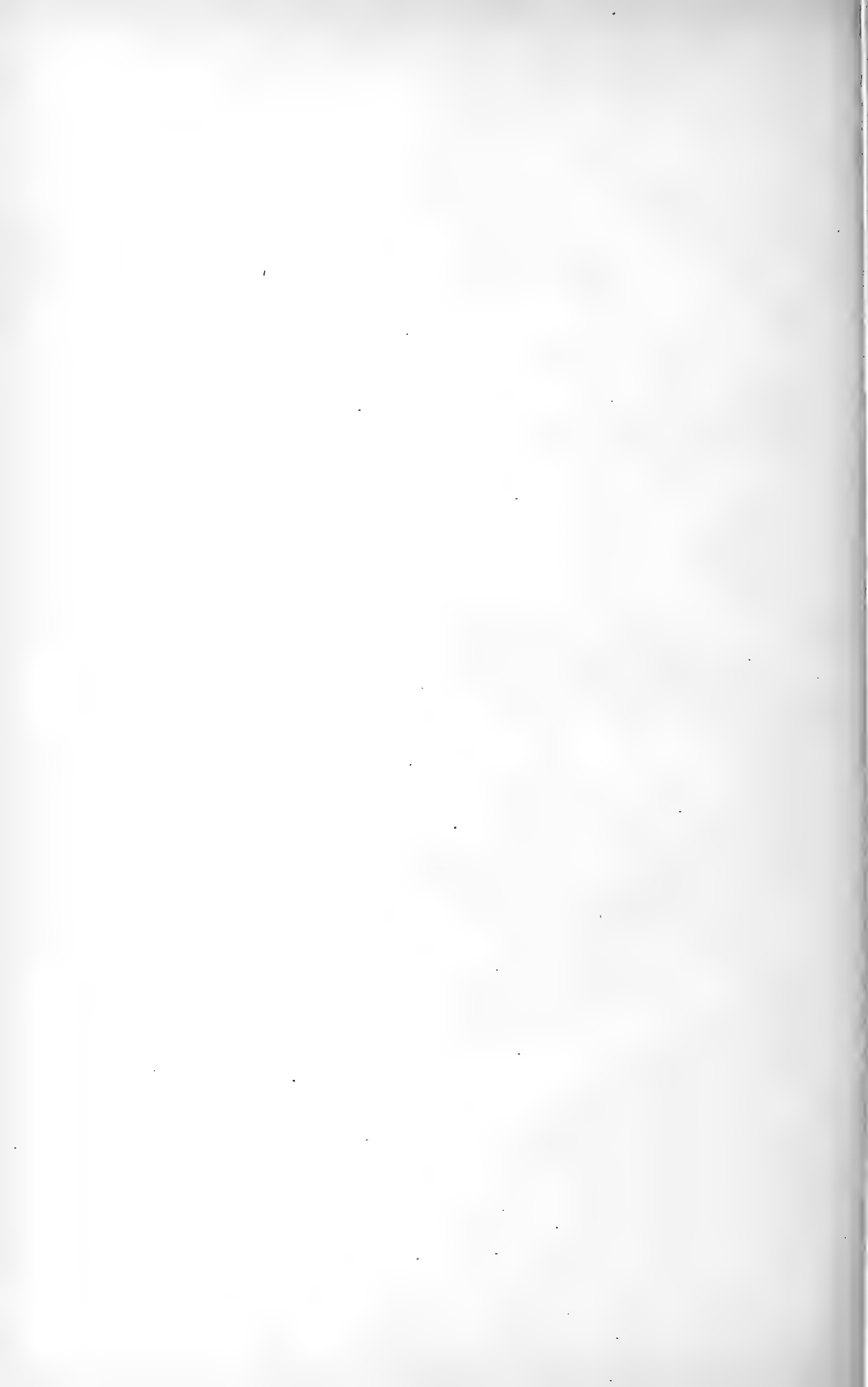
PLATE XLIV.

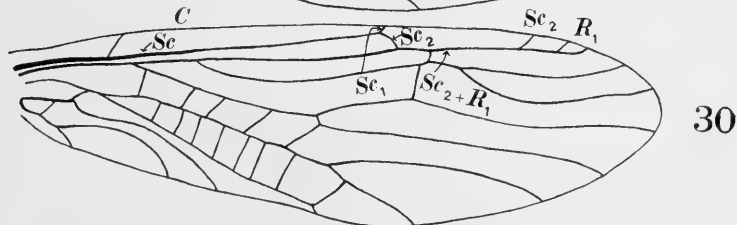
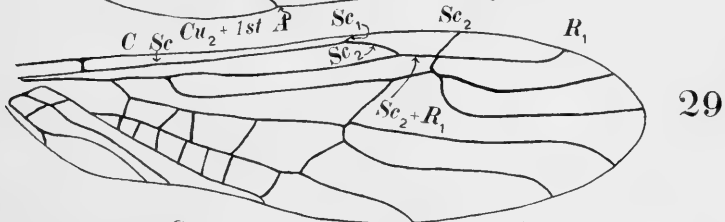
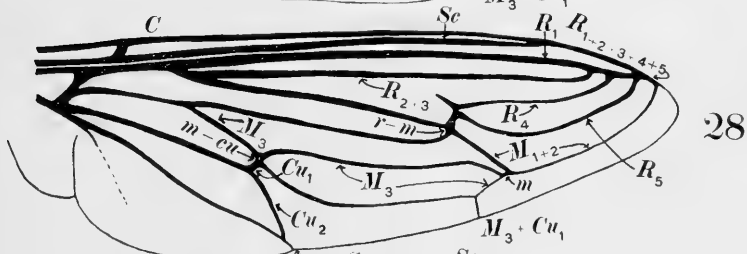
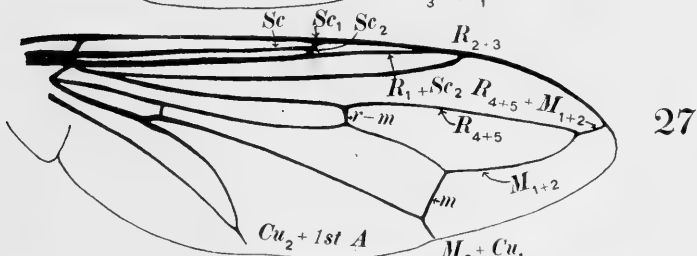
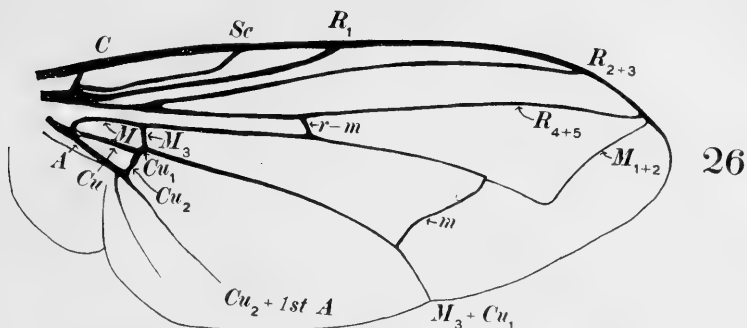
- FIG. 95. Wings of *Macrocephus satyrus*.
96. Wings of *Cephus pygmaeus*.
97. Wings of *Oryssus abietinus*.



WINGS OF PANTARBES, ERAX, TABANUS, SCENOPINUS, AND RHAMPHOMYIA.

FOR EXPLANATION OF PLATE SEE PAGE 651.

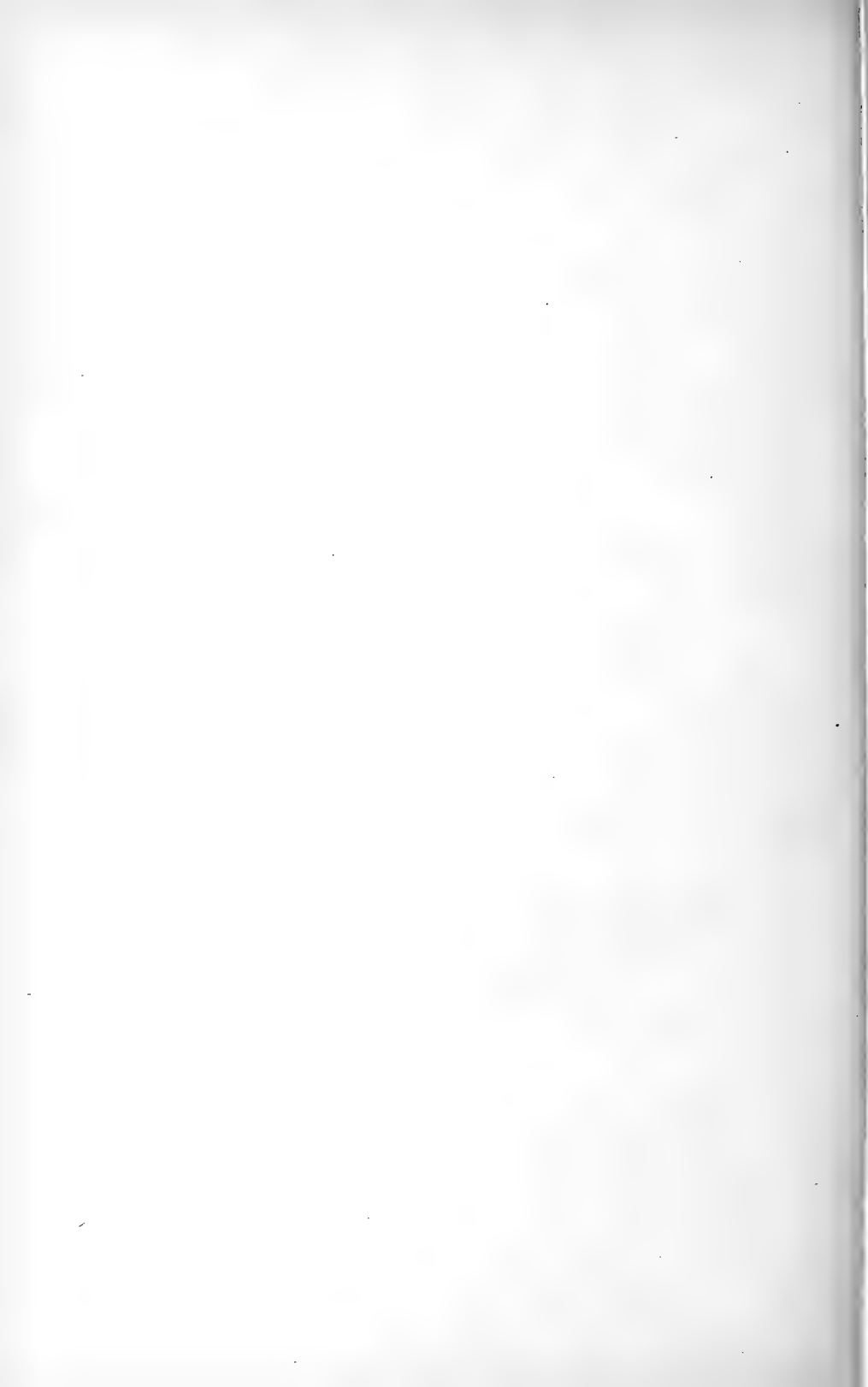


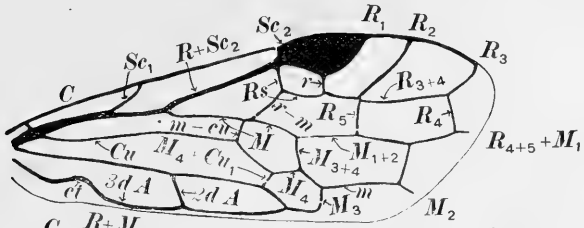


WINGS OF MUSCA, CONOPS, MIDAS, NEMOURA, AND TÆNIPTERYX.

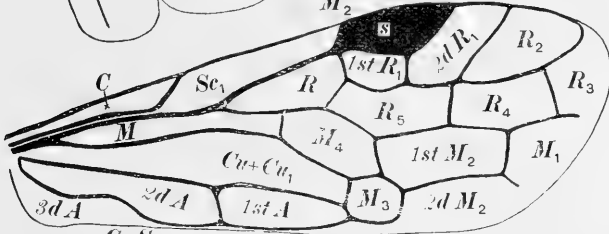
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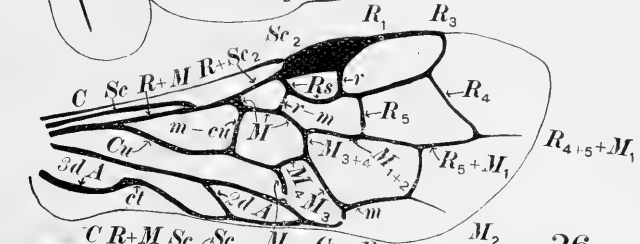




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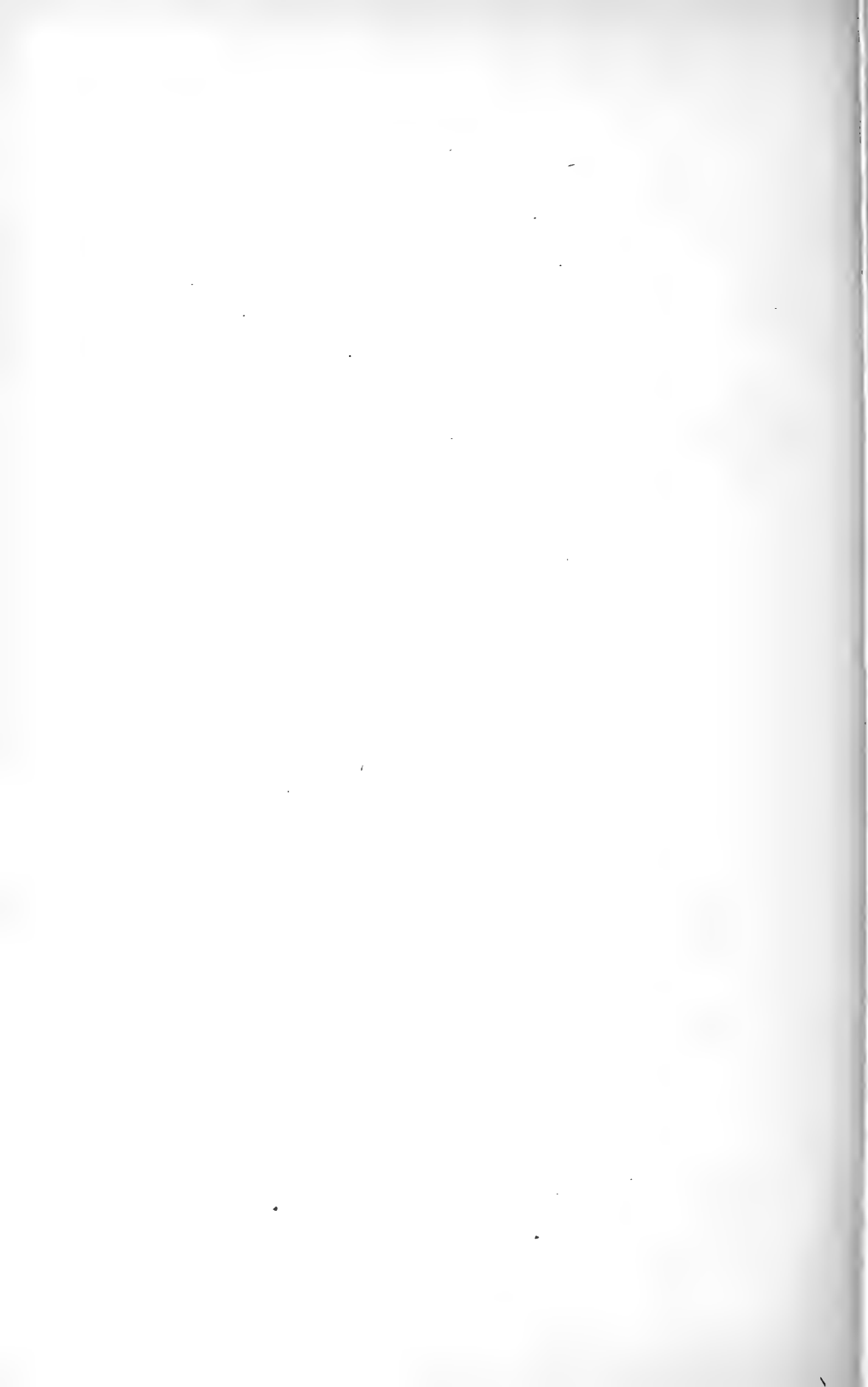
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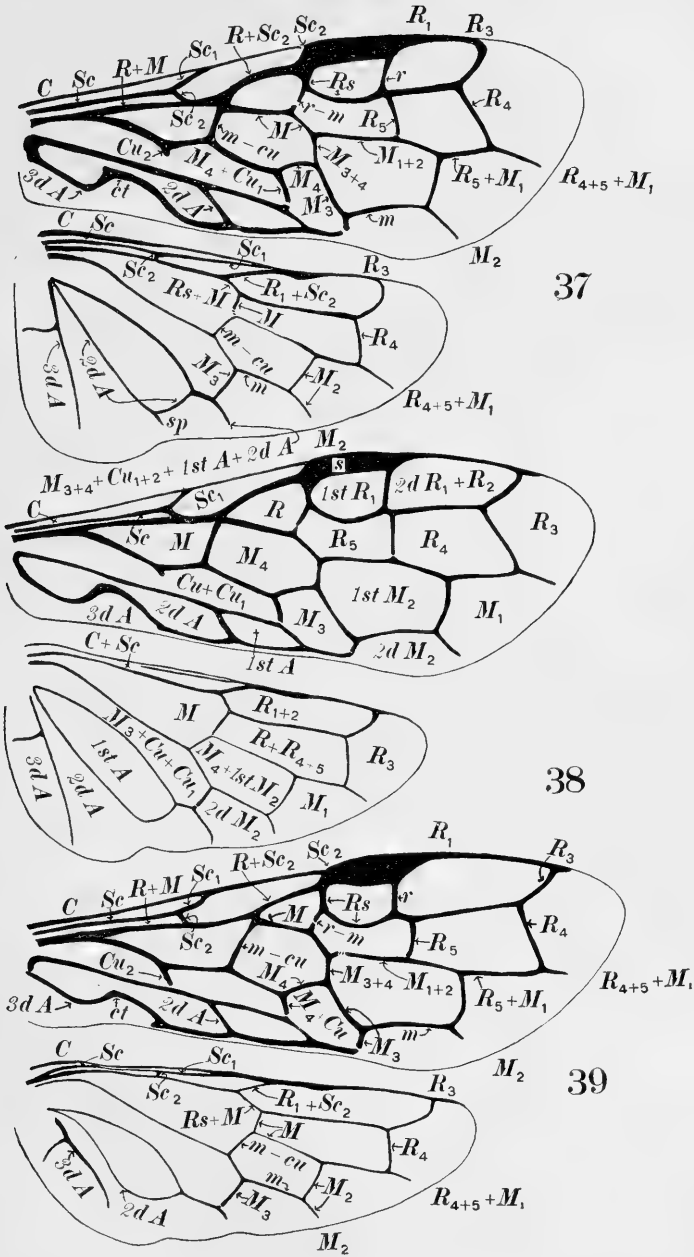


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WINGS OF MANOXYELA, XYELA, AND NEUROTOMA

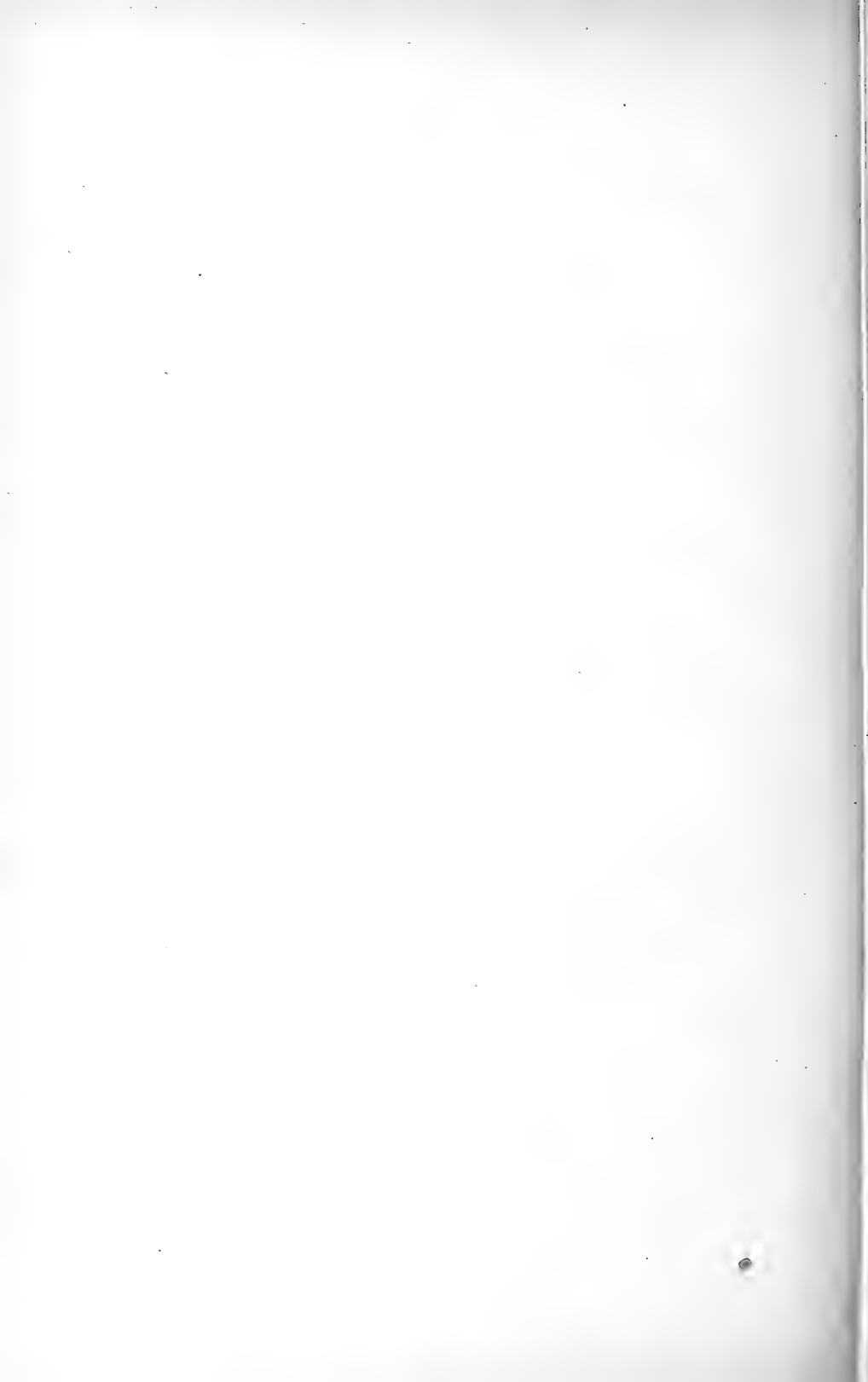
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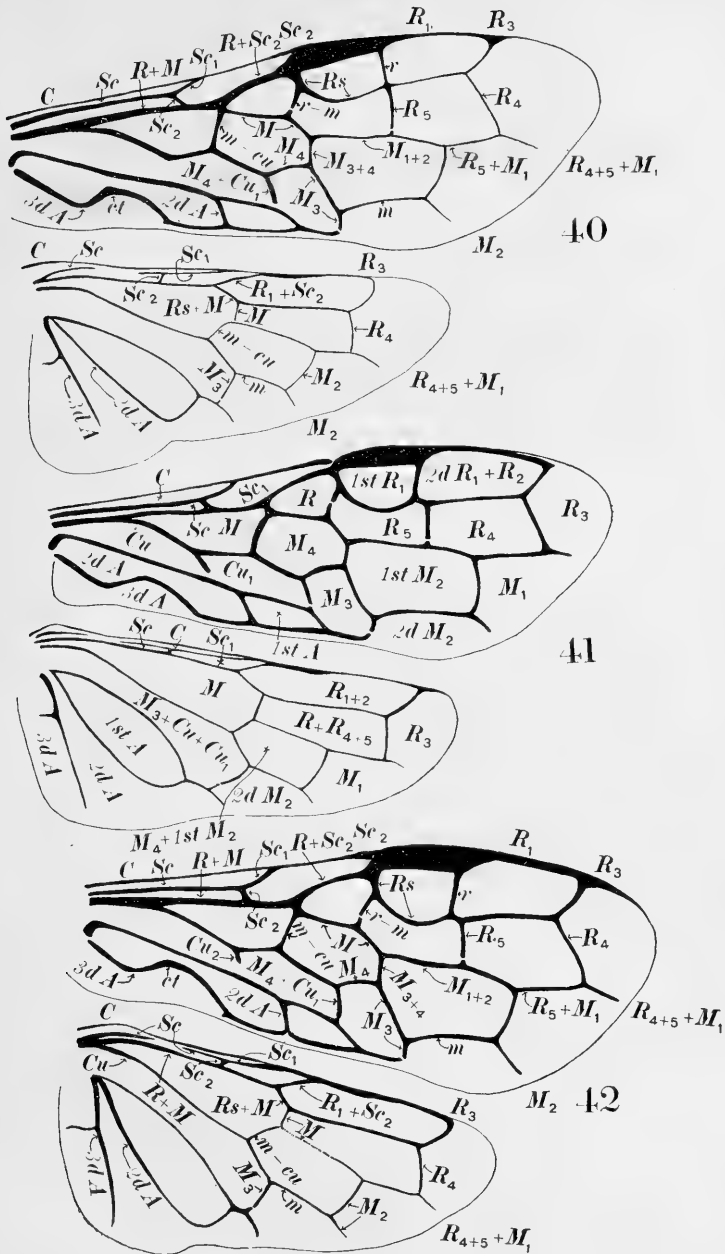




WINGS OF LYDA, CÆNOLYDA, AND PAMPHILIUS.

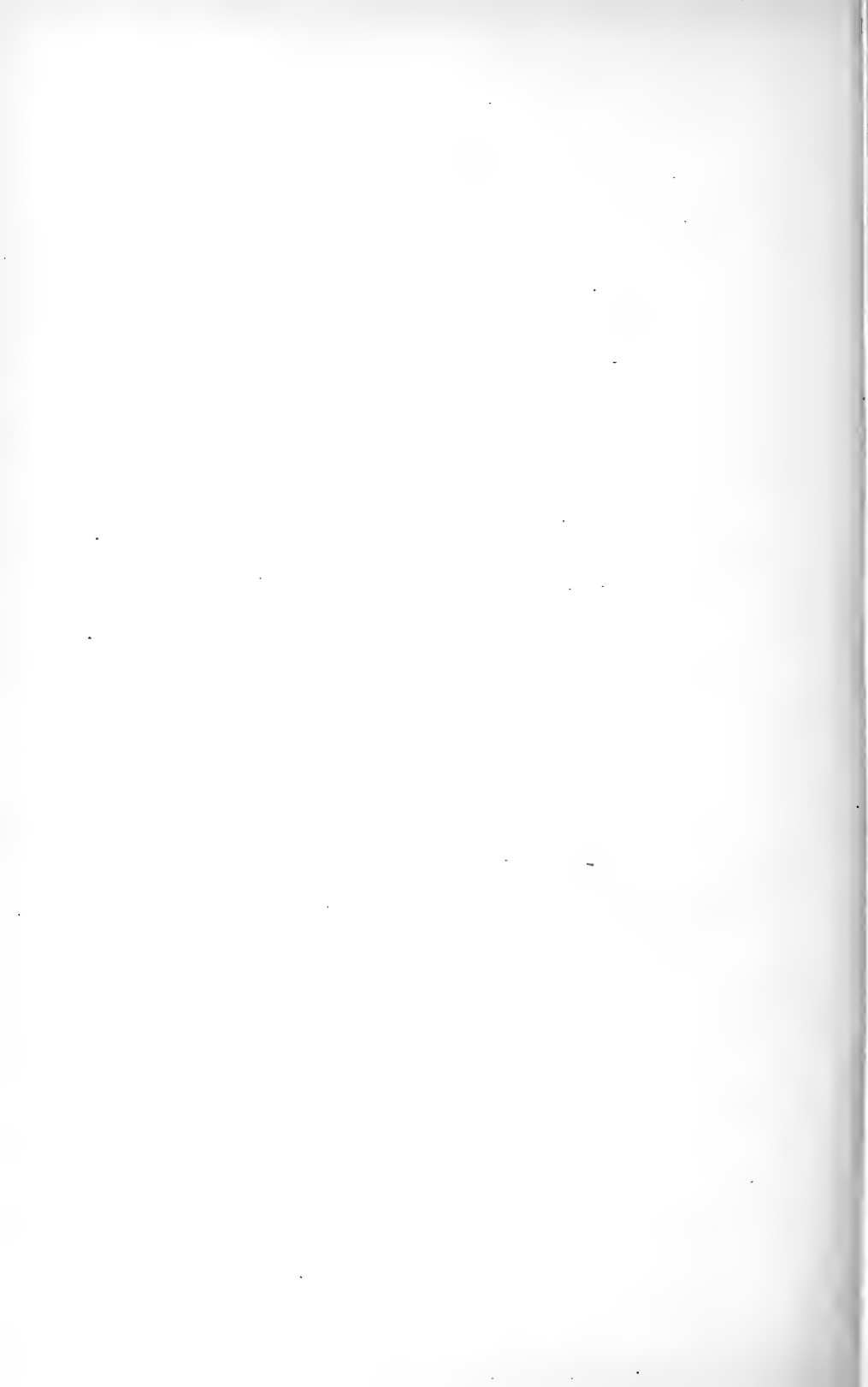
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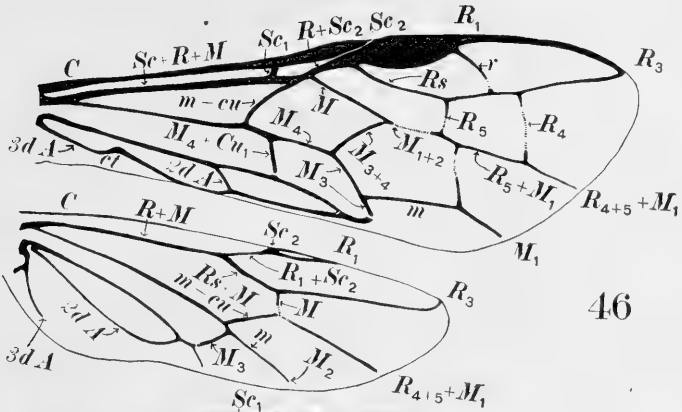


WINGS OF ITYORSIA, BACTROCEROS, AND CEPHEALEIA.

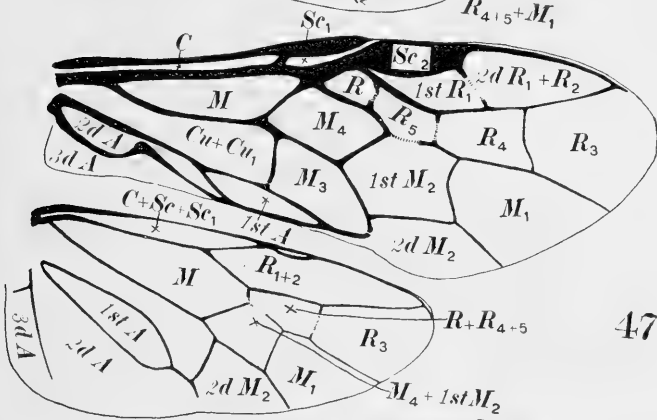
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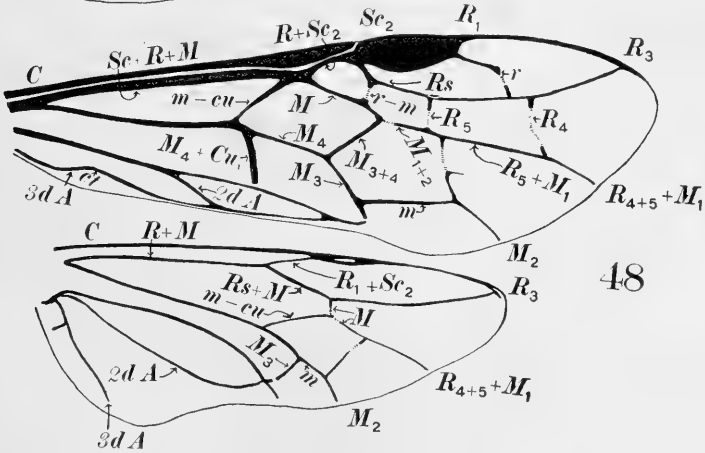




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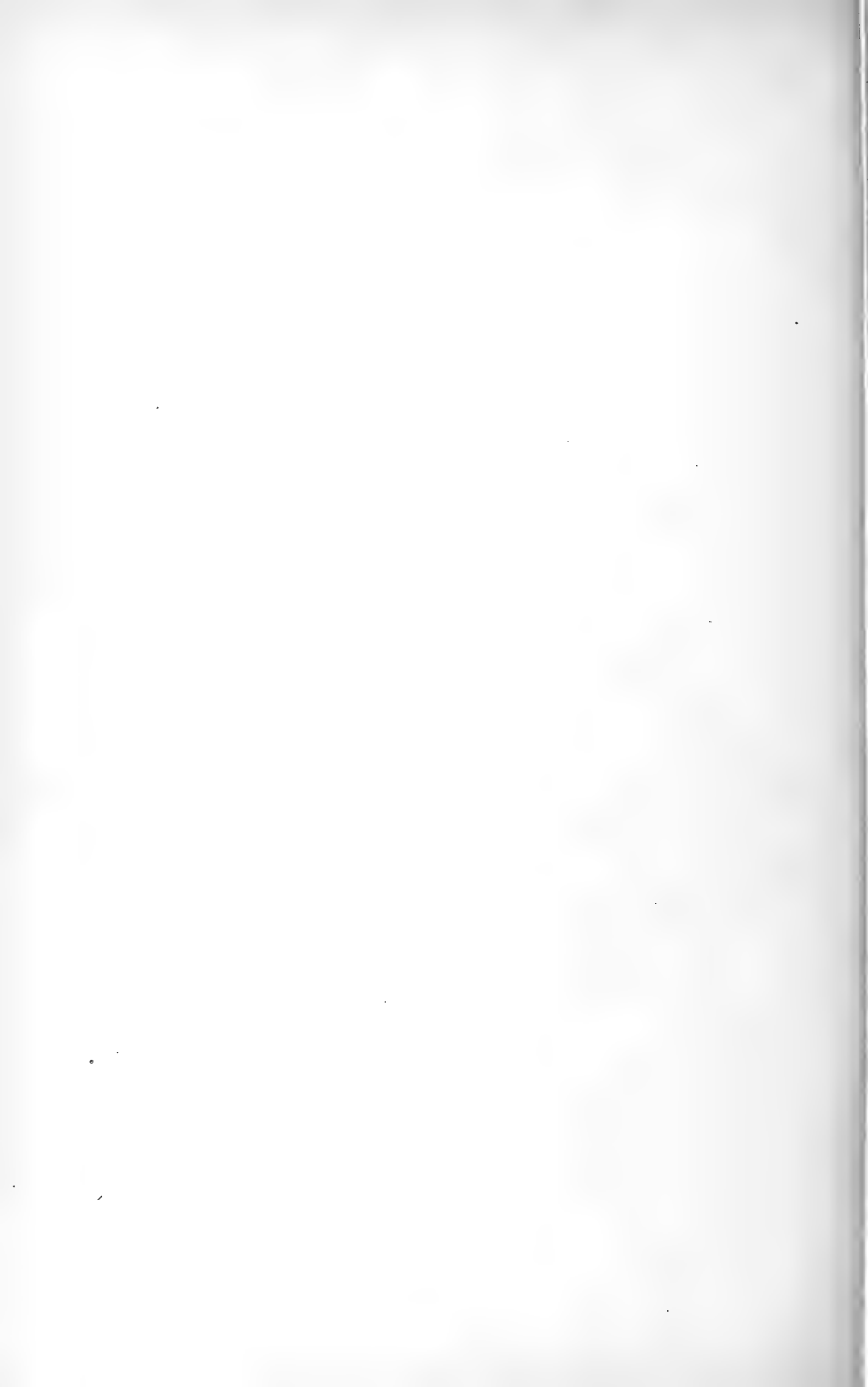
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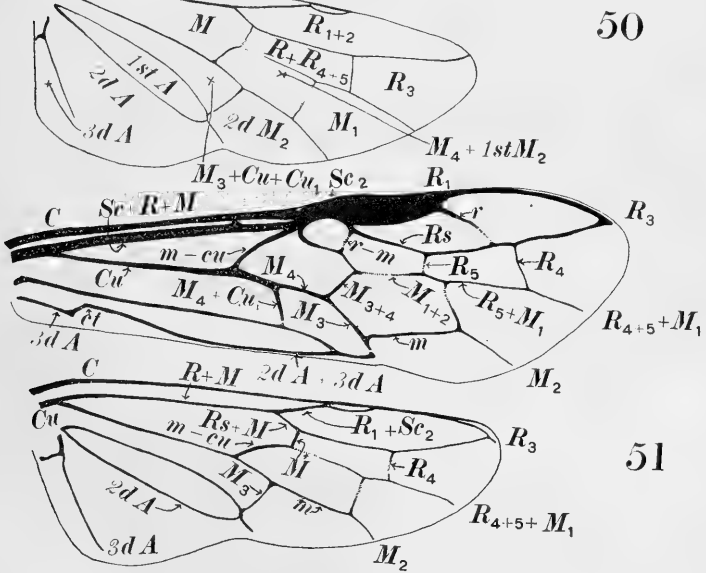
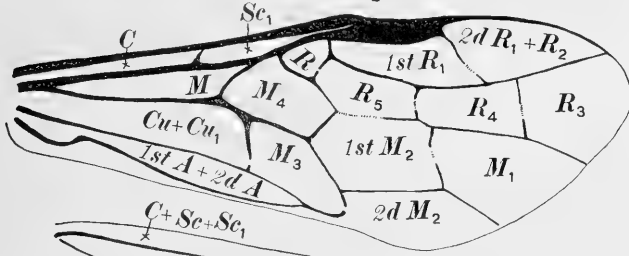
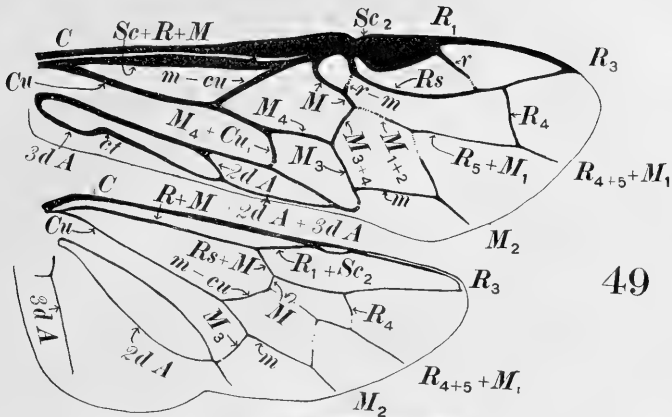


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WINGS OF EMPHYTUS, ERIOCAMPA, AND PSEUDOSIOBLA.

FOR EXPLANATION OF PLATE SEE PAGE 652.

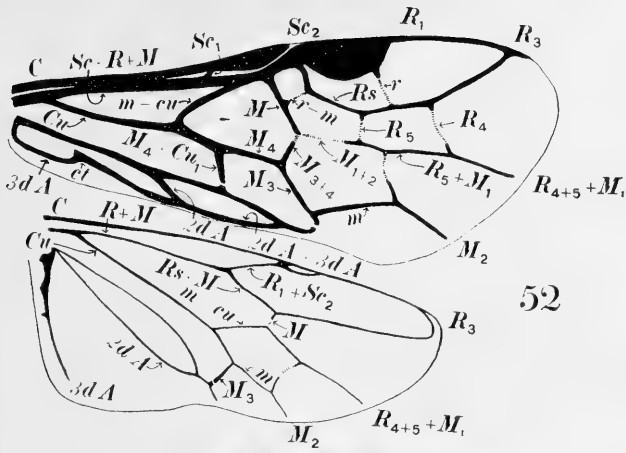




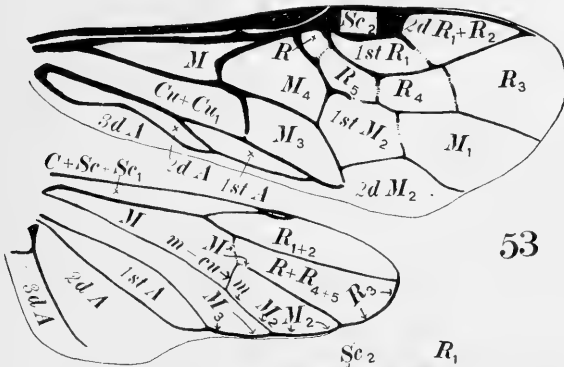
WINGS OF DOLERUS, STROMBOCEROS, AND STRONGYLOGASTER.

FOR EXPLANATION OF PLATE SEE PAGE 652.

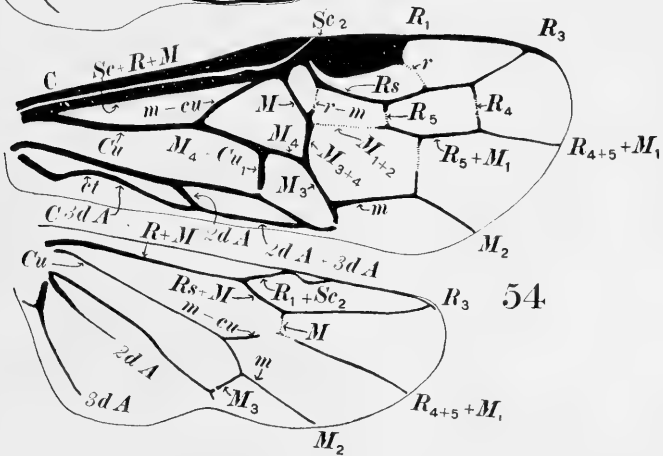




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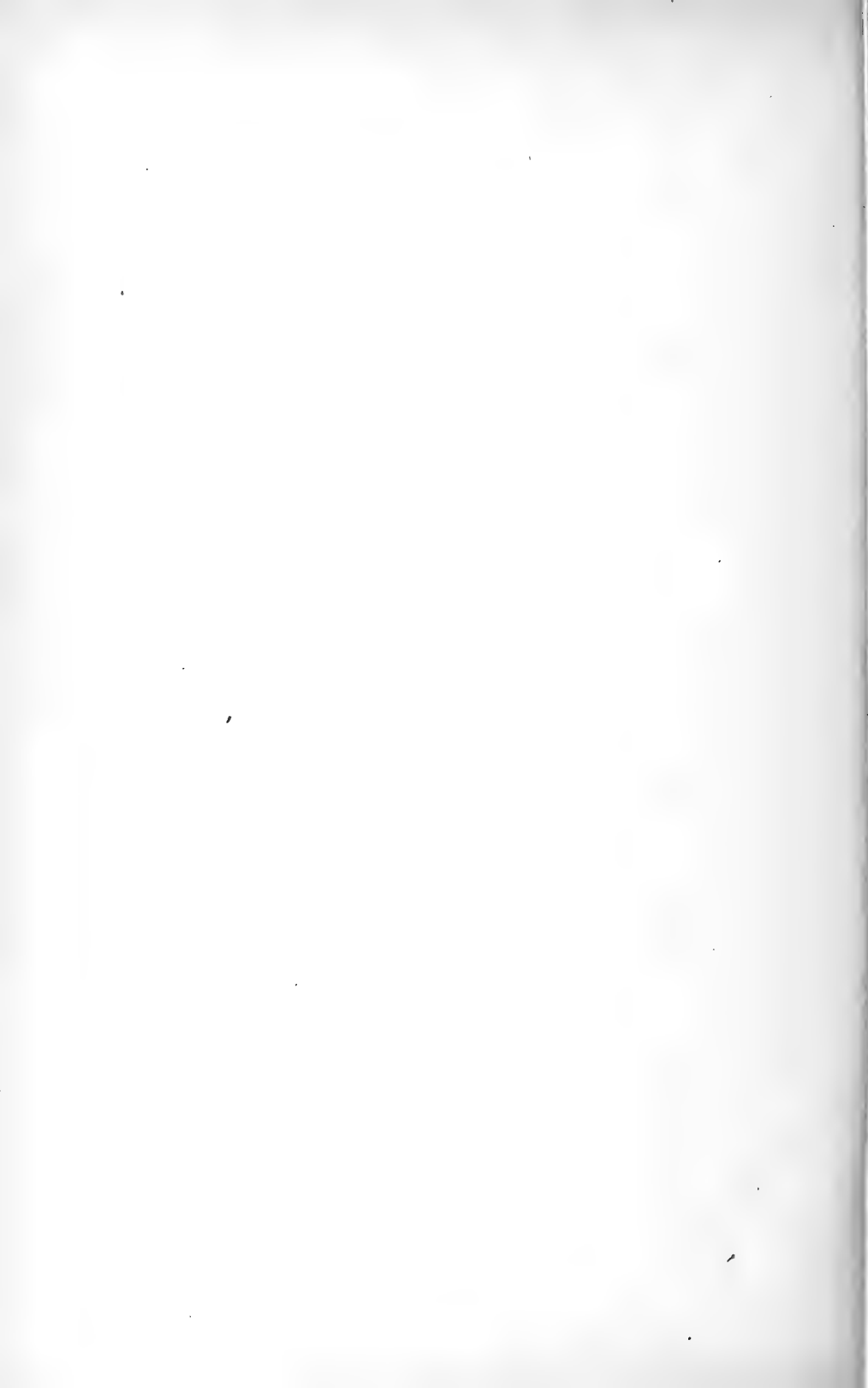
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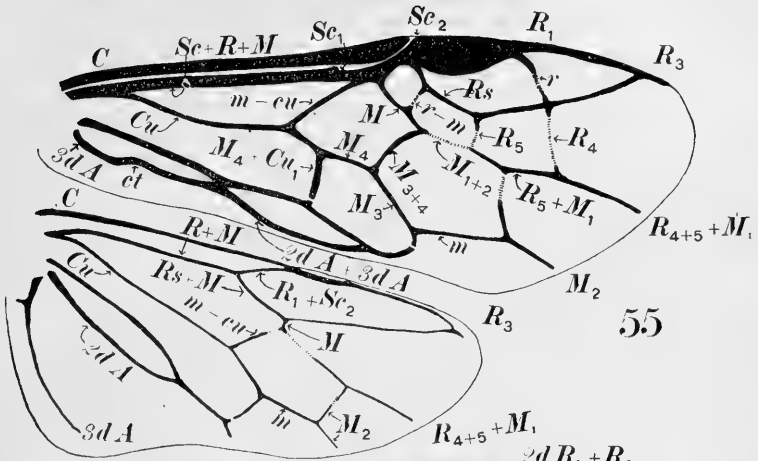


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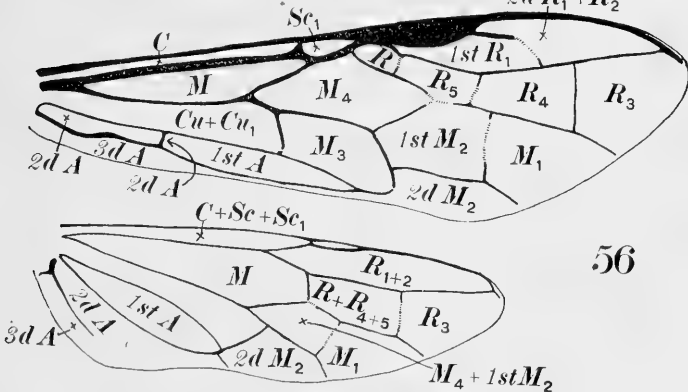
WINGS OF ERIOCAMPOIDES AND PHYLLOSTOMA.

FOR EXPLANATION OF PLATE SEE PAGE 652.

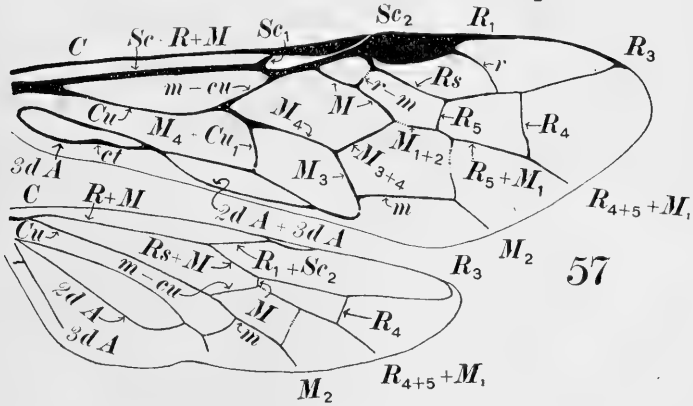




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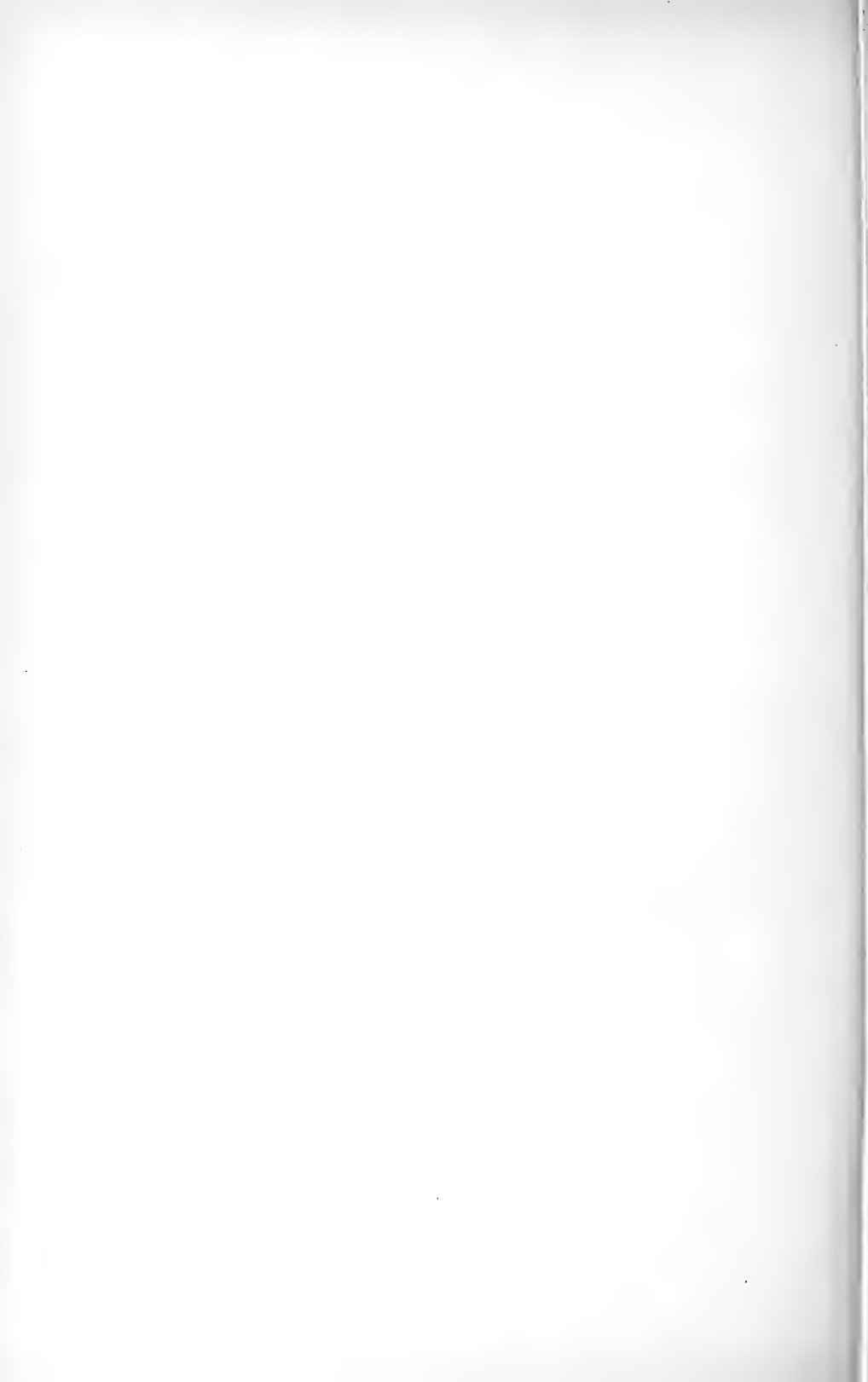
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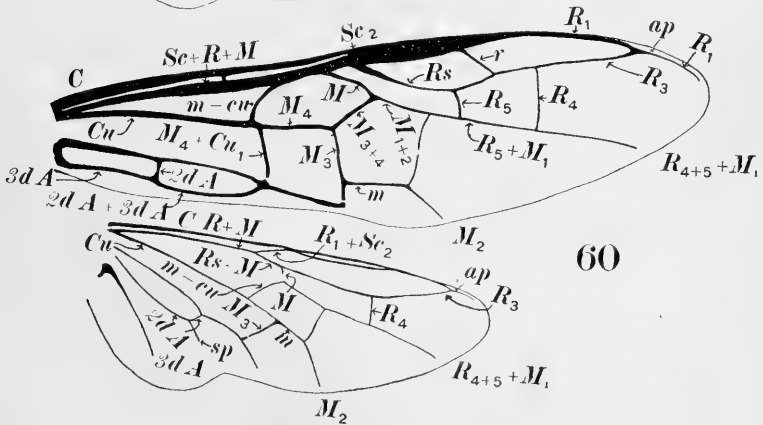
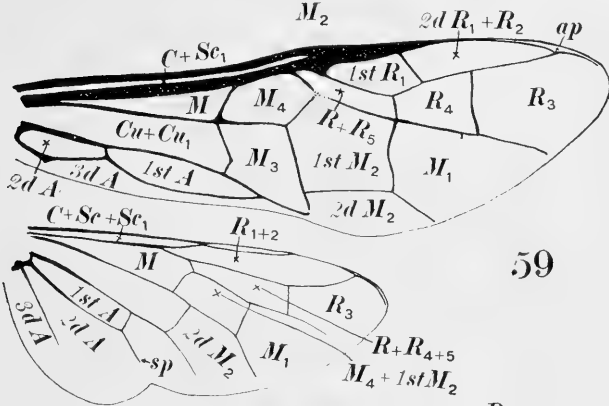
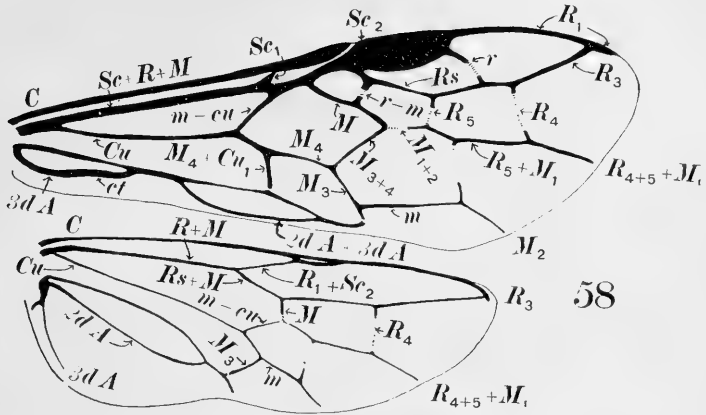


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WINGS OF LYCAOTA, TENTHREDO, AND MACROPHYA.

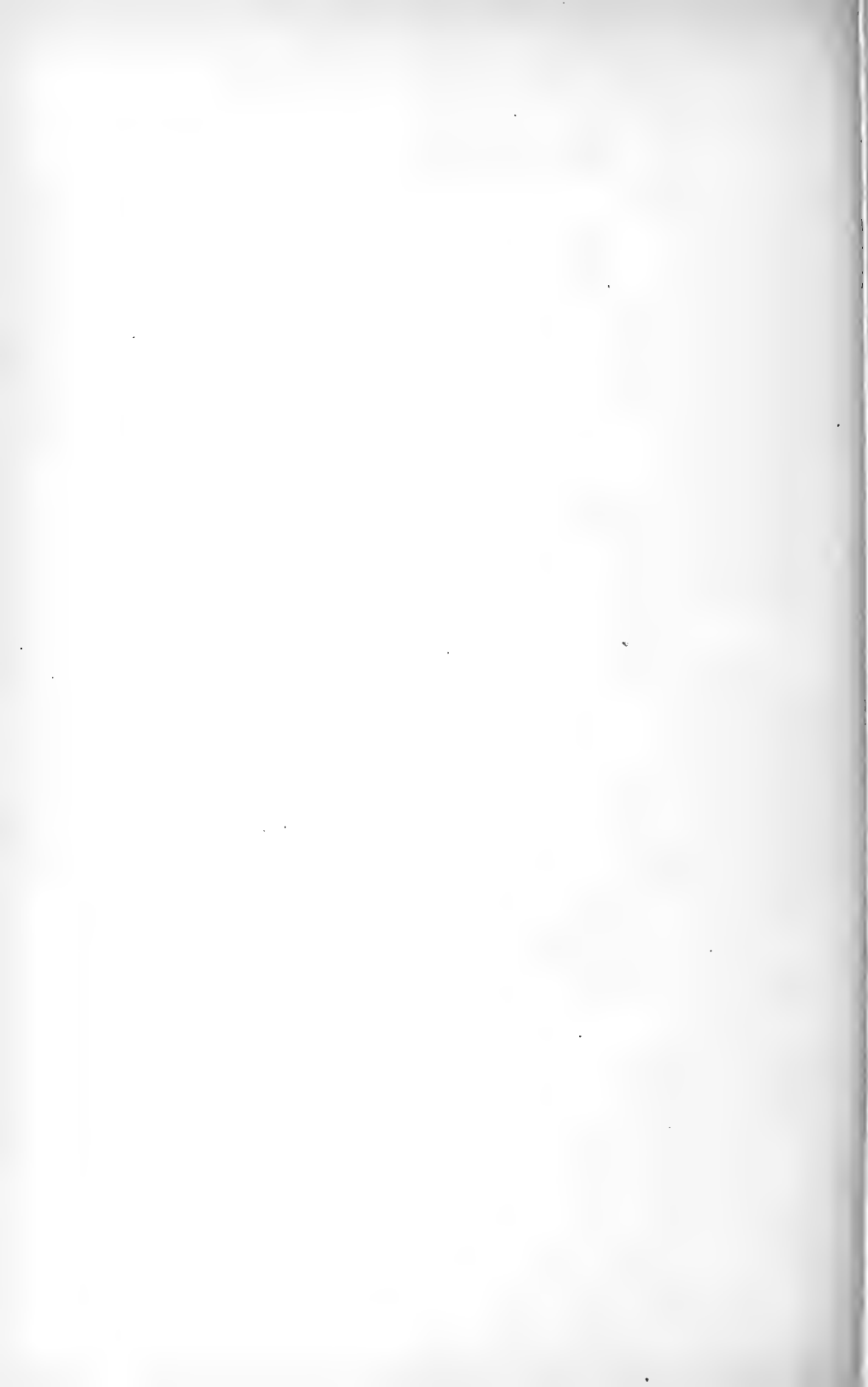
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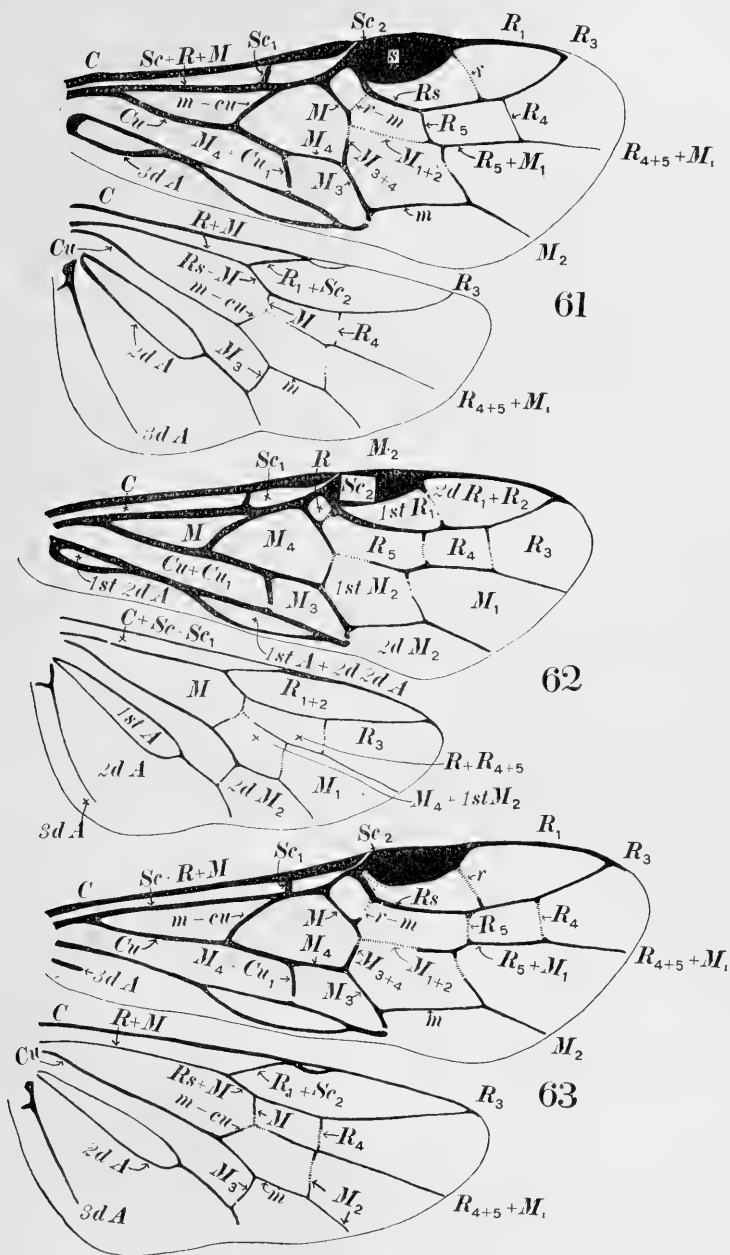




WINGS OF PACHYPROTASIS, TRICHIOSOMA, AND CLAVELLARIA.

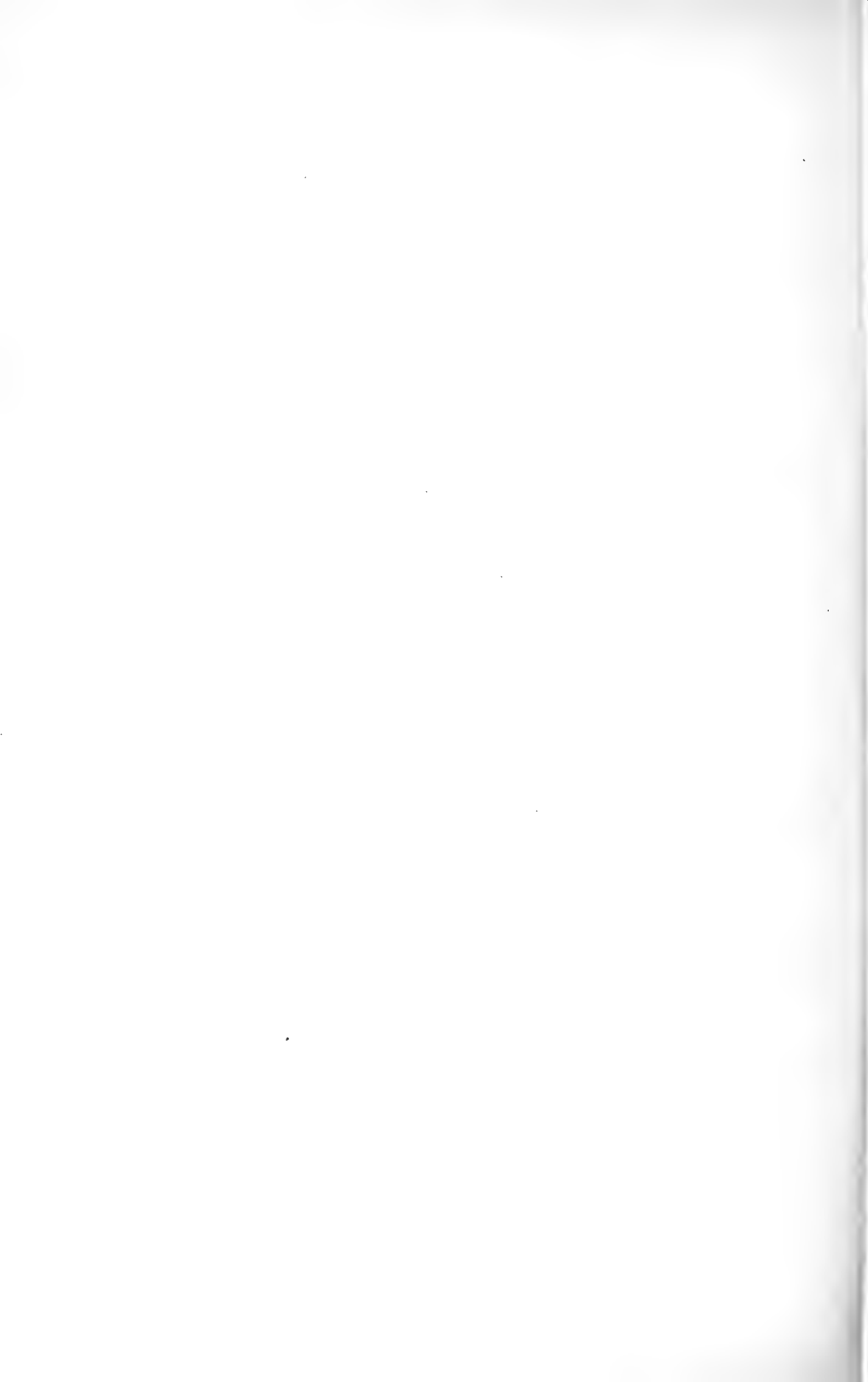
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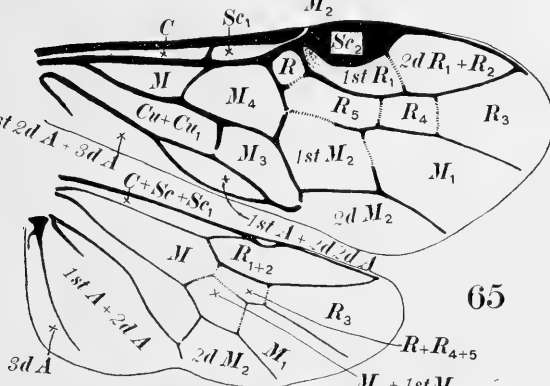
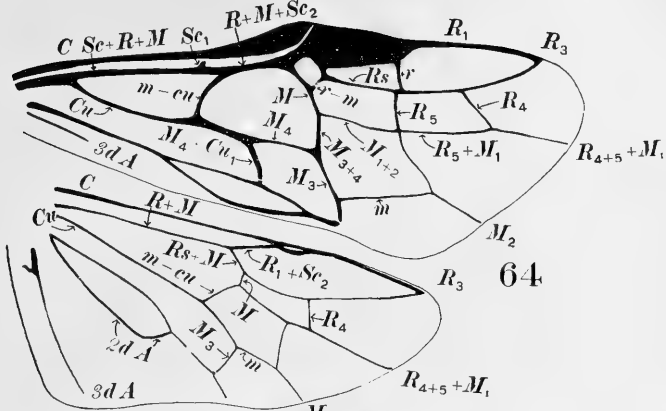




WINGS OF HOPLOCAMPA, HEMICHRÖA, AND DINEURA.

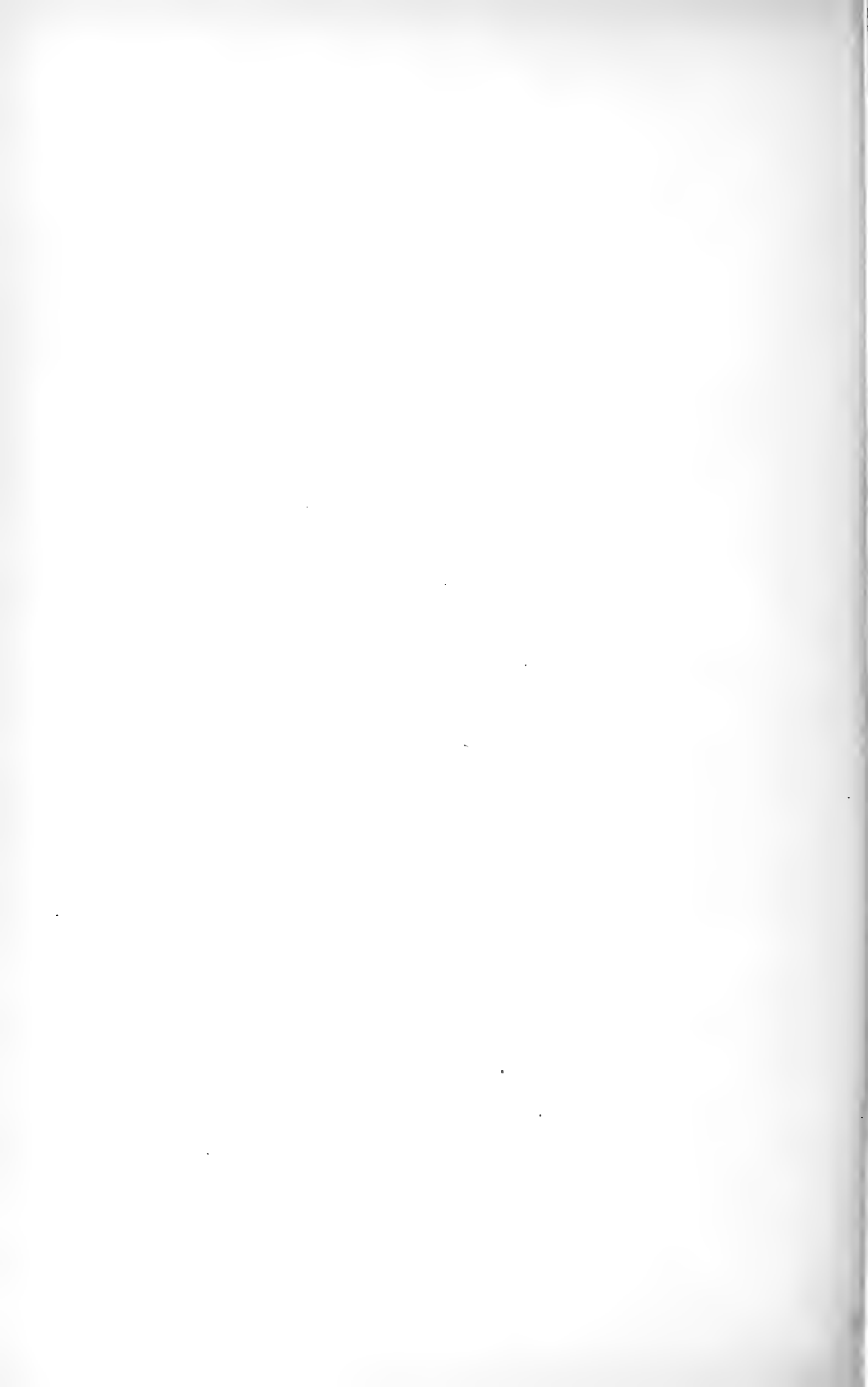
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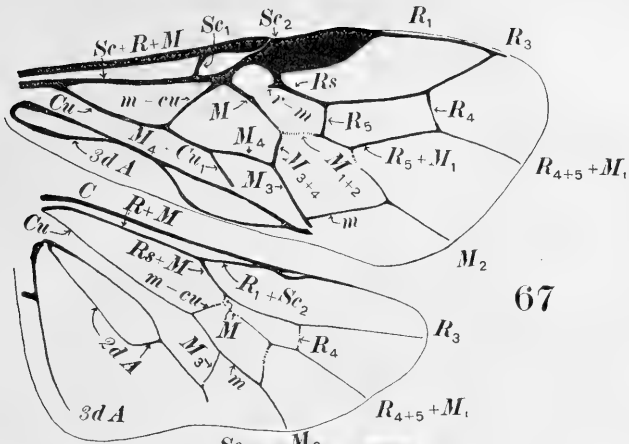




WINGS OF MESONEURA, PSEUDODINEURA, AND CLADIUS.

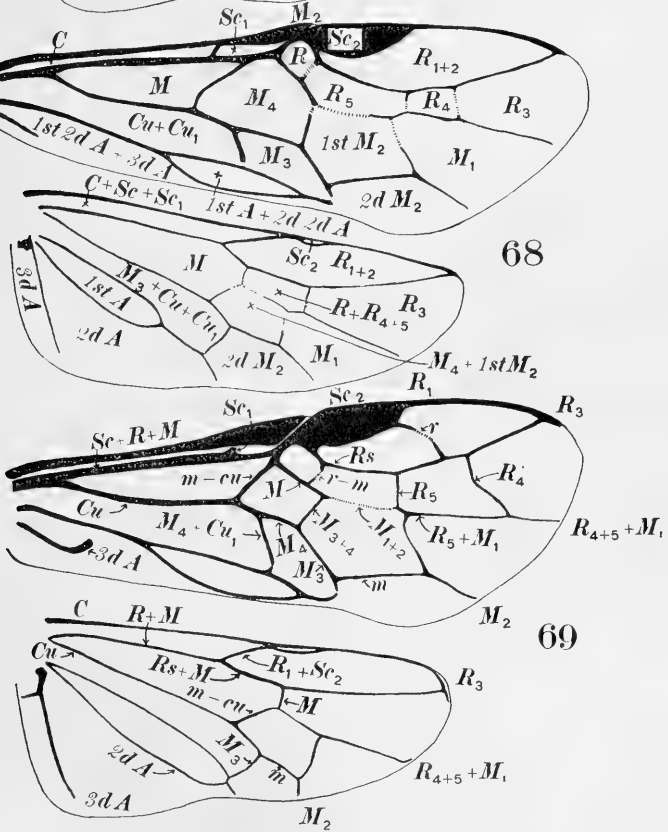
FOR EXPLANATION OF PLATE SEE PAGE 653.





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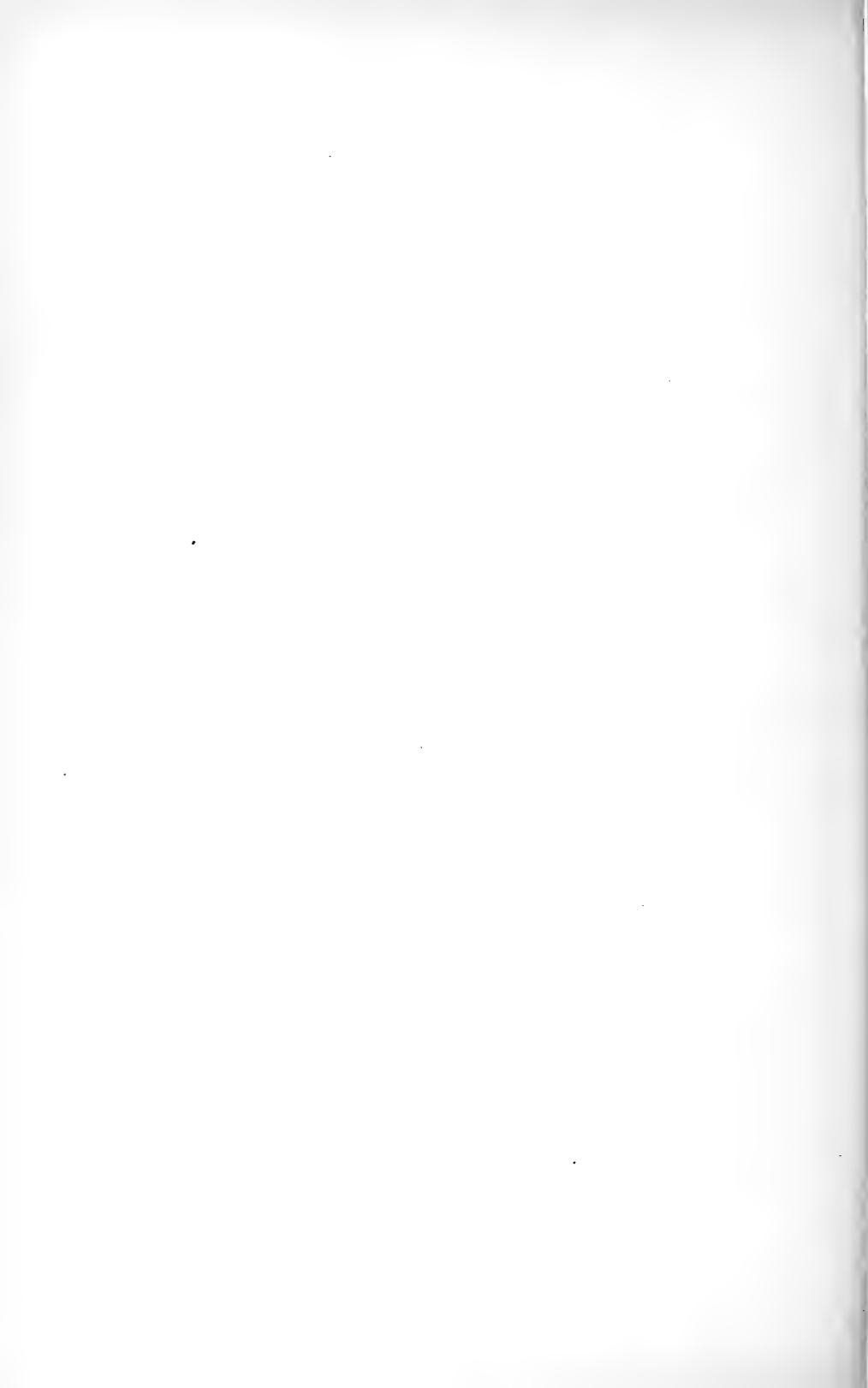


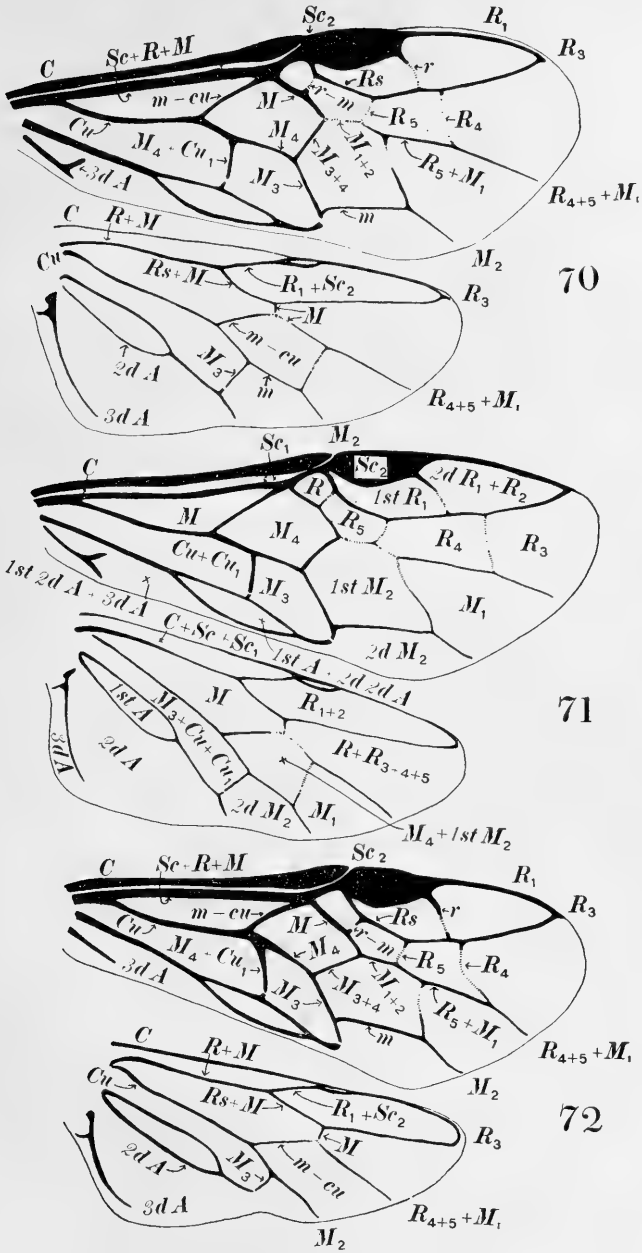
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WINGS OF MONOTENUS, PTERONUS, AND PERICLISTA.

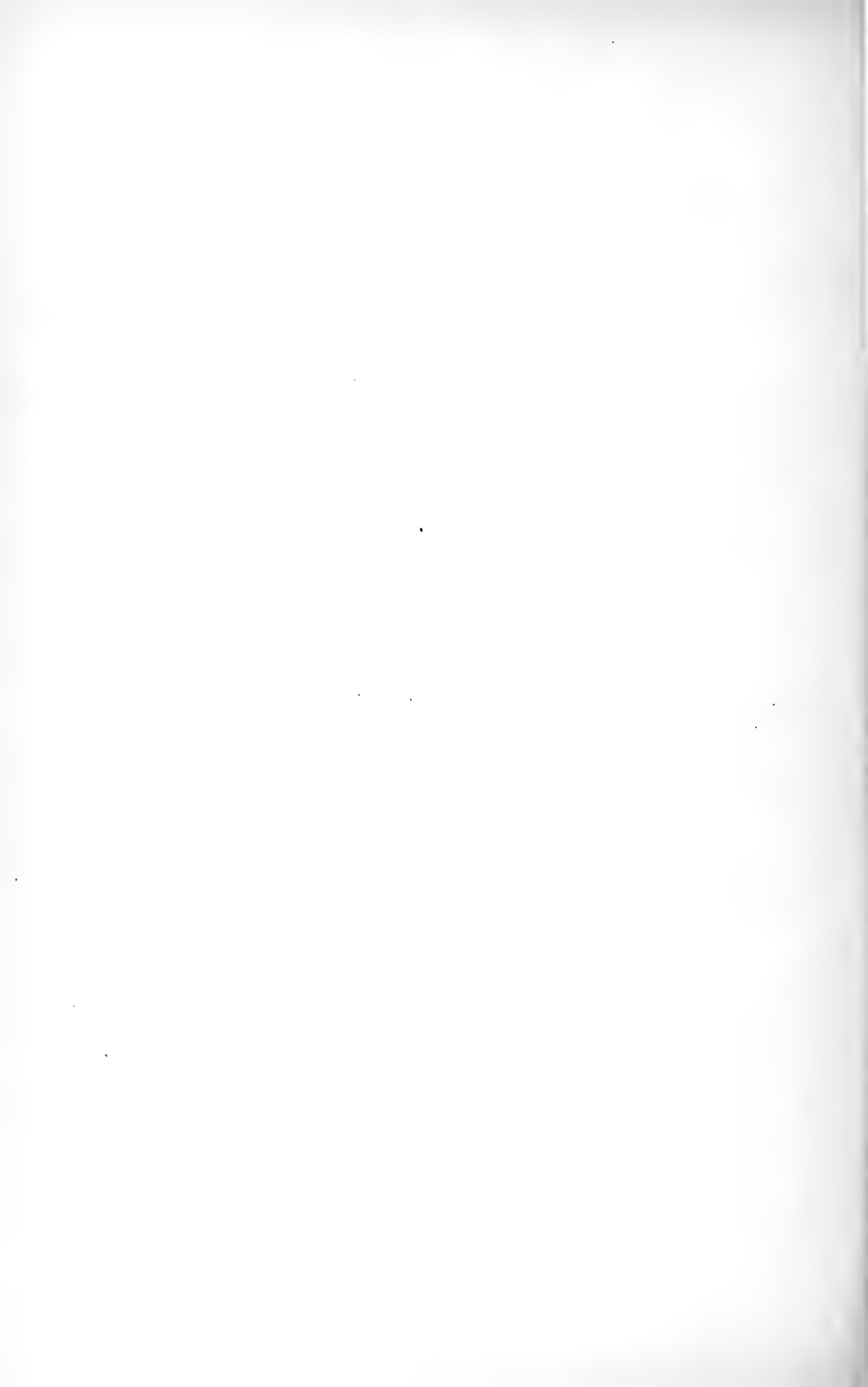
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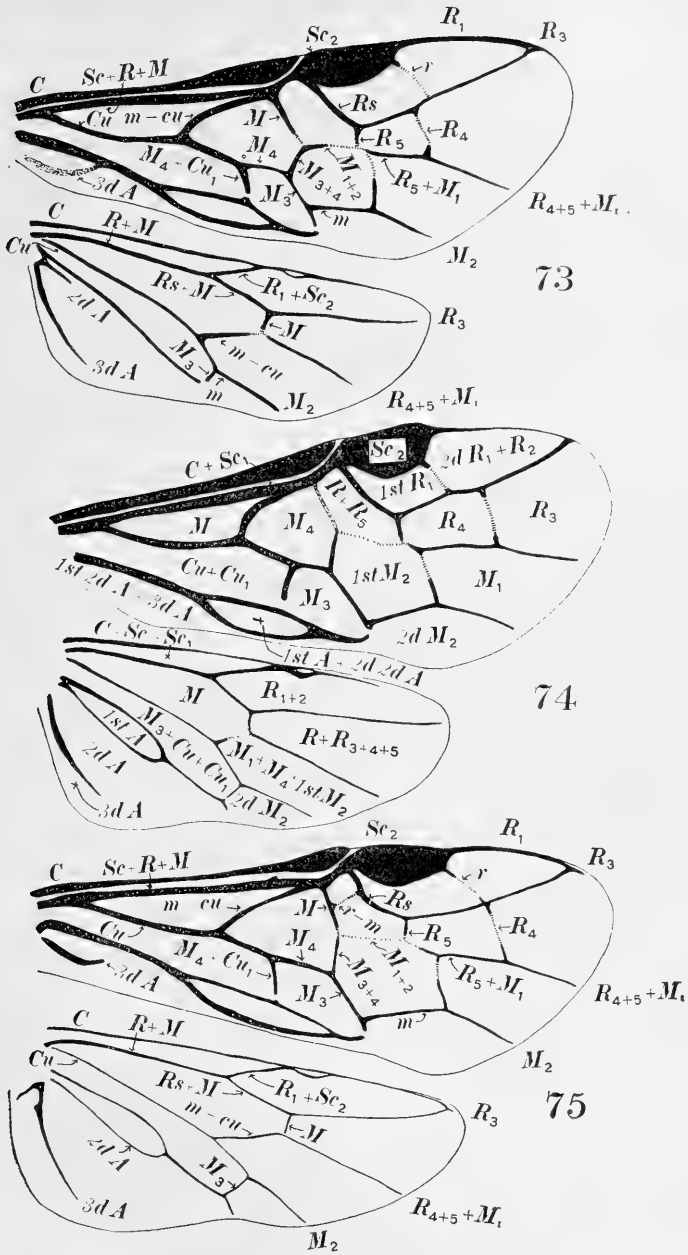




WINGS OF RHADINOCERÆA, PHYMATOCERA, AND BLENNOCAMPA.

FOR EXPLANATION OF PLATE SEE PAGE 653.

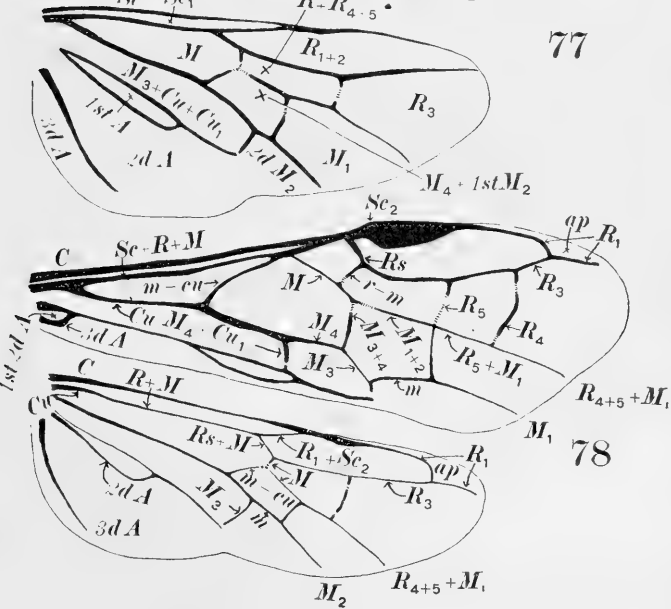
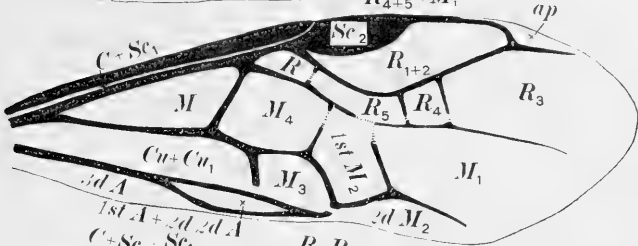
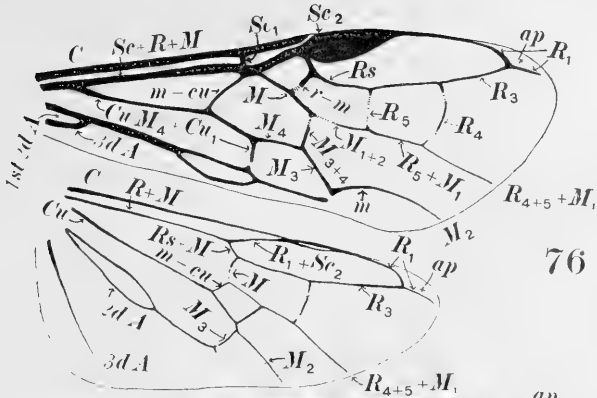




WINGS OF KALIOSYPHINGA, FENUSA, AND SCOLIONEURA.

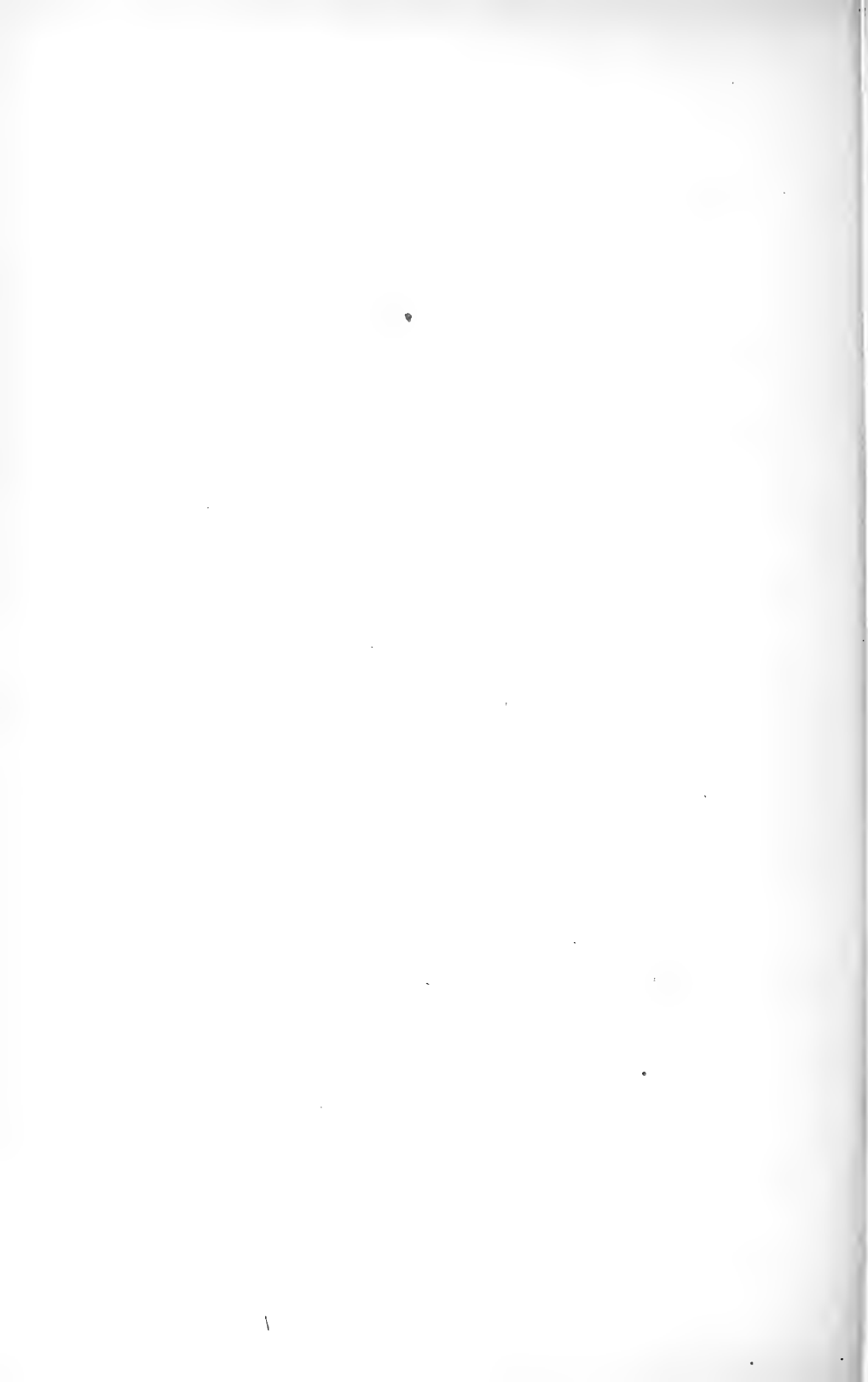
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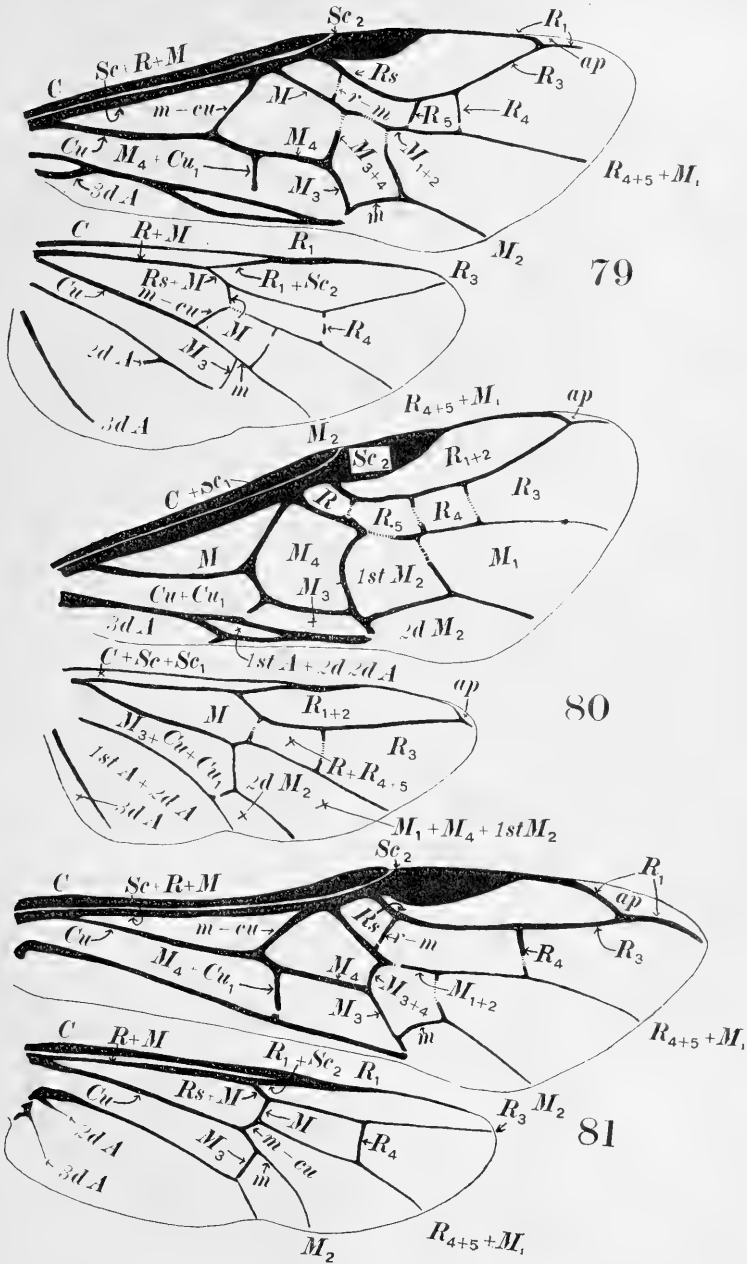




WINGS OF HYLOTOMA, PACHYLOTA, AND LABIDARGE.

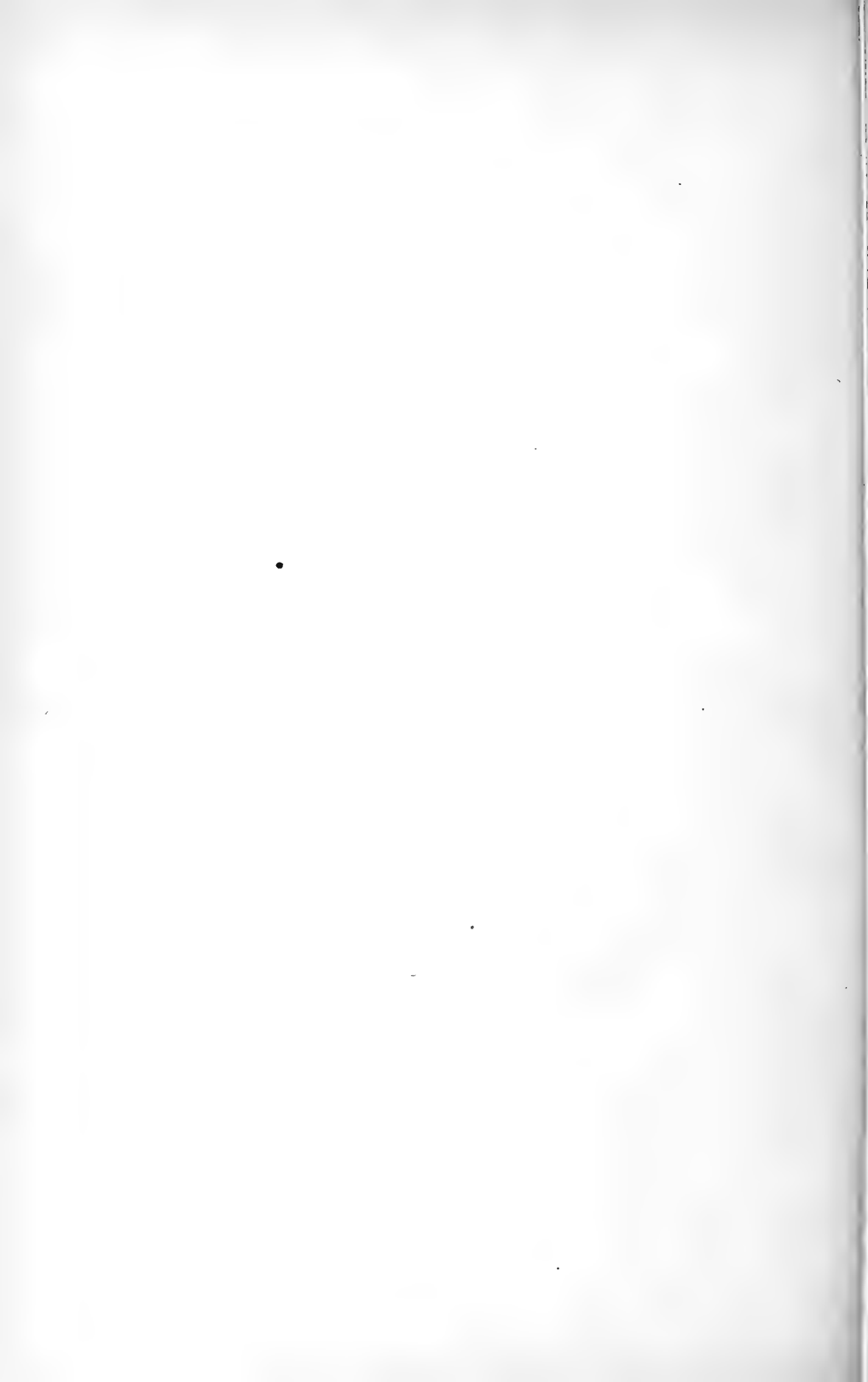
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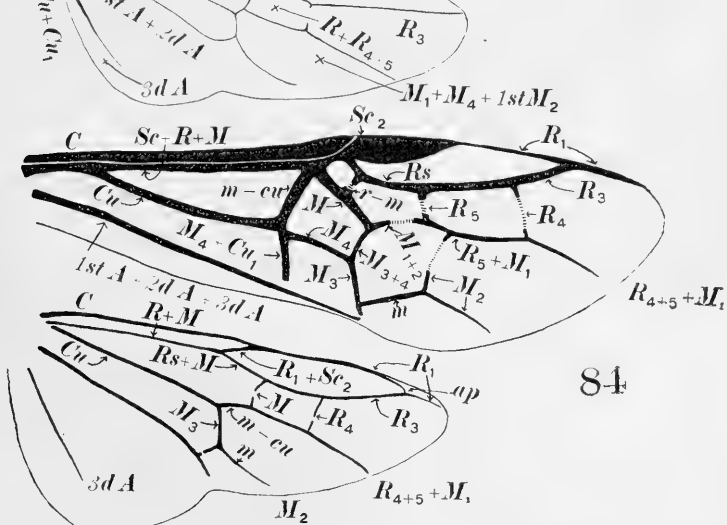
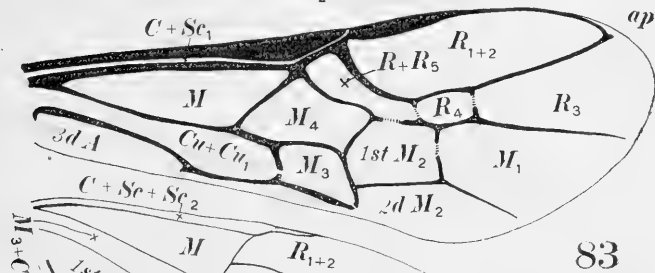
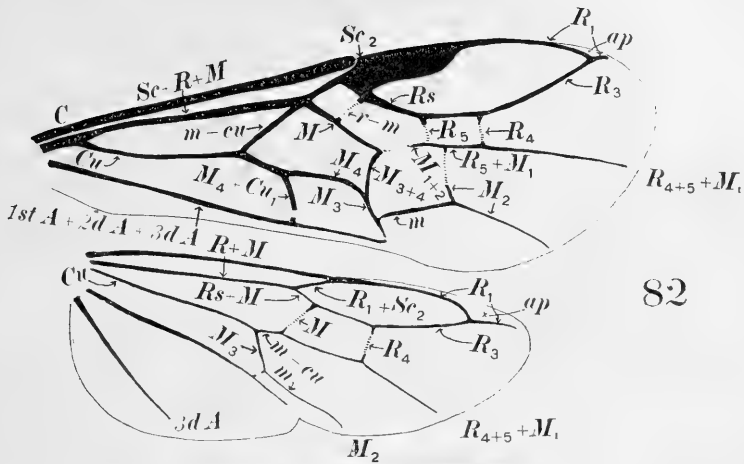




WINGS OF DIELOCERUS, PERREYIA, AND PTERYGOPHORUS.

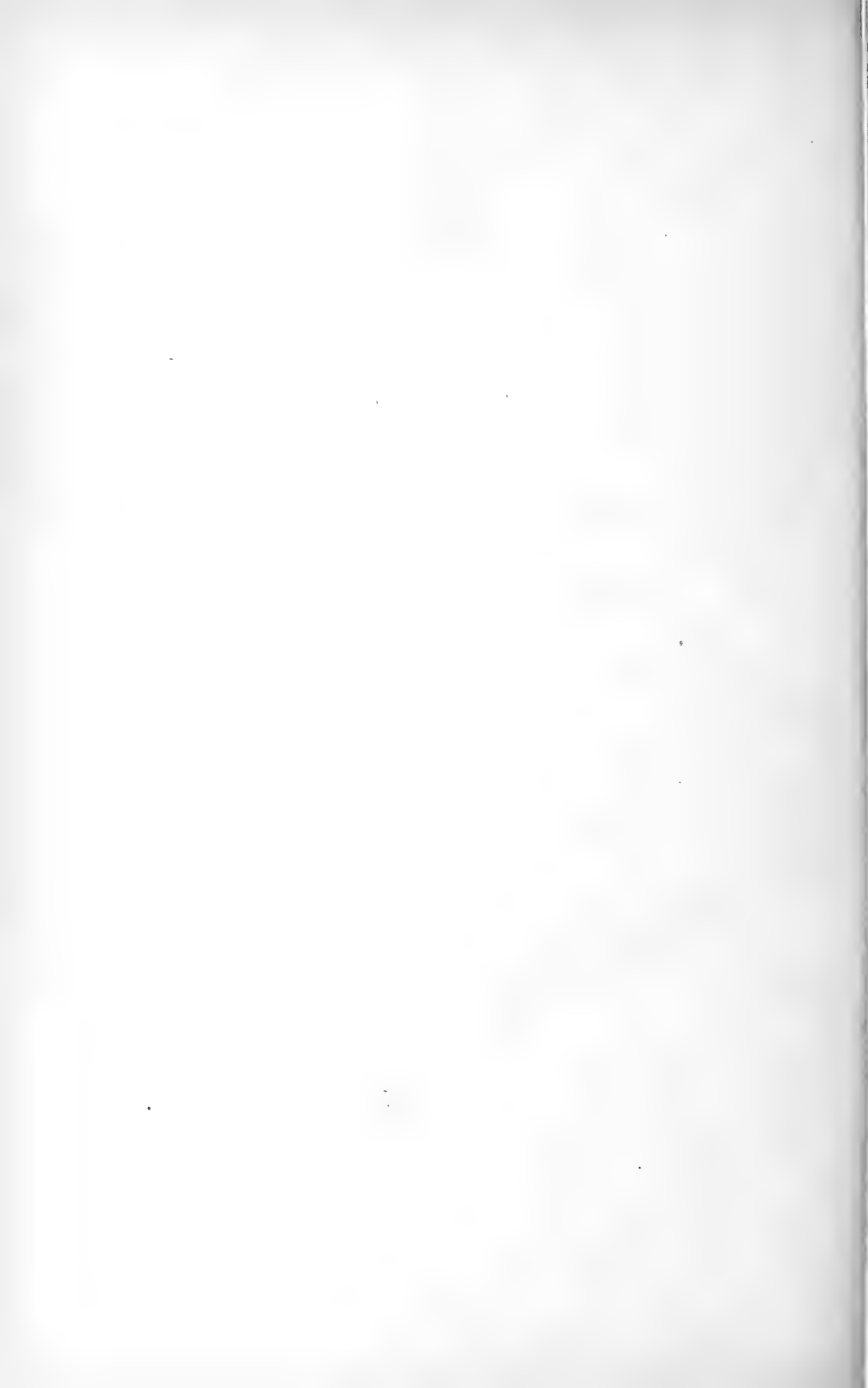
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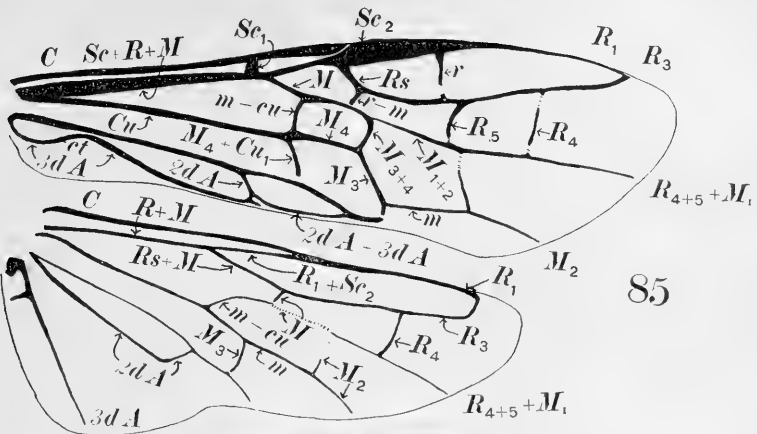




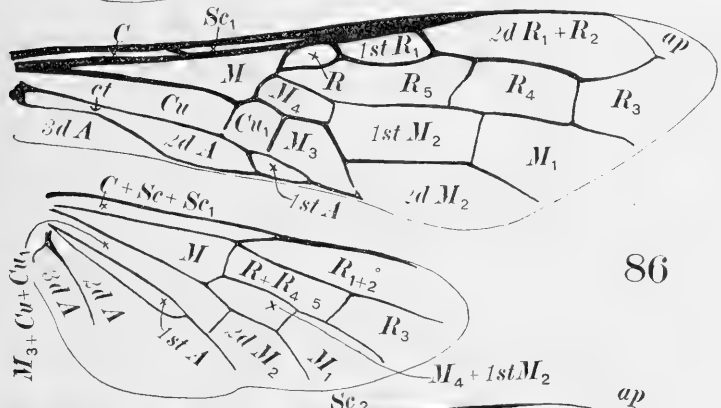
WINGS OF LOBOCERAS, ACORDULECERA, AND PERGA.

FOR EXPLANATION OF PLATE SEE PAGE 653.

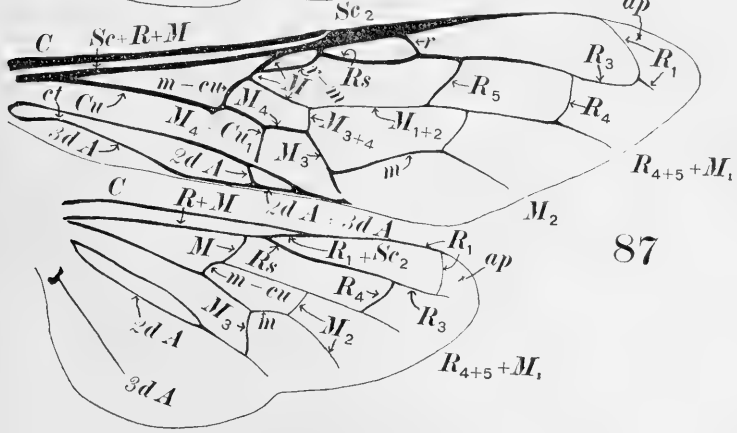




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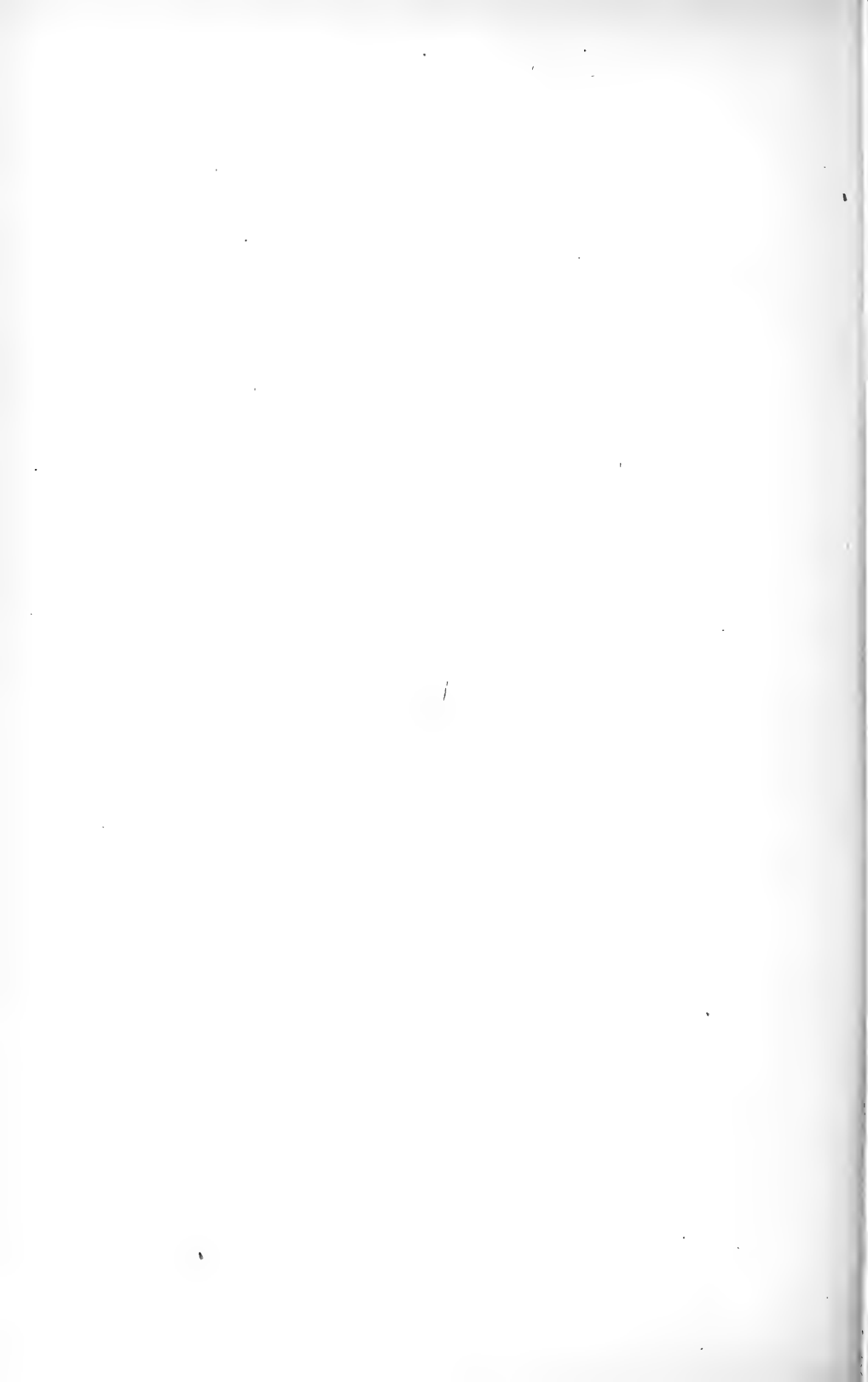
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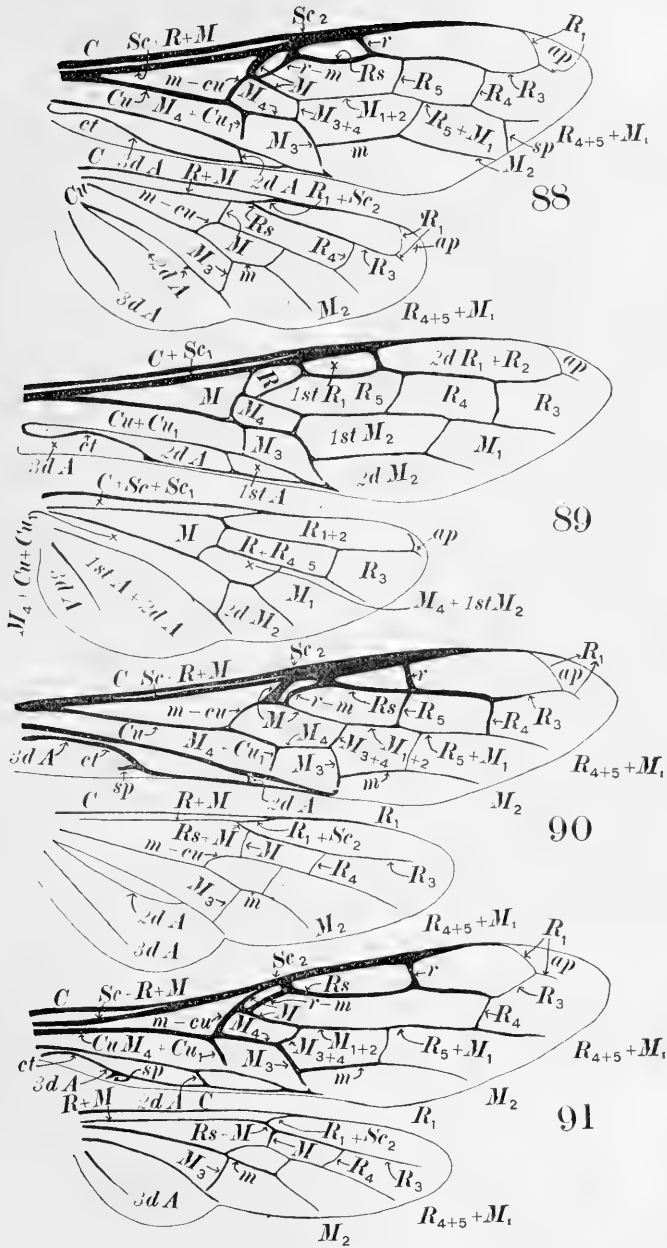


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WINGS OF XIPHYDRIA, PAURURUS, AND SIREX.

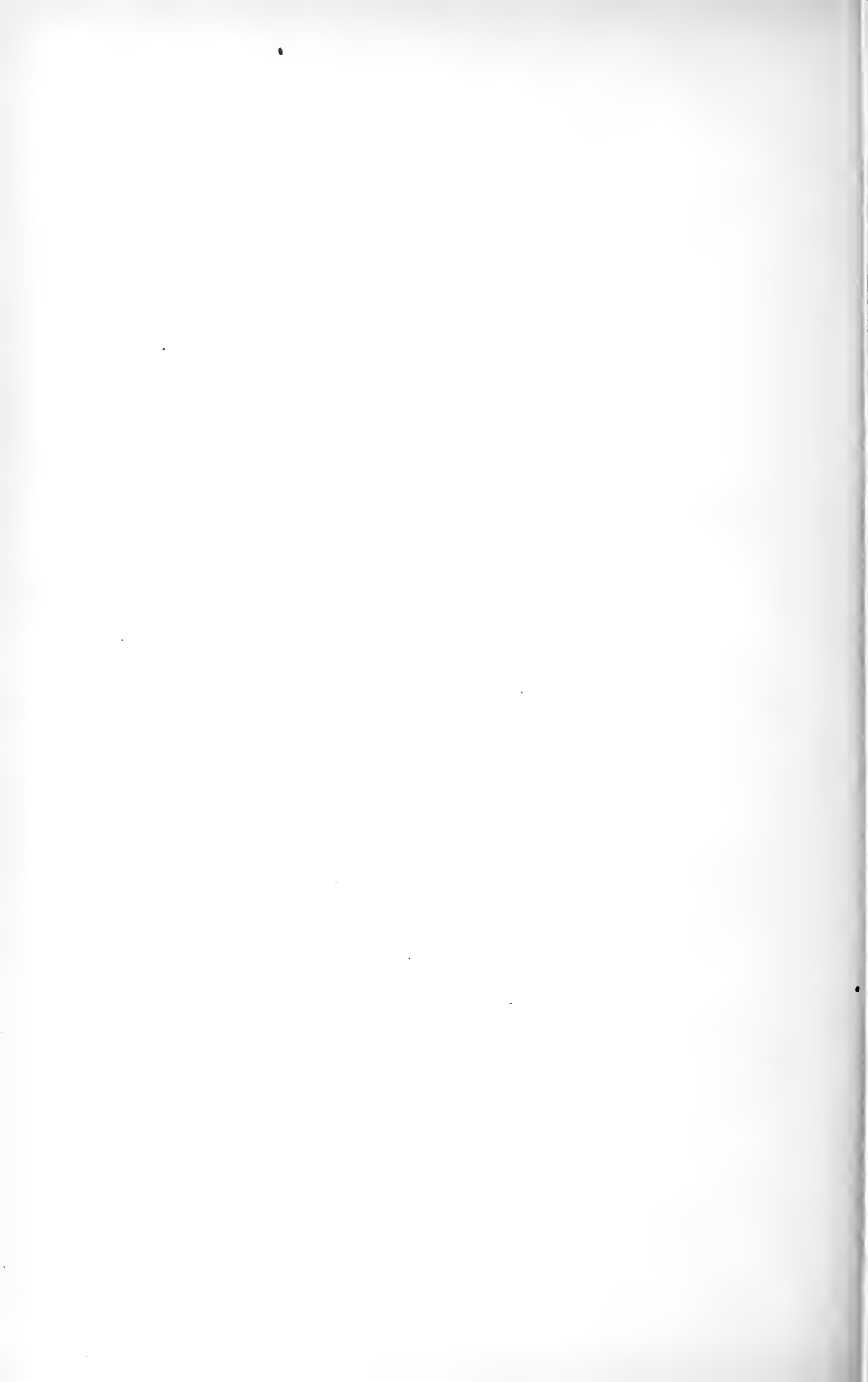
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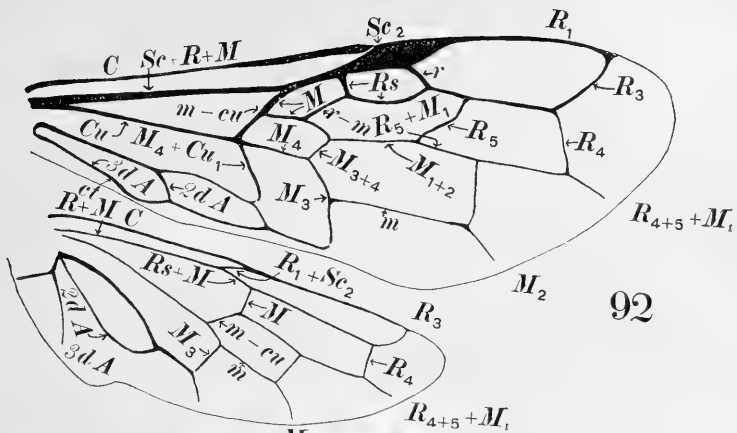




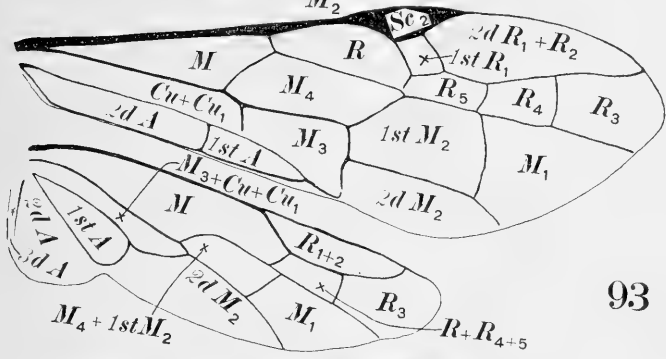
WINGS OF SIREX, XERIS, TEREPHON, AND TREMEX.

FOR EXPLANATION OF PLATE SEE PAGE 654.

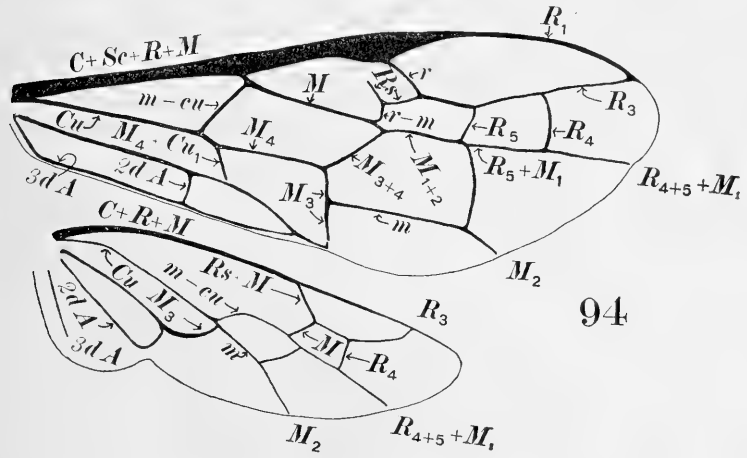




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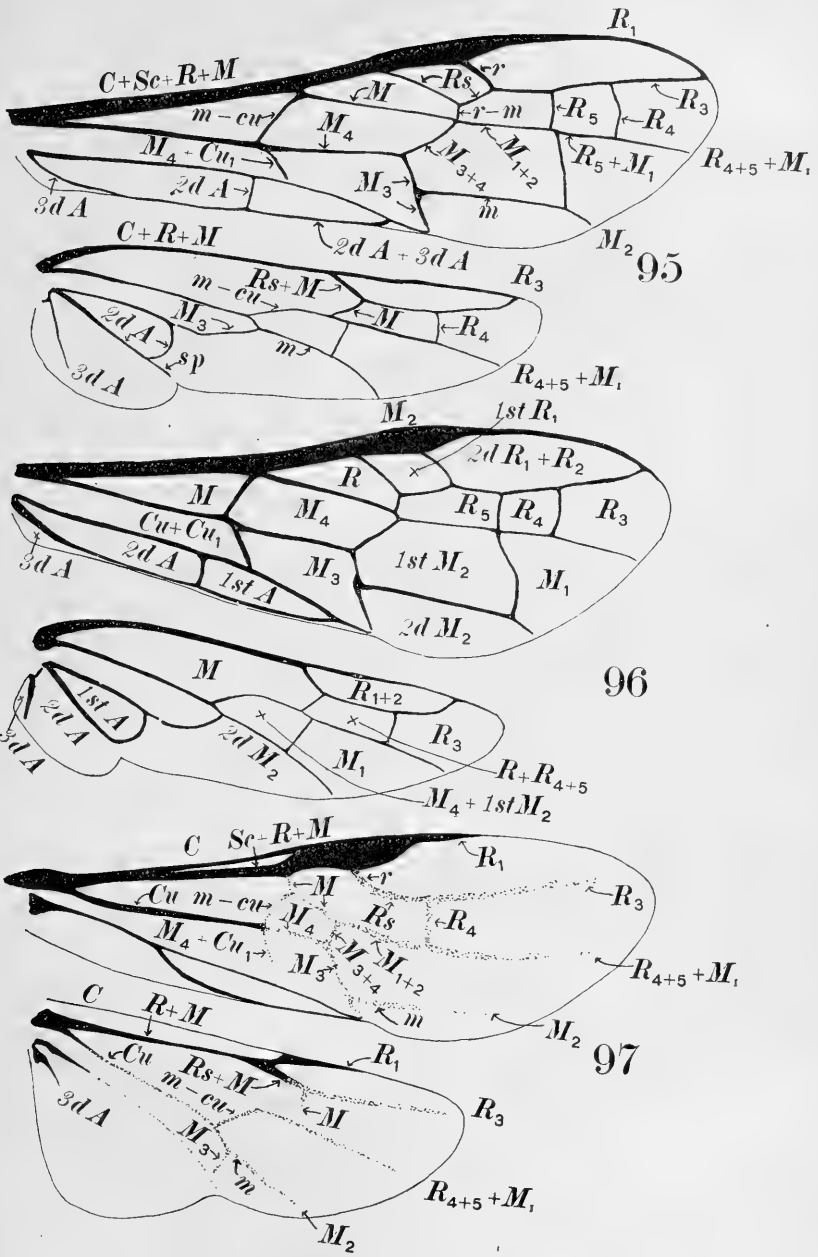


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WINGS OF MEGALODONTES AND JANUS.

FOR EXPLANATION OF PLATE SEE PAGE 654.





WINGS OF MACROCEPHUS, CEPHUS, AND ORYSSUS.

FOR EXPLANATION OF PLATE SEE PAGE 654.



A NEW BLATTOID FROM THE CRETACEOUS FORMATION OF NORTH AMERICA.^a

By ANTON HANDLIRSCH,

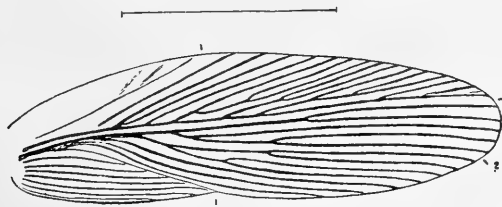
Adjunct Curator of the Royal Imperial Natural History Museum, Vienna, Austria.

During the summer of 1903, while members of the U. S. Geological Survey were investigating the Judith River beds of the Upper Cretaceous of Montana, the following very interesting blattoid was discovered:

STANTONIA, new genus.

STANTONIA CRETACEA, new species.

Description.—Front wing 29 mm. long, nearly elliptical, and three and one-third times as long as wide. Costal area reduced, reaching two-fifths the length of the wing, and without distinct veins, lanceet shaped. Radius extending in an almost straight course to the tip of the wing and with its eight more or less compound branches, which



STANTONIA CRETACEA.

are directed obliquely forward, taking up nearly half the surface of the wing. Parallel with the radius runs a second principal vein, from which three simple and two compound branches are sent off backward, part striking the apical border and part the inner margin. I am not in a position to determine whether these veins pertain to the media

^aTranslated from the German by Lucy Peck Bush, librarian and assistant, geological department, Yale University Museum.

and the cubitus or only to the latter; still it seems to me the most probable that the first four veinlets belong to the media and the last six to the cubitus. Or, is it possible that the media has entirely disappeared? The anal area is long and narrow, three and one-half times as long as high, and occupies almost two-fifths the length of the wing; its veins run parallel with the posterior margin, and nearly all end on the suture. The veins are remarkably stout. I was not able to distinguish accessory or cross veins.

This highly specialized blattoid form is the first that has been found in the Cretaceous formation, and may well be regarded as the type of a distinct family.

Holotype.—Cat. No. 35389, U.S.N.M.

Locality.—The genus is named in honor of Dr. T. W. Stanton, of the U. S. Geological Survey, who collected the type specimen in the Judith River beds of the Upper Cretaceous, at Willow Creek, Montana, where it was found associated with the fossil plants described by Dr. F. H. Knowlton in Bulletin No. 257 of the U. S. Geological Survey.

ON SOME BATS OF THE GENUS RHINOLOPHUS, COLLECTED BY DR. W. L. ABBOTT IN THE ISLANDS OF NIAS AND ENGANO.

By KNUD ANDERSEN.

The authorities of the United States National Museum have intrusted me with the identification of a series of Horseshoe Bats lately collected by Dr. W. L. Abbott in Sumatra, Nias, and Engano. The present paper deals with the *Rhinolophi* only. The *Hipposideri* will be worked out together with the British Museum material of that genus.

RHINOLOPHUS CIRCE, new species.

Diagnosis.—Closely related to *Rh. sumatranus*,^a but smaller. Fore-arm 45.2–49 mm.

Remarks.—Horseshoe, sella, connecting process, lancet, and ears as in *Rh. sumatranus*, but forearm, metacarpals, and phalanges shorter. The subjoined table of measurements^b shows the details.

Skull of the *Rh. sumatranus* pattern, but on the whole slightly more slenderly built. Dentition as in the Sumatra representative: p_3 external to the tooth-row; p_2 and p_4 generally in contact, sometimes slightly separated; p^2 in row.

Type.—Male adult (in alcohol, originally in formalin). Nias. Collected by Dr. W. L. Abbott (no. 4094). Cat. No. 141343, U.S.N.M.

Specimens examined.—Eight (6 male adults, 2 female adults), all from the type locality. Skulls of 4 specimens.

RHINOLOPHUS CALYPSO K. Andersen.

The species was based on two examples collected in Engano by Dr. E. Modigliani, and preserved in the British Museum.^c The fine series (2 male adults, 4 female adults, Nov. 17, 1904,) obtained on the same

^a Knud Andersen, Proc. Zool. Soc. London, 1905, II, pp. 133–134 (Oct. 17, 1905).

^b For explanation of measurements see Ann. Mag. Nat. Hist. (7), XVI, p. 248, footnote (August, 1905).

^c Knud Andersen, Proc. Zool. Soc. London, 1905, II, pp. 134–135, pl. iv, figs. 19 a, b, c (Oct. 17, 1905).

island by Doctor Abbott confirm the original diagnosis and description, and enables me to point out, with more confidence, the distinguishing characters of the species. *Rh. calypso* differs from *Rh. sumatranus* chiefly in the following respects: The horseshoe is broader, 9.6–10.2 mm. (in *sumatranus* 8.2–8.3); the sella broader, at base 2.7 (in *sumatranus* 2), immediately above the expansion 2.2 (in *sumatranus* 1.8); the ears larger.

In one example p_3 is almost quite in row, an individual variation (or, if preferred, reversion to a more primitive stage) which I hitherto had not seen in this species or its closest allies (*sumatranus*, *acuminatus*), but which certainly was to be expected; in all other individuals examined this small tooth is external to the row.

RHINOLOPHUS TRIFOLIATUS NIASENSIS, new subspecies.

Diagnosis.—Similar to the typical *Rh. trifoliatu*s, but with longer tail.

Remarks.—In 14 specimens of *Rh. trifoliatu*s, from Lower Siam, the Malay Peninsula, Sumatra, and N. Borneo, the length of the tail varies between 29.3 and 36 mm.; in the only Nias specimen obtained by Doctor Abbott it measures 40 mm. In other respects, cranial, dental, and external, the Nias form is indistinguishable from the typical form of *Rh. trifoliatu*s.

Type.—Female adult (in alcohol, originally in formalin). Nias, March 15, 1905. Collected by Dr. W. L. Abbott (no. 4088). Cat. No. 141350, U.S.N.M.

GENERAL REMARKS.

From Sumatra the following species of *Rhinolophus* are known to me: *Rh. affinis superans*, *Rh. sumatranus*, *Rh. trifoliatu*s *typicus*.

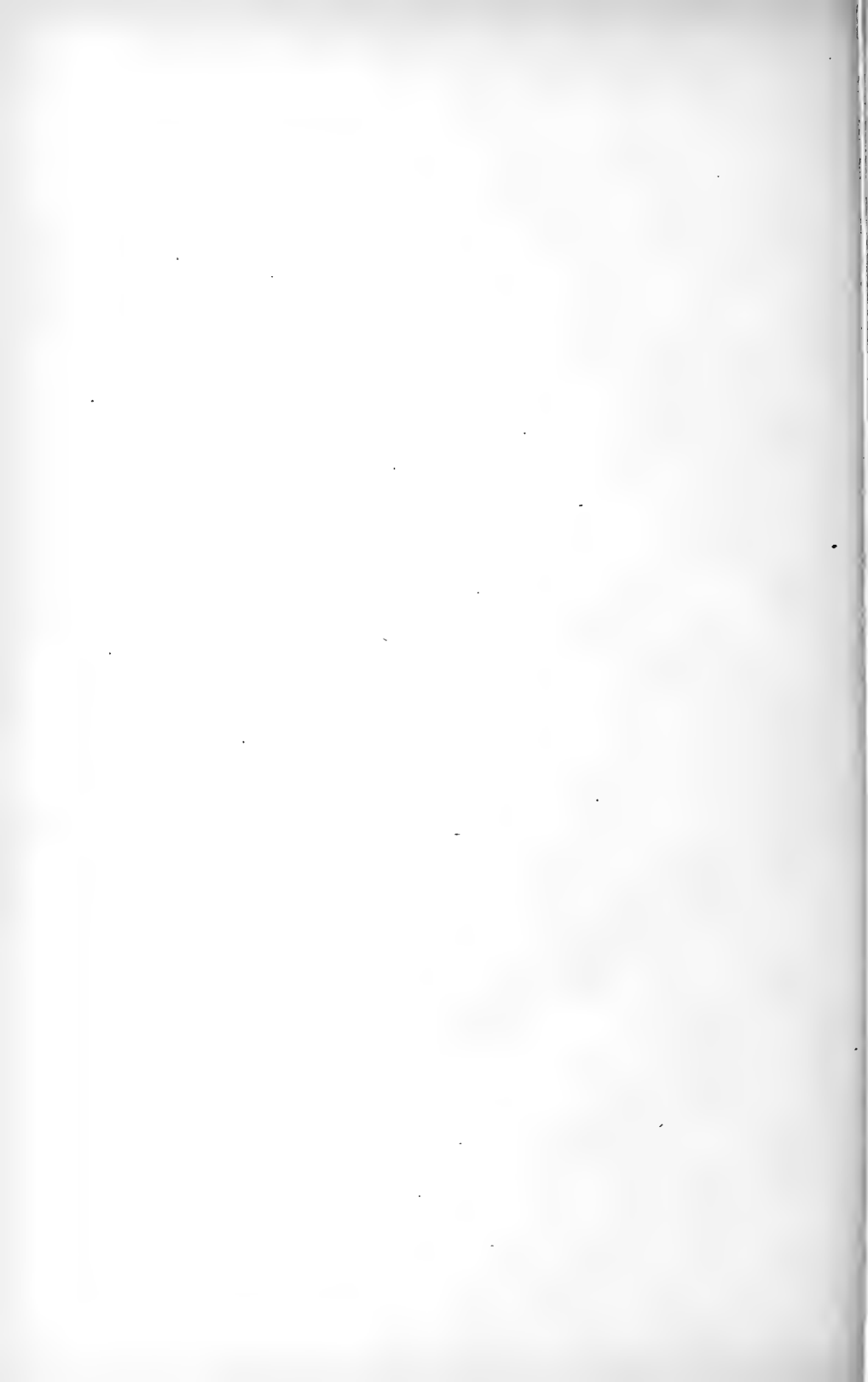
From Nias.—*Rh. circe*, *Rh. trifoliatu*s *niasensis*.

From Engano.—*Rh. calypso*.

Rh. sumatranus, *Rh. circe*, and *Rh. calypso*, together with *Rh. acuminatus* (Java) and *Rh. acuminatus audax* (Lombok), form a small, well defined section of the *Rh. lepidus* group. As will be observed from the above, the Nias and Engano representatives of this section are specifically different from the Sumatra representative, and also specifically different *inter se*. The only other *Rhinolophus* as yet recorded from these small islands (*Rh. t. niasensis*) is so exceedingly like the typical *trifoliatu*s that, for the present at least, I do not think it advisable to separate it as a distinct "species;" the small difference in the length of the tail pointed out above may ultimately prove to be indicative of an average difference only. But the total result, that the three *Rhinolophi* as yet known from Nias and Engano are either specifically or subspecifically different from the Sumatra species, is worth noticing.

Measurements.

Part.	<i>Rh. sumatranus.</i>		<i>Rh. circe.</i>		<i>Rh. calypso.</i>		<i>Rh. trifoliatus.</i>		<i>niaser- sis.</i> Female adult type.
	2 specimens, 1 skull.		8 specimens, 4 skulls.		8 specimens, 5 skulls.		<i>forma typica.</i> 16 specimens, 12 skulls.		
	Mini- mum.	Maxi- mum.	Mini- mum.	Maxi- mum.	Mini- mum.	Maxi- mum.	Mini- mum.	Maxi- mum.	
Ear:	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>
Length	18.7	19	16.7	19	19	21.5	22	26	24
Greatest breadth	14.3	14.3	14	15	16	17.2	17	19.2	17.5
Breadth of horseshoe	8.2	8.3	8	8.5	9.6	10.2	10.5	12.6	11.7
Forearm	51	51.2	45.2	49	49	52.8	47	55	52.2
Third metacarpal	35.2	36.8	32	34.2	35	38.3	30.5	37	35.7
III ¹	15.2	16.3	13	14.8	13.8	15.8	17.8	22.3	20.8
III ²	20	21	17.5	19.3	18.2	21.5	25	31	28.8
Fourth metacarpal	37.2	38	32.5	35.8	36	39.3	35.5	42	40
IV ¹	11	11.7	8.7	10.2	9.3	10.8	10.5	13	13.1
IV ²	13	13.6	11	12	12.2	13.8	14.8	20	18
Fifth metacarpal	37.5	38.3	33	35.8	36.2	39.3	37	43.8	41.2
V ¹	12.2	12.7	10	11.2	10.8	11.8	11	13.7	13.8
V ²	13.7	14.6	11.7	12.8	11.7	14	15	19.7	18.8
Tail	25.2	26.5	21.5	24	23	26.5	29.3	36	40
Lower leg	22.5	22.5	19.7	22	20.6	23.2	23.2	27.8	27.2
Foot	10.8	11	10.2	11.5	10.3	11.5	11.8	14.5	13.2
Skull:									
Total length			20.2	21.7	20.9	23	22.6	24.9	22.7
Mastoid width			10	10.2	9.9	10.7	10.7	11.6	10.3
Width of brain case			8.8	9.1	8.8	9.7	9.5	10.3	9.7
Zygomatic width			10.6	11	10.9	11.7	11.4	12.7	11.8
Width of nasal swell- ings		6.2	5.7	6	6.2	6.9	6.1	6.5	6
Mandible, length		15.8	14.6	15.2	14.8	16	15.7	17.6	16
Upper teeth		8.8	8.1	8.6	8.4	8.9	8.7	9.7	8.8
Lower teeth		9.5	8.8	9.2	9	9.8	9.2	10.3	9.3



REVISION OF AMERICAN PALEOZOIC INSECTS.^a

By ANTON HANDLIRSCH.

Adjunct Curator of the Royal Imperial Natural History Museum, Vienna, Austria.

INTRODUCTION.

During many years the late Mr. R. D. Lacoë, of Pittston, Pennsylvania, was an ardent collector of plants and insects. Until recently but one locality in the United States yielded specimens of Paleozoic insects in numbers sufficient to warrant collectors to look for these rarest of fossils. This locality is along Mazon Creek, in Grundy County, Illinois, where the nodules have weathered out of the Upper Carboniferous shales. Mr. Daniels tells the present writer that about one insect is found to every 1,000 concretions, and were it not for the splendid plants and the rare invertebrates found inside the other 99% nodules no collecting at all could be done. For many years Mr. Lacoë offered a premium for every nodule containing an insect, arachnid, or myriapod, and eventually he was enabled to assemble 70 insect-bearing concretions. These were partially described by Prof. S. H. Scudder, and now all of them have been studied by Prof. Anton Handlirsch.

In the plant-bearing beds of the anthracite and bituminous regions Mr. Lacoë occasionally secured a single insect wing, and when the finds became sufficient to warrant digging for them he would specially detail a collector to examine the shales of a given locality. Rarely did such work yield more than a few insect wings each day, but after long perseverance about 625 specimens were collected.

With the greatest generosity all this material was presented by Mr. Lacoë during his lifetime to the U. S. National Museum, on condition that the collection should be made accessible to paleontologists and that he be allowed to add further material from time to time. Unfortunately for science, he lived but a few months after making this splendid gift, and it will probably be a long while before another person so generous, large-hearted, and financially equipped will give of his time and talents so abundantly for the furtherance of this branch of paleontology.

^aTranslated from the German by Lucy Peck Bush, librarian and assistant, geological department, Yale University Museum.

Owing to the large collections of Carboniferous fossil plants made for the U. S. Geological Survey, chiefly by Mr. David White, a number of other specimens of insects have been secured; these are also included in the present work.

As continued illness and other causes have prevented Dr. Samuel H. Scudder from making a complete study of the Lacoe collection of Paleozoic insects, the writer often expressed the hope that some one might be found to investigate this very interesting material, but as no one of the American entomologists working in recent forms could be induced to make a study of these fossils, he despaired of ever getting an expert and competent hand to monograph the collection.

The material thus lay in obscurity for a few years, when Professor Handlirsch, of the Royal Imperial Museum of Austria, requested the loan of certain of Scudder's type specimens. A rule of the U. S. National Museum forbids the loan of "types" from Washington, but after the full scope of Doctor Handlirsch's work became known the authorities made an exception in this case to that wise ruling, and asked to be allowed to lend all the Paleozoic insect material in the National Museum for incorporation in the Monograph of Paleozoic Insects by Professor Handlirsch. The entire collection was therefore sent to him in the summer of 1902.

Mr. L. E. Daniels, formerly of Morris, Illinois, now of Laporte, Indiana, was also for many years engaged in making a collection of the forms found in the nodules of Mazon Creek, and this he will eventually present to the National Museum. With a liberality second only to that of the late Mr. Lacoe, Mr. Daniels likewise consented to loan his insect material for the work in question. The collection includes 16 nodules.

Hence, the majority of American Paleozoic insects have been studied by Professor Handlirsch. Only one other large collection, that assembled by the late Prof. O. C. Marsh, and now the property of Yale University Museum, has not been seen by him. This collection, also, would have been sent to Professor Handlirsch had it not been in the hands of Dr. E. H. Sellards, whose studies are not yet completed.

The paleontology of America has thus been greatly benefited. The work of Professor Handlirsch indicates plainly that his genera and species are more finely drawn than those of the Americans, but this is due in part to the larger collections at his disposal and the monographic nature of his work. It will be also noted that his arrangement of the genera into families, and the lines of descent, are often at variance with those of Doctor Scudder.

The U. S. National Museum is deeply indebted to Prof. Anton Handlirsch and to the authorities of the Royal Imperial Museum at Vienna for this very valuable work.

CHARLES SCHUCHERT.

REVISION OF AMERICAN PALEOZOIC INSECTS.

Through the long-continued activity of Dr. S. H. Scudder a great number of forms of fossil insects from the American Paleozoic rocks have become known to us, and interest in this branch of paleontology has thus been widely increased. As a result, new collections of these organisms, which have furnished valuable material for study, have been secured from many sources. A large share of these new specimens is in the possession of the U. S. National Museum, and to me has been intrusted the working up of this collection. This unusual privilege has placed me under the greatest obligations, since without the investigation of this valuable material it would have been hardly possible to complete in a satisfactory manner my general studies on the paleontology and phylogeny of insects.

Several years of research have furnished me proof that Scudder's classification required a thorough revision, because his groups include mainly quite heterogeneous elements and morphologically are not founded on sufficiently broad lines. Hence, the paleontology of insects, in a wider sense, could not be previously employed in phylogenetic conclusions.

If I have now succeeded in rightly interpreting various errors, and have obtained a more exact description of forms and a sharper delimitation of groups, I am indebted not only to the abundance and richness of the existing European and American material, but especially to the progress which has been recently made in the domain of insect morphology, and particularly to the fundamental investigations of Comstock and Needham on the venation of the wings of insects. As a result of these studies, the establishment of homologies seems to be divested of its greatest difficulties.

I can not close this introduction without acknowledging my deepest obligations to the administration of the U. S. National Museum, as well as to Prof. Charles Schuchert, now of Yale University Museum, but formerly assistant curator, division of stratigraphic paleontology in the National Museum, and to Messrs. David White and L. E. Daniels, not only for the magnificent collections placed at my disposal, but also for valuable aid and advice.

Mr. David White has had the kindness to prepare the following comprehensive statement of the geological relations of the American Paleozoic, as far as the insect-bearing deposits are concerned. With these data at hand, the relative age of individual forms can now be much more accurately determined and compared with European discoveries.

GEOLOGICAL POSITION OF THE PRINCIPAL INSECT-BEARING
LOCALITIES OF THE AMERICAN PALEOZOIC.

The American specimens of Paleozoic insects have been generally brought to light in the search for fossil plants, and accordingly they are geologically referred to more or less well-known plant beds. Exceptions are those from the shales above the Ames (Crinoidal) limestone at Richmond and Steubenville, Ohio. It must be remembered that for stratigraphical or areal purposes various formations have been recognized in more or less distant areas of the American coal fields, and the exact interequivalence of these has in many cases not yet been ascertained. The anthracite coal fields also have a stratigraphical nomenclature for the most part different from that in use in the bituminous regions, the subdivisions being largely according to the grouping of the coal beds or "veins," which in the Northern Anthracite field (Pennsylvania) are lettered from the base upward.

In the following list the geological formation and horizon or stage, so far as the latter has been determined by paleobotanical or stratigraphical correlations, will be given in connection with the designation of each locality. In a number of instances a locality has been cited in various papers in different terms, which have sometimes been erroneously interpreted to mean distinct places. Such cases will be pointed out below:

1. Near Altamont No. 1 Colliery, anthracite region, Pennsylvania. Lower Pottsville; Lower Lykens group. Waidenburg-Ostrauer. (= "Lower Lykens of Pottsville, Altamont Colliery, Pennsylvania.")
2. Boston mine, near Pittston, Pennsylvania. Near top of Pottsville series; Upper Transition group. Lower Westphalian. (= "Lowest productive c. m., Boston mine near Pittston, Pennsylvania.") (= "Roof shales of coal C, Boston mine.") (= "Upper Coal Measures (coal C) Boston mine.")
3. Butler mine, near Pittston, Pennsylvania. Anthracite series; Pittston or E coal. Lower Stephanian. This coal lies paleobotanically in or near the Freeport stage of the Allegheny formation of the bituminous coal fields of Pennsylvania. (= "Pittston coal in the Butler mine at Pittston, Pennsylvania.")
4. Campbell's Ledge, near Pittston, Pennsylvania. Near top of Pottsville; Upper Transition group. Lowest Westphalian. (= "Interconglomerate of Millstone Grit of Campbell's Ledge, Pittston, Pennsylvania.") (= "Interconglomerate Upper Coal Measures, Campbell's Ledge, Pittston, Pennsylvania.") (= "Upper Coal Measures, Upper Campbell's Ledge, Pittston, Pennsylvania.")
5. Cannelton, Pennsylvania. Allegheny formation; Kittanning group; roof of the Middle Kittanning coal. Westphalian. (= "Bituminous coal shale of the Lowest Productive Coal Measures, Cannelton, Pennsylvania.")
6. Cassville, West Virginia. Dunkard formation; parting in the Waynesburg coal. Probably Autunian.

NOTE.—The main body of the Waynesburg coal bed forms the topmost stratum of the Monongahela formation. But, for convenience in grouping, the richly plant-bearing shale parting in the upper part of the coal was placed, with the top shale and sandstone, in the base of

the Dunkard formation. The formation (Dunkard) was referred, in 1880, by Professors Fontaine and I. C. White, to the Permian. This reference has been doubted by most American geologists. Recently, however, additional plant evidence has been obtained to show that the beds above the Washington coal, 175 feet above the Waynesburg coal, are clearly Lower Rothliegende (cf. Cuseler); and it is not impossible that the Rothliegende boundary may, on the acquisition of further paleontological material, be shown to lie unquestionably below the Waynesburg coal. (=“Lower Permian Cassville, West Virginia, Waynesburg coal.”)

7. Clendennin, West Virginia. Charleston sandstone formation. The plant bed furnishing the insect remains is probably nearly of the age of the Kittanning group in the Allegheny formation in Pennsylvania. Westphalian.
8. Drake Tunnel, Old Forge, Pennsylvania. Anthracite series; Marcy or D coal. This bed probably falls in the stage of the Kittanning group of the Allegheny formation of the bituminous regions. Westphalian. (=“Middle Coal Measures (Marcy or D) Drake Tunnel, Old Forge, Pennsylvania.”)
9. Empire mine, Wilkes-Barre, Pennsylvania. Anthracite series; E coal. Referable to Freeport group of the Allegheny formation in the bituminous regions. Stephanian.
10. Fishing Creek Gap in Sharp Mountain, Pennsylvania. Anthracite series; lower part; horizon undetermined. Stephanian ?
11. Frog Bayou, Arkansas. Upper Coal-bearing Division. Probably included in the Allegheny stage of Pennsylvania. Westphalian ?
12. Gibson Fork, near Decota, West Virginia. Upper Pottsville; Lower Kanawha series. Probably near stage of the Sharon group in Ohio and Pennsylvania. Westphalian.
13. Lawrence, Kansas. Upper Coal Measures; Le Roy (Lawrence) shales; regarded as near or at the stage of the Conemaugh formation, or possibly as old as the Freeport group of the Allegheny formation. Stephanian.
14. Lemon's Coal Mine, near Fayetteville, Washington County, Arkansas. Middle Pottsville; Lower Coal-bearing shale. Referable to the Sewanee (Sewell) stage, in the Appalachian trough. Waldenburg-Ostrauer.
15. Lorberry Gap, in Sharp Mountain, near Tremont, Pennsylvania. Anthracite series; stage undetermined. Stephanian ? (=“Buck Mountain coal, Lorberry Gap, Lorberry, Pennsylvania.”)
16. Switchback, near Pittston, Pennsylvania. Anthracite series; D? coal. Belongs to Allegheny stage in bituminous regions. Westphalian.
17. Port Griffith, Pennsylvania. Anthracite series; E coal. Freeport stage of the Allegheny formation in the bituminous regions. Stephanian.
18. Pottsville, Pennsylvania. Anthracite series; stage unknown. Westphalian ?
19. Scranton, Pennsylvania. Uppermost Pottsville; Dunnore coal No. 2. Referable to Mercer stage of Allegheny formation. Westphalian.
20. Tallmadge, Ohio. Upper Pottsville; Sharon shales. Lower Westphalian. (=“Lowest coal bed, Tallmadge, Ohio.”)
21. Near Tremont, Pennsylvania. Pottsville; Lykens series; stage unknown. Waldenburg-Ostrauer ? (=“Lykens Coal Measures, Tremont, Pennsylvania.”)
22. Tremont, Pennsylvania. Anthracite series; Mammoth coal. Probably in Freeport stage of Allegheny formation of bituminous regions. Lower Stephanian?
23. Tremont, Pennsylvania. Anthracite series; Buck Mountain coal. Clarion stage of Allegheny formation of bituminous regions. Westphalian.
24. Yatesville, Pennsylvania. Anthracite series; D coal. Referable to the Freeport stage of the Allegheny formation in the bituminous region. Stephanian.

25. Wills Creek, near Richmond, Ohio. Conemaugh formation; shales above the Ames limestone. Stephanian. (= "Lower Barren Coal Measures, Wills Creek.")
26. Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone. Stephanian.
- NOTE.—These shales are about 600 feet below the plant and insect bed at Cassville, West Virginia (No. 6 above).
27. Pratt Mines, near Birmingham, Alabama. Middle Pottsville; Pratt group; probably Sewell stage. Waldenburg-Ostrauer. (= "Coal Measures, Pratt Mines, Birmingham, Alabama.")
28. Cordova, Alabama. Middle (?) Pottsville; Mary Lee group; Upper Quinnimont ? stage. Waldenburg-Ostrauer.
29. Coalburg, Alabama. Middle Pottsville; Pratt group; probably Sewell stage. Waldenburg-Ostrauer. (= "Lower Coal Measures, Coalburg, near Birmingham, Alabama.")
30. Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage. Highest Westphalian or low Stephanian. (= "Lowest Productive Coal Measures, Mazon Creek, Illinois.")
31. Colchester, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage. Highest Westphalian or low Stephanian.
32. Braidwood, Illinois. Pennsylvanian; Conemaugh ? stage. Stephanian.
33. Danville, Illinois. Pennsylvanian Conemaugh (or Freeport ?) stage. Stephanian.
34. Little Vermilion River, Vermilion County, Illinois. Pennsylvanian; Allegheny ? stage. Westphalian ?
35. 170 feet above the base of the Upper Coal Measures, near Kansas City, Missouri. Chanute shales; Conemaugh ? stage; Lower Stephanian. (= "Upper Coal Measures, Kansas City, Missouri.")
36. Clinton, Missouri. Cherokee shales; Kittanning (Allegheny) stage. Westphalian. (= "Very lowest Productive Coal Measures, Clinton, Missouri.")
37. Gilkerson Ford, Henry County, Missouri. Cherokee shales; Kittanning (Allegheny) stage. Westphalian. (= "Lowest Coal Measures, Gilkerson Ford, Clinton, Missouri.")
38. Near French Lick, Indiana. Middle Pottsville; Mansfield formation; Quinnimont ? stage. Waldenburg-Ostrauer. (= "Carboniferous. Orange County, Indiana.")
39. Braxton Quarry, near French Lick, Indiana. Middle Pottsville; Mansfield formation; Quinnimont ? stage. Waldenburg-Ostrauer. Probably same locality as 38. *Paolia vetusta*.
40. Pawtucket, Rhode Island. Pennsylvanian; Ten-mile series; probably Allegheny or Conemaugh stage. Stephanian ? (= "Lower ? Productive Coal Measures, Pawtucket, Rhode Island.") (= "Coal Measures, Pawtucket, Rhode Island.")
41. Silver Spring, East Providence, Rhode Island. Pennsylvanian; Ten-mile series; Allegheny or Conemaugh stage. Stephanian ? (= "Lowest (?) Productive Coal Measures, Silver Spring, East Providence, Rhode Island.")
42. East Providence, Rhode Island. Pennsylvanian; Ten-mile series; Allegheny or Conemaugh stage. Stephanian ?
43. Fenner's Ledge, Cranston, Rhode Island. Pennsylvanian; near base of section; stage unknown. Westphalian ? (= "Lower (?) Productive Coal Measures, Fenner's Ledge, Cranston, Rhode Island.")
44. Cranston, Rhode Island. Pennsylvanian; near base of section; stage unknown. Westphalian ?
45. Bristol, Rhode Island. Pennsylvanian; probably Allegheny or Conemaugh stage. Stephanian ? (= "Lowest Productive Coal Measures, Bristol, Rhode Island.")

46. Fairplay, Colorado. Permo-Carboniferous.

The plant and insect beds at Fairplay, referred by Doctor Scudder to the Trias, and by Lesquereux to the Permian, can, on the evidence of the plants, not be regarded as later than Permian, if indeed they are above the highest Coal Measures. Autunian ?

47. Sydney, Cape Breton. Middle Coal formation; Allegheny stage ? Upper Westphalian ? (= "Very lowest Productive Coal Measures, Sydney, Cape Breton.")

48. Main Coal, East River, Picton, Nova Scotia. Pennsylvanian; Stephanian ?

49. St. John, New Brunswick. Little River group (Devonian ? ?).

These plant beds were referred by Sir William Dawson to the Middle Devonian and are regarded as of that age by most Canadian geologists, the stratigraphy of the beds being interpreted as conclusively indicating such a reference. On the evidence of the fossil plants entirely, they are considered by Mr. R. Kidston and myself as certainly Carboniferous, and probably of Lower Coal Measures (of Great Britain) or Pottsville (in America) age.

The general geological and age relations of the insectiferous beds, so far as these relations have been correlatively ascertained, are shown in the following table, in which the respective localities, when admitting of approximate correlation, are designated by numbers. (Exceptions are Nos. 10, 15, 18, 40-42, 46, 48, 49.)

DAVID WHITE.

Appalachian Coal Measures, as correlated by the fossil floras.

[The numbers are those given in the foregoing list of localities.]

Central Appalachian region.		Northern Appalachian bituminous region.		Anthracite region.		European divisions.	
[Wanting.]	Dunkard. 6.	[Wanting ?]	Autunian.	Lower Rothliegende.	Caseler.		
Braxton.	Monongahela. (Upper Productive Coal Measures. (Lower Carbon Measures.) 13, 25, 26, 32 ¹ , 33 ¹ , 35 ¹ , 45 ² .) Freeport.	Anthracite series. Coals A, B, C, etc. Coal E. 3, 9, 17, 22 ² .	Stephanian.		Commentry, [Ottewiller.] [Saarbrückian.]		
Charleston.	Allegheny. (11) (43?) (44?) (47?) Kittanning. 5, 30 ⁷ , 31 ⁷ , 34 ⁷ , 36, 37, 7 ⁷ Clarion.	Coal D. 8, 16, 24. Coal C ² . 23.					
Kanawha.	Homewood. Mercer Group. 12, 19. Conoquenessing Shales. 20. Sharon Conglomerate.	Upper Transition series. 2, 4.	Lower Coal Measures, Great Britain.		Valenciennes. [Schatlarer.] [Saarbrückian.]		
Nuttall. Sewell. (14), 27, 29. Raleigh. Quinnimont. 28 ⁷ , 38 ² , 39. Clark. Pocahontas.	[Discordance]	Upper Lykens series. (21 ⁷) Lower Transition series. Lower Lykens series. 1. (Discordance ?)	Millstone Grit.				
	Mauch Chunk Shales. Greenbrier Limestone. Pocono (conglomerates, shales, and coals). = Horton series of Nova Scotia.				Yoredale. Mountain Limestone. Calcareous Sandstone. Series of Scotland.		
	Devonian.						

Pennsylvanian. (Upper Carboniferous.)
Mississippian. (Lower Carboniferous.)

SYSTEMATIC REVIEW OF THE INSECTS AT PRESENT KNOWN
FROM THE AMERICAN PALEOZOIC.

The following pages contain an abridged characterization of the orders and families into which American Paleozoic insects are divided; further, an enumeration of all forms previously made known, with amended names and localities, as well as the descriptions of 137 new species from the collection of the U. S. National Museum and that of Mr. L. E. Daniels. In the treatment of the species already known, I have confined myself strictly to necessary critical observations and important references to literature. For detailed descriptions and figures of these species the reader is referred to my larger work, that will shortly appear; but for citations, to Scudder's catalogue. The figures of the new species have all been prepared by myself with the aid of the camera lucida; hence are claimed to be accurate. All reconstructions have been completed chiefly in stippled lines only, perplexing details of the matrix, flaws, and other things not pertinent to the fossil being omitted. In the description of the neuration of the wing I have made use of the terminology proposed by Comstock and Needham merely for the principal veins (C=costa, Sc=subcosta, R=radius, Rs=radial sector, M=media, Cu=cubitus, A=anal), the homologies of which I have been able to determine in all recent and fossil insects. On the other hand, the branches of the main veins and the cross veins I have not been able to homologize; the numbers adopted, therefore, are of value only for the species concerned and have no higher morphological significance.

My views on the system of recent insects have been already set forth in the publications of the Royal Imperial Academy of Vienna and in the *Zoologischer Anzeiger* (1904).

Class PTERYGOGENEA (Brauer)
Handlirsch.

Order PALÆODICTYOPTERA Goldenberg.

Generally slenderly built insects, with 4 similar membranous wings which are independent of each other and move only in a vertical direction, their veins almost exactly corresponding to those in the hypothetical type constructed by Comstock and Needham. Costa marginal, not branched; subcosta independent, not far removed from the costa, not furcate; radius simple, preserved to the tip; radial sector springing forth from the radius more or less near to the base of the wing, and dividing in various ways, its branches mainly continuing obliquely to the apical border. Media and cubitus generally with a simple or slightly dichotomous anterior branch and a more strongly branching

inferior member; their branchlets are always more or less strongly arcuate and directed backward; anal veins always well developed, more or less branched and curved back to the inner margin; almost without exception, cross veins are abundantly developed and irregularly distributed. Anal area neither separated by a fold nor enlarged by fanlike plaitings. Pterostigamata, cross folds, and intersections of the veins, as well as all other higher specializations occurring in recent insects, are wanting in all Palæodictyoptera. The head is moderately large, with eyes distinctly developed and rather long simple antennæ. Mouth parts fitted for chewing. Three similar thoracic segments, the first mostly with winglike pleurites. Abdomen sessile, slender, and uniformly segmented; the sides of the segments often with persistent tracheal gills or similar processes. Legs homonomous, fitted for running, with 3 to 4 tarsal joints. Eleventh segment with more or less long cerci.

The larvæ of the Palæodictyoptera were similar to the imago, and developed their wings gradually without resting stages; they probably lived in the water as predaceous animals.

This order is exclusively Paleozoic and includes the oldest fossil insects at present known. This fact, taken in connection with the very primitive organization, especially with the lack of all specialized structures, leads me to seek in the Palæodictyoptera the ancestors of all other orders of insects.

Family DICTYONEURIDÆ Handlirsch.

I consider the genus *Dictyoneura* Goldenberg the type of this family. The wings of the Dictyoneuridæ are distinguished by a very irregular reticulate intercalary neuration, and have feebly divided principal veins. As a rule the radial sector, as well as the cubitus and the media, always separate into not more than from 4 to 6 branches.

A group prevailing throughout the middle and upper parts of the Upper Carboniferous of Europe.

HAPLOPHLEBIUM Scudder.

HAPLOPHLEBIUM BARNESII Scudder.

Haplophlebiium barnesii SCUDDER, Proc. Boston Soc., XI, 1867, p. 151; Geol. Mag., IV, 1867, p. 386, pl. XVII, fig. 1.

Dictyoneura haplophlebia GOLDENBERG, Fauna saraep. foss., II, 1877, p. 16.

Haplophlebiium barnesii BRONGNIART, Fauna ent. terr. prin., 1893, p. 504, pl. III, figs. 4, 5.

Locality.—Sydney, Cape Breton. Allegheny stage!

This fossil has been referred by Scudder to the protophasmids (orthopteroid Palæodictyoptera).

MAMMIA, new genus.

Costal border gently curved. Costal area narrow. Radius situated nearer the subcosta. Radial sector arising about in the middle of the wing. The media sends off its very strongly arcuate anterior branch just before the origin of the radial sector, which it approaches and then continues in a large curve backward. The posterior branch of the media again furcates at about the level of the origin of the radial sector. The cubitus is already divided very near the base of the wing, its branches, as well as the first anal vein, extending in a broad curve to the inner margin. The intercalary neuration consists of a close irregular network.

MAMMIA ALUTACEA, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

The fragment, 24 mm. long, of a wing from 40 to 50 mm. in length.

Holotype.—Cat. No. 38829, U.S.N.M.

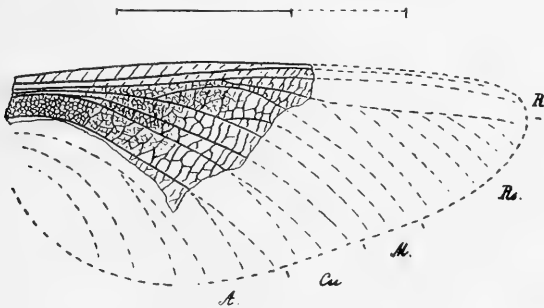


FIG. 1.—MAMMIA ALUTACEA.

Notwithstanding the incompleteness of this specimen I believe it possible to regard it as nearly related to the European Dictyoneuridae.

TITANODICTYA, new genus.

TITANODICTYA JUCUNDA (Scudder).

Titanophasma jucunda SCUDDER, Proc. Amer. Acad., XX, 1885, p. 169.

Dictyoneura jucunda BRONGNIART, Bull. Soc. Rouen (3), XXI, 1885, p. 62.

Locality.—Campbells Ledge, near Pittston, Pennsylvania. Upper Transition group, near top of Pottsville.

This form, as yet not figured, is closely allied to the genus *Dictyoneura* Goldenberg.

The genus *Titanophasma* Scudder is different from Brongniart's genus of the same name, and must therefore receive a new name. Scudder ranks this form, also, with the protophasmids.

Holotype.—Cat. No. 38154, U.S.N.M.

GEREPHEMERA Scudder.

GEREPHEMERA SIMPLEX Scudder.

——— SCUDDER, Geol. Mag., V, 1868, p. 174.

Gerephemera simplex SCUDDER, Devon. Insects, N. B., 1880, p. 12, pl. 1, figs. 8, 8a.

Gerephemera simplex HAGEN, Bull. Mus. Comp. Zool., VIII (14), 1881, p. 277; Zool. Anz., VIII, 1885, p. 298.

Gerephemera simplex BRONGNIART, Bull. Soc. Rouen (3), XXI, 1885, p. 56.

Gerephemera simplex BRAUER, Anal. Hofmus. Wien, I, 1886, p. 111.

Locality.—St. John, New Brunswick. Little River group; = ? Pottsville.

This is one of the so-called Devonian insects which gave rise to the lively controversy between Scudder and Hagen. The former at first regarded it as an ephemerid, but later founded a distinct family upon it, which he named "Atocina," and classed with the protophasmids. Hagen, on the other hand, desired to make an odonate of the fossil at any cost, and sought to establish this view in several very polemical writings, without, however, attaining the desired result.

In my opinion, the specimen probably pertains as little to an ephemerid as to an odonate or to a protophasmid, but is, however, a dictyoneurid-like form with very close, irregular intercalary veins.

Family HYPERMEGETHIDÆ, new family.

As type of this new family, I take an American form of Palæodictyoptera, the gigantic wing of which, even though only half is preserved, still shows a series of positive characters, which depart sufficiently from the previously mentioned families and disclose important differences in the entire organization of the animal.

Costa marginal, costal area broad, radius simple, radial sector issuing from near the base, immediately after widely branched. Media and cubitus likewise forked near the base, and all crowded into the anterior half of the wing. Anal area not marked off, large, with 3 forked anal veins widely removed from one another and extending in long flat curves to the inner border. The narrow areas between the veins are bridged over by irregular cross veins; the wider ones are filled up with a quite irregular wide-meshed network.

HYPERMEGETHES, new genus.

Costal border almost straight, subcosta approaching close to the radius, so that the costal area attains a considerable width. Radius straight and probably not branched. Radial sector arising in about the first fourth of the length of the wing, and shortly after its origin immediately divided into a narrow fork. Media close to the radius and separated into a long, narrow fork just before the origin of the radial sector. Very near the base of the wing the cubitus is divided

into two branches, which continue almost parallel and close to the media to the middle of the wing without further division. Half the width of the wing is taken up by the three widely separated anal veins, the offshoots of which are forked and branch off backward. The costal area and the entire space below the cubital vein are very irregularly and coarsely reticulate, while the spaces between the other veins are bridged over by isolated cross veins.

HYPERMEGETHES SCHUCHERTI, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

The basal half, 60 mm. long, of a wing about 120 mm. in length.

Daniels collection. Reverse of holotype in the U. S. National Museum: Cat. No. 35575.

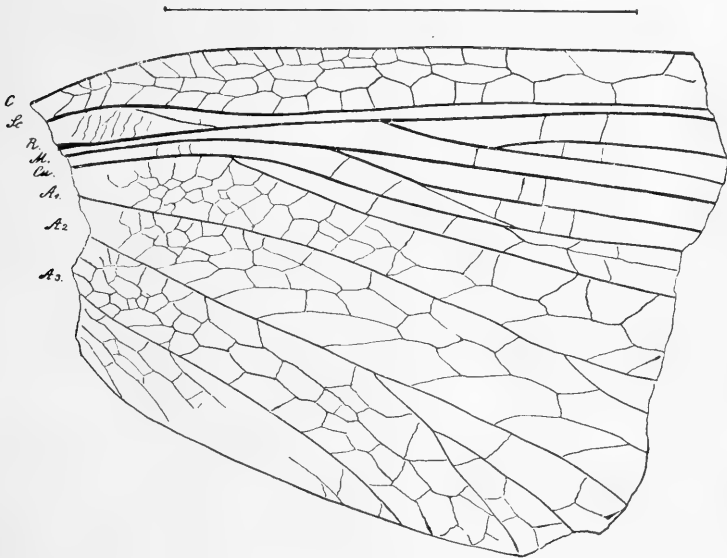


FIG. 2.—HYPERMEGETHES SCHUCHERTI.

Family **LITHOMANTIDÆ**, new family.

In many respects, this group is closely allied to the Dictyoneuridæ, but differs in the less frequent cross veins pertaining to the intercalary venation, which are only occasionally reticulate. The branching of the principal veins is scarcely more abundant than in the Dictyoneuridæ, and as in that group we here find the familiar isolated anterior branch of the media and of the cubitus, the marginal costa, and the simple radius, whose sector sends off several divided branches backward. Also, the veins of the anal and cubital groups extending in gentle curves to the outer margin are here present as in the Dictyo-

neuridæ. I would unite these groups were it not that in some known species, the form of the body differs strikingly from that of the dictyoneurids. In any event, however, the two groups are closely related.

The family Lithomantidæ, the type of which is *Lithomantis carbonaria* Woodward, includes a number of beautiful forms from the middle and upper parts of the Upper Carboniferous of Europe, to which I now add two American species.

EURYTÆNIA, new genus.

Of this form there is, unfortunately, only a large portion of the middle of the wing preserved. The anterior margin is rather strongly curved, the inner margin, on the contrary, is almost straight, so that one can infer a longer wing of nearly equal width. Costa, subcosta, and radius are separated by broad interspaces, and run nearly parallel, as does also the radial sector, which originates immediately back of the base of the wing, but which first widely branches in the apical half. The media extends in a long curve to the inner border and sends off its anterior branch far above the center of the wing. In contrast to most related forms, this branch dichotomizes. The inferior branch of the media divides into a number of branchlets, which are repeatedly bent. The long superior branch of the cubitus remains undivided, and forms a very long curve, while the lower branch of the cubitus separates into three veinlets, which like the anal veins extend in a flat curve to the outer margin. All interspaces are bridged over by numerous straight and close, mostly obliquely arranged cross veins.

EURYTÆNIA VIRGINIANA, new species.

Locality.—Gibson Fork of Fifteen-mile Creek, above Decota, West Virginia, "60 feet above coal locality called 'Keystone.'" Upper Pottsville; Lower Kanawha series.

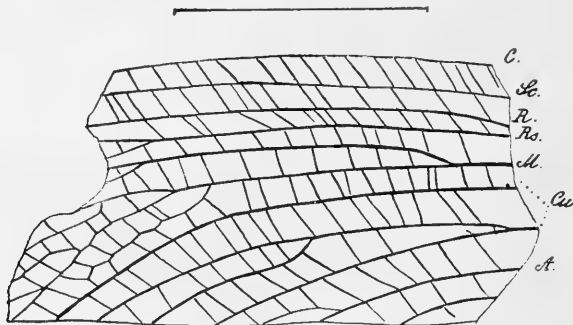


FIG. 3.—EURYTÆNIA VIRGINIANA.

Length of fragment preserved, 34 mm.; probable length of the entire wing, 55 to 60 mm.

Holotype.—Cat. No. 25631, U.S.N.M.

EURYTHMPTERYX, new genus.

In its wing veins this form exhibits great conformity to the slender winged dictyoneurids, but differs in the delicate and rather regular, straight, and nowhere intersecting cross veins. The wing is long and narrow, almost four times as long as broad, with nearly straight costal margin and gently arcuate posterior border. The subcosta extends about two-thirds the length of the wing and proceeds obliquely to the costa. The radius runs nearly parallel with the subcosta and later with the costa, remains simple, and bends somewhat backward before the end. The radial sector arises directly below the base, but first divides in two-thirds the length of the wing into 2 branches, the superior of which forms 3 and the inferior 2 twigs. The long media sends out its isolated anterior branch above the first third of the length of the wing, and then separates in about the middle of the wing into a superior dichotomous and one inferior 3-parted branches. The undivided isolated superior branch of the cubitus issues immediately back of the base and stretches in a gently S-shaped curve to the posterior border, while the lower branch of this vein sends out backward successively 1 forked and 2 simple offshoots. The anal veins extend in curves to the outer margin.

EURYTHMPTERYX ANTIQUA, new species.

Locality.—Pratt mines, near Birmingham, Alabama. Middle Pottsville; Pratt group; ? Sewell stage.

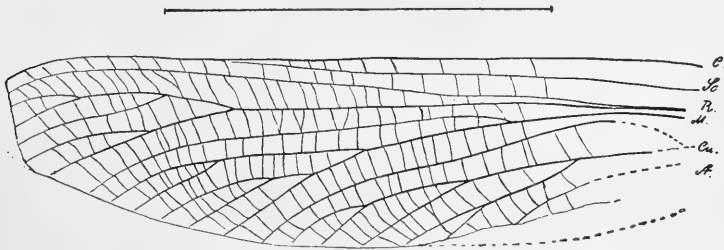


FIG. 4.—EURYTHMPTERYX ANTIQUA.

Length of the wing, 50 mm. Very well preserved.

Holotype.—Cat. No. 38707, U.S.N.M.

Family LYCOCERCIDÆ, new family.

According to my view, Brongniart described as *Lithomantis goldenbergi* two specifically different forms, which in the increased branching of the principal veins are sufficiently distinguished from *Lithomantis* and the other lithomantids. On the other hand, the intercalary venation is preserved, at least in part, as a close network, and recalls that of the dictyoneurids, with which, however, the forms named in

the structure of their bodies do not agree. For this reason I have placed these two French forms in a new genus *Lycocercus*, which is to be regarded as the type of a distinct family.

In all probability one of Scudder's renowned "Devonian insects" may also belong in this group.

PLATEPHEMERA Scudder.

PLATEPHEMERA ANTIQUA Scudder.

——— SCUDDER, Devon. Insects, N. B., 1865, p. 1.

Platephemera antiqua SCUDDER, Canad. Nat., n. s., III, 1867, p. 205, fig. 2; Anniv. Mem. Boston Soc., 1880, p. 7, pl. I, figs. 9, 10.

Platephemera antiqua HAGEN, Bull. Mus. Comp. Zool., VIII, 1881, p. 276.

Platephemera antiqua SCUDDER, Mem. Boston Soc., III, 1885, p. 323.

Locality.—St. John, New Brunswick. Little River group; = ? Pottsville.

Scudder sought to demonstrate that this wing could only belong to an ephemerid-like insect; but Hagen strenuously opposed this view, emphatically declaring the fossil to be an odonate of the family Gomphidae. On the other hand, Eaton conceded a measure of accuracy to Scudder's opinion, yet Brauer thought that comparison could also be made with the wings of certain mantids, blattids, and locustids, but finally expressed himself in favor of Hagen's view. Brongniart again agreed with Scudder, who, however, later departed from his former opinion and raised the fossil to the type of a distinct family, which he wrongly named "Palephemeridae," and brought into relation with the "orthopteroid" protophasmids, yet placed it in the "neuropteroid" Paleodictyoptera.

In my opinion, all the authors mentioned are wrong, and *Platephemera* belongs to the true Paleodictyoptera. Not only the direction of the main veins declares in favor of this view, but also the intercalary venation.

Family HOMOTHETIDÆ Scudder.

This family was originally founded by Scudder on a fossil insect from the Little River group, which undoubtedly belongs to the true Paleodictyoptera. Later this author placed a large number of unrelated forms in this group.

In its shape the wing recalls the forms allied to *Homoioptera* Brongniart, from the Stephanian of Commeny. The costa is marginal, the subcosta not very far removed from it, and preserved nearly to the tip. Radius vaulted like the subcosta, not branched. Radial sector issuing near the base of the wing, with 3 or 4 oblique branches directed backward. Media probably divided near the base into 2 large, doubly forked branches, which are arched as they extend

backward. To all appearance the cubitus had an isolated, long, simple superior branch and a forked inferior branch, both arcuate and directed backward. Anal veins also curved and stretching posteriorly. Anal area neither defined nor ample. Cross veins probably simple and straight, irregularly distributed, and not reticulate.

HOMOTHETUS Scudder.

HOMOTHETUS FOSSILIS Scudder.

——— SCUDDER, *Devon. Insects*, N. B., 1865, p. 1.

Homothetus fossilis SCUDDER, *Canad. Nat.* (2), III, 1867, p. 205, pl. III; *Anniv. Mem. Boston Soc.*, 1880, p. 17, pl. I, figs. 1, 2.

Homothetus fossilis HAGEN, *Bull. Mus. Comp. Zool.*, VIII, 1881, p. 278.

Locality.—St. John, New Brunswick. Little River group; = ? Pottsville.

According to Scudder, the Homothetidae unite the genuine neuropteroides with the pseudoneuropteroides, an assumption for which the present fossil, however, offers very little support. Hagen and Brauer considered *Homothetus* a sialid; Brongniart, on the contrary, an ephemerid. Personally I have no doubt that this form also belongs to the true Palæodictyoptera.

Family HEOLIDÆ, new family.

I here class an American form, which in the structure of the wing differs sufficiently from the European homiopteroids, so that the existence of essential differences in the structure of the body can be also inferred.

In form the wing is more elongated and pointed, with gently arcuate costal border and uniformly rounded inner margin. The anal portion is not broadened. The branches of the radial sector advance far out to the apex, and those of the cubitus as well as of the anal veins continue in gentle curves to the posterior margin. The cross veins are delicate, widely separated, and occasionally branched.

HEOLUS, new genus.

Wing pointed, its costal margin slightly curved and its inner border strongly and uniformly arched, about three times as long as broad. Costal area running out to a point and moderately wide. The subcosta attains three-fourths the length of the wing and fuses in the costa. Radius simple, reaching to the apex and not far removed from the subcosta. The radial sector originates in about one-third the length of the wing and diverges widely from the radius; its first branch arises quite a distance back of the center of the wing, and is divided into 4 twigs; the 4 following simple branches are parallel with each other and directed obliquely backward. The superior branch of

the media issues somewhat above the middle of the wing and forms a large curve with a small terminal fork. The inferior branch separates into 2 or (?) 3 veinlets; then follows a strongly vaulted vein, which in its last third divides into 2 wide forks, and issues either from the entire cubitus or only from its superior branch. Further on there is then seen a similarly curved vein with a short, broad terminal fork; this may pertain to the inferior branch of the cubitus or to the first anal vein. Beyond this still another vein is visible, which runs off in a nearly horizontal curve to the inner border, and forms a small forked end after it had sent off a larger branch obliquely backward and outward; finally, a simple arcuate vein may be seen. Both the latter are anal veins. To all appearance about 5 to 6 anal veins may have been present. The wide interspaces between the branches of the medial, cubital, and anal veins are very striking; all the intervals are bridged over by delicate, somewhat undulating, and occasionally branched cross veins running in an oblique direction.

HEOLUS PROVIDENTIÆ, new species.

Locality.—East Providence, Rhode Island. Pennsylvanian; Allegheny or Conemaugh stage.

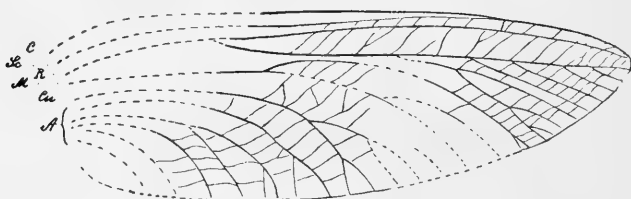


FIG. 5.—*HEOLUS PROVIDENTIÆ*.

Length of the well-preserved fragment, 40 mm.; probable length of the entire wing, 50 mm.

Holotype.—Cat. No. 38700, U.S.N.M.

Family POLYCREAGRIDÆ, new family.

I establish this family on a beautiful, large palæodictyopteran wing from North America, which in respect to the structure and copious branching of the principal veins recalls the spilapterids of Europe; in the form of the anal area, on the contrary, it appears more like *Lamproptilia*, and in the furcation of the medial and cubital veins calls the dictyoneurids to mind.

POLYCREAGRA, new genus.

Wing broadest at the base and of subtriangular form, fully three times as long as wide, with distinctly curved anterior margin. Costa

marginal. Subcosta attaining two-thirds the length of the wing and then uniting with the costa. Radius simple, reaching to the tip, separated from the subcosta and from the radial sector by a uniformly wide interspace; the latter vein originates near the base, and in the apical half of the wing sends off one 5-parted and farther out 7 simple or forked branches, which extend obliquely backward. The simple anterior branch of the media, continuing in a long curve to the inner margin, arises above the first third of the length of the wing, while the lower branch furcates many times, so that 15 twigs reach the margin. The superior branch of the cubitus emerges near the base and forms a long curve with a dichotomous end; the posterior branch, on the other hand, separates into 5 branchlets. The group of anal veins consists of 8 to 9 compound branches, which advance more obliquely than in curves to the inner border, and thus present a nearly fanlike appearance. Plating, however, was not present. The numerous very delicate curved cross veins are undulating or branched, not reticulate.

POLYCREAGRA ELEGANS, new species.

Locality.—Cranston, Rhode Island. Pennsylvanian; near base of section; stage unknown.

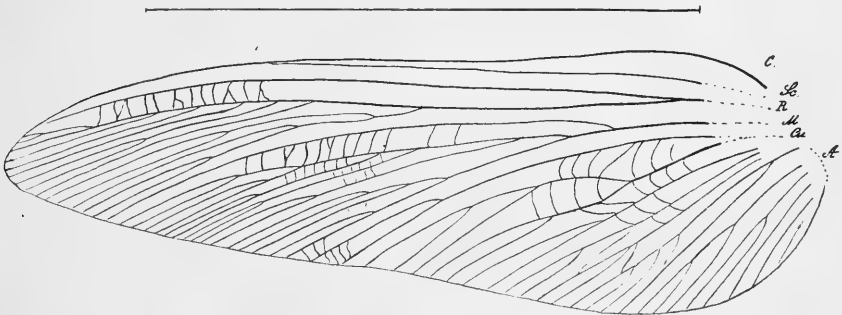


FIG. 6.—POLYCREAGRA ELEGANS.

This finely preserved wing has a length of 75 mm.

Holotype.—Cat. Nos. 38705, 38706, U.S.N.M.

Family EUBLEPTIDÆ, new family.

This family is founded on one of the smallest palæodictyopteran forms from America, which may be distinguished by its remarkably ephemeropterid-like appearance. The four equal wings have a feebly branched venation, which comes very near to the hypothetical type of Comstock and Needham, mentioned above. The head is comparatively large, with large compound eyes; the body slender, with long jointed cerci.

EUBLEPTUS, new genus.

Wing subelliptical, with slightly curved anterior margin and more strongly arcuate inner border, apex rounded off, narrow costal area, and feebly developed anal area. The subcosta reaches almost to the tip of the wing and fuses in the costa. Radius straight, parallel with the subcosta. Radial sector issuing not far above the middle of the wing, twice forked, so that 4 veinlets extend to the border. The media sends out its gently curved upper branch, furnished with a dichotomous end, somewhat above the origin of the radial sector, and further divides into 3 twigs only. The superior branch of the cubitus, which arises near the base, also forms a short terminal fork, and

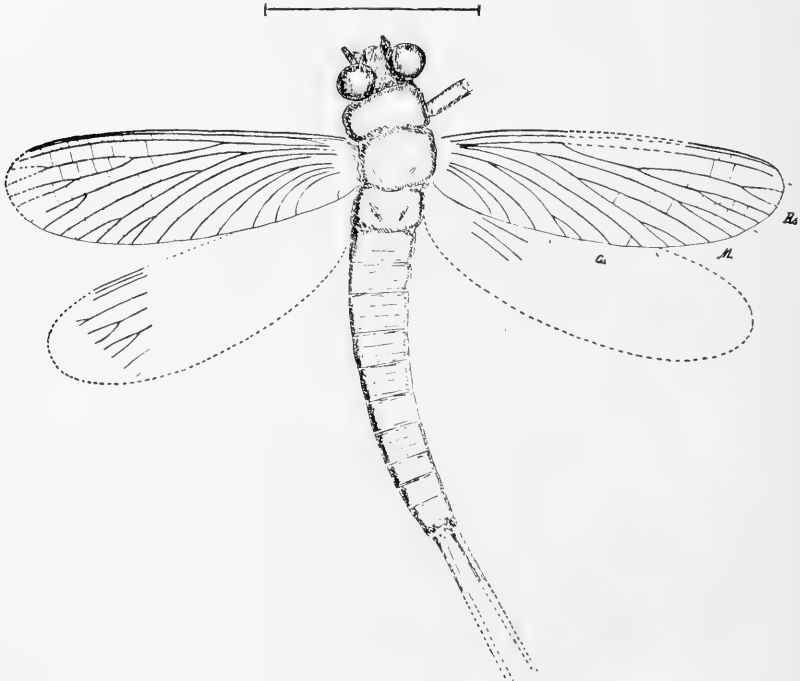


FIG. 7.—EUBLEPTUS DANIELSI.

the inferior stem likewise separates into 3 branchlets. The 3 or 4 anal veins remain simple and extend in strong curves to the inner margin. The remote and irregularly distributed straight cross veins stand perpendicular to the course of the longitudinal veins. The head with its large, arched compound eyes is nearly as broad as the thorax, which consists of 3 nearly equal, never strongly united segments, and no winglike pleurites can be discerned on the prothorax. The 10 distinct abdominal segments are individually broader than long, and very similar to each other. Below the tenth ring follows a short segment, on which the basal portion of the many jointed probably very long cerci are preserved.

EUBLEPTUS DANIELSI, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Length of the wings 13 to 14 mm. This fossil pertains to the smallest insect that has yet been found in the Carboniferous.

Daniels collection. Reverse of holotype in the U. S. National Museum: Cat. No. 35576.

Family METROPATORIDÆ, new family.

I regard a small paleodictyopteran wing from the lower part of the Upper Carboniferous as the type of this family; this is one of the oldest insects yet discovered.

The shape of the wing is subelliptical, with broadly rounded tip. The costal area is not preserved, but judging from the form of the wing may have been rather wide. The subcosta reaches nearly to the tip of the wing. Radius simple. Radial sector arising near the base and dividing into 6 veinlets. Media with a long, forked superior branch and a 3-parted lower branch. Cubitus consisting of slightly arcuate offshoots extending to the posterior border. Judging from the shape of the wing, the anal portion (not preserved) certainly was not ample. Intercalary venation indistinct, consisting of a few irregular cross veins interspersed with delicate little folds.

METROPATOR, new genus.

Wing delicately membranous. Radial sector divided into 3 forks, which are all directed to the apical border. The upper branch of the media forms a short fork and extends obliquely to the end of the inner border. All the following veins stretch obliquely to the posterior margin, and I am not quite certain whether my interpretation of these is correct, because the basal portion of the wing, in which their point of union lies, is wanting. Below the superior branch of the media follows a 3-branched fork, in which the inferior medial branch may be sought; then follows a vein with a very short terminal fork, then a simple one, and lastly a 3-branched vein. These probably all belong to the cubitus, but possibly the last pertains to the anal group.

METROPATOR PUSILLUS, new species.

Locality.—Near Altamont Colliery, Anthracite region, Pennsylvania. Lower Pottsville; Lower Lykens group.

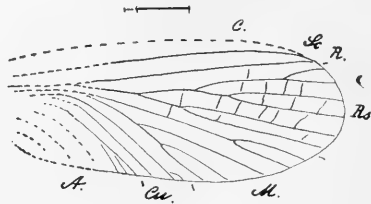


FIG. 8.—METROPATOR PUSILLUS.

Length of the part of the wing preserved, 7 mm.; probable length of the wing, 9 mm.

Holotype.—Cat. No. 35382, U.S.N.M.

Family PAOLIIDÆ, new family.

In this family I place two of Scudder's species of *Paolia*. Notwithstanding that some features in these forms point to the beginning of a higher specialization, as the spreading out and copious branching of the cubital and anal veins along the inner margin, still I believe that they should best be placed, at least for the present, in the Palæodictyoptera. Probably they are rather closely allied to the spilapterids.

PAOLIA Smith.

PAOLIA VETUSTA Smith.

Paolia vetusta SMITH, Amer. Jour. Sci. (3), I, 1871, p. 44, text fig.

Paolia vetusta SCUDDER, Zittel's Handbuch, I, 1885, p. 758, fig. 942.

Locality.—Braxton Quarry, near French Lick, Indiana. Middle Pottsville; Mansfield formation; Quinnimont? stage.

Scudder referred this form to the protophasmids; Brongniart, on the contrary, to the protolocustids, which, in my opinion, is quite wrong:

PAOLIA GURLEYI Scudder.

Paolia gurleyi SCUDDER, Proc. Amer. Acad., XX, 1885, p. 173.

Paolia gurleyi MELANDER, Jour. Geol., XI, 1903, p. 185, pl. VII, fig. 7.

Locality.—Near French Lick, Orange County, Indiana. Middle Pottsville; Mansfield formation; Quinnimont? stage.

Paolia lacoana Scudder and *P. superba* Scudder belong, in my opinion, in another group.

Family ÆNIGMATODIDÆ, new family.

I here place a new palæodictyopteran form from the middle of the Upper Carboniferous of North America, which does not differ essentially from all other forms of this group.

The wing is strongly arched and apparently of firmer texture, broadly rounded at the apex. The anal area is not enlarged.

ÆNIGMATODES, new genus.

The subcosta reaches nearly to the apex of the wing. Radius simple; radial sector divided into 3 members. Media separating into 4 branches. Below the media follows an oblique vein directed to the inferior margin and terminating in a short fork; then 3 simple veins, whose strongly curved ends merge into the lower border. The last 2 of these veins probably belong to the anal group. The intercalary venation consists in part of regular stout cross veins and in part of a polygonal network.

ÆNIGMATODES DANIELSI, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

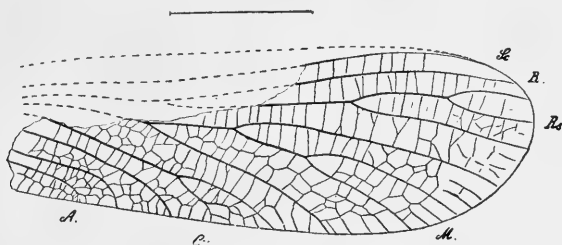


FIG. 9.—ÆNIGMATODES DANIELSI.

Length of the preserved fragment, 18 mm.; probable length of the entire wing, 20 mm.

Daniels collection. Reverse of holotype in the U. S. National Museum; Cat. No. 35578.

PALÆODICTYOPTERA INCERTÆ SEDIS.

The following forms are too imperfectly preserved for accurate description, but most probably they all belong in the order Palæodictyoptera.

LITHENTOMUM Scudder

LITHENTOMUM HARTTII Scudder.

————— SCUDDER, Devon. Insects, N. B., 1865, p. 1.

Lithentomum harttii SCUDDER, Canad. Nat. (2), III, 1867, p. 206, pl. iv: Anniv. Mem. Boston Soc., 1880, p. 22, pl. 1, fig. 3.

Locality.—St. John, New Brunswick. Little River group; = ?Pottsville.

In this small fragment of a wing Scudder discovered "relationship" to the ephemerids, embids, and raphidids, and supposed it to be closely allied to the sialids; it was, therefore, to be regarded as the progenitor of this group. On this ground, also, the family "Chronicosialidæ" was erected. Hagen supposed the fragment to belong to a true sialid; Brauer, however, again found similarity to orthopteres and homopteres. Finally Scudder placed the fossil in the "hemeristines," a group of his "neuropteroid Paleodictyoptera," which, however, as we shall see, contained the most heterogeneous elements.

DYSCRITUS Scudder.

DYSCRITUS VETUSTUS Scudder.

————— SCUDDER, Devon. Insects, N. B., 1865, p. 1.

Dyscritus vetustus SCUDDER, Geol. Mag., V, 1868, pp. 172, 176; Anniv. Mem. Boston Soc., 1880, p. 20, pl. 1, fig. 4.

Locality.—St. John, New Brunswick. Little River group; = ? Pottsville.

A small fragment, which neither Scudder nor any other author has been able to classify.

XENONEURA Scudder.

XENONEURA ANTIQUORUM Scudder.

————— SCUDDER, Devon. Insects, N. B., 1865, p. 1.

Xenoneura antiquorum SCUDDER, Canad. Nat., n. s., III, 1867, p. 206, fig. 5; Anniv. Mem. Boston Soc., 1880, p. 24, pl. 1, figs. 5-7.

Locality.—St. John, New Brunswick. Little River group; = ? Pottsville.

This small, poorly preserved remnant of an insect gave rise to the erection of risky hypotheses and called forth a vigorous controversy among authors. A wrinkled place near the base of the wing was interpreted by Scudder as an organ of stridulation, and led to the establishment of a distinct family, "Xenoneridæ," which combined the characters of the locustids with those of the neuropteres. Darwin, Dawson, and Packard then made use of this fossil as a "striking" example of a synthetical type and of the earliest appearance of organs of stridulation. Later, Scudder himself was obliged to confess that

the structure described as a stridulating organ had nothing whatever to do with the wing. Instead, however, in the sparingly veined, little remnant, he now found indications of a relationship with the ephemerids, sialids, raphidids, and coniopterids. A close examination of the fossil by Hagen gave no positive result, yet it was determined by him that the venation recognized by Scudder pertained in part to a second underlying wing. From Hagen's statements I have sought to correct Scudder's figure, and I have thus succeeded in a plan of neuration which allows the specimen to be referred to the Palæodictyoptera. A more accurate classification, however, appears to me for the time being excluded, and could be obtained only after a second careful examination of the original.

PSEUDOHOMOTHETUS, new genus.

PSEUDOHOMOTHETUS ERUTUS (Matthew.)

Homothetus erutus MATTHEW, Trans. Roy. Soc. Canada, IV, 1894, p. 95, pl. 1, fig. 11.

Locality.—St. John, New Brunswick. Little River group; = ? Pottsville.

I have no doubt that this wing belongs to the Palæodictyoptera, but certainly not to the genus *Homothetus*, with which it has only very slight similarity; I therefore propose a new generic name.

CAMPTERONEURA, new genus.

CAMPTERONEURA RETICULATA, new species.

Locality.—Cordova, Alabama. Middle (?) Pottsville; Mary Lee group; ? Upper Quinnimont stage.

A portion 47 mm. long, from the anal part of a large wing, which permits the recognition

of 8 successive veins, nearly all furcate, and strongly curving to the inner margin; these correspond to the anal group and (? the first 2) probably to a part of the cubitus. Between the veins is found a thin, irregular and wide-meshed network. The characteristic curvature of the principal veins excludes every doubt as to the palæodictyopteran nature of this fossil, to the exact classification of which, however, further data are wanting.

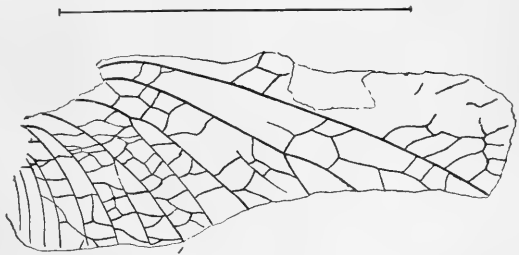


FIG. 10.—CAMPTERONEURA RETICULATA.

Holotype.—Cat. No. 38709, U.S.N.M.

ORTHOAGONOPHORA, new genus.

ORTHOAGONOPHORA DISTINCTA, new species.

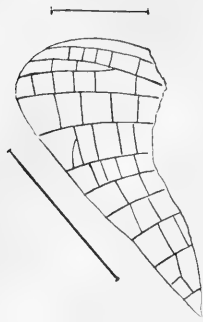


FIG. 11.—ORTHOAGONOPHORA
DISTINCTA.

Locality.—Drews Creek, West Virginia. Coal Measures.

A small piece of a medium-sized wing, permitting the recognition of the end only of the simple radius, a portion of the radial sector with its last short branch, and the ends of 8 other almost parallel veins curving toward the inner margin; the latter certainly belong to the radial sector and to the media. All these veins are united by conspicuous, straight, vertical cross veins.

This fossil, also, most probably belongs to the Palaeodictyoptera, but is too imperfectly preserved to be more accurately determined.

Holotype.—Cat. No. 25632, U.S.N.M.

BATHYTAPTUS, new genus.

BATHYTAPTUS FALCIPENNIS, new species.

Locality.—Coalburg, near Birmingham, Alabama. Upper Pottsville; Pratt group; probably Sewell stage.

The tip of a larger wing, whose sinuate lower border and straight costal margin somewhat recall *Breyeria*. The subcosta is preserved nearly to the tip of the wing and fuses in the costa. The radius is simple and runs parallel with the subcosta. The radial sector, which is separated from the radius by a wide area, sends out its partly dichotomous, partly simple branches, obliquely backward. Delicate, somewhat undulating, and occasionally branched cross veins unite the longitudinal veins, but form no network.

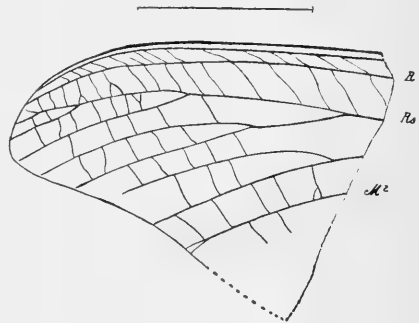


FIG. 12.—BATHYTAPTUS FALCIPENNIS.

In some points this fossil recalls the European breyeriids, but for the present can not be placed with certainty in any family. Doubtless, however, it belongs to the Palaeodictyoptera.

Holotype.—Cat. No. 38708, U.S.N.M.

PALAIOTAPTUS, new genus.

PALAIOTAPTUS MAZONUS, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage.

The tip of a wing. Anterior margin gently curved, lower margin not sinuate. Subcosta near to the costa and continuing almost to the tip. Radius simple, radial sector with oblique, simple, or compound

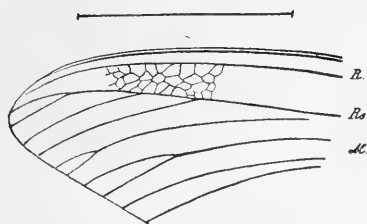


FIG. 13.—PALAIOTAPTUS MAZONUS.

veins extending backward and separated from the radius by a broad space. The intercalary venation consists of a wide-meshed network, like that in the dictyoneurids.

Holotype.—Cat. No. 38815, U.S.N.M.

PSEUDOPAOLIA, new genus.

PSEUDOPAOLIA LACOANA (Scudder).

Paolia lacoana SCUDDER, Proc. Amer. Acad., XX, 1885, p. 173.

Locality.—Pittston, Pennsylvania. Pennsylvanian.

In any event this species does not belong in the genus *Paolia* Scudder, but most probably likewise to the Palæodictyoptera.

Holotype.—Cat. No. 38100, U.S.N.M.

PARAPAOLIA, new genus.

PARAPAOLIA SUPERBA (Scudder).

Paolia superba SCUDDER, Proc. Amer. Acad., XX, 1885, p. 173.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage.

This palæodictyopteran form also certainly belongs in a distinctly different genus from *Paolia* Scudder and *Pseudopaolia* Handlirsch.

LARVAL PALÆODICTYOPTERA.

(PALÆODICTYOPTERON) MAZONUM, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage.

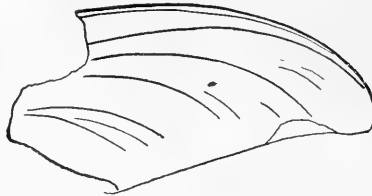


FIG. 14.—(PALÆODICTYOPTERON) MAZONUM.

A portion of a wing pad of cambered and stoutly pointed form; 18 mm. in length.

Holotype.—Cat. No. 38831, U.S.N.M.

(PALÆODICTYOPTERON) LATIPENNE, new species.

Locality.—Braidwood, Illinois. Pennsylvanian; Conemaugh ? stage.



FIG. 15.—(PALÆODICTYOPTERON) LATIPENNE.

A wing pad 22 mm. long, with gently curved anterior margin, broadly rounded tip, and broader base.

Holotype.—Cat. No. 38838, U.S.N.M.

(PALÆODICTYOPTERON) VIRGINIANUM, new species.

Locality.—McGinnis's mine, near Redbird, West Virginia. (Raleigh ? Pottsville ?).

Probably 400 feet above the Hampton conglomerate. Soft coal. Raleigh sheet. Collector, B. F. Phillips.

A portion of the thorax with the wing pads and some remnants of the abdominal segments. The well-preserved pad of the hind wing



FIG. 16.—(PALEODICTYOPTERON) VIRGINIANUM.

shows a strongly arched upper margin and an almost straight posterior border. It has a length of about 12 mm.

Holotype.—Cat. No. 25635, U.S.N.M.

Order PROTODONATA (Brongniart) Handlirsch.

Generally large insects, whose slender body very quickly recalls that of the odonates. The four equal wings are independent of each other and movable only in a vertical direction; at rest, horizontally outspread. The neuration of the wing is more highly specialized by the coalescence of several longitudinal veins in the basal portion of the wing, by the conversion of longitudinal veins into the so-called accessory sectors, and by the regular arrangement of cross veins. Intersection of the longitudinal veins, pterostigma, "wing triangles," as well as the reduction of the anal veins, which are quite generally present in the odonates, are still entirely wanting in the present group. The head is large, with large eyes, and powerful mandibles; the thorax is constructed like that in the odonates, with much reduced tergites of the meso- and metathorax, on account of which the wing bases appear to be nearer together. The legs are strong, similar in form, and of normal length; the antennæ short. Unfortunately, in no specimen has the end of the abdomen yet been found, so that at present nothing can be said as to the nature of the appendages.

There is indeed no doubt that this group constitutes a connecting link between the palæodictyopteres and the odonates, combining the characters of the two orders.

The protodonates embrace the largest fossil insects yet discovered (length of wing over 300 mm.), and are found principally in the younger beds of the Carboniferous of Europe and America.

PARALOGUS Scudder.

PARALOGUS ÆSCHNOIDES Scudder.

Paralogus æschnoides SCUDDER, Bull. U. S. Geol. Surv., No. 101, 1893, p. 21, pl. 1, figs. a, b.

Paralogus æschnoides BRONGNIART, Faune ent. terr. prim., 1893, p. 521, fig.

Locality.—Silver Spring, East Providence, Rhode Island. Pennsylvanian; ten-mile series; Allegheny or Conemaugh stage.

A well-preserved wing of 60 mm. length.

PALÆOTHERATES, new genus.

PALÆOTHERATES PENNSYLVANICUS, new species.

Locality.—Campbells Ledge, near Pittston, Pennsylvania. Near top of Pottsville; upper transition group.

A fragment of a wing, 45 mm. long. Probable length of wing, 100 mm. One can distinguish numerous longitudinal veins, partly simple, partly compound in the form of accessory sectors, which are united by straight cross veins, as in the odonates, so that rectangular or polygonal cells result. In my opinion, the first conspicuous marginal vein in the specimen may correspond to the costa, and indeed to that part which lies outside the point of union with the subcosta.

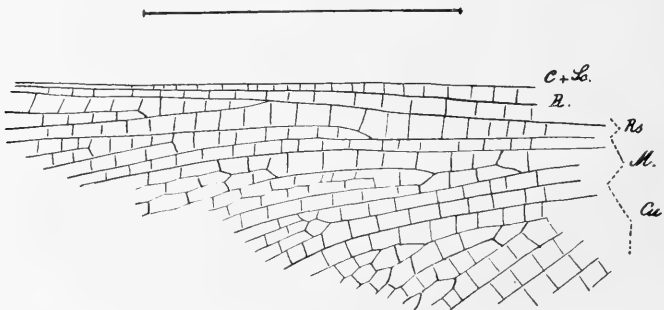


FIG. 17.—PALÆOTHERATES PENNSYLVANICUS.

The second vein visible may then be the radius, and the 2 following branched veins should belong to the radial sector, the 3 succeeding this to the media, and the next to the cubitus. The accuracy of this assumed interpretation rests upon a portion only of the terminal half of a very large wing. On the other hand, should the second conspicuous vein be declared the subcosta, the interpretation would then be a much more difficult one and the resemblance to the other prodonates much lessened.

Holotype.—Cat. No. 38787, U.S.N.M.

Order MEGASECOPTERA (Brongniart) Handlirsch.

In this order I place a series of more highly developed forms, which are derived directly from the Palæodictyoptera. These forms are especially distinguished by the fact that a tendency to degeneration appears, namely, a specialization of the anal part of the wing, as well as a reduction in the number of cross veins, the regular arrangement of these, and the partial coalescence of the media and cubitus with the base of the radius. A further important character to be noted is the differentiation of the thoracic segments by the diminution of the prothorax. In agreement with the Palæodictyoptera we here also find \pm equal, horizontal, outspread wings, independent of one another, rather uniform segmentation of the abdomen, and very well-developed cerci.

I believe that it will not appear too hazardous if I express the opinion that the megasecopteres are a lateral branch of the palæodictyopteres, from which the insects of the panorpatean series have later developed. Various features support this opinion, as, for instance, the cordate head of many Megasecoptera, the independently moving wings diminished at the base, the approaching cerci of many forms, the reduction of the cross veins, etc.

The megasecoptera are represented by numerous forms in the middle and upper parts of the Upper Carboniferous of Europe. The first two species were discovered in America.

RHAPHIDIOPSIS Scudder.

RHAPHIDIOPSIS DIVERSIPENNA Scudder.

Rhaphidiopsis diversipenna SCUDDER, Bull. U. S. Geol. Surv., No. 101, 1893, p. 11, pl. 1, figs. c. d.

Locality.—Cranston, Rhode Island. Pennsylvanian; near base of section; stage?

This fossil requires further investigation.

ADIAPHTHARSIA, new genus.

ADIAPHTHARSIA FERREA, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

An entire insect with horizontally outspread wings. Length of the body (without appendages) 10.2 mm.; length of wing, 8 mm.

The abdomen is as wide at the base as the thorax, but diminishes posteriorly in a manner similar to that in many megasecopteres. The four wings are similar in form and size, their anterior border is nearly straight, the lower margin strongly arched, the anal area neither defined nor expanded. Costa, subcosta, and radius are adjacent and nearly parallel; the radial sector appears to emerge about in the mid-

dle of the wing. The media enters into union with the radial sector by means of its superior branches; likewise the cubitus with the media. The anal veins arise from one common stem, which stretches obliquely

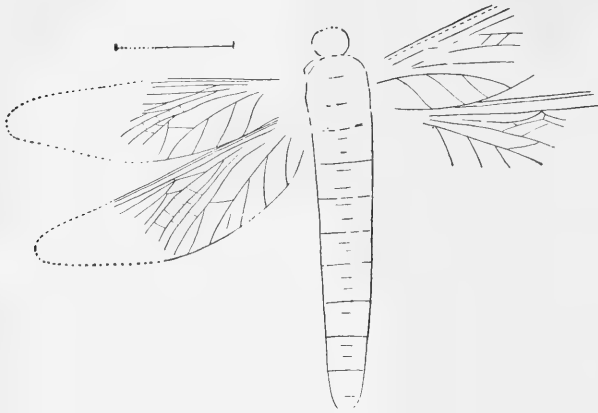


FIG. 18.—*ADIAPHTHARSIA FERREA*.

to the inner edge, so that we apparently see but one anal vein with 3 offshoots branching off posteriorly. Cross veins are developed in small numbers.

Unfortunately, there is but one specimen of this interesting form at hand, which is from the collection of

Mr. Daniels. The wings are all preserved only to the middle, and their venation is, on account of occasional shifting, hard to decipher.

Order HADENTOMOIDEA, new order.

I establish this order upon a very interesting insect, which in many points still recalls the Palaeodictyoptera; in other respects, however, it departs so widely from this and all other fossil groups that I regard the new order warranted.

The head is free, rather large, and apparently prognathous; it shows moderately large, lateral, compound eyes, and its form somewhat recalls the head of perlids or embids. The prothorax is remarkably elongate and wider than the head, without pleurites. Meso- and metathorax somewhat smaller than the prothorax. Abdomen rather compressed, shorter than the wings. Hind wing only slightly shorter and broader than the front wing, while the difference in their venation is scarcely worth mentioning. Costa marginal, well developed; subcosta abridged, ending immediately below the middle of the wing. Radius simple and stout, continuing to the tip. The radial sector arises near the base and is far removed from the radius; it separates into 3 branches. The media is free and forms a large fork. The likewise free cubitus extends obliquely to the inner border and sends out posteriorly 4 short, simple, or furcate branchlets. The first anal vein forms a short fork, the second is simple, and both continue in a curve to the posterior margin. The anal area is small in both pairs of wings and is not defined. The wide space between the radius and the radial sector is filled up with large polygonal cells and the remaining inter-

spaces are bridged over by straight cross veins far removed from each other. The wings are not horizontally outspread, as in previously mentioned forms, but are laid back flat over the abdomen, yet not folded.

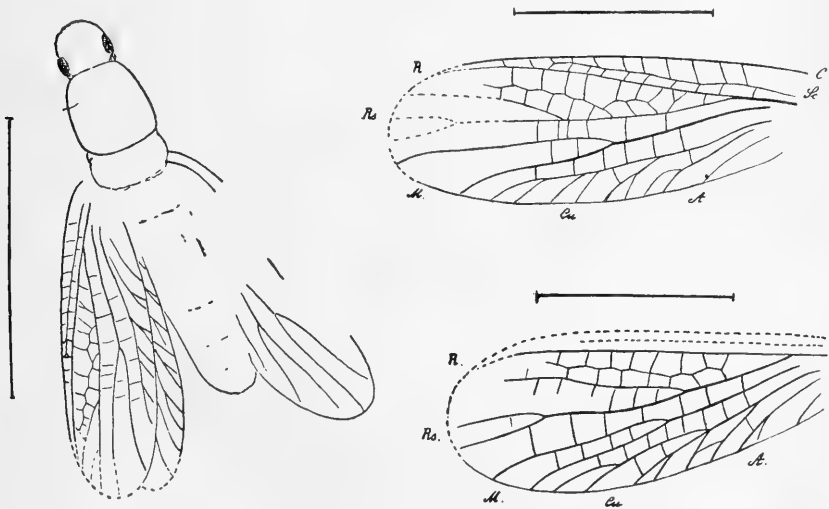
The derivation of this form from the palaeodictyopteres is certainly not so difficult as the determination of its relations to the more highly developed groups, of which, in my opinion, the highest perllids and embids come into consideration. In view of the entire course of evolution, the latter of these groups seems to me to agree most closely, on account of the stronger reduction of the anal portion of the wing and of the cross veins, for it must be admitted that the progenitors of the perllids may also have already possessed a tendency to the formation of an anal fan in the hind wing; further, that the number of their longitudinal and cross veins may have been still greater. If the reduction of the cross and longitudinal veins in the wing of *Hadentomum* is imagined to have advanced only a little farther, there would result in any event an embidlike form of wing.

This explanation, however, still remains very uncertain, and it is easily possible that direct descendants of *Hadentomum* no longer exist.

HADENTOMUM, new genus.

HADENTOMUM AMERICANUM, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.



FIGS. 19, 20, 21.—HADENTOMUM AMERICANUM.

Length of front wing, 26 mm.; length of entire specimen 35 mm.

Daniels collection. Reverse of cotype in the U. S. National Museum; Cat. No. 35579.

Order HAPALOPTEROIDEA, new order.

This order is to be regarded as provisional, and, moreover, includes but one American fossil of which there is only one front wing known, and which permits itself at present to be ranked in no other order.

The neuration of this wing may be easily traced to the palaeodictyopteran type, yet in the reduction of the cubitus and in the more vaulted (instead of extending in a curve to the lower margin) anal veins, it shows itself more highly specialized. A separation of the anal area has not yet been attained, and the wing appears to have been of a very tender, delicate, membranous nature. As neither the body nor the hind wing is present, I have not attempted to place this interesting fossil in one of the other Paleozoic orders, although it is always possible that it belongs in the protorthopteran group. It may be, however, that in this specimen we must seek a forerunner of the perliidae, the venation of which can quite easily be traced in that of the present fossil. However, in any case, further discoveries must be awaited before we can here render a final decision.

HAPALOPTERA, new genus.

HAPALOPTERA GRACILIS, new species.

Locality.—Sharp Mountain Gap, near Tremont, Pennsylvania. Anthracite series; stage undetermined.

Length of wing, 15 mm. The greatest width amounts to scarcely one-third the length and lies somewhat below the middle of the wing. The tip is rounded off obliquely; the costal border is so slightly curved as to be almost straight; the costal area is narrow. The subcosta

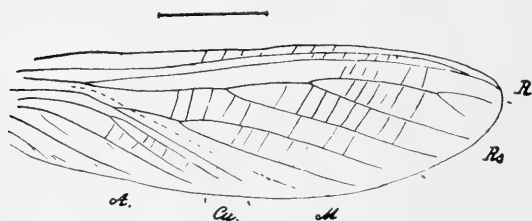


FIG. 22.—HAPALOPTERA GRACILIS.

fuses with the radius just above the tip of the wing. Radius simple, not far removed from the subcosta. Radial sector originating near the base of the wing, with 3 simple branches extending obliquely to

the apical border. Media independent, not uniting with the radius; it first sends off an oblique branch to the inner margin and then forms a large long fork, whose branches continue obliquely to the lower end of the apical border. The cubitus is restricted to a single long fork, below which 2 distinctly vaulted, simple anal veins are then to be seen. Midway through the medial group stretches a furrow, but the limits of the anal area are not fixed. The cross veins are not very distinct, but appear to have been rather regularly distributed. The wing joins the thorax with a broad base.

Holotype.—Cat. No. 38731, U.S.N.M.

Order MIXOTERMITOIDEA, new order.

This order is likewise a provisional one, and includes only two forms, *Mixotermes luganensis* Sterzel, from Saxony, and *Geroneura wilsoni* Matthew, from St. John, New Brunswick, the placing of which in other orders has seemed to me hazardous.

The wings of these forms are distinguished by a broadly rounded apical border, and in respect to their neurulation they very closely approach the palæodictyopteran type. The few branches of the media, the cubitus, and the anal veins extend obliquely to the lower margin. The anal area is feebly developed, and its limits are not fixed; the subcosta is reduced, the radius simple, and its sector feebly branched. Cross veins straight and numerous.

There will probably be no doubt cast on the direct derivation of these forms from the palæodictyopteres. Whether, however, they must be brought into nearer relations to the protorthopteres or to the perliids, I have not been able for the present to decide.

GERONEURA Matthew.

GERONEURA WILSONI Matthew.

Geroneura wilsoni MATTHEW, TRANS. Roy. Soc. Canada, IV, 1889, p. 57, pl. iv, fig. 10.

Locality.—St. John, New Brunswick. Little River group; = ? Pottsville age.

Order PROTORTHOPTERA Handlirsch.

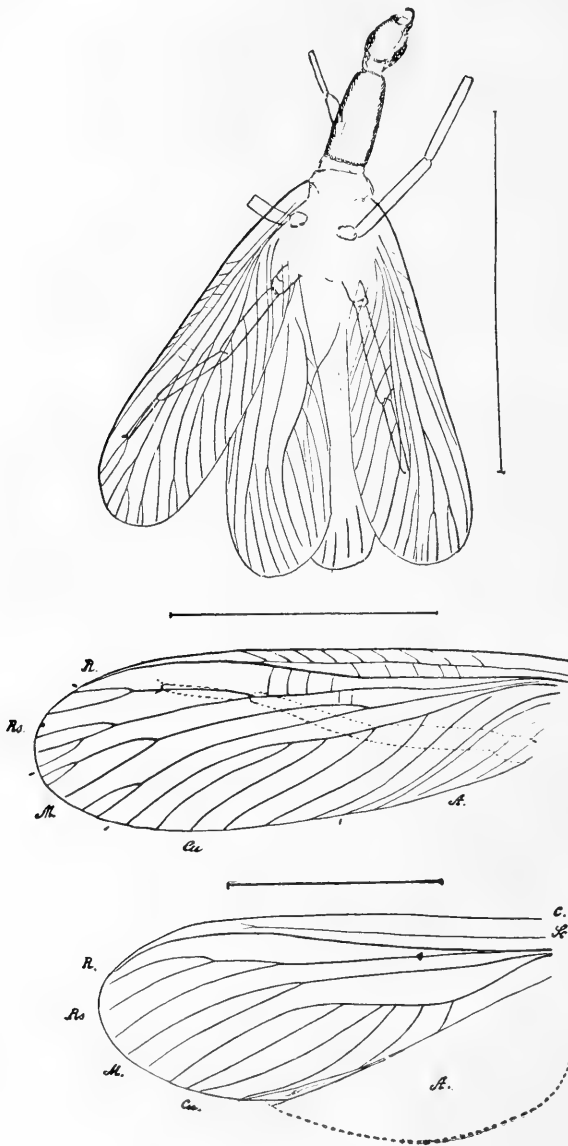
This order embraces a series of Paleozoic forms, which are distinguished by more highly specialized wings and, according to my view, constitute a transition from the palæodictyopteres to the orthopteres (*s. str.*). The wings of these forms are folded over the abdomen when at rest; the front wings no longer have the simple venation which we have seen in the Palæodictyoptera, and their veins no longer extend in regular curves to the inner margin. The hind wings are rather similar to the front ones, yet possess an enlarged anal area marked off by a fold. When the wings are at rest, this area is doubled under. The body is more or less strongly built; the prothorax large, often much elongated; the head large with strong mouth parts fitted for chewing, and with long slender antennæ. The legs are either similar in form and fitted for running, or the hind ones are transformed into legs for jumping. Stridulatory organs not yet present.

Family SPANIODERIDÆ, new family.

In this family I place a number of American forms with greatly elongated prothorax and strongly vaulted cubital vein, whose oblique branches are directed backward. These forms have as yet no legs for jumping.

SPANIODERA, new genus.

Front wing with apical border broadly rounded, slightly curved marginal costa, and abridged subcosta. Radius simple, reaching nearly



FIGS. 23, 24, 25.—SPANIODERA AMBULANS.

to the tip of the wing. Radial sector issuing near the base, furcate below the middle, and each branch again divided. About in the middle of the wing, the media separates into 2 forked branches. The

cubitus is long, continued in a gently S-shaped curve, and sends out 5 simple offshoots obliquely backward. The few anal veins are gently arcuate. Hind wing with a large anal area, limited by a straight fold, radial sector 3-branched and media simply furcate; its cubital vein is more strongly arcuate and the branches extend in part to the apical margin, in part to the anal furrow. Cross veins not very distinct, oblique in the costal area, elsewhere more perpendicularly arranged.

The prothorax is long and narrow, the head rather large and seemingly prognathous, with moderately developed compound eyes. Middle and hind legs appear far removed from one another and are long and stout.

SPANIODERA AMBULANS, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Length of the entire insect, 48 mm. Length of the front wing, 35 mm.

Holotype.—Cat. No. 38817, U.S.N.M.

GYROPHLEBIA, new genus.

Very similar to *Spaniodera*. Costa nearly straight. Subcosta continued farther toward the tip of the wing. Radius simple. Radial sector originating near the base, with 3 branches directed backward. Media (?) not forked. Cubitus arcuate, with 4 branches extending obliquely to the inner margin. Anal veins similar to those in *Spaniodera*.

Prothorax long; head somewhat prognathous, antennae long and slender; front legs shorter; middle and hind legs longer, all only in part preserved and therefore not to be described in detail.

GYROPHLEBIA LONGICOLLIS, new species.

"Near *Cheliphlebia*" SCUDDER, Mem. Boston Soc., III, 1885, p. 329, pl. xxx, fig. 7.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

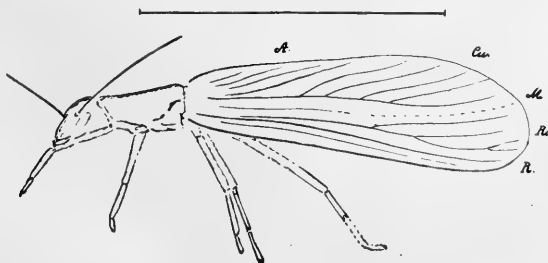


FIG. 26.—GYROPHLEBIA LONGICOLLIS.

Length of the entire insect, 40 mm.

Scudder has placed this fossil in the homothetids and rightly recognized its affinity with *Cheliphlebia*. He, however, regarded the homothetids as neuropteroid forms.

Holotype.—Cat. No. 38150, U.S.N.M.

MIAMIA Dana.

MIAMIA BRONSONI Dana.

Miamia bronsoni DANA, Amer. Jour. Sci. (2) XXXVII, 1864, p. 34, fig. 1.

Miamia bronsoni SCUDDER, Mem. Boston Soc., I, 1866, p. 190, pl. VI, figs. 2, 4.

Miamia bronsoni BRONGNIART, Bull. Soc. Rouen (3), XXI, 1885, p. 62.

Locality.—Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

On this fossil Scudder founded the "neuropteran" group Pakeopterina, which he brought into relation with the termitids. Gerstaecker considered the fossil a perlid; Brongniart, a "neurorthopteron" of the family "Hadrobrachypoda;" Brauer, on the other hand, found more affinity with the orthopteres.

PROPTETICUS Scudder.

PROPTETICUS INFERNUS Scudder.

Propteticus infernus SCUDDER, Mem. Boston Soc., III, 1885, p. 334, pl. XXXI, figs. 3, 4.

Locality.—Little Vermilion River, Vermilion County, Illinois. Pennsylvanian; Allegheny? stage.

Scudder placed this form also in the neuropteroid series, in the Palaeopterina. Brauer stated that its systematic position was undetermined, but found relationship with the sialids.

CAMPTOPHLEBIA, new genus.

CAMPTOPHLEBIA CLARINERVIS (Melander).

Dictyonera clarinervis MELANDER, Jour. Geol., XI, 1903, p. 185, pl. VI, fig. 1; pl. VII, fig. 8.

Locality.—Danville, Illinois. Pennsylvanian; Conemaugh (or Freeport?) stage.

Melander wrongly referred this form to the dictyoners, which he regarded as a protophasmid. I am therefore forced to propose a new generic name for the fossil.

METACHELIPHLEBIA, new genus.

METACHELIPHLEBIA ELONGATA (Scudder).

Cheliphlebia elongata SCUDDER, Mem. Boston Soc., III, 1885, p. 328, pl. XXIX, fig. 7.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

This form was likewise referred by Scudder to the "neuropteroid" homothetids. In my opinion, the insect belongs to the protorthopteres, and in a genus other than *Cheliphlebia carbonaria* Scudder; wherefore, I propose a new generic name.

PARACHELIPHLEBIA, new genus.

PARACHELIPHLEBIA EXTENSA (Melander).

Cheliphlebia extensa MELANDER, Jour. Geol., XI, 1903, p. 186, pl. vi, fig. 2; pl. vii, fig. 9.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

This appears to me to be also generically different from *Cheliphlebia carbonaria*.

PETROMARTUS Melander.

PETROMARTUS INSIGNIS Melander.

Petromartus insignis MELANDER, Jour. Geol., XI, 1903, p. 192, pl. vi, fig. 6; pl. ix, figs. 12, 13.

Locality.—Petty's Ford, Little Vermilion River (Danville), Illinois. Pennsylvanian; Allegheny? stage.

Melander referred this form to the homothetids.

DIECONEURA Scudder.

DIECONEURA ARCUATA Scudder.

Dieconeura arcuata SCUDDER, Mem. Boston Soc., III, 1885, p. 336, pl. xxx, fig. 4.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Scudder placed this fossil with the Palæopterina, a family of his neuropteroid Palæodictyoptera.

Holotype.—Cat. No. 38146, U.S.N.M.

DIECONEURITES, new genus.

DIECONEURITES RIGIDUS (Scudder).

Dieconeura rigida SCUDDER, Mem. Boston Soc., III, 1885, p. 336, pl. xxix, fig. 10.

Locality.—Campbells Ledge, Pittston, Pennsylvania. Near top of Pottsville; upper transition group.

A poorly preserved fossil, which, however, still makes it possible to discern that it belongs in a different genus from *Dieconeura arcuata* Scudder. Scudder referred the form to the Palæopterina.

Holotype.—Cat. No. 38156, U.S.N.M.

METRYIA, new genus.

Front wing of a form similar to that in *Dicooneura*, but somewhat less slender. The marginal costa not vaulted. Subcosta reduced. Radius simple, reaching to the tip. Sector issuing near the base and divided into 2 dichotomous branches below the middle of the wing. Media probably simple. Cubitus apparently forming a large curve, from which one simple offshoot, then 2 forked ones, and finally one more simple, short branch run off successively backward. Anal area with 2 compound and 1 simple veins. Cross veins preserved only on the costal border.

METRYIA ANALIS, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

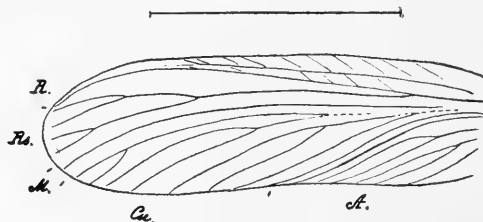


FIG. 27.—METRYIA ANALIS.

This large wing, 34 mm. long, most probably belongs to a spanioiderid form, although the cubitus appears to be somewhat differently constructed than in the other genera of the group.

Holotype.—Cat. No. 38834, U.S.N.M.

Family CEDISCHIIDÆ, new family.

A number of the protorthopteres are characterized by the fact that the superior branch of the media of the front wing coalesces with the radial sector, and later again furcates to continue on apparently as an offshoot of the latter vein. In one of the previously discovered forms of this group, the hind legs are preserved and are developed as legs for jumping (as in locustids).

This group is represented in Europe and America.

GENENTOMUM Scudder.

GENENTOMUM VALIDUM Scudder.

Genentomum validum SCUDDER, Mem. Boston Soc., III, 1885, p. 329, pl. xxx, figs. 2, 3.

Edischia valida BRONGNIART, Faune ent. terr. prim., 1893, p. 559.

Locality.—Mazon Creek, near Morris, Illinois; Pennsylvanian; Kittanning? (Allegheny) stage.

Seudder took the hind wings for the front ones, and referred the form to the homothetids (Palaeodictyoptera Neuropteroidea); Brauer found affinity with the sialids, and only Brongniart recognized the relationship with the orthopteres in a strict sense.

Holotype.—Cat. No. 38135, U.S.N.M.

PROGENENTOMUM, new genus.

Closely allied to the genus *Genentomum*. The front wing is somewhat more pointed, its anterior margin slightly arched; subcosta reduced; radius simple, its sector emerging far above the middle, with 4 in part furcate anterior branches. Media with (?) 5 nearly parallel principal offshoots, the first of which comes in contact with the radial sector at one point. Cubital and anal parts not preserved. Cross veins almost straight, rather regular and numerous, but not very strongly imprinted.

PROGENENTOMUM CARBONIS, new species.

Locality.—Mazon Creek, near Morris, Illinois; Pennsylvanian; Kittanning? (Allegheny) stage.

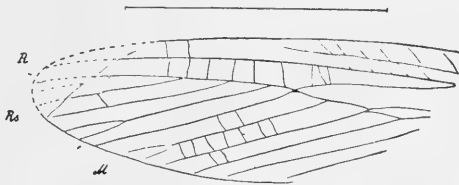


Fig. 28.—PROGENENTOMUM CARBONIS.

A piece, 35 mm. long, of a wing whose length was about 50 mm. Daniels collection. Reverse of holotype in the U. S. National Museum; Cat. No. 35580.

Family GERARIDÆ, new family.

In this family I place a series of larger American forms, which in the main are not sufficiently well preserved to be accurately described, yet permit it to be clearly seen that they belong to the protorthopteres. The bodies of these insects are not well preserved, nevertheless they appear to have been rather slender and the prothorax seems compressed, with margins, borders, or processes perhaps similar to those which we find in many recent Orthoptera. Unfortunately, in all the fossils of this group at hand the front and hind wings lie over one another—that is, are folded over the abdomen, so that the deciphering of the neuration is attended with considerable difficulty.

It is possible that this family may coincide with the œdischiids when better preserved examples become known.

GERARUS Scudder.

Wings with slightly arcuate anterior border, marginal costa, broadly rounded end, and abridged subcosta. Radius simple. Radial sector issuing near the base, with numerous in part divided branches. Media (at least in the hind wing) free; cubitus with several offshoots branching out backward.

Anal area of hind wing fanlike, enlarged, and plaited.

GERARUS VETUS Scudder.

Gerarus vetus SCUDDER, Mem. Boston Soc., III, 1885, p. 344, pl. xxxi, fig. 6.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Scudder placed this form in the group "Gerarina," of his neurop-
teroid Palaeodictyoptera.

Holotype.—Cat. No. 38136, U.S.N.M.

GERARUS LONGUS, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

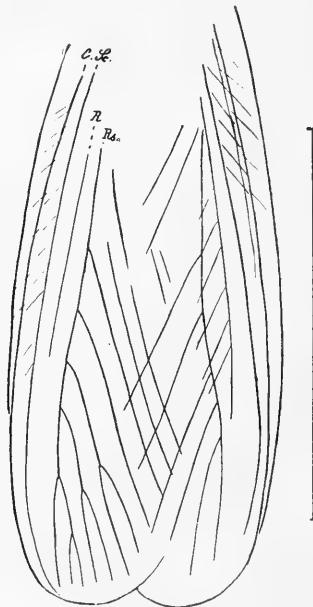


FIG. 29.—GERARUS LONGUS.

Length in similar wings, 50 mm.; more slender than the preceding species.

Holotype.—Cat. No. 38822, U.S.N.M.

GERARUS DANIELSI, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Obverse and reverse of a magnificently preserved example, in which, however, the wings again unfortunately lie over one another. With the exception of the anterior margin, the front wing has only mere traces left, so that the venation of the hind wing, at least, can be more clearly made out.

The accompanying figure shows on the right side the well-defined marginal costa, then the subcosta ending in the costa above the apex, the simple radius, the radial sector arising near the basal attachment of the wing, and having 5 simple or (on the left) compound branches, then the many-times branched media, and finally the cubitus, with its abridged offshoots continuing downward toward the anal furrow. In the evidently plaited anal fan, a number of straight veins are to be seen diverging radially. Cross

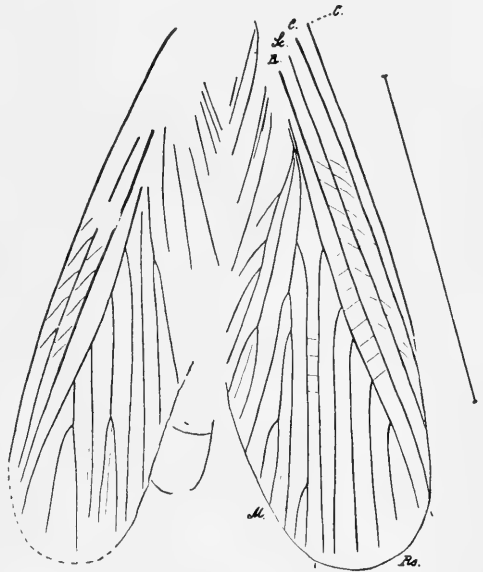


FIG. 30.—GERARUS DANIELSI.

veins appear to have been abundantly developed, but are not sharply defined. The abdomen was shorter than the wings, and moderately stout; the prothorax large, almost saddle-shaped, and not broader than long, rugose and always furnished with 2 spinelike processes on the sides. A longer process lying in front of the prothorax may pertain to a part of the head.

Daniels collection. Plastotype and reverse of holotype in the U. S. National Museum: Cat. Nos. 25928, 35574.

GERARUS MAZONUS Scudder.

Gerarus mazonus SCUDDER, Mem. Boston Soc., III, 1885, p. 344, pl. xxxii, fig. 7.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

GERARUS ANGUSTUS, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

This species was longer and more slender than the foregoing, and may have had a length of wing of about 65 mm., of which 53 mm. are preserved.

Holotype.—Cat. No. 38811, U.S.N.M.

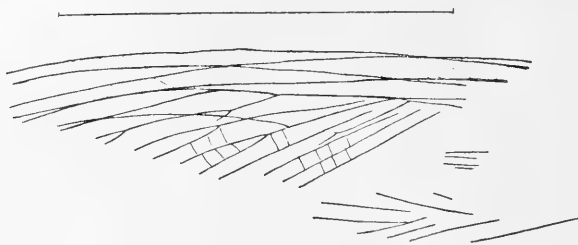


FIG. 31.—GERARUS ANGSTUS.

GENOPTERYX Scudder.

By this generic name Scudder designated a fossil which in any event is most nearly related to *Gerarus*.

GENOPTERYX CONSTRICTA Scudder.

Genopteryx constricta SCUDDER, Mem. Boston Soc., III, 1885, p. 327, pl. XXIX, fig. 11.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Scudder referred this form not to the Geraridae, but to the homothetids.

Holotype.—Cat. No. 38148, U.S.N.M.

GERAROIDES, new genus.

By this name I distinguish a form which has been recently published by Melander and erroneously placed in the genus *Dieconcura* Scudder.

GERAROIDES MAXIMUS (Melander).

Dieconcura maxima MELANDER, Jour. Geol., XI, 1903, p. 193, pl. VI, fig. 5; pl. VII, figs. 14-17.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Melander referred this fossil to the Palaeopterina, one of the "neuropteroid" palaeodictyopteran groups.

Order PROTOBLATTOIDEA, new order.

The forms which I include in this order appear to stand in the same relation to the recent blattaforms as do the protorthopteres to the recent orthopteroids—that is, they seem to form a connecting link

between the Palæodictyoptera and the blattæforms. The great similarity existing between many protorthopteres and protoblattoides clearly indicates, therefore, that the two groups were derived from nearly related Palæodictyoptera.

The protoblattoids are characterized by a distinct, rounded head, by a prothorax either not expanded or only moderately so, and by wings which stand about midway between the blattoids and the palæodictyopteran type. When at rest the wings are laid back over the abdomen. The front wings have an anal area fairly well defined and filled up with arcuate or oblique veins descending to the posterior margin; the hind wings, on the other hand, have an enlarged, fold-bearing anal area. The body is not very slender, but still is more so than in the majority of blattoids.

Family ORYCTOBLATTINIDÆ, new family.

This family embraces a series of forms that have been referred by authors partly to the blattids and partly to the homopteræ (Fulgoroïdæ). These forms are distinguished by a well-defined anal area, with a variously large number of more or less oblique or arcuate longitudinal veins; further, by a strongly compound radial sector, a less copiously divided media, and by a large number of delicate veins running out obliquely from the cubitus. The costal area is broad and filled up with numerous veins issuing from the subcosta. From the radius also such veins extend forward. Intercalary venation abundantly developed, often forming accessory sectors between the principal veins. Legs stout, homonomous. Antennæ long and many jointed. Thorax stout, with the pronotum not much expanded.

Very similar wings are still found to-day among the mantoids; for example, in *Metallentica*.

ORYCTOBLATTINA Scudder.

Media free from the base on, not united with the radial sector.

ORYCTOBLATTINA LAQUEATA Scudder.

Oryctoblattina laqueata SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 133, pl. XI, fig. 6.

Locality.—170 feet above the base of the Upper Barren Coal Measures, near Kansas City, Missouri. Chanute shales; Conemaugh ? stage. Scudder regarded this form as one of the Palæoblattariæ.

Holotype.—Cat. No. 38160, U.S.N.M.

ORYCTOBLATTINA AMERICANA, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

A front wing of 19 mm. length. Similar to *Oryctoblattina laqueata*

Scudder. Radial sector with 4 nearly parallel branches extending in an almost straight course to the apical margin. Media free and independent, divided below the middle of the wing into 3 forked branches. Cubitus consisting of 2 long stems, which send out numerous oblique offshoots to the inner margin. Subcosta and radius

with similar branchlets directed to the anterior border. Anal area rather small, with few slightly curved veins. Intercalary venation unfortunately not well preserved.

Holotype.—Cat. No. 38647, U.S.N.M.

ORYCTOBLATTINA LATIPENNIS, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

A fragment 11 mm. long, from the base of a long, proportionally broad wing about 18 mm. in length. The space above the subcosta is filled up with oblique veins, and the wide space between the subcosta and the radius by rather regular cross veins. Radial sector with only a few distant branches. Media free, first furcating below the middle. Cubitus dichotomous, with many oblique veinlets stretching backward.

All interspaces are filled up with straight or undulating cross-veins.

Holotype.—Cat. No. 38656, U.S.N.M.

BLATTINOPSIS Giebel.

Germer's *Blattina reticulata* is to be regarded as the type of this genus. Above the origin of the radial sector, there spring forth proximally from the radius from 1 to 2 longitudinal veins, which most probably belong to the media.

BLATTINOPSIS ANTHRACINA, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

Length of the front wing about 17 mm. Costal border strongly arcuate. Costal area broad. Subcosta does not extend far beyond

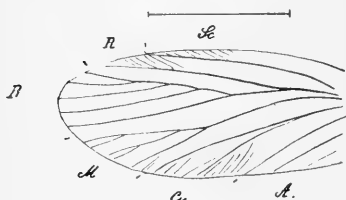


FIG. 32.—ORYCTOBLATTINA AMERICANA.

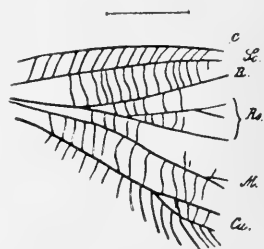


FIG. 33.—ORYCTOBLATTINA LATIPENNIS.

the middle of the wing. Radius continued far toward the apex. Radial sector with 6 nearly parallel branches, the third of which divides into 3 twigs. Above the radial sector only 1 straight branch issues from the radius. Media, however, twice forked. Cubitus furcate, with numerous veinlets extending to the margin. Anal area limited by an arcuate fold, with several nearly straight longitudinal veins. Cross veins in the costal area oblique, as well as in the distal portion of the space above the radius; but in the basal part of the wing they are straighter. Between the branches of the radial sector and the media, as well as in the postcubital area and below the radius, are polygonal cells. In the smaller areas, these cells are arranged in two rows, so that their connecting veins become almost like accessory sectors, as in other species.

Holotype.—Cat. No. 38629, U.S.N.M.

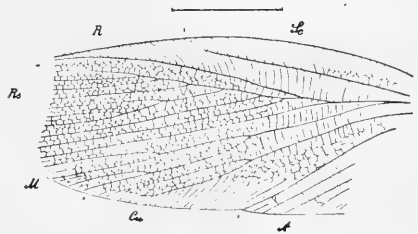


FIG. 34.—BLATTINOPSIS ANTHRACINA.

GLAPHYROPHLEBIA, new genus.

In this genus the number of veins is much more reduced than in those preceding. The media is free and forms a simple fork; the radial sector has 5 simple branches, and the cubitus sends out a series of inclined branchlets which are directed backward without presenting a typical forking. Anal area small, with few veins, and marked off by a nearly straight fold. Intercalary veins well developed. Cross veins not very close; in the larger areas united in a net-like manner.

GLAPHYROPHLEBIA PUSILLA, new species.

Locality.—From a coal mine 150 feet deep, at Braceville, Grundy County, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Length of the front wing, 10 mm. Anterior margin moderately curved, apex very broadly rounded. Costal area broad. Subcosta reaching not far beyond the middle of the wing. Radial sector emerging above the middle of the wing and sending out successively to the apical border 5 simple branches, which diverge in a fanlike manner. Media free, divided into a large fork about in the middle of the wing. Cubitus vaulted, not furcate, sending out backward about 5 branches with accessory sectors lying between them. Anal area small, defined anteriorly by

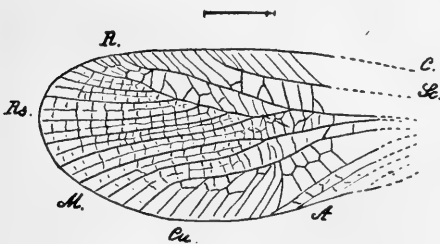


FIG. 35.—GLAPHYROPHLEBIA PUSILLA.

a nearly straight fold. Costal area with oblique cross veins. The remaining broad areas have a wide-meshed network; the small ones have cross and intercalary veins. From the distal end of the radius oblique veins stretch to the anterior margin.

Daniels collection.

MICROBLATTINA Scudder.

Subcosta reduced. Radius with a number of branches directed to the costal margin. Radial sector with about 6 offshoots branching off backward. Media with 2 furcate branches. Cubitus with several oblique veinlets extending backward. Of intercalary and cross-veins there is nothing to be seen.

MICROBLATTINA PERDITA Scudder.

Microblattina perdita SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1898, p. 57, pl. III, fig. 5.

Locality.—East Providence, Rhode Island. Pennsylvanian; Ten-mile series; Allegheny or Conemaugh stage.

Referred by Scudder to the Palæoblattariæ.

Holotype.—Cat. No. 38098, U.S.N.M.

Family ÆTHOPHLEBIDÆ, new family.

In this family, which I regard as a provisional one, I place a form whose relations to the oryctoblattids can hardly be misunderstood.

The costal area is broad. The subcosta sends out numerous oblique veins to the slightly curved costal margin. The radial sector issues from the radius not far above the middle of the wing and sends out several (3 or 4) branches to the apical border. The media separates into 1 superior furcate, and 1 inferior copiously-branched offshoot. The cubitus sends out 4 or 5 oblique branches to the inner border. Anal area long and narrow, marked off by a gently-curved vein. The larger interspaces are bridged over by cross veins far removed from each other.

ÆTHOPHLEBIA Scudder.

ÆTHOPHLEBIA SINGULARIS Scudder.

Æthophlebia singularis SCUDDER, Mem. Boston Soc., III, 1885, p. 338, pl. XXXI, fig. 9.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Length of wing, 33 mm.

Scudder referred this fossil to the Palæopterina, a group of neurop-teroid palæodictyopteres. According to my view, it can scarcely be doubted that the specimen pertains to a form of the blattoid series.

Holotype.—Cat. No. 38147, U.S.N.M.

Family CHELIPHLEBIDÆ, new family.

This is likewise a provisional group, established for the reception of a North American fossil, the systematic position of which still appears not quite clear, although many features indicate that it belongs in the blattæform series.

The wings are folded over the abdomen. The front wings have a distinctly curved anterior margin, a broad costal area, which is filled up with irregular, oblique, and intersecting veins. The radius runs out parallel with and close to the subcosta, and above the middle of the wing sends off a sector divided into 3 to 4 branches. Media free, with a furcate superior branch and a many-times divided inferior offshoot. Cubitus free, with a number of branches stretching toward the inner margin. Anal area small, defined by an arched vein. Cross veins irregular, occasionally reticulate.

CHELIPHLEBIA Scudder.

CHELIPHLEBIA CARBONARIA Scudder.

Cheliphlebia carbonaria SCUDDER, Mem. Boston Soc., III, 1885, p. 328, pl. xxx, fig. 8.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Length of wing, about 40 mm.

Scudder also considered this fossil a "neuropteroid" insect of the group of homothetids. In my opinion, however, this insect can not belong to the Palæodictyoptera, but only to the orthopteroids or to the blattæforms. The reduction of the subcosta and the bow-shaped furrow of the anal area point to the latter group.

Holotype.—Cat. No. 38149, U.S.N.M.

Family EUCÆNIDÆ, new family.

In this family I unite a series of American forms of well-marked blattid-like habit, with broad, nearly elliptical front wings, shieldlike, enlarged, oblong prothorax, and robust body. In some examples, an ovipositor is to be seen. Middle and hind legs are short, their femora stout; the front legs, on the contrary, are longer, and were evidently fitted for the seizing of prey. At the end of the abdomen are 2 rather short cerci. The neuration is characterized by a very broad costal area, which attains about two-thirds the length of the wing, by a reduction of the radius to few branches, and by the expansion of the cubital area. The anal area is reduced and is marked off by a curved suture. When at rest, the firmly chitinized, arched front wings were folded over the abdomen.

EUCÆNUS Scudder.

EUCÆNUS OVALIS Scudder.

Eucænus ovalis SCUDDER, Mem. Boston Soc., III, 1885, p. 325, pl. XXIX, fig. 4.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Two of these specimens show a distinct ovipositor.

Scudder regarded this insect, also, as a neuropteroid form and placed it in the homothetids.

Holotype.—Cat. Nos. 38142, 38810, 38820, U.S.N.M.

EUCÆNUS MAZONUS Melander.

Eucænus mazonus MELANDER, Jour. Geol., XI, 1903, p. 188, pl. VI, fig. 3; pl. VII, fig. 10.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

EUCÆNUS ATTENUATUS Melander.

Eucænus attenuatus MELANDER, Jour. Geol., XI, 1903, p. 188, pl. VI, fig. 4; pl. VII, fig. 11.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

The U. S. National Museum possesses one example (No. 38828), which without doubt belongs to this species. This specimen shows us that the part which Melander took for a head pertains to the prothorax. A second poorly preserved example (No. 38827) exhibits distinctly preserved gonapophyses, which stand out in the form of a short ovipositor.

EUCÆNUS ROTUNDATUS, new species.

"Neuropteroid. Fam. Homothetidae" SCUDDER, Mem. Boston Soc., III, 1885, pl. XXIX, fig. 9.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

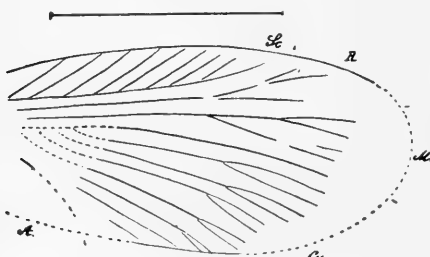


FIG. 36.—EUCÆNUS ROTUNDATUS.

A front wing of about 32 mm. in length and 15 mm. in breadth. The costal area attains scarcely two-thirds the length of the wing and is very broad. The radius first divides below the middle of the wing and forms but a few branches, as does the media. More than

half the breadth of the wing is filled up by the numerous offshoots of the cubitus, which are mainly furcate.

Holotype.—The original bears the Cat. No. 38153, U.S.N.M., and the label "cf. *Aceridiites priscus* Andree."

Family GERAPOMPIDÆ, new family.

The forms of this group are rather closely allied to the eucænidæ; yet the costal area of the front wing appears more reduced and is supplanted by a great number of branches extending forward from the radius. Here, also, the radius and media are crowded back by the strongly developed cubitus. The anal area is marked off by a curved fold. Prothorax elongated.

GERAPOMPUS Scudder.

GERAPOMPUS BLATTINOIDES Scudder.

Gerapompus blattinoides SCUDDER, Mem. Boston Soc., III, 1885, p. 326, pl. xxix, fig. 1.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Scudder regarded this form, which is to be considered the type of the genus, as a homothetid (neuropteroid Palæodictyoptera).

GERAPOMPUS EXTENSUS Scudder.

Gerapompus extensus SCUDDER, Mem. Boston Soc., III, 1885, p. 326, pl. xxix, figs. 5, 8.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Holotype.—Cat. No. 38141, U.S.N.M.

GERAPOMPUS SCHUCHERTI, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Length of the front wing, 27 mm.; breadth, 11 mm.

The form of the wing is almost elliptical, with strongly arcuate anterior border and broadly rounded outer margin. The subcosta extends not far beyond the middle of the wing and sends off 7 in part simple, in part compound veins to the anterior margin. The costal area is more band shaped and narrower than in *Eucænis*. The radius proceeds in an almost straight course to the anterior border and sends off about a dozen oblique twigs directed forward; the sector arises in about the middle of the wing and forms a single fork. The media separates into 3

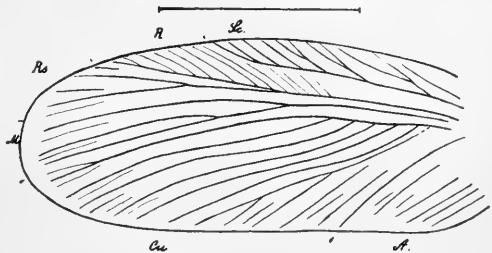


FIG. 37.—GERAPOMPUS SCHUCHERTI.

oblique twigs directed forward; the sector arises in about the middle of the wing and forms a single fork. The media separates into 3

branches, and the strongly developed cubitus gives off about 8 in part compound offshoots obliquely backward. The anal area is defined by an arcuate fold, and contains numerous veins continuing to the posterior border. Between many of the principal branches accessory veins are to be noted.

Holotype.—Cat. No. 38816, U.S.N.M.

FAMILY ADIPHLEBIDÆ, new family.

In this family I place two forms with highly specialized wings and enlarged, shield-shaped prothorax. The habit of these forms is decidedly blattid like, but the venation departs so widely from that of all known Paleozoic blattids that it can be hardly possible for its derivation to be traced from a blattid wing. The branches of the radius, the media, and the cubitus, as well as those of the subcosta, run off almost ray like from the base of the wing, and are separated by numerous intercalary veins; the interspaces are bridged over by many cross veins.

In my opinion, we may be dealing with a highly aberrant side branch of the Protoblattoidea, which probably again disappears in the Paleozoic.

ADIPHLEBIA Scudder.

ADIPHLEBIA LACOANA Scudder.

Adiphebia lacoana SCUDDER, Mem. Boston Soc., III, 1885, p. 345, pl. XXXII, fig. 6.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Holotype.—Cat. No. 38143, U.S.N.M.

ADIPHLEBIA LONGITUDINALIS (Scudder).

Termes longitudinalis SCUDDER, Mem. Boston Soc., III, 1885, p. 350.

Goldenbergia longitudinalis BRONGNIART, Bull. Soc. Rouen (3), XXI, 1885, p. 61.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

This form may possibly coincide with *Adiphebia lacoana*. The original distinctly shows the form of the thorax and the wings folded over one another, the neuration of which appears to have great similarity with that of the foregoing species.

Later, Scudder himself recognized that this fossil was not a termite.

Holotype.—Cat. No. 38140, U.S.N.M.

FAMILY ANTHRACOTHREMMIDÆ, new family.

I establish this family on one of the remarkable insects described by Scudder, the wings of which essentially differ from those of all other Carboniferous insects hitherto known; its chief relations are nevertheless still with the blattæform series. The body of this insect is robust,

constructed similar to that in *Eucænus* and *Adiphebia*; the prothorax is enlarged disk shaped. The front legs, like those in *Eucænus*, appear to have been somewhat elongated. The front wings are slender, 4 times as long as wide, and have a strongly arcuate anterior border, a very narrow costal area extending about two-thirds the length of the wing, and a short anal area which is marked off by a bow-shaped fold. The radius is simple, and reaches nearly to the tip of the wing. The radial sector emerges very near the base of the wing, and sends off 4 or 5 simple branches extending in a curve to the apical border. The offshoots of the media and of the cubitus are hard to separate, are nearly parallel, and are oriented toward the apical border. The neuuration of the hind wing is similar to that of the front wing, yet the subcosta proceeds much farther toward the tip. The anal area is, unfortunately, not to be made out, but was evidently plaited.

Like the foregoing form this appears to be a highly aberrant side branch of the Protoblattoidea.

ANTHRACOTHREMMA Scudder.

ANTHRACOTHREMMA ROBUSTA Scudder.

Anthracothremma robusta SCUDDER, Mem. Boston Soc., III, 1885, p. 327, pl. xxx, figs. 1, 5, 6.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Holotype.—Cat. No. 38139, U.S.N.M.



PROTOBLATTOIDEA INCERTÆ SEDIS.

MEGALOMETER, new genus.

MEGALOMETER LATA, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

The impression of an entire insect, with broad, elliptical wings folded over the abdomen, proportionally narrow abdomen, and small, kidney-shaped prothoracic shield. In habit this form resembles *Eucænus*, yet the prothorax as well as the venation appear to be different.

The length of the entire impression amounts to about 37 mm.; the length of the front wing is about 30 mm.

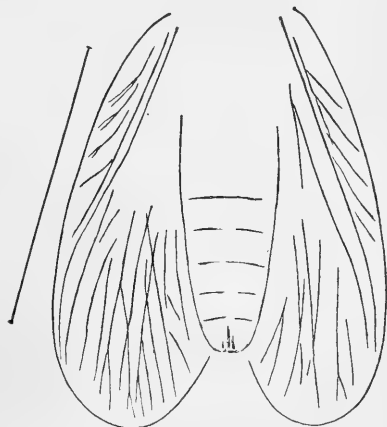


FIG. 38.—MEGALOMETER LATA.

A wide costal area can be distinguished, which takes up about two-thirds the length of the wing. The subcosta is like that in *Euczenus* and sends off 5 or 6 oblique branches anteriorly. Above its extremity the radius curves toward the apical margin and is simple. Its sector appears to arise about in the middle of the wing. In consequence of the overlapping of the front and hind wings, I can not decipher the remaining venation.

Holotype.—Cat. No. 38825, U.S.N.M.

PSEUDETOLATTINA, new genus.

PSEUDETOLATTINA RELIQUA (Scudder).

Eoblattina reliqua SCUDDER, Bull. U. S. Geol. Surv., No. 101, 1893, p. 18, pl. II, fig. g; No. 124, 1895, p. 106, pl. IX, fig. 10.

Locality.—Pawtucket, Rhode Island. Pennsylvanian; Ten-mile series; ? Allegheny or Conemaugh stage.

It seems to me improbable that this fossil belongs to the true blattids, since the shape of the subcosta and of the radius indicate a nearer relationship to *Euczenus*, *Gerapompus*, etc. In many respects, also, the neuration recalls the oryctoblattids.

AGOGOBLATTINA, new genus.

AGOGOBLATTINA OCCIDUA (Scudder).

Oryctoblattina occidua SCUDDER, Proc. Acad. Nat. Sci. Phila., 1885, p. 37; Mem. Boston Soc., IV, 1890, pl. XXXII, fig. 3.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

This form does not probably belong to the oryctoblattids, as Scudder believed, but in any case in the order Protoblattoidea. Unfortunately Scudder's drawing is not clear enough to make it possible to distinguish the veins of the overlapping wings; consequently I am not in a position to determine the systematic position more accurately.

Holotype.—Cat. No. 38103, U.S.N.M.

POLYERNUS Scudder.

POLYERNUS COMPLANATUS Scudder.

Polyernus complanatus SCUDDER, Mem. Boston Soc., III, 1885, p. 343, pl. XXXI, figs. 8, 11.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Obverse and reverse of an insect about 50 mm. long, with front and hind wings folded over the abdomen, and in proportion to the size of the body, with a very small, semicircular pronotum, the tuberculate middle portion of which Scudder took for an eye.

The veins are much more numerous than in most other forms of this order, but through overlapping and folding are so confused that from this example an interpretation is scarcely possible.

Scudder likewise considered this fossil a "neuropteroid" form and placed it in the gerarins.

Holotype.—Cat. No. 38144, U.S.N.M.

POLYETES, new genus.

POLYETES FURCIFER, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Front wing, 24 mm. long, broadly elliptical, with rounded apical margin. The subcosta may have attained about two-thirds the length of the wing. The radius is simple and somewhat recurved toward the end; near the base of the wing it sends out the sector, which is divided into 5 branches. The media likewise separates near the base of the wing into 2 main branches, each of which again divides into 3 branchlets. The twigs of the inferior branch, as well as those of the cubitus, proceed to the inner margin. The anal area may have been small and permits the recognition of several veins extending to the posterior border. Cross veins irregular, occasionally reticulate. Front and hind wings had a similar neurotation and were folded over the rather slender abdomen. The prothorax appears to have been of moderate size.

I believe that this fossil may yet be brought into relation primarily with *Cheliphlebia*. Perhaps in just this form we must seek for the connecting link between the Blattaformia series and the Paleodictyoptera.

Holotype.—Cat. No. 38823, U.S.N.M.

Order BLATTOIDEA Handlirsch.

Scudder has attempted to separate, as an order, the Paleozoic blattoids from the later fossil and recent forms. In my opinion (which moreover agrees with that of several authors), such a separation, however, is not practicable, because no sharply differentiating characters exist, and those selected are in no wise valid. The fusion of the anal veins in the inner margin, on the one hand, still occurs in recent forms, as well as the independence of the principal veins from each

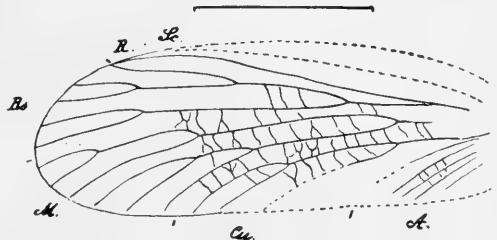


FIG. 39.—POLYETES FURCIFER.

other; and, on the other hand, among the typical Paleozoic blattoid forms there are also those in which the type of venation prevailing today is to be observed. In primordial time, the hind wings of blattoids were already straight as at present, exhibiting an anal area plaited lengthwise (contrary to the view of Sellards); there were also even then forms in which a cross folding of the wing was indicated (in the European Permian), and; as a rule, cross veins were clearly developed. In many living forms the cerci are still long and distinctly jointed. The ovipositors mentioned by Sellards could probably not hold ground in a critical investigation, and may in all probability never have existed; they have been hitherto observed only in several nymphs, which very likely belong to the protoblattoids, but as yet in no true blattoid imago, and it seems to me very hazardous to assume the existence of long ovipositors as a character of the Palaeoblattariae.^a On the other hand, the discovery of several egg cases proves to us that the Carboniferous blattids even at that time laid their eggs in a way similar to that which their descendants still practice to-day. The young stages of Paleozoic blattoids also strikingly resemble those of recent forms, though in general it is to be noted that in individual cases the former, in their more distinctly jointed and longer cerci and in their more slender form, more nearly approach the type of palaeodictyopteran larvæ. As previously mentioned, it is extremely difficult to make a sharp distinction between the protoblattoids and the blattoids, and at the present time one can hold only to the fact that the former, at least in respect to the venation of their wings, are much more closely allied to the primitive type (Palaeodictyoptera) than the latter.

A systematic arrangement of Paleozoic blattoids in natural groups clearly meets with not inconsiderable difficulties, because in the course of time all series must be bound together by intermediate forms. The systematic arrangement attempted by Scudder has proved itself wholly defective in every respect, and rests upon entirely artificial, arbitrarily selected characters. Moreover, as a rule, Scudder's generic diagnoses do not at all apply to the majority of forms as arranged by him, and according to this system very closely related species must be separated in widely different genera.

I have therefore attempted to set up a new grouping, to the extent of bringing the genera and families, as far as possible, into agreement with those of recent blattoids. In so doing, I have been forced to erect a large number of new groups, in order to avoid uniting heterogeneous elements. I am fully convinced that many of my genera will be combined when more abundant material becomes known; still I

^a The ovipositors mentioned by Brongniart as occurring in several Carboniferous blattids are likewise a *lusus naturæ*, and no "prolongation of the lower genital process."

consider it wiser for the present to separate them than to unite them with uncertainty.

In the establishment of families I have allowed myself to be governed by chronogenesis, taking those forms which most nearly approach the protoblattoids, namely, the palæodictyopteran type, as the stem group. This group includes, among others, the genus *Archimylacris* Scudder, which, being the first described, I use in the family name "Archimylacridæ." This family embraces the large majority of Paleozoic forms, and scarcely continues into the Mesozoic; it likewise includes the *oldest* forms. All other families—and among these the mylacrids also, which were previously regarded as a stem group—are more highly specialized and may be traced back to the archimylacrid type. They appear chiefly in later strata and several of them pass over into the Mesozoic.

If, with Scudder and Sellards, we should regard the mylacrids as the most primitive blattoids, we should then be forced to go much further, and consider the blattoids the most primitive insects; then the archimylacrid wing would form the connection with the Palæodictyoptera, which, however, in all points are incomparably more primitive forms and are also proved to be decidedly older than the mylacrids and the blattoids in general.

It is not possible to derive the blattoids from more highly specialized orthopteran forms, as the locustids, etc.; and even if elongated ovipositors should actually have been present in some blattoids, which I, however, question, there would still be no ground for such an acceptance, because, as is well known, similar structures occur in the most diverse developmental series, and were also present in many Palæodictyoptera. The fact is that in those old beds in which as yet no blattoids have been discovered, no true Orthoptera have likewise been met with, but only Palæodictyoptera. In the very oldest forms, cross veins are always present. A disappearance of cross veins always indicates a higher specialization, and in the blattids is frequently associated with a stronger chitinization of the front wing.

Family ARCHIMYLACRIDÆ, new family.

This group embraces the large majority of Paleozoic blattoids, and is united with the protoblattoids, namely, the Palæodictyoptera, by transitional forms. The neuration of the Archimylacridæ mainly resembles the palæodictyopteran type, and may be regarded as the point of origin for the succeeding more highly specialized families.

The subcosta of the front wing is always preserved as an independent vein and sends off a variously large number of branches to the costal margin. These offshoots are either equally divided (pectinate) or are united in groups, but never issue in a raylike manner from one point at the base of the wing. The subcosta is never restricted to a short,

strongly chitinized swelling at the base of the anterior border. The radius is more or less copiously branched, and only in the most primitive forms still shows the typical ancestral separation into radius and sector. The entire radial group is mainly divided into several clusters of twigs, or the branches all arise apparently on the superior side of the principal vein. The media is either separated into 2 main compound offshoots, or it forms one vein with branches running off backward, or, finally, one such with the branches ramifying anteriorly. All these modifications are united by transition forms.

In a majority of cases the cubitus sends out its branches sloping to the inner margin; more rarely there is one isolated, widely furcating superior offshoot. The anal area is always marked off by a bow-shaped furrow and contains a number of veins which fuse in the posterior margin.

The intercalary venation is either irregularly reticulate or it consists of very delicate regular cross veins. In the forms whose wings are more firmly chitinized, we find in place of these cross veins only a more or less irregular leathery structure, which further often exhibits distinct cross wrinkles.

In the primitive forms the body is more slender; in those more highly developed, often greatly expanded. Cerci are well developed, distinctly jointed. Legs more or less slender, often with spines. Antennæ slender.

PALÆOBLATTA, new genus.

With this name I distinguish a very primitive form, which in many respects shows great similarity to certain protoblattoids (*Eucoccus*, *Gerapompus*, etc.) and which in their venation very strikingly resemble the palæodictyopteran type, so that they could be referred with almost equal right to the protoblattoids as to the blattoids.

The subcosta reaches somewhat beyond half the length of the wing and sends out about 10 branches. The radius proceeds in a nearly straight course to the tip of the wing and above the end sends off about 10 branchlets to the anterior margin. The radial sector originates in the typical manner above the middle of the wing and forms 4 twigs. The media likewise separates above the middle of the wing into 2 equally furcate branches, of which the last end in the inner margin. The cubitus sends 4 oblique branches to the inner margin. The anal area is slender and attains nearly half the length of the wing; it is defined by a gently curved vein and contains several (about 5) in part compound veins which end in the posterior border. The intercalary venation is irregular and occasionally reticulate. The costal margin is strongly curved, and the costal area wide. Wing $2\frac{2}{3}$ times as long as broad. Shield of the pronotum comparatively small, almost semicircular in form. Abdomen rather slender.

PALÆOBLATTA PAUCINERVIS (Scudder).

Archimylacris paucinervis SCUDDER, Mem. Boston Soc., IV, 1890, p. 441, pl. xxxi, fig. 5.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Holotype.—Cat. No. 38091, U.S.N.M.

APHTHOROBLATTINA, new genus.

Similar to the foregoing genus, but differs in the somewhat more abundant branching of the veins, the narrower costal area, and the more regular cross veins. The subcosta reaches about two-thirds the length of the wing. Radius and sector are divided in the typical manner; the former with about 5 small veinlets directed forward, the latter separated into 4 to 6 branches. The media separates about in the middle of the wing and forms about 4 offshoots. The 7 to 8 branches of the cubitus extend to the inner margin. Anal area slender; cross veins not very compact and somewhat irregular, but not so strongly reticulate. Body like that in *Palæoblatta*. Front wing scarcely $2\frac{1}{2}$ times as long as broad.

Type of genus, *Aphthoroblattina fascigera* (Scudder).

APHTHOROBLATTINA FASCIGERA (Scudder).

Blattina fascigera SCUDDER, Proc. Boston Soc., XIX, 1878, p. 238.

Gerablattina fascigera SCUDDER, Mem. Boston Soc., III, 1879, p. 113, pl. vi, figs. 1, 2.

Locality.—Campbell's Ledge, near Pittston, Pennsylvania. Near top of Pottsville; upper transition group.

This form was pointed out by Scudder as the "oldest" blattid.

Two species from the middle of the Upper Carboniferous of Europe also belong in this genus.

Cotypes.—Cat. No. 38058, U.S.N.M.

POLYETOBLATTA, new genus.

Similar to the genus *Aphthoroblattina*. Anterior margin of the front wing strongly curved. Costal area narrow, extending two-thirds the length of the wing. Radius with 5 stouter branches directed upward; sector arising above the middle of the wing and divided into 3 forks, all of which end in the apical border. Media with 2 simple and 1 furcate branches directed toward the inner border and branching off backward from the main stem. The 5 simple oblique branches which extend downward from the strongly arcuate cubital vein occupy only the middle third of the posterior margin. Anal area small and slender, continuing only one-third the length of the wing, with but 4 or 5 veins ending in the inner margin. Interspaces filled up with very regular and delicate cross veins. Front wing fully $2\frac{1}{2}$ times as long as broad.

POLYETOBLATTA CALOPTERYX, new species.

Locality.—Road from Hampton to Peachtree Creek, West Virginia. Pottsville? (From Coal blum about 400 feet above Hontton conglomerate. Same as McGinness' mine.)

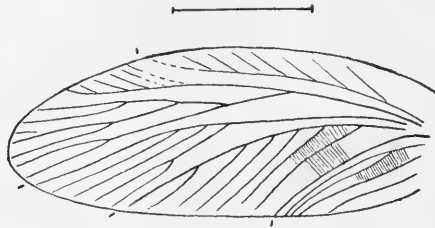


FIG. 40.—POLYETOBLATTA CALOPTERYX.

Length of front wing, 19 mm.

Holotype.—Cat. No. 25633, U.S.N.M.

KINKLIDOBLATTA, new genus.

Front wing fully $2\frac{1}{2}$ times as long as broad, nearly elliptical, with strongly curved anterior margin. Costal area narrow, scarcely reaching over beyond the middle of the front margin. Subcosta with about 7 branches. Radius divided just above the middle of the wing; the superior branch (radius *s. str.*) forming a large fork, the inferior branch (sector) separated into two 4-branched parts. All offshoots of the radius are directed toward the anterior margin. The media sends off successively one furcate and 3 simple branches backward, all of which fuse in the apical border. The cubitus stretches obliquely backward and with its 6 branches occupies the entire space between the anal area and the apical margin, anal area taking up two-fifths the length of the wing, with numerous veins partly united at the base. About two-thirds of the wing appears to be firmly chitinized and shows no intercalary venation; the outer third, on the contrary, exhibits a dense, small meshed, and irregular network.

KINKLIDOBLATTA LESQUEREUXI (Scudder).

Etoblattina lesquereuxi SCUDDER, Mem. Boston Soc., III, 1879, p. 67, pl. vi, fig. 34.

Locality.—Near Pittston, Pennsylvania; Anthracite series; Roof shales; D seam.

Holotype.—Cat. No. 38077, U.S.N.M.

ADELOBLATTA, new genus.

Front wing about $2\frac{1}{2}$ times as long as broad, nearly elliptical, with equally strongly curved anterior and posterior margins. Costal area of normal breadth, reaching somewhat over half the length of the wing.

Radius forked somewhat above the middle of the wing, the superior branch with about 3 or 4 twigs, the inferior strongly vaulted, with about 6 twigs, all of which are oriented toward the front margin. The branches of the strongly arcuate media issue posteriorly and turn in part to the apical border, in part to the inner margin, so that for the 4 to 5 branches of the cubitus but little more than the middle third of the margin remains. The anal area occupies about two-fifths of the length of the wing and is marked off by a strongly curved fold; it contains about 6 veins. Pronotum somewhat less than twice as broad as long and nearly semicircular in form. The intercalary venation is not known.

Type of genus, *Adeloblatta columbiana* (Scudder).

ADELOBLATTA COLUMBIANA (Scudder).

Progonoblattina columbiana SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 131, pl. XI, fig. 9.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage.

? **ADELOBLATTA GORHAMI** (Scudder).

Eoblattina gorhami SCUDDER, Bull. U. S. Geol. Surv., No. 101, 1893, p. 16, pl. II, fig. a; No. 124, 1895, p. 80, pl. v, fig. 8.

Locality.—Pawtucket, Rhode Island. Pennsylvanian; Ten-mile series; ? Allegheny or Conemaugh stage.

PLAGIOBLATTA, new genus.

Front wing more than $2\frac{1}{2}$ times as long as broad, nearly elliptical, with strongly curved anterior margin and more slightly arcuate inner border. Costal area not expanded at the base, extending about five-eighths the length of the wing, with about 8 branches. Radius vaulted, its superior principal branch separated into 4 to 5 twigs, which end in the anterior border, besides 4 to 6 mostly compound branches generally oriented toward the apical margin. Media proceeding obliquely backward and divided into 2, always 3 to 4 parted forks, whose branches in part fuse in the inner margin, so that the 5 to 6 offshoots of the cubitus take up not more than the middle third of the posterior border. The anal area reaches about two-fifths the length of the wing. The intercalary venation consists of distinct regular cross veins. The prothorax (preserved in one species) is almost transversely elliptical, and about one-fourth broader than long.

Type of genus, *Plagioblatta parallela* (Scudder).

PLAGIOBLATTA PARALLELA (Scudder).

Archimylaeris parallela SCUDDER, Mem. Boston Soc., III, 1879, p. 85, pl. VI, fig. 6.

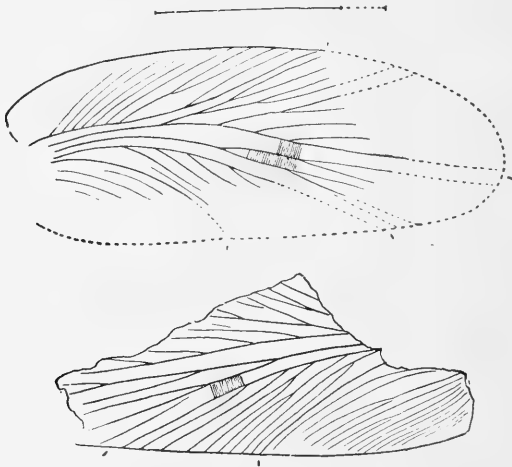
Locality.—Cannelton, Pennsylvania. Allegheny formation; Kittanning group; roof of the Middle Kittanning coal.

Holotype.—Cat. No. 38093, U.S.N.M.

PLAGIOBLATTA CAMPBELLI, new species.

Locality.—Railway cut, Moss Creek, one-half mile above Gorman's Mills, Pennsylvania. From shales about 40 feet below B coal (?). Pennsylvanian; Coal Measures? Conemaugh stage.

Length of the front wing about 30 mm. Costal area broader than in *Plagioblatta parallela*. Radius directed more to the middle of the apical border.



FIGS. 41, 42.—PLAGIOBLATTA CAMPBELLI.

Cotypes.—Cat. No. 35391, U.S.N.M. Collected by Messrs. Burrows and Campbell. Survey of the Barnsboro, Pennsylvania, quadrangle.

SCHIZOBLATTA, new genus.

Front wing elliptical, about $2\frac{2}{3}$ times as long as broad. Costal area extending about three-fifths the length of the wing, with about 9 or 10 normal veins; not expanded at the base. Radius divided into 2 principal stems, the superior of which separates into 6 branches and the inferior into 8, the majority of the latter ending in the apical border. The media likewise divides into 2 main stems, the anterior of which forms 5 branches and the posterior 4, all of which fuse in the apical margin. The 8 branches of the gently vaulted cubitus take up the entire inner border. The anal area attains nearly half the length of the wing. Cross veins are not to be distinguished, but instead there is a fine-grained leathery structure.

SCHIZOBLATTA ALUTACEA, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

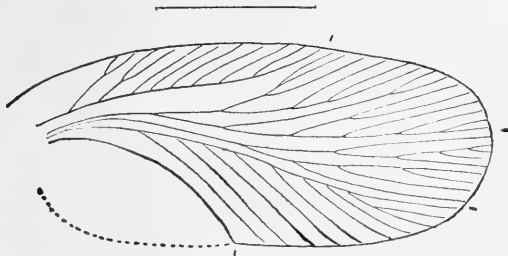


FIG. 43.—SCHIZOBLATTA ALUTACEA.

Length of front wing, 22 mm.

Holotype.—Cat. No. 38668, U.S.N.M.

ATIMOBLATTA, new genus.

Front wing elongated, $2\frac{3}{4}$ times as long as broad, and subreniform, with strongly-arched front margin, very gently curved inferior border, and rounded apical edge, with a remarkably elongated anal area, which is fully half as long as the wing. Costal area extending three-fifths the length of the wing, band-shaped, with about 6 simple or forked veins. Superior branch of the radius emerging just below the first fourth of the length of the wing, and separated into 4 branches by

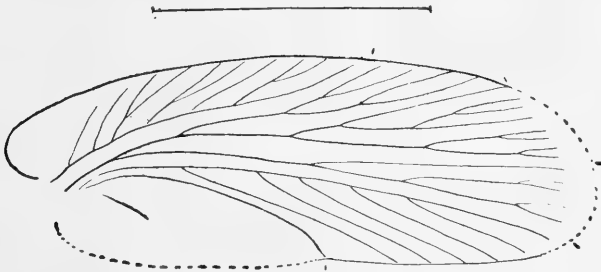


FIG. 44.—ATIMOBLATTA CURVIPENNIS.

double furcation; by repeated forking the inferior offshoot is divided into 8 to 9 branches, which in part fuse in the apical margin. The media stretches obliquely to the lower portion of the outer border, and sends off 3 nearly horizontal and in part furcate branches to the apical margin. The long, gently-arched cubitus joins the lower end of the apical border and sends off 5 to 6 simple, very oblique offshoots downward and outward. No distinct cross veins.

Type of genus, *Atimoblatta curvipennis*, new species.

ATIMOBLATTA CURVIPENNIS, new species.

Locality.—Scranton, Pennsylvania. Uppermost Pottsville; Dunmore coal, No. 2.

Length of the front wing, 38 mm. The veins of the costal area are occasionally forked. Cubitus with 5 branches.

Holotype.—Cat. No. 35380, U.S.N.M.

ATIMOBLATTA RENIFORMIS, new species.

Locality.—Scranton, Pennsylvania. (Anthracite region.) Uppermost Pottsville; Dunmore coal, No. 2.

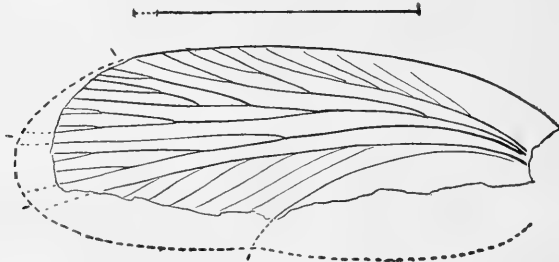


FIG. 45.—*ATIMOBLATTA RENIFORMIS*.

Length of front wing, about 38 mm. Very much like the previous species. Veins of the costal area not furcate. Cubitus with 6 veins.

Holotype.—Cat. No. 35383, U.S.N.M.

ASEMOBLATTA, new genus.

Front wing with gently arcuate front edge, obliquely truncate apical margin, and more strongly curved inner border; $2\frac{1}{3}$ to $2\frac{2}{3}$ times as long as broad. Costal area band-shaped, rather wide, and extending about three-fifths the length of the wing. Superior offshoot of the radius branching out above the middle of the wing, divided into 2 to 4 twigs; inferior branch of the radius separated into 5 to 9 twigs by repeated furcation. The media continues in a gentle oblique curve to the lower extremity of the apical margin, and sends off 3 to 5 more or less compound branches forward to the apical border. The likewise vaulted media reaches to the lower end of the apical edge, and with its 7 to 9 in part compound branches takes up the entire posterior margin. The anal area is proportionally short, and is marked off by a strongly curved fold; it occupies only one-third the length of the wing and contains but a limited number of veins. The intercalary venation is either obliterated by the strong chitinization of the wing or it consists of delicate and irregular cross veins. Prothorax nearly semicircular, about one-third to one-half broader than long.

Type of genus, *Asemoblatta anthracophila* (Germar).

ASEMOBLATTA PENNSYLVANICA, new species.

Locality.—Drake Tunnel, Old Forge, Pennsylvania. Anthracite series; Marcy or D Coal.

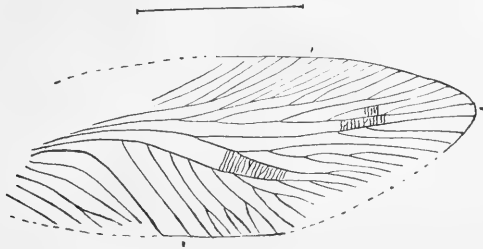


FIG. 46.—ASEMOBLATTA PENNSYLVANICA.

Length of front wing, 22 mm. Cross veins distinct.

Holotype.—Cat. No. 38799, U.S.N.M.

ASEMOBLATTA DANIELSI, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

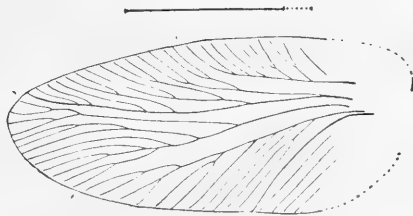


FIG. 47.—ASEMOBLATTA DANIELSI.

Length of the front wing, 26 mm. No structure to be observed.

Daniels collection. Reverse of holotype in the U. S. National Museum. Cat. No. 35577.

ASEMOBLATTA MAZONA (Scudder).

Etoblattina mazona SCUDDER, Mem. Boston Soc., III, 1882, p. 181, pl. x; Bull. U. S. Geol. Surv., No. 124, 1895, p. 89, pl. vi, fig. 5.

Etoblattina mazona SELLARDS, Amer. Jour. Sci. (4), XVII, 1904, p. 131, fig. 16.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Length of the front wing, 24 mm.

The young forms referred by Sellards to this species will be discussed in another place. I must here again call attention to the fact that the ovipositor represented by Sellards in the imago (fig. 15) was not observed, but is merely restored, and in further considerations should be received for the present with great reserve.

Holotype.—Cat. No. 38068, U.S.N.M.

ARCHOBLATTINA Sellards.

Front wing nearly elliptical, $2\frac{1}{2}$ times as long as broad. Costal area extending about two-thirds the length of the wing, not expanded, with numerous, mostly compound veins. Superior offshoot of the radius more strongly branched than the inferior one, which is given off near the base. All branches of the radius end in the anterior margin. Media with 2 (or 3!) compound branches running off forward. Cubitus strongly vaulted, with many (about 9) mainly furcate veinlets, which take up the entire free inner border. Anal area wide, occupying two-fifths the length of the wing, with numerous veins. Pronotum not broader than long and of nearly pear-shaped outline. Very large forms.

Type of genus, *Archoblattina beecheri* (Sellards).

ARCHOBLATTINA BEECHERI Sellards.

Megablattina beecheri SELLARDS, Amer. Jour. Sci. (4), XV, 1903, p. 312, pl. VIII.

Archoblattina beecheri SELLARDS, Amer. Jour. Sci. (4), XVIII, 1904, p. 218, figs. 30, 31, 32.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

The length of the front wing of this gigantic form amounts nearly to 70 mm.

The name *Megablattina*, being preoccupied, was changed by Sellards himself to *Archoblattina*.

? ARCHOBLATTINA SCUDDERI, new species.

Blattina sp. SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 142, pl. XII, fig. 5 (not pl. x, fig. 16).

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

A hind wing, about 55 mm. long, with numerous cross veins, which possibly may belong to the preceding species.

Holotype.—Cat. No. 38105, U.S.N.M.

GYROBLATTA, new genus.

Front wing $2\frac{1}{3}$ times as long as broad, with very strongly curved front margin, and nearly straight posterior border, therefore nearly semicircular in form. The rather broad costal area reaches three-fourths the length of the wing, and contains about 7 many-times branched oblique offshoots, some of which are given off at the base. The radius forks very near the base of the wing and its superior branch separates into 4 to 6 twigs; the inferior, on the other hand, into 2 to 5. The media stretches in a strong vault to the inner border and sends off 3 to 4 long, more or less divided, branches horizontally forward to

the tip of the wing. The much-reduced cubitus, with its about 4 mainly compound veinlets, occupies the middle portion of the inner margin, whose basal third is taken up by the short, broad anal area. In one species, distinct, closely crowded, and regular cross veins are present; in the other, there is nothing stated on this point.

Type of genus, *Gyroblatta clarkii* (Scudder).

GYROBLATTA CLARKII (Scudder).

Etblattina clarkii SCUDDER, Bull. U. S. Geol. Surv., No. 101, 1893, p. 14, pl. II, fig. j; No. 124, 1895, pl. v, fig. 10.

Locality.—Pawtucket, Rhode Island, Pennsylvanian; Ten-mile series; ? Allegheny or Conemaugh stage.

? **GYROBLATTA SCAPULARIS** (Scudder).

Gerablattina scapularis SCUDDER, Bull. U. S. Geol. Surv., No. 101, 1893, pl. II, fig. l; No. 124, 1895, pl. x, fig. 7.

Locality.—Pawtucket, Rhode Island. Pennsylvanian; Ten-mile series; ? Allegheny or Conemaugh stage.

Holotype.—Cat. No. 38060, U.S.N.M.

DYSMENES, new genus.

Front wing in any case very broad, probably not much more than twice as long as wide, with strongly arched anterior margin, and gently curved posterior border. Costal area wide, scarcely reaching two-thirds the length of the wing, with veins branching several times. Superior principal offshoot of the radius separated into 4 twigs, which, as well as the 6 twigs of the inferior branch, all run out to the front margin. The media proceeds obliquely to the apical border and sends out forward 4 compound branches. Near the base the cubitus divides into one superior, 3-parted branch, which extends to the apical edge, and into one normal branch reaching to the end of the inner margin, the twigs of which (about 5) are several times furcate and take up the entire posterior border. The broad anal area occupies somewhat more than one-third the inner margin. Nothing is said of cross veins.

DYSMENES ILLUSTRIS (Scudder).

Etblattina illustris SCUDDER, Bull. U. S. Geol. Surv., No. 101, 1893, p. 12, pl. II, fig. i; No. 124, 1895, p. 70, pl. IV, fig. 11.

Locality.—Pawtucket, Rhode Island. Pennsylvanian; Ten-mile series; ? Allegheny or Conemaugh stage.

Holotype.—Cat. No. 38074, U.S.N.M.

PHOBEROBLATTA, new genus.

Front wing $2\frac{2}{3}$ times as long as broad, with strongly arched anterior margin, very abruptly rounded apical border, and nearly straight posterior edge. Costal area narrow, attaining about three-fifths the length of the wing. The subcosta advances in an almost straight course to the anterior margin, and just at the base forms a many-times parted branch, which occupies nearly half the costal area; further on then follow 2 forked and 2 simple branches, all of which are very obliquely arranged. The radial vein proceeds in a nearly straight line to the end of the anterior border, and its first branch (radius *s. str.*) issues very near the base, by repeated furcation separating into 5 offshoots; the 3 following forked branches are very obliquely directed toward the front border. The media turns in a gentle vault toward the lower end of the apical margin, to which it sends out 2 forked, and one simple, very long branches. The entire inner edge is taken up by the 4 obliquely placed branches of the cubitus, which are separated into 14 twigs, only the basal third being filled by the small anal area, which has but a limited number of veins. The surface of the wing is coarse-grained leathery, rugose, with a tendency to the formation of cross veins.

In many respects this genus recalls *Eumorphoblatta*, but differs in form and structure.

PHOBEROBLATTA GRANDIS, new species.

Locality.—Fishing Creek Gap, in Sharp Mountain, Pennsylvania. Anthracite series; lower part; horizon?

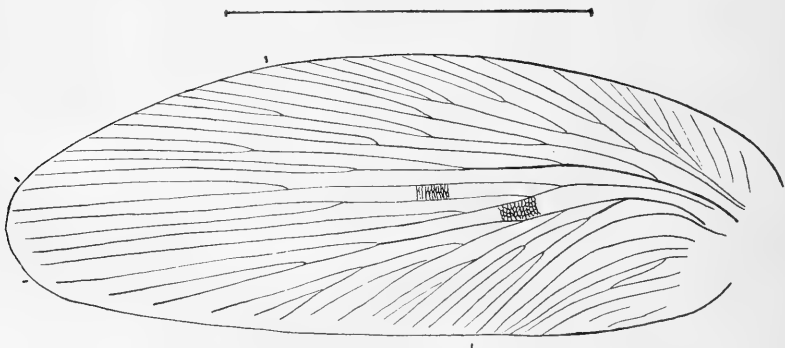


FIG. 48.—PHOBEROBLATTA GRANDIS.

The length of the front wing amounts to 50 mm.

Holotype.—Cat. No. 38756, U.S.N.M.

EUMORPHOBLATTA, new genus.

Front wing $2\frac{2}{3}$ to 3 times as long as broad, elliptical, with almost equally strongly arched anterior and inner borders. The costal

area extends two-thirds to three-fourths the length of the wing, and forms a very pointed triangle. The branches of the subcosta are united into several groups and very obliquely placed. The radius forks near the base of the wing, and its superior branch, divided into several twigs, advances obliquely to the anterior border, while the posterior twigs of the copiously branched main inferior offshoot fuse in the apical margin. The media stretches obliquely to the lower extremity of the apical edge, and sends out forward a series of simple or compound branches in a nearly horizontal direction toward the apical margin. The cubitus gives off a larger number of mostly simple branches toward the inner border and (in *Eumorphoblatta heros*) one furcate offshoot forward to the lower edge of the apical margin. The anal area occupies more than one-third the length of the wing. Cross veins are delicate and regular, very thickly crowded.

Type of genus, *Eumorphoblatta heros* (Scudder).

This genus is also represented in Europe.

EUMORPHOBLATTA HEROS (Scudder).

Necmylaeris heros SCUDDER, Mem. Boston Soc., III, 1879, p. 54, pl. v, fig. 9.

Locality.—Cannelton, Pennsylvania. Allegheny formation; Kittanning group; roof of the Middle Kittanning coal.

Holotype.—Cat. No. 38056, U.S.N.M.

METAXYBLATTA, new genus.

Front wing elongate-ovate, only a little more than twice as long as broad. Costal area the length of half the wing, wider at the base, and of more triangular form, with 5 (to 6?) mostly compound veins. The radius runs out nearly straight from the base to the end of the anterior border, and sends out 7 mostly forked oblique branches forward to the anterior margin; by dichotomous forking, the first of these offshoots separates into 4 twigs. The slightly vaulted media, with its 6 in part compound branches running off forward, takes up the entire apical margin. The cubitus advances obliquely to the end of the posterior border, and sends off to it 7 simple, regular branches. The small anal area contains few veins and is defined by a very slightly curved fold; it reaches about three-sevenths the length of the wing. I was able to make out nothing either of structure or cross veins.

METAXYBLATTA HADROPTERA, new species.

Locality.—Port Griffith Switchback, Pennsylvania. Anthracite series; E coal.

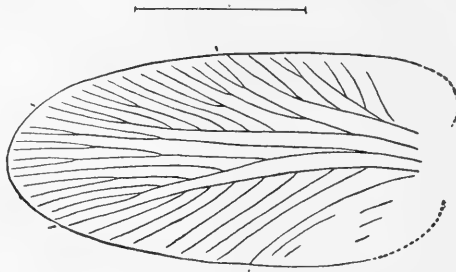


FIG. 49.—METAXYBLATTA HADROPTERA.

Length of the front wing, 23 mm.

Holotype.—Cat. No. 38783, U.S.N.M.

ARCHIMYLACRIS Scudder.

Front wing twice as long as broad, with very strongly arched anterior margin and gently curved inner border; hence, subreniform. Costal area extending two-thirds the length of the wing, band shaped, with 10 to 16 in part compound veins. Radius divided before or in the center of the wing; its upper branch sends off about 3 forked or simple twigs to the front margin, while the lower branch separates into 5 twigs, which are oriented toward the apical border. The media curves toward the lower end of the apical margin and sends out to it 3 to 4 offshoots, which branch off forward. The cubitus gives off 5 to 8 rather regular branches to the posterior border. The anal area contains only a limited number of veins and occupies about two-fifths the length of the wing. The cross veins are close and rather regular.

Type of genus, *Archimylacris acadica* Scudder.

ARCHIMYLACRIS ACADICA Scudder.

Archimylacris acadica SCUDDER, Dawson's Acadian Geol., 2 ed., 1868, p. 388, fig. 153; Mem. Boston Soc., III, 1879, p. 84, pl. vi, figs. 8, 14.

Locality.—Main coal, East River, Pictou, N. S. Pennsylvanian.

ARCHIMYLACRIS VENUSTA (Lesquereux.)

Blattina venusta LESQUEREUX, 2d Rept. Geol. Ark., 1860, p. 314, pl. v, fig. 11.

Etblattina venusta SCUDDER, Mem. Boston Soc., III, 1879, p. 70, pl. vi, fig. 12.

Locality.—Frog Bayou, Arkansas. Upper coal-bearing division (!= Allegheny stage).

PHYLOBLATTA, new genus.

Under this name I include a series of forms with more or less regularly elliptical front wings, whose length is at least $2\frac{1}{4}$ times, but mainly $2\frac{1}{2}$ times as great as the breadth. The costal area is always band shaped, never especially wide, and also never particularly expanded at the base; it extends at least one-half, but chiefly three-fifths or two-thirds the length of the wing and contains a variously large number of veins. The radius always remains in the anterior half of the wing and occupies, with its forward-directed branches, the free portion of the front margin. The first of these veins is either simple or furcate or is divided into 3 to 5 twigs. The media stretches in a gentle curve to the lower end of the apical border or to the extremity of the posterior border and sends off forward a variously large number of more or less compound branches, mainly rather straight to the apical margin, which they almost entirely occupy. The cubitus, with its chiefly compound veinlets, takes up nearly the entire free inner border, and with its distal branches frequently reaches even to the lower end of the apical margin. The anal area extends one-third to two-fifths the length of the wing and contains a moderately large number of veins. The intercalary venation is either more rugosely leathery or more cross wrinkled. (?) Regular cross lines do not seem to be developed.

This genus, which is very abundant in forms, is spread over America and Europe, and seems to represent the origin of many more highly specialized types. The species are found in the upper parts of the Carboniferous formation and in the lower portion of the Permian formation. I am convinced that after further and more careful investigation of more abundant material many of the succeeding species will be combined.

Type of genus, *Phyloblatta schroeteri* (Giebel).

PHYLOBLATTA COMMUNIS (Scudder).

Etblattina communis SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 93, pl. VII, fig. 10 (not figs. 11 to 17).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

In my opinion, Scudder has united several species under the name *Etblattina communis*, from which I select the one represented in fig. 10 as the type.

Cotype.—Cat. No. 38188, U.S.N.M.

PHYLOBLATTA MACROPTERA Handlirsch.

Etblattina communis SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 93, pl. VII, fig. 17 (not figs. 10 to 16).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38891, U.S.N.M.

PHYLOBLATTA MACILENTA (Scudder).

Etolblattina macilenta SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 101, pl. VIII, fig. 9.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38163, U.S.N.M.

PHYLOBLATTA MUCRONATA (Scudder).

Etolblattina mucronata SCUDDER; Bull. U. S. Geol. Surv., No. 124, 1895, p. 74, pl. v, fig. 3.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38199, U.S.N.M.

PHYLOBLATTA MEDIANA (Scudder).

Etolblattina mediana SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 69, pl. iv, fig. 4.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38198, U.S.N.M.

PHYLOBLATTA OVATA (Scudder).

Etolblattina ovata SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, pl. iv, fig. 6.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38201, U.S.N.M.

PHYLOBLATTA DEDUCTA (Scudder).

Gerablattina deducta SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 123, pl. x, fig. 15.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38063, U.S.N.M.

PHYLOBLATTA ABDICATA (Scudder).

Gerablattina abdicata SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 118, pl. x, fig. 6.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38065, U.S.N.M.

PHYLOBLATTA UNIFORMIS (Scudder).

Gerablattina uniformis SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 120, pl. x, fig. 8 (not figs. 9 to 11).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

In my opinion, the forms united by Scudder under the name *Gerablattina uniformis* belong in various species.

Cotype.—Cat. No. 38177, U.S.N.M.

PHYLOBLATTA FUNERARIA (Scudder).

Etoblattina funeraria SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 78, pl. v, fig. 5.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Cotype.—Cat. No. 38078, U.S.N.M.

PHYLOBLATTA LATA (Scudder).

Etoblattina lata SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 67, pl. iv, fig. 2.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38200, U.S.N.M.

PHYLOBLATTA ANGUSTA (Scudder).

Etoblattina angusta SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 100, pl. viii, fig. 8.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38185, U.S.N.M.

PHYLOBLATTA RESIDUA (Scudder.)

Etoblattina residua SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 78, pl. v, fig. 1.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38179, U.S.N.M.

PHYLOBLATTA CASSVILLEANA, new species.

Gerablattina uniformis SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 120, pl. x, fig. 10 (not figs. 8, 9, 11).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38892, U.S.N.M.

PHYLOBLATTA REGULARIS, new species.

Gerablattina uniformis SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 120, pl. x, fig. 9 (not figs. 8, 10, 11).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38893, U.S.N.M.

PHYLOBLATTA ABBREVIATA, new species.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Front wing, 17 mm. long, $2\frac{1}{3}$ times as long as broad. Costal area occupying more than two-thirds the length of the wing. Radius but

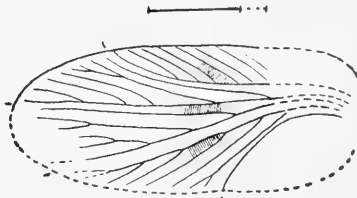


FIG. 50.—PHYLOBLATTA ABBREVIATA.

little vaulted, with 5 branches, of which only the second is compound. Media with one simple and 2 forked offshoots. Cubitus with about 6 branches, of which only the first is furcate. Distinct delicate cross veins.

Holotype.—Cat. No. 38588, U.S.N.M.

PHYLOBLATTA MACTATA (Scudder.)

Etblattina mactata SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 92, pl. vii, fig. 9.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38081, U.S.N.M.

PHYLOBLATTA EXPUGNATA (Scudder.)

Etblattina expugnata SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 102, pl. ix, fig. 4.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38193, U.S.N.M.

PHYLOBLATTA OBATRA (Scudder).

Etblattina obatra SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 103, pl. ix, fig. 5.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38087, U.S.N.M.

PHYLOBLATTA ELATIOR, new species.

Etblattina communis SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 93, pl. vii, fig. 14 (not figs. 10 to 13, 15 to 17).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38895, U.S.N.M.

PHYLOBLATTA DICHOTOMA, new species.

Etblattina communis SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 93, pl. vii, fig. 11 (not figs. 10, 12 to 17).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38896, U.S.N.M.

PHYLOBLATTA FRACTA, new species.

Etblattina communis SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 93, pl. vii, fig. 12 (not figs. 10, 11, 13 to 17).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38897, U.S.N.M.

PHYLOBLATTA ARCUATA, new species.

Etblattina communis SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 93, pl. vii, fig. 13 (not figs. 10 to 12, 14 to 17).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38898, U.S.N.M.

PHYLOBLATTA MORTUA, new species.

Etblattina communis SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 93, pl. vii, figs. 15, 16 (not figs. 10 to 14, 17).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38899, U.S.N.M.

PHYLOBLATTA EXSECUTA (Scudder).

Etblattina exsecuta SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 96, pl. VIII, fig. 4.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Cotypes.—Cat. No. 38180, U.S.N.M.

PHYLOBLATTA GRATIOSA (Scudder).

Etblattina gratiosa SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 90, pl. IV, fig. 5.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38166, U.S.N.M.

PHYLOBLATTA VULGATA, new species.

Etblattina expulsata SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 89, pl. IX, fig. 4 (not fig. 3).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38901, U.S.N.M.

PHYLOBLATTA VIRGINIANA, new species.

Etblattina secreta SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 105, pl. IX, fig. 7 (not fig. 6).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38902, U.S.N.M.

PHYLOBLATTA IMMOLATA (Scudder).

Etblattina immolata SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 92, pl. VII, fig. 7 (not fig. 8).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Cotype.—Cat. No. 38079, U.S.N.M.

PHYLOBLATTA DEBILIS, new species.

Etblattina immolata SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 92, pl. VII, fig. 8.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38903, U.S.N.M.

PHYLOBLATTA ACCUBITA (Scudder).

Etblattina accubita SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 88, pl. VII, fig. 2.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38169, U.S.N.M.

PHYLOBLATTA EXPULSATA (Scudder).

Etblattina expulsata SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 89, pl. VII, fig. 3 (not fig. 4).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Cotype.—Cat. No. 38178, U.S.N.M.

PHYLOBLATTA MACERATA (Scudder).

Etblattina macerata SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 91, pl. VII, fig. 6.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38183, U.S.N.M.

PHYLOBLATTA IMPERFECTA (Scudder).

Etblattina imperfecta SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 104, pl. IX, fig. 8.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38083, U.S.N.M.

PHYLOBLATTA SECRETA (Scudder).

Etblattina secreta SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 105, pl. IX, fig. 6 (not fig. 7).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Cotypes.—Cat. No. 38167, U.S.N.M.

PHYLOBLATTA CONCINNA (Scudder).

Gerablattina concinna SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 119, pl. X, fig. 4 (not fig. 5).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Cotypes.—Cat. No. 38172, U.S.N.M.

PHYLOBLATTA SCUDDERIANA, new species.

Gerablattina concinna SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 119, pl. x, fig. 5 (not fig. 4).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38904, U.S.N.M.

PHYLOBLATTA PRÆDULCIS (Scudder).

Etblattina prædulcis SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 98, pl. viii, fig. 12.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38165, U.S.N.M.

PHYLOBLATTA ROGI (Scudder).

Etblattina rogi SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 102, pl. ix, figs. 2, 3.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Cotypes.—Cat. No. 38088, U.S.N.M.

? PHYLOBLATTA DIMIDIATA, new species.

Gerablattina uniformis SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 120, pl. x, fig. 11 (not figs. 8 to 10).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38905, U.S.N.M.

? PHYLOBLATTA REBAPTIZATA, new species.

Poroblattina gratiosa SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 136, pl. xi, fig. 13.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38106, U.S.N.M.

? PHYLOBLATTA HILLIANA.

Etblattina hilliana SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 99, pl. viii, fig. 11.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage.

This, unfortunately, still imperfectly known form perhaps belongs in another genus.

Holotype.—Cat. No. 38069, U.S.N.M.

? *PHYLOBLATTA SELLARDSII*, new species,

Etblattina hilliana? SELLARDS (not Scudder), Amer. Jour. Sci. (4), XVIII, 1894, p. 213, pl. I, fig. 4.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Similar to the preceding form, but probably to be regarded as a distinct species.

? *PHYLOBLATTA OCCIDENTALIS* (Scudder).

Etblattina occidentalis SCUDDER, Mem. Boston Soc., IV, 1890, p. 410, pl. XXXII, fig. 4.

Locality.—Lawrence, Kansas. Upper Coal Measures; Le Roy (Lawrence) shales.

This form also perhaps belongs in another genus.

Cotypes.—Cat. No. 38071, U.S.N.M.

DISTATOBLATTA, new genus.

Nearly related to *Phyloblatta*. Front wing similarly formed, $2\frac{1}{2}$ times as long as broad. Costal area extended only a little beyond the middle of the wing. Radius proceeding in an almost straight course to the end of the anterior margin, with 6 simple or feebly branched offshoots. Media strongly vaulted, continuing to the middle of the apical border, with 3 long veinlets branching off forward. Cubitus strongly developed, stretching obliquely to the second third of the posterior border, with 6 branches directed backward; in addition, however, there are 3 compound branches running out forward to the apical margin. Anal area rather short. No cross veins.

DISTATOBLATTA PERSISTENS (Scudder.)

Etblattina persistens SCUDDER, Mem. Boston Soc., IV, 1890, p. 459, pl. XLI, fig. 9; pl. XLII, figs. 10, 19.

Locality.—Fairplay, Colorado. Lower Permian.

METAXYS, new genus.

Front wing inclining somewhat to a cordate form, with rather broadly rounded apex, twice as long as wide. Costal area broad, half as long as the wing, inclining to a triangular shape, with 5 or 6 veins, some of which appear to be given off at the base of the wing. Radius strongly vaulted, not reaching to the apex; its branches directed toward the front margin; the first is furcate, the second twice forked, and third and fourth are simple. Media not strongly arcuate; its rambling compound branches directed forward toward the apical margin. Cubitus with few very strongly branched offshoots taking up the entire free inner margin. Anal area attaining two-fifths the length of

the wing. The intercalary venation consists of irregular cross veins, thus causing the wing to appear reticulate.

This form is closely connected with *Phylloblatta*, and differs principally in the form of the costal area.

METAXYS FOSSA (Scudder).

Etblattina fossa SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 70, pl. iv, fig. 5.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

AMOEOBLATTA, new genus.

This genus stands very close to *Phylloblatta*, but differs in the expansion of the radius, which spreads over a large part of the apical margin, together with a reduction of the anastomosing media. Costal area extending almost four-fifths the length of the wing. Radius with 3 furcate and 1 simple branches, which occupy the larger part of the apical border. Media with but 1 short branch. Cubitus normal, with 7 simple offshoots. Anal area large, with 7 veins. The form of the wing appears to be like that in *Phylloblatta*, about $2\frac{1}{2}$ times as long as broad. Cross veins are present.

AMOEOBLATTA PERMANENTA (Scudder).

Gerablattina permanenta SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 121, pl. x, fig. 12.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38064, U.S.N.M.

LIPAROBLATTA, new genus.

Related to *Phylloblatta*, but differing in the broader, more oval form of the wings, which are not quite twice as long as wide. The costal area extends nearly four-fifths the length of the wing and is band-shaped. The radius sends 3 to 4 variously branched members forward and takes up the upper part of the apical margin. The media proceeds obliquely to the end of the inner border and sends out 2 to 4 branches forward to the apical margin. The cubitus, with its 4 to 5 offshoots, occupies the greater portion of the posterior border. Anal area large, but short, with a limited number of branches. Cross veins are to be seen.

Type of genus, *Liparoblatta ovata* (Scudder).

LIPAROBLATTA OVATA (Scudder).

Gerablattina ovata SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 126, pl. xi, fig. 4.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38170, U.S.N.M.

LIPAROBLATTA RADIATA (Scudder).

Gerablattina radiata SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 124, pl. xi, fig. 1.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38175, U.S.N.M.

BRADYBLATTA, new genus.

Related to *Phyloblatta* and *Liparoblatta*, but differs in the much more bluntly cordate form of the wing, the length of which amounts to not quite twice the breadth. The relatively narrow, band-shaped costal area extends three-fifths the length of the wing. With its last branches, the radius continues down to the apical margin; it sends out 5 branches anteriorly, the first two of which always separate into 3 twigs. The media gives off 5 simple, parallel branches forward to the apical border. The cubitus is normally formed, with 7 offshoots branching backward. Anal area very large and not longer than high, with about 5 to 6 veins. Cross veins are not to be seen.

BRADYBLATTA SAGITTARIA (Scudder).

Etblattina sagittaria SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 68, pl. iv, fig. 3.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Cotypes.—Cat. No. 38171, U.S.N.M.

EXOCHOBLATTA, new genus.

In form similar to *Bradyblatta*. Front wing cordate, twice as long as broad. Costal area band-shaped, but only half as long as the wing. Radius forming successively one simple branch, then one 4-parted, then one forked, and finally one more simple one, which take up the entire anterior margin. The media appears quite uniquely constructed; it advances in a short curve to the middle of the posterior margin and sends out toward the apical border 3 branches that are nearly parallel with each other as well as with the inner margin. The strongly reduced cubitus forms but 2 furcate offshoots, and the large anal area contains several compound veins. No cross veins.

EXOCHOBALATTA HASTATA (Scudder).

Petrablattina hastata SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 141, pl. xi, fig. 10.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38205, U.S.N.M. *

ACOSMOBLATTA, new genus.

This genus is likewise derived from the *Phyloblatta* type, from which it is distinguished by a strong reduction of the radius with a corresponding enlargement of the media. The form of the wing is like that in *Phyloblatta*, about $2\frac{1}{2}$ times as long as broad. The band-shaped costal area takes up at least two-thirds the length of the wing. The radius does not extend quite to the tip of the wing and gives off anteriorly but 2 simple branches; instead, however, the first branch of the media separates in 4 to 5 twigs. The 3 following branches of the media are normally directed toward the apical margin. The cubitus, as well as the anal area, are similar to those in *Phyloblatta*. Cross veins very delicate.

Type of genus, *Acosmoblatta permacra* (Scudder).

ACOSMOBLATTA PERMACRA (Scudder).

Gerablattina permacra SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 121, pl. x, fig. 13.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

ACOSMOBLATTA EAKINIANA (Scudder).

Etblattina eakiniana SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 88, pl. vii, fig. 1.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38169, U.S.N.M.

AMBLYBLATTA, new genus.

Front wing broad, truncate, with somewhat diminished base, twice as long as wide. Costal area band-shaped, occupying nearly the entire anterior margin. Radius vaulted and ending nearly in the center of the apical border, with 2 furcate and 2 simple branches. Media strongly arcuate, with 2 dichotomous and 1 simple offshoots, which are directed forward toward the apical margin. The arcuation of the cubitus is S-shaped, and the vein fuses in the apical margin, with 7 mainly simple branches directed backward. Anal area short, defined by a very strongly curved fold, with 5 veins. Distinct tremulous cross lines.

AMBLYBLATTA LATA (Scudder).

Gerablattina lata SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 125, pl. XI, fig. 2.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38174, U.S.N.M.

PENETOBLATTA, new genus.

Front wing broad, truncate, about twice as long as wide. Costal area reaching three-fourths the length of the wing. Radius vaulted, extending to the middle of the apical margin, with 4 more or less compound veins directed forward. Media divided into 2 principal stems, each of which forms about 5 twigs. The twigs of the main anterior branch run off backward and end in the apical border; those of the main posterior branch take up a portion of the inner margin. In consequence of this, the cubitus is somewhat more reduced and forms only about 4 branches, which occupy the central part of the posterior border. The cross veins are not well developed, being partially or wholly replaced by a close network.

Type of genus, *Penetoblatta virginiensis* (Scudder).

PENETOBLATTA VIRGINIENSIS (Scudder).

Anthracoblattina virginensis SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 130, pl. XI, fig. 8.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38104, U.S.N.M.

PENETOBLATTA ROTUNDATA (Scudder).

Gerablattina rotundata SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 126, pl. XI, fig. 3.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38171, U.S.N.M.

PAREINOBLATTA, new genus.

Front wing shaped like that in *Phylloblatta*, $2\frac{1}{2}$ times as long as broad. Costal area very narrow, extending two-thirds the length of the wing. Radius slightly vaulted and stretching toward the upper part of the apical border; its first branch consists of 5 twigs, while the second and third are simply forked. Media anastomosing with the radius to the first third of the length of the wing, then directed obliquely to the extremity of the inner margin, with 4 simple off-

shoots reaching forward to the apical border. The cubitus with its 6 branches takes up the greater part of the posterior margin. No cross veins are to be seen. Perhaps this genus will be combined with *Phyloblatta*.

PAREINOBLATTA EXPUNCTA (Scudder).

Etblattina expuncta SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 79, pl. v, fig. 6.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38192, U.S.N.M.

SYMPHYOBLATTA, new genus.

Front wing similarly shaped as in *Phyloblatta*, about $2\frac{1}{4}$ times as long as wide. Costal area broad, reaching two-thirds the length of the wing. Radius extending in a nearly straight course to the upper part of the apical margin, with about 6 to 7 regular simple branches. As in *Pareinoblatta*, the media and the radius are united almost to the first third of the length of the wing, then the latter advances obliquely to the extremity of the inner margin, with 3 (or 4?) simple offshoots directed toward the apical border. Cubitus with its 3 (or 4?) in part furcating branches taking up the greater part of the posterior edge. Anal area large, with 8 veins. Cross veins present. Perhaps this genus also will be combined with *Phyloblatta*.

SYMPHYOBLATTA DEBILIS (Scudder).

Etblattina debilis SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 71, pl. iv, fig. 8.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Cotypes.—Cat. No. 38197, U.S.N.M.

APEMPHERUS, new genus.

Front wing shaped like that in *Phyloblatta*, $2\frac{1}{2}$ to $2\frac{2}{3}$ times as long as broad, costal area extending one-half to two-thirds the length of the wing. Radius slightly vaulted and fusing with the end of the anterior margin, with 4 to 7 branches. Media continuing obliquely to the extremity of the inner border, with 3 to 5 branches running off forward toward the apical margin and some running off backward to the posterior border. Cubitus reduced, with its about 5 veins taking up only the middle portion of the posterior margin. Anal area with numerous veins. No cross veins to be seen.

Type of genus, *Apempherus complexinervis* (Scudder).

APEMPHERUS COMPLEXINERVIS (Scudder).

Poroblattina complexinervis SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 139, pl. xi, fig. 14.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38204, U.S.N.M.

APEMPHERUS FOSSUS (Scudder).

Poroblattina fossa SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 137, pl. xi, fig. 15.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Cotypes.—Cat. No. 38203, U.S.N.M.

XENOBLATTA, new genus.

Front wing subelliptical, $2\frac{1}{2}$ times as long as broad, costal area reaching three-fifths to three-fourths the length of the wing, band-shaped. The radius with its branches takes up the free portion of the upper margin and the greater part of the apical margin; its superior branch forms 3 to 4 twigs. The few offshoots of the media branch off forward and are directed obliquely backward to the end of the apical border. The cubitus does not reach the apical margin. The anal area occupies about two-fifths the length of the wing. The intercalary venation consists of delicate, irregular, somewhat crinkled cross veins.

Type of genus, *Xenoblatta fraterna* (Scudder).

One European species also belongs to this genus.

XENOBLATTA FRATERNA (Scudder).

Gerablattina fraterna SCUDDER, Bull. U. S. Geol. Surv., No. 101, 1893, p. 19, pl. ii, figs. d, i; No. 124, 1895, pl. x, fig. 16.

Locality.—East Providence, Rhode Island. Pennsylvanian; Ten-mile series; Allegheny or Conemaugh stage.

Holotype.—Cat. No. 38059, U.S.N.M.

OLETHROBLATTA, new genus.

Front wing broadly elliptical, twice as long as wide, with very strongly arched front margin and symmetrically rounded apical border. Costal area of moderate breadth, band-shaped attaining three-fifths the length of the wing, with about 8 to 10 chiefly simple veins. Radius comparatively stout, directed forward, with 5 more or less compound veins oriented toward the anterior margin, the first of which remains simple. The media continues in a gentle curve through the middle of the wing and sends out 3 rarely compound branches forward to the

apical margin. The slightly vaulted cubitus reaches to the extremity of the apical border and gives off 5 to 7 mainly simple branches to the inner margin. The anal area, which is marked off by a strongly curved fold, takes up two-fifths the length of the wing. The intercalary venation consists of delicate, closely crowded, undulating cross veins.

By the rounded form of the wing, the feebly branched veins, and the structure of the radius, this genus is adequately characterized.

Type of genus, *Olethroblatta intermedia* (Goldenberg).

OLETHROBLATTA AMERICANA, new species.

Locality.—Sharp Mountain Gap, near Tremont, Pennsylvania; Anthracite series; stage?

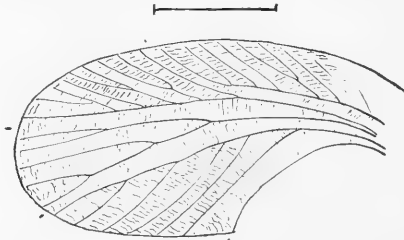


FIG. 51.—OLETHROBLATTA AMERICANA.

Length of the front wing, 17 mm. Cubitus with 5 unforked branches.

Holotype.—Cat. No. 38720, U.S.N.M.

STYGETOBLATTA, new genus.

Front wing about twice as long as broad, probably more kidney-shaped. Costal area remarkably wide and extending three-fourths the length of the wing, with 7 or 8 mostly simple veins. Radius forked about in the middle of the wing; its superior branch separated into 3 twigs, which continue to the anterior margin; the inferior offshoot not very strongly compound, with its branches directed toward the apical border. The media remains undivided beyond the middle of the wing and then separates into few veinlets, which are oriented toward the tip and inner margin. The cubitus with its few branches appears not quite to fill up the inner margin. The anal area is defined by a very strongly curved fold and contains only a limited number of veins. The surface of the wing appears leathery with a fine grain, and shows no cross veins.

A genus very well characterized by the broad costal area.

STYGETOBLATTA LATIPENNIS, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

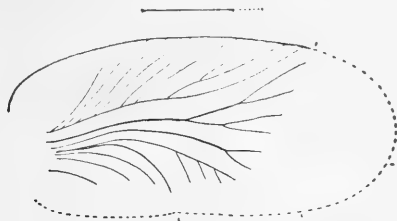


FIG. 52.—STYGETOBLATTA LATIPENNIS.

Length of the front wing, about 16 mm.

Holotype.—Cat. No. 38642, U.S.N.M.

METACHORUS, new genus.

Front wing of nearly cordate outline, about twice as long as broad. Costal area short, triangular, and not extending beyond half the length of the wing, with about 4 to 5 veins issuing successively from the subcosta. Radius divided into 2 main branches almost equally compound, the first of which sends out its twigs to the anterior border, while the twigs of the main inferior branch fuse in the apical margin. Media with 1 to 2 branches extending forward toward the lower portion of the tip. Cubitus strongly vaulted, with only 3 or 4 branches. The large anal area, defined by a strongly curved fold, reaches nearly half the length of the wing. In one species I discern distinct, delicate cross lines between the veins.

Type of genus, *Metachorus testudo* (Scudder).

METACHORUS TESTUDO (Scudder).

Promylacris testudo SCUDDER, Mem. Boston Soc., IV, 1890, p. 403, pl. XXXII, fig. 6.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Plesiotype.—Cat. No. 38158, U.S.N.M.

METACHORUS STRIOLATUS, new species.

Locality.—Indian Territory. Pennsylvanian; ? Allegheny stage.

Length of the front wing, 15 mm. Costal area somewhat shorter than in *Metachorus testudo*. Fine, close cross stripes are distinctly to be seen.

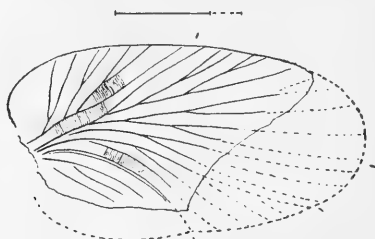


FIG. 53.—*METACHORUS STRIOLATUS*.

Holotype.—Cat. No. 35386, U.S.N.M.

Collector, J. A. Taff, of the U. S. Geological Survey.

OXYNOBLATTA, new genus.

Front wing cordate, twice as long as wide, and running off rather pointed. Costal area broad, not reaching quite two-thirds the length of the wing, with about 4 to 5 oblique veins, issuing successively from the subcosta. Radius divided into 2 main branches, and each of these into 4 twigs, all of which end in the front margin. The strongly arcuate media sends off 2 compound and 1 simple branches forward to the tip of the wing and to the extremity of the posterior margin. Like the media, the cubitus is vaulted and sends out 1 compound and 4 simple branches to the inner margin. The anal area occupies about two-fifths the length of the wing. Structure leathery.

Type of genus, *Oxynoblatta alutacea*, new species.

OXYNOBLATTA ALUTACEA, new species.

Locality.—Furnace Hollow, near mouth of Labor Creek, Wayne County, West Virginia. Allegheny series.

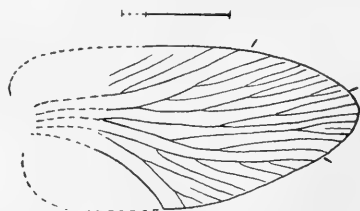


FIG. 54.—*OXYNOBLATTA ALUTACEA*.

Length of the front wing, about 14 mm. Distinguished by the remarkably pointed shape.

Holotype.—Cat. No. 35381, U.S.N.M.

Collected by Messrs. M. R. Campbell and W. C. Mendenhall, of the U. S. Geological Survey.

? OXYNOBLATTA TRIANGULARIS (Scudder).

Paromylacriss triangularis SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 52, pl. III, fig. 3.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Holotype.—Cat. No. 38046, U.S.N.M.

? OXYNOBLATTA AMERICANA (Scudder).

Anthracoblattina americana SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 129, pl. XI, fig. 7.

Locality.—Clinton, Missouri. Pennsylvanian; Kittanning (Allegheny) stage.

Holotype.—Cat. No. 38162, U.S.N.M.

DISCOBLATTA, new genus.

Front wing not quite twice as long as broad, oval. Costal area extending two-thirds the length of the wing, wide, with few veins very obliquely arranged. The branches of the slightly vaulted radius continue obliquely to the anterior margin and the first of these separates into 3 twigs, while the 4 succeeding ones are simple or furcate. The media sends out 2 strongly compound branches forward, nearly horizontally, to the apical border. The well-developed, slightly vaulted cubitus advances to the lower end of the apical border, which it entirely fills with its 8 more or less compound branches. The anal area is comparatively short, and is limited by a strongly curved vein. No mention is made of cross veins.

DISCOBLATTA SCHOLFIELDI (Scudder).

Etoblattina scholfieldi SCUDDER, Bull. U. S. Geol. Surv., No. 101, 1893, p. 15, pl. II, fig. b; No. 124, 1895, p. 71, pl. IV, fig. 7.

Locality.—East Providence, Rhode Island. Pennsylvanian; Tenmile series; Allegheny or Conemaugh stage.

Holotype.—Cat. No. 38076, U.S.N.M.

ARCHIMYLACRIDS OF DOUBTFUL SYSTEMATIC POSITION.

NECYMYLACRIS LACOANA Scudder.

Necymylacriss lacoana SCUDDER, Mem. Boston Soc., III, 1879, p. 53, pl. v, fig. 12.

Locality.—Boston Mine, Pittston, Pennsylvania. Upper transition group.

This form may be regarded as type of the genus *Necymylacriss*.

Holotype.—Cat. No. 38057, U.S.N.M.

(ARCHIMYLACRIDÆ) EXILIS (Scudder).

Etolblattina exilis SCUDDER, Bull. U. S. Geol. Surv., No. 101, 1893, p. 17, pl. II, fig. e;
No. 124, 1895, p. 101, pl. IX, fig. 1.

Locality.—East Providence, Rhode Island. Pennsylvanian; Ten-mile series; Allegheny or Conemaugh stage.

(ARCHIMYLACRIDÆ) SEPULTA (Scudder).

Blattina sepulta SCUDDER, Proc. Amer. Assoc., XXIV, B, 1876, p. 111, fig. 2.

Petrablattina sepulta SCUDDER, Mem. Boston Soc., III, 1879, p. 125, pl. VI, fig. 7.

Locality.—Sydney, Cape Breton. Middle Coal formation; ? Allegheny stage.

(ARCHIMYLACRIDÆ) MEIERI (Scudder).

Petrablattina meieri SCUDDER, Proc. Acad. Nat. Sci. Phila., 1885, p. 38; Mem. Boston Soc., IV, 1890, p. 465, pl. XLII, fig. 17.

Poroblattina meieri SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 138.

Locality.—Fairplay, Colorado. Lower Permian.

(ARCHIMYLACRIDÆ) PERITA (Scudder).

Gerablattina perita SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 114, pl. IX, fig. 17.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38061, U.S.N.M.

(ARCHIMYLACRIDÆ) INCULTA (Scudder).

Gerablattina inculta SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 113, pl. IX, fig. 16.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38173, U.S.N.M.

(ARCHIMYLACRIDÆ) JEFFERSONIANA (Scudder).

Etolblattina jeffersoniana SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 77, pl. V, fig. 7.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

PETRABLATTINA ÆQUA Scudder.

Petrablattina æqua SCUDDER, Proc. Acad. Nat. Sci. Phila., 1885, p. 38; Mem. Boston Soc., IV, 1890, p. 465, pl. XLII, fig. 13.

Locality.—Fairplay, Colorado. Lower Permian.

This unfortunately very imperfectly preserved form must be recognized as the type of the genus *Petrablattina*; it appears to be closely related to *Phylloblatta*.

(ARCHIMYLACRIDÆ) EVERSA (Scudder).

Gerablattina eversa SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 122, pl. x, fig. 14.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Is most probably a species of *Phyloblatta*.

Holotype.—Cat. No. 38066, U.S.N.M.

(ARCHIMYLACRIDÆ) CORIACEA (Sellards).

Etoblattina coriacea SELLARDS, Amer. Jour. Sci. (4), XVIII, 1904, p. 213, fig. 29, pl. 1, fig. 11.

Locality.—Lawrence, Kansas. Upper Coal Measures; Le Roy (Lawrence) shales.

Family SPILOBLATTINIDÆ, new family.

In this family I unite a series of forms from the upper part of the Upper Carboniferous and from the Permian formation of Europe and America. These forms permit themselves to be readily derived from the archimylacrids, from which they differ only in a character of relatively limited morphological importance. In the central portion of the front wing the interspaces between the main veins are remarkably broad, and it seems as though the wing membrane in this place must have been very delicate, for on the impression along the veins there is always a thicker edge, in which remnants of cross veins are to be seen; these, however, do not extend over the entire interval, so that in all large interspaces fenestrate, empty patches occur.

The costal area is always band shaped, of various lengths, and the branches of the subcosta successively arise in a pectinate manner. The radius separates either in 2 widely compound main branches or it sends out forward a larger number of feebly compound offshoots. The media only rarely divides into 2 equally branched principal stems, but mainly forms a series of branches running out forward; posteriorly the branches run out in a single fold. The cubitus is formed like that in the archimylacrids, as well as the anal area, the veins of which always end in the inner margin.

SYSCIOPHLEBIA, new genus.

Front wing subreniform, with strongly arcuate front margin and slightly curved inner border, about $2\frac{1}{2}$ times as long as wide, with more or less broadly rounded apical edge. Costal area reaching at least one-half and rarely more than two-thirds the length of the wing. The branches of the media always run off forward and are directed toward the apical margin. The branches of the radius take up the entire anterior margin; those of the cubitus the entire posterior border. Anal area marked off by a strongly curved fold.

Numerous forms from Europe and America.

Type of genus, *Sysciophlebia egyptina* (Germar).

I am convinced that, after a careful investigation of very abundant material, many of the species separated by me will be combined. However, in order that an arbitrary association may be avoided, it will be necessary first to determine exactly the limits of variation in recent forms. So long as that is not done, I consider it advisable to separate the fossil forms rather than unnaturally and arbitrarily to unite them.

SYSCIOPHLEBIA ARCUATA (Sellards).

Gerablattina arcuata SELLARDS, Amer. Jour. Sci. (4), XVIII, 1904, p. 216, fig. 1, pl. 1, fig. 7.

Locality.—Lawrence, Kansas. Upper Coal Measures; Le Roy (Lawrence) shales.

SYSCIOPHLEBIA WHITEI, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

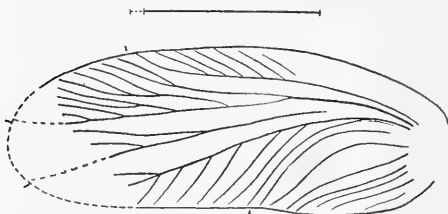


FIG. 55.—SYSCIOPHLEBIA WHITEI.

Length of the front wing, 26 mm. Costal area narrow, extending three-fourths the length of the wing. The 5 branches of the radius are directed obliquely forward, the first being furcate, the second twice divided. Media with few offshoots directed

forward. Cubitus strongly arcuate, with 7 or 8 simple branches. Anal area with 7 veins. The wing has a more kidney-shaped form, and is more than $2\frac{1}{2}$ times as long as wide. The veins are distinctly bordered.

The specific name is in honor of Dr. David White of the U. S. Geological Survey.

Holotype.—Cat. No. 38697, U.S.N.M.

SYSCIOPHLEBIA SCUDDERI, new species.

Etblattina gracilentia SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 95, fig. 7 (not fig. 6).

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

It seems to me that Scudder has combined several species under *Etblattina gracilentia*.

SYSCIOPHLEBIA HYBRIDA, new species.

Etolblattina maledicta SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 83, pl. VI, fig. 3 (not figs. 1, 2).

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

SYSCIOPHLEBIA MALEDICTA (Scudder).

Etolblattina maledicta SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 83, pl. VI, fig. 1 (not figs. 2, 3).

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

SYSCIOPHLEBIA BENEDICTA (Scudder).

Etolblattina benedicta SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 84, pl. V, fig. 4.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

SYSCIOPHLEBIA SELLARDSII, new species.

Spiloblattina maledicta SELLARDS (not Scudder) (part), Amer. Jour. Sci. (4), XVIII, 1904, p. 214, fig. 26, pl. I, fig. 5 (not figs. 6, 10).

Locality.—Lawrence, Kansas. Upper Coal Measures; Le Roy (Lawrence) shale.

I do not regard this form as identical with *Sysciophlebia maledicta* Scudder or *S. benedicta* Scudder, since it differs from both in many respects and comes from quite other beds. In my opinion, Sellards goes much too far in the association of forms, and if we should follow his example, we must unite all Carboniferous blattids in few species.

SYSCIOPHLEBIA LAWRENCEANA, new species.

Spiloblattina maledicta SELLARDS (not Scudder) (part), Amer. Jour. Sci. (4), XVIII, 1904, p. 214, fig. 27, pl. I, fig. 6 (not figs. 5, 10).

Locality.—Lawrence, Kansas. Upper Coal Measures; Le Roy (Lawrence) shales.

I consider this species sufficiently distinct from the preceding, and also believe that among the intermediate forms mentioned by Sellards other species will yet be found, of which, naturally, I can form no opinion so long as they are not figured.

SYSCIOPHLEBIA AFFINIS, new species.

Etolblattina benedicta SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 84, pl. V, fig. 15 (not fig. 14).

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

This appears to be different from *Etolblattina benedicta* Scudder.

SYSCIOPHLEBIA RAMOSA (Scudder).

Etoiblattina ramosa SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 81, pl. v, fig. 12.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

SYSCIOPHLEBIA VARIEGATA (Scudder).

Etoiblattina variegata SCUDDER, Proc. Boston Soc., XXIV, 1889, p. 51; Bull. U. S. Geol. Surv., No. 124, 1895, p. 99, pl. VIII, fig. 10.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

SYSCIOPHLEBIA SCHUCHERTI, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

Front wing, 26 mm. long, $2\frac{1}{2}$ times as long as broad. Costal area half as long as the wing. Radius with 6 branches, the first (3-parted)

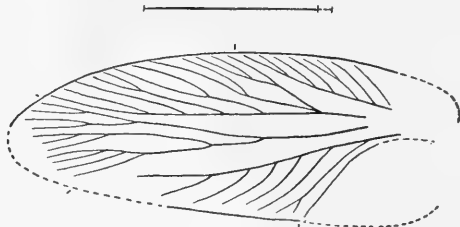


FIG. 56.—SYSCIOPHLEBIA SCHUCHERTI.

and second (furcate) of which arise from one point; the third and fourth offshoots are forked, the fifth and sixth, simple. The media forms 3 compound branches, the cubitus about 7 simple ones. Veins distinctly bordered.

Holotype.—Cat. No. 38691, U.S.N.M.

SYSCIOPHLEBIA PICTA, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

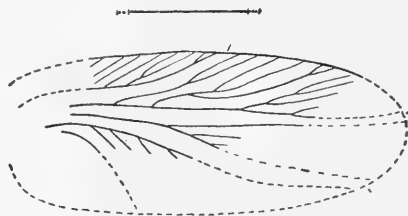


FIG. 57.—SYSCIOPHLEBIA PICTA.

Length of the front wing, 22 mm. The costal area extends half the length of the wing. Radius with 4 branches, the first of which

forms 2 twigs, the second and third always 3 twigs. Media with 3 or 4 offshoots. Veins bordered.

Holotype.—Cat. No. 38673, U.S.N.M.

SYSCIOPHLEBIA ADUMBRATA, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

Length of the front wing, about 26 mm. Scarcely $2\frac{1}{2}$ times as long as broad. Costal area hardly more than half as long as the wing.

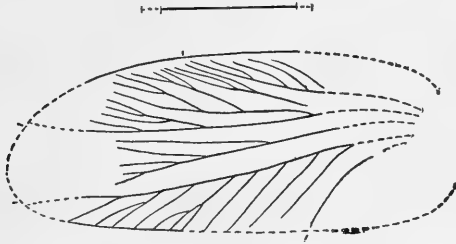


FIG. 58.—SYSCIOPHLEBIA ADUMBRATA.

Radius with 4 branches, of which the first forms 3, the second, 6, and the third, 3 twigs. Media with 4 branches. Cubitus extended, with about 9 chiefly simple branches. Veins bordered.

Holotype.—Cat. No. 38640, U.S.N.M.

SYSCIOPHLEBIA FUNESTA (Scudder).

Etblattina funesta SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 85, pl. VI, fig. 4.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

SYSCIOPHLEBIA ROTUNDATA, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

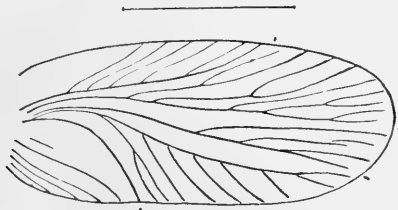


FIG. 59.—SYSCIOPHLEBIA ROTUNDATA.

Front wing, 23 mm. long, less than $2\frac{1}{2}$ times as long as broad. Costal area attaining two-thirds the length of the wing. Radius with 5 branches, the first, second, and fourth of which are furcate. Media

with 3 simple offshoots. Cubitus vaulted, with 7 branches, the first of which is forked. Apical border broadly rounded.

Holotype.—Cat. No. 38651, U.S.N.M.

SYSCIOPHLEBIA NANA, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

Front wing, 20 mm. long, not quite $2\frac{1}{2}$ times as long as broad. Costal area reaching half the length of the wing. Radius with 5

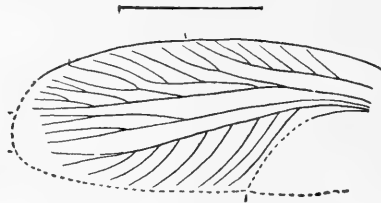


FIG. 60.—SYSCIOPHLEBIA NANA.

branches, the first, third, fourth, and fifth of which are forked, and the second is divided into 3 twigs. Media with 2 offshoots. Cubitus with 8 simple branches directed backward, and with one offshoot directed backward. Veins bordered.

Holotype.—Cat. No. 38648, U.S.N.M.

SYSCIOPHLEBIA OBTUSA, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

Front wing, 22 mm. long, scarcely $2\frac{1}{3}$ times as long as wide. Costal area extending half the length of the wing, and obliquely truncate at

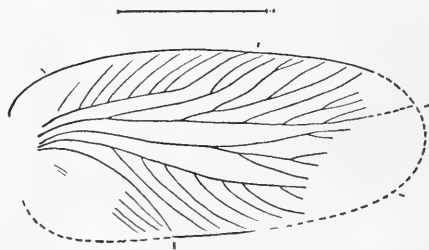


FIG. 61.—SYSCIOPHLEBIA OBTUSA.

the end. Radius with 5 branches, the second of which is twice furcate, all others being simply forked. Media with 2 compound branches. Cubitus with about 8 or 9 simple offshoots.

Holotype.—Cat. No. 38660, U.S.N.M.

SYSCIOPHLEBIA ACUTIPENNIS, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

Front wing, about 29 mm. long, fully $2\frac{1}{2}$ times as long as broad, and more pointed than in the other species. Costal area reaching some-

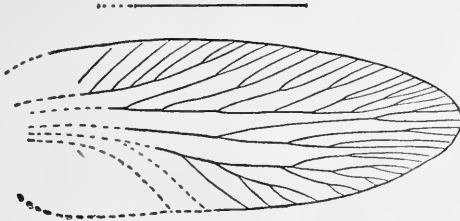


FIG. 62.—SYSCIOPHLEBIA ACUTIPENNIS.

what beyond half the length of the wing. Radius with 6 almost uniformly furcate branches and with one simple veinlet. Media with 3 offshoots. Cubitus strongly vaulted, with about 7 more or less compound branches turning backward, and with one forked offshoot branching forward. Veins bordered.

Holotype.—Cat. No. 38639, U.S.N.M.

SYSCIOPHLEBIA HASTATA (Scudder).

Etolblattina hastata SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 94, pl. VIII, fig. 1.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

SYSCIOPHLEBIA FASCIATA (Scudder).

Etolblattina fasciata SCUDDER, Proc. Boston Soc., XXIV, 1889, p. 47; Bull. U. S. Geol. Surv., No. 124, 1895, p. 81, pl. v, fig. 11.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

SYSCIOPHLEBIA MARGINATA (Scudder).

Etolblattina marginata SCUDDER, Proc. Boston Soc., XXIV, 1889, p. 48; Bull. U. S. Geol. Surv., No. 124, 1895, p. 95, pl. VIII, fig. 2.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

SYSCIOPHLEBIA APICALIS (Scudder).

Gerablattina apicalis SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 114, pl. IX, fig. 18.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

SYSCIOPHLEBIA CASSVICI (Scudder).

Gerablattina cassvici SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 117, pl. x, figs. 2, 3.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Cotypes.—Cat. No. 38176, U.S.N.M.

SYSCIOPHLEBIA DIVERSIPENNIS (Scudder).

Gerablattina diversipennis SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 115, pl. ix, fig. 15.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

SYSCIOPHLEBIA OCCULTA (Scudder).

Etolblattina occulta SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 107, pl. ix, fig. 13.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38085, U.S.N.M.

SYSCIOPHLEBIA PATIENS (Scudder).

Etolblattina patiens SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 73, pl. iv, fig. 9.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38184, U.S.N.M.

? SYSCIOPHLEBIA RECIDIVA (Scudder).

Etolblattina recidiva SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 109, pl. ix, fig. 14.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38202, U.S.N.M.

SYSCIOPHLEBIA TRIASSICA (Scudder).

Spiloblattina triassica SCUDDER, Proc. Acad. Nat. Sci. Phila., 1885, p. 36; Mem. Boston Soc., IV, 1890, p. 461, pl. xli, fig. 1.

Locality.—Fairplay, Colorado. Lower Permian.

SYSCIOPHLEBIA GUTTATA (Scudder).

Spiloblattina guttata SCUDDER, Proc. Acad. Nat. Sci. Phila., 1885, p. 36; Mem. Boston Soc., IV, 1890, p. 461, pl. xli, fig. 2; pl. xlii, fig. 14.

Locality.—Fairplay, Colorado. Lower Permian.

SYSCIOPHLEBIA FENESTRATA, new species.

Spiloblattina gardineri SCUDDER (part), Mem. Boston Soc., IV, 1890, p. 461, pl. XLVI, fig. 8.

Locality.—Fairplay, Colorado. Lower Permian.

SYSCIOPHLEBIA INVISA (Scudder).

Etblattina invisa SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 106, pl. IX, fig. 9.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38164, U.S.N.M.

DICLADOBLATTA, new genus.

Very closely related to the genus *Sysciophlebia*, differing principally in the structure of the media, which separates into 2 equivalent, widely ramifying, main branches. The costal area extends half the length of the wing and is of more pointed, triangular form. The equivalent branches of the radius proceed forward and are feebly compound. Cubitus, form of the wing, and anal area like those in *Sysciophlebia*.

Type of genus; *Dicladoblatta tenuis* (Scudder).

DICLADOBLATTA TENUIS (Scudder).

Etblattina tenuis SCUDDER, Proc. Boston Soc., XXIV, 1889, p. 46; Bull. U. S. Geol. Surv., No. 124, 1895, p. 87, pl. VI, fig. 6.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

DICLADOBLATTA WILLSIANA (Scudder).

Etblattina willsiana SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 82, pl. V, fig. 13.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

DICLADOBLATTA DEFOSSA (Scudder).

Etblattina defossa SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 108, pl. IX, fig. 12.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38194, U.S.N.M.

? DICLADOBLATTA MARGINATA (Scudder).

Spiloblattina marginata SCUDDER, Proc. Acad. Nat. Sci. Phila., 1885, p. 37; Mem. Boston Soc., IV, 1890, p. 461, pl. XLI, fig. 3.

Locality.—Fairplay, Colorado. Lower Permian.

SYSCIOBLATTA, new genus.

Very similar to the two preceding genera. Costal area band shaped, extending one-half to two-thirds the length of the wing. Radius divided into 2 main offshoots, the superior of which sends out anteriorly at least 4, but usually more twigs, while the inferior one branches off in various ways. Media with few branches directed forward. Cubitus, anal area, and form of the wing like those in the foregoing genera. Veins usually distinctly bordered.

Type of genus, *Syscioblatta dohrni* (Scudder).

SYSCIOBLATTA EXSENSA (Scudder).

Etolattina exsensa SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 86, pl. vi, figs. 7, 8.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

SYSCIOBLATTA OBSCURA, new species.

Etolattina maledicta SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 83, pl. vi, fig. 2 (not figs. 1, 3).

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

SYSCIOBLATTA ANOMALA, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

A fragment of a very slender front wing, about 25 mm. long. The superior branch of the radius separates into at least 6 (probably more)

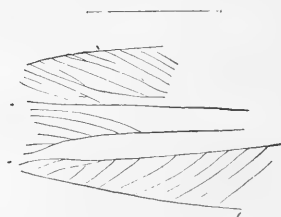


FIG. 63.—SYSCIOBLATTA ANOMALA.

twigs. Near its extremity the media first sends out anteriorly 5 short simple branches. The cubitus forms about 10, almost entirely simple offshoots. Veins distinctly bordered.

Holotype.—Cat. No. 38653, U.S.N.M.

SYSCIOBLATTA MINOR, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

A large piece, about 20 mm. long, from the middle of a long front wing, the length of which may have mounted to somewhat less than $2\frac{1}{2}$ times the breadth. Costal area extending about three-fifths the

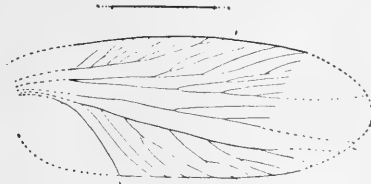


FIG. 64.—SYSCIOBLATTA MINOR.

length of the wing. Superior branch of the radius with 4 twigs, inferior branch with about 8. Media with 2 (or 3?) branches. Cubitus with about 6 simple or furcate offshoots. Veins bordered.

Holotype.—Cat. No. 38665, U.S.N.M.

SYSCIOBLATTA HUSTONI (Scudder).

Etioblattina hustoni SCUDDER, Proc. Boston Soc., XXIV, 1889, p. 53; Bull. U. S. Geol. Surv., No. 124, 1895, p. 87, pl. vi, fig. 9.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

SYSCIOBLATTA GRACILENTA (Scudder).

Etioblattina gracilentu SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 95, pl. VIII, fig. 6 (not fig. 7).

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

SYSCIOBLATTA STEUBENVILLEANA, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

Front wing, 24 mm. long, $2\frac{1}{2}$ times as long as broad. Costal area reaching two-thirds the length of the wing. Superior branch of the

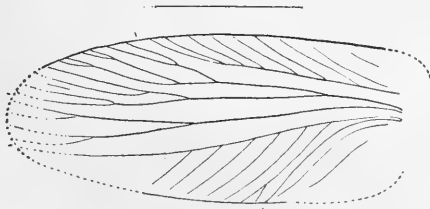


FIG. 65.—SYSCIOBLATTA STEUBENVILLEANA.

radius separated into 6 twigs, the inferior branch into about 5. Media with 2 short offshoots. Cubitus with about 8 to 9 mainly simple branches. Veins bordered.

Holotype.—Cat. No. 38671, U.S.N.M.

SYSCIOBLATTA MISERA, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

Front wing, 28 mm. long, $2\frac{1}{2}$ times as long as broad, costal area attaining three-fifths the length of the wing. Superior branch of the

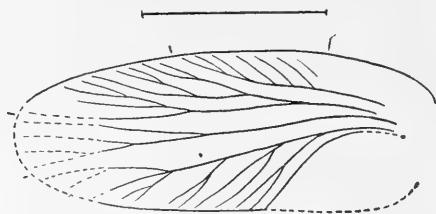


FIG. 66.—SYSCIOBLATTA MISERA.

radius with 5 offshoots, inferior branch probably with 6 twigs. Media with 2 or 3 short branches. Cubitus with 4 furcate branches extending backward and one branching off anteriorly. Veins bordered.

Holotype.—Cat. No. 38658, U.S.N.M.

SPILOBLATTINA Scudder.

Very nearly related to the preceding genera. Front wing rather slender, $2\frac{1}{2}$ to 3 times as long as broad. Costal area narrow, reaching one-half to three-fifths the length of the wing. Radius vaulted, attaining not quite to the extremity of the anterior margin, with a larger number of branches directed forward, the first of which separates into 4 to 5 twigs. Media first divides below the middle of the wing into 2 main branches, the twigs of which again run off backward. The cubitus is very strongly vaulted and forms about 8 to 10 simple branches. Intercalary venation finely reticulate. Interspaces between the main veins made wider by strong fenestration.

Type of genus, *Spiloblattina gardineri* Scudder (restricted).

SPILOBLATTINA GARDINERI Scudder.

Spiloblattina gardineri SCUDDER (part), Proc. Acad. Nat. Sci. Phila., 1885, p. 36; Zittel's Handbuch, 1885, p. 754, fig. 933; Mem. Boston Soc., IV, 1890, p. 461, pl. XLI, fig. 10.

Locality.—Fairplay, Colorado. Lower Permian.

In my opinion, Scudder has united several different forms under this name, of which the one first figured I regard as the type of the species.

SPILOBLATTINA PERFORATA, new species.

Spiloblattina gardineri SCUDDER (part), Proc. Acad. Nat. Sci. Phila., 1885, p. 36; Mem. Boston Soc., IV., 1890, p. 461, pl. XLI, fig. 6.

Locality.—Fairplay, Colorado. Lower Permian.

ARRHYTHMOBLATTA, new genus.

Front wing somewhat curved, $2\frac{1}{2}$ times as long as broad. Costal area very narrow, reaching about three-fifths the length of the wing. Radius not extending to the end of the anterior border, or scarcely so, with 4 very oblique, simple, or furcate branches. Media very strongly developed, with its 4 offshoots, which branch off anteriorly and of which the first forms several twigs, taking up the entire apical margin and the terminal portions of the front and inner borders. Cubitus, therefore, not reaching the end of the posterior margin, with 6 to 9 mainly simple branches directed backward. Anal area broad and short, with about 7 veins. Interspaces between the principal veins very wide in the middle of the wing. No distinct cross veins.

Type of genus, *Arrhythmoblatta detecta* (Scudder).

ARRHYTHMOBLATTA DETECTA (Scudder).

Etblattina detecta SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 75, pl. iv, fig. 12 (not fig. 13).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Cotypes.—Cat. No. 38084, U.S.N.M.

ARRHYTHMOBLATTA SCUDDERIANA, new species.

Etblattina detecta SCUDDER (part), Bull. U. S. Geol. Surv., No. 124, 1895, p. 75, pl. iv, fig. 13 (not fig. 12).

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38894, U.S.N.M.

AMETROBLATTA, new genus.

Front wing of more compressed form, subreniform. Costal area extending two-thirds the length of the wing. The radius with its branches, in addition to the anterior margin, takes up a large part of the apical border; the 4 divisions branch off forward and the first is furcate, the second separates into 6 twigs, the third into 3 twigs. In the figure, the media is represented as a simple unbranched vein. The cubitus divides close to the base into one long superior branch, several twigs of which are given off to the apical border, and into the inferior branch that continues obliquely to the extremity of the inner margin and gives off posteriorly about 6 branches. The large, broad anal area is limited by a strongly curved fold and contains about 7 veins. Cross veins are not to be seen distinctly.

Type of genus, *Ametroblatta strigosa* (Scudder).

AMETROBLATTA STRIGOSA (Scudder).

Etoblattina strigosa SCUDDER, Proc. Boston Soc., XXIV, 1889, p. 52; Bull. U. S. Geol. Surv., No. 124, 1895, p. 72, pl. iv, fig. 10.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

?AMETROBLATTA LONGINQUA (Scudder).

Poroblattina longinqua SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 135, pl. xi, fig. 12.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

ATACTOBLATTA, new genus.

Front wing remarkably slender, more than 3 times as long as broad, with more strongly curved anterior margin and slightly arcuate inner border. Costal area band-shaped, but short, reaching but two-fifths the length of the wing. The longitudinally extended radius, with its 6 forked offshoots branching off forward, fills up the entire anterior margin. The gently vaulted media passes through the middle of the wing and sends out posteriorly 3 long oblique branches toward the apical margin. The long cubitus, with its about 9 mainly forked branches directed backward, takes up the largest part of the posterior border. The veins are bordered, and in the edges traces of cross veins are to be seen. The interspaces between radius, media, and cubitus are very wide; consequently the radius approaches very close to the subcosta.

ATACTOBLATTA ANOMALA, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

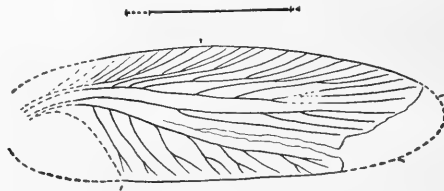


FIG. 67.—*ATACTOBLATTA ANOMALA*.

The length of the wing amounts to about 22 mm.

Holotype.—Cat. No. 38698, U.S.N.M.

DORYBLATTA, new genus.

Front wing slender, lancet-shaped, 3 times as long as broad, with almost equally curved anterior and posterior margins. Costal area attaining about half the length of the wing, band-shaped. Radius

reaching the tip of the wing in a gentle vault, with 5 offshoots branching anteriorly, the first of which forms 5, the second 4, and the third 3 twigs. Below the middle of the wing, the media divides into 2 main branches, the superior of which separates into 4 twigs and the inferior into 3, oriented toward the end of the inner margin. The cubitus sends out backward 9 simple or furcate branches. The anal area is long, and is defined by a slightly vaulted vein; it contains 6 veins, which are bordered.

DORYBLATTA LONGIPENNIS, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

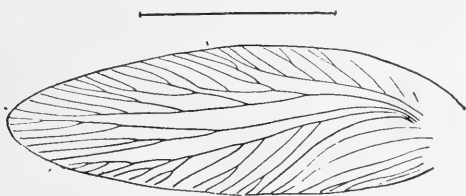


FIG. 68.—DORYBLATTA LONGIPENNIS.

The length of the front wing amounts to 26 mm.

Holotype.—Cat. No. 38662, U.S.N.M.

SPILOBLATTINIDS OF DOUBTFUL POSITION.

(SPILOBLATTINIDÆ) **BALTEATA** Scudder.

Gerablattina balteata SCUDDER, Mem. Boston Soc., III, 1879, p. 110, pl. vi, figs. 9, 10.

Etohlattina balteata SCUDDER, Proc. Boston Soc., XXIV, 1889, pp. 46, 48.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

(SPILOBLATTINIDÆ) **GARDINERI** Scudder.

Spiloblattina gardineri SCUDDER (part), Mem. Boston Soc., IV, 1890, p. 461, pl. xli, fig. 4.

Locality.—Fairplay, Colorado. Lower Permian.

(SPILOBLATTINIDÆ) species. (Hind wing).

Spiloblattina maledicta SELLARDS (part), Amer. Jour. Sci. (4), XVIII, 1904, p. 214, pl. i, fig. 10.

Locality.—Lawrence, Kansas. Upper Coal Measures; Le Roy (Lawrence) shales.

This may belong to *Sysciophlebia*.

(SPILOBLATTINIDÆ) species. (Abdomen.)

Spiloblattina sp. SELLARDS, Amer. Jour. Sci. (4), XVIII, 1904, p. 133, fig. 22.

Locality.—Lawrence, Kansas. Upper Coal Measures; Le Roy (Lawrence) shales.

Family MYLACRIDÆ Scudder.

Front wing of very variable shape, but generally broad and short; nearly always widest at the base. Costal area always of a more or less triangular form, never band-shaped; the veins never arranged in a regularly pectinate manner on the subcosta, but the main ones always issue radially from one point. The radius, as a rule, sends numerous branches anteriorly or it divides into 2 widely branched, principal offshoots. The media gives off its branches either serially from one stem backward, or it forms 2 compound main branches or (more rarely) the offshoots are directed forward. Cubitus with a very variable number of veinlets branching off posteriorly. Anal area chiefly rather large, its veins never or but quite exceptionally ending in the anal fold, but in the posterior border. The structure is more or less fine-grained leathery, often more cross wrinkled. Regular cross veins as well as borders to the veins were not observed. The body was very broad and flat.

I regard the Mylacridæ, which occur principally in the Middle and Upper Carboniferous formations of North America, as an extremely developed lateral branch of the blattid series, which probably branched off very early, and consequently in many respects has still preserved rather primitive characters; for instance, the structure of the media in the majority of forms. Perhaps they owe their origin to an adaptation to their environment, for it is remarkable how similar many of them are to certain leaves of ferns, with which they are generally found (to which fact Scudder has already called attention). Probably they lived under deciduous fern fronds, and by their similarity to the pinnæ were protected from their enemies.

HEMIMYLACRIS, new genus.

This genus could be almost as well referred to the archimylacrids. The costal area is broad; in one species almost quite triangular; in the others, still somewhat band-shaped; the branches of the subcosta issue in part from one point, in part from the subcosta, so that there is a choice between the two families mentioned. The radius sends 4 branches forward, the first of which separates into 2 or 3 twigs. The 3 offshoots of the media are directed backward to the apical and inner borders, and the 4 or 5 branches of the cubitus do not take up the entire free portion of the posterior margin. The anal area extends over about two-fifths the length of the wing, and is more than twice

as long as high. It contains a limited number of compound veins. The form of the wing is subelliptical, about $2\frac{1}{2}$ times as long as broad. No distinct structure.

Type of genus, *Hemimylacris clintoniana* (Scudder).

HEMIMYLACRIS CLINTONIANA (Scudder).

Paromylacris clintoniana SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 53, pl. III, fig. 6.

Locality.—Clinton, Missouri. Cherokee shales; Kittanning (Allegheny) stage.

HEMIMYLACRIS RAMIFICATA, new species.

Locality.—Lorberry Gap, in Sharp Mountain, near Tremont, Pennsylvania. Anthracite series; stage?

Front wing, about 22 mm. long. Subcosta nearly rectilinear, not reaching out much beyond half the length of the wing. Its 3 or 4

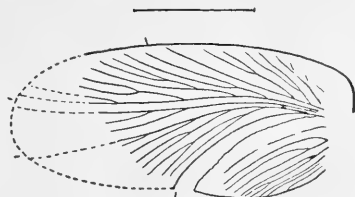


FIG. 69.—HEMIMYLACRIS RAMIFICATA.

branches successively arise near the base. The first branch of the radius separates into 2, the second into 3, and the third into 2 twigs. The 4 branches of the cubitus are compound. Otherwise this species is like the preceding.

Holotype.—Cat. No. 38713, U.S.N.M.

EXOCHOMYLACRIS, new genus.

Front wing scarcely twice as long as broad. The subcosta long, somewhat curved, the costal area therefore not quite triangular, very broad, and reaching almost to the tip of the wing. The first 5 branches of the subcosta arise at the base, but the 3 following ones are given off from the subcosta itself. The radius continues to the middle of the apical border and sends out 4 branches forward, the second of which separates into three twigs. The media runs parallel with the radius to the apical margin, to which it sends 3 branches posteriorly. The cubitus extends obliquely to the lower end of the apical border and gives off 3 furcate and one simple offshoot to the posterior margin. The anal area is fully twice as long as high and nearly half as long as the wing; it contains about 9 veins. Structure not to be distinguished.

In respect to the costal area, this genus likewise forms a transition to the archimylacrids.

EXOCHOMYLACRIS VIRGINIANA, new species.

Locality.—Clendennin, West Virginia. Charleston sandstone.

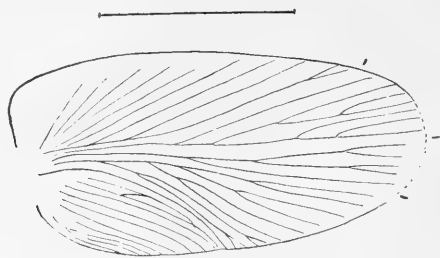


FIG. 70.—EXOCHOMYLACRIS VIRGINIANA.

Length of the front wing, 26 mm.

Holotype.—Cat. No. 25634, U.S.N.M.

ORTHOMYLACRIS, new genus.

Front wing 2 to $2\frac{1}{3}$ times as long as broad, of subcordate outline. Costal area extending one-half to two-thirds the length of the wing. Radius continuing to the apical border, with a variously large number of offshoots branching off forward. The superior branch either simple or forked, more rarely strongly compound. Media with few veins directed obliquely backward to the apical and inner borders. Cubitus never continuing to the apical margin, with few branches. Anal area very long, at least twice as long as high, and extending two-fifths to one-half the length of the wing, with numerous more or less compound veins. Structure leathery, more or less distinctly cross wrinkled.

Type of genus, *Orthomylacris analis*, new species.

ORTHOMYLACRIS ANALIS, new species.

Locality.—Port Griffith, Pennsylvania. Anthracite series; E coal (=Freeport stage).

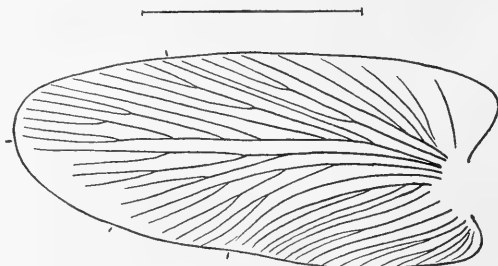


FIG. 71.—ORTHOMYLACRIS ANALIS.

Front wing, 29 mm. long, about $2\frac{1}{2}$ times as long as wide. Costal area extending two-thirds the length of the wing; its veins united into about 4 bunches. Radius with 7 branches, the first of which is

simple, the second 3-parted. Media with 3 (forked) branches. Cubitus turned strongly backward, with 2 forked and one simple branch. Anal area extending nearly half the length of the wing; the first anal vein with several branches running off posteriorly. Structure cross wrinkled.

Holotype.—Cat. No. 38784, U.S.N.M.

ORTHOMYLACRIS RUGULOSA, new species.

Locality.—Lorberry Gap, in Sharp Mountain, near Tremont, Pennsylvania. Anthracite series; stage?

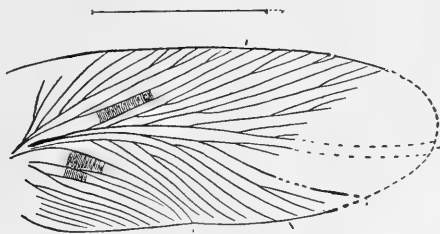


FIG. 72.—*ORTHOMYLACRIS RUGULOSA*.

Front wing, 26 mm. long, about $2\frac{1}{3}$ times as long as broad. Very similar to the foregoing species. Costal area shorter. Anal area only extending two-fifths the length of the wing. Cross veins more distinct.

Holotype.—Cat. No. 38791, U.S.N.M.

ORTHOMYLACRIS TRUNCATULA, new species.

Locality.—Port Griffith, Pennsylvania; Anthracite series; E coal.

Front wing, 23 mm. long, twice as long as wide. Costal area fully two-thirds the wing in length, its veins divided into about 5 bunches.

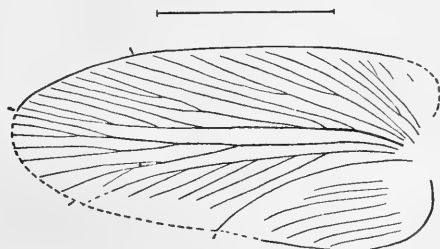


FIG. 73.—*ORTHOMYLACRIS TRUNCATULA*.

Radius with 6 branches, the first and second of which are simple, the third, 3-parted. Media with 3 compound branches. Cubitus with 5 offshoots. Anal area reaching nearly half the length of the wing. Indistinctly leathery.

Holotype.—Cat. No. 38773, U.S.N.M.

ORTHOMYLACRIS ELONGATA, new species.

Locality.—Lorberry Gap, in Sharp Mountain, 5 miles west of Tremont, Pennsylvania. Anthracite series; stage?

Front wing, 26 mm. long, $2\frac{2}{3}$ times as long as broad. Costal area reaching about five-eighths the length of the wing, its veins united into

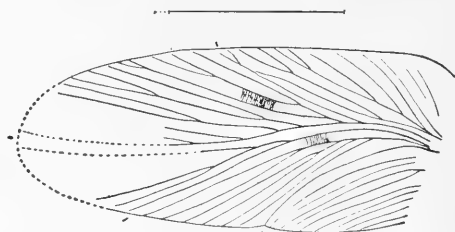


FIG. 74.—ORTHOMYLACRIS ELONGATA.

3 or 4 bunches. Radius with 6 branches, the first simple, the second with 5 twigs, and the third with 3. Media with about 3 branches, cubitus with 4. Anal area extending two-fifths the length of the wing. Finely crinkled cross veins.

Holotype.—Cat. No. 25687, U.S.N.M.

ORTHOMYLACRIS MANSFIELDI (Scudder).

Mylacris mansfieldi SCUDDER, Mem. Boston Soc., III, 1879, p. 47, pl. v, fig. 15.

Locality.—Cannelton, Pennsylvania. Allegheny formation; Kittanning group; roof of the Middle Kittanning coal.

ORTHOMYLACRIS LUCIFUGA (Scudder).

Mylacris lucifuga SCUDDER, Mem. Boston Soc., III, 1884, p. 301, pl. xxvii, fig. 8.

Locality.—Port Griffith Switchback, near Pittston, Pennsylvania. Anthracite series; ? D coal.

Holotype.—Cat. No. 38054, U.S.N.M.

ORTHOMYLACRIS HEERI (Scudder).

Blattina heeri SCUDDER, Canad. Nat., VII, 1874, p. 272, fig. 2.

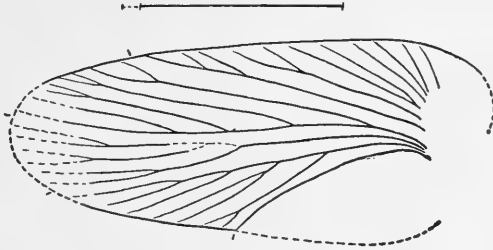
Mylacris heeri SCUDDER, Mem. Boston Soc., III, 1879, p. 43, pl. v, fig. 11.

Locality.—Sydney, Cape Breton. Middle coal formation; Allegheny stage?

ORTHOMYLACRIS ALUTACEA, new species.

Locality.—Port Griffith Switchback, Pennsylvania. Anthracite series; ? D coal.

Front wing, 30 mm. long; $2\frac{1}{4}$ times as long as broad. Costal area extending nearly three-fourths the length of the wing. Radius with

FIG. 75.—*ORTHOMYLACRIS ALUTACEA*.

4 branches, which form short terminal forks. Media with 3 offshoots. Cubitus with 4 branches. Anal area extending nearly half the length of the wing. Fine-grained leathery structure.

Holotype.—Cat. No. 38772, U.S.N.M.

ORTHOMYLACRIS PLUTEUS (Scudder).

Paromylacris ? pluteus SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 54, pl. III, fig. 2.

Locality.—Butler Mine, near Pittston, Pennsylvania. Anthracite series; E. coal.

Holotype.—Cat. No. 38048, U.S.N.M.

ORTHOMYLACRIS ANTIQUA (Scudder).

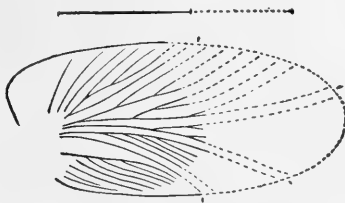
Mylacris antiqua SCUDDER, Mem. Boston Soc., III, 1884, p. 300; Bull. U. S. Geol. Surv., No. 124, 1895, p. 46, pl. II, figs. 5, 6.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage.

Holotype.—Cat. No. 38050, U.S.N.M.

ORTHOMYLACRIS PENNSYLVANICA, new species.

Locality.—Lorbery Gap, in Sharp Mountain, 5 miles west of Tremont, Pennsylvania. Anthracite series; stage ?

FIG. 76.—*ORTHOMYLACRIS PENNSYLVANICA*

Fragment, about 32 mm. long, of a front wing, costal area extending two-thirds the length of the wing. Radius with about 3 branches, the

first of which divides into 3 twigs; the second is furcate. Media with few forked branches. Cubitus with 4 branches. Anal area long, reaching nearly half the length of the wing. The first anal vein sends out several twigs backward. Structure leathery, with a tendency to the formation of cross wrinkles.

Holotype.—Cat. No. 38748, U.S.N.M.

ANOMOMYLACRIS, new genus.

Front wing slenderly cordate, nearly $2\frac{1}{2}$ times as long as the basal width. Costal area triangular, half as long as the wing, with about 7 veins issuing radially from the base. Radius with 5 branches directed toward the anterior margin, only the first and third of which are furcate. Media continuing in a nearly straight course through the middle of the wing, with 2 forked branches which run off backward and extend to the apical border. Between the radius and the media lies an accessory vein. The cubitus is greatly developed and proceeds in a nearly straight horizontal line from the base to the apical margin; its first (proximal) is forked, the second divides into 4 or 5 twigs, the third is simple, the fourth is furcate, and the fifth is again simple. The anal area is $2\frac{1}{2}$ times as long as high and nearly half as long as the wing. The first anal vein sends 4 twigs backward; then follow about 8 to 9 veins. The structure consists of a fine, close network.

ANOMOMYLACRIS CUBITALIS, new species.

Locality.—Lorberry Gap, in Sharp Mountain, 5 miles west of Tremont, Pennsylvania. Anthracite series; stage ?

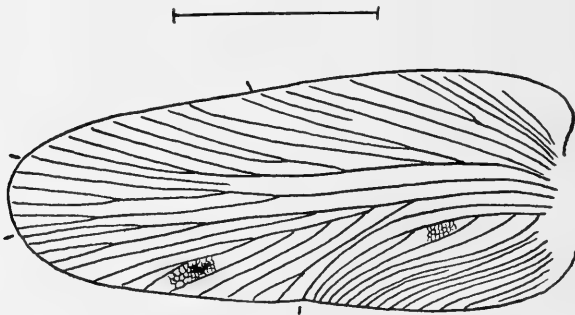


FIG. 77.—ANOMOMYLACRIS CUBITALIS.

Length of front wing, 27 mm.

Holotype.—Cat. No. 38747, U.S.N.M.

STENOMYLACRIS, new genus.

Front wing very slender, $2\frac{3}{4}$ times as long as broad. Costal area triangular, not quite reaching the middle of the wing, the veins arising from the subcosta near the base. Radius stretching in a strong

vault to the tip of the wing, its first branch twice forked, the second simple, the third, fourth, and fifth furcate, and the last simple. The media proceeds obliquely to the end of the apical border and sends out 1 forked and 1 simple branch obliquely backward to the extremity of the inner margin, besides 1 simple and 2 forked offshoots forward to the apical border. The strongly arcuate cubitus, with its 4 furcate or simple branches, occupies the central portion of the inner margin. The anal area is more than twice as long as high and takes up about three-sevenths the length of the wing; it contains about 8 to 9 veins. Structure leathery.

STENOMYLACRIS ELEGANS, new species.

Locality.—Sharp Mountain Gap, mammoth vein, 2 miles south of Tremont, Pennsylvania. Anthracite series; stage ?

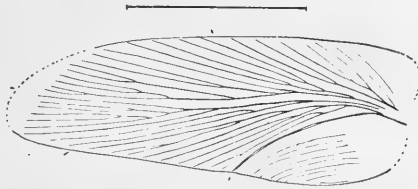


FIG. 78.—STENOMYLACRIS ELEGANS.

Length of the front wing, 25 mm.

Holotype.—Cat. No. 38738, U.S.N.M.

ACTINOMYLACRIS, new genus.

Front wing cordate, twice as long as broad. Costal area short, triangular, not extending beyond half the length of the wing; the veins nearly all issue from the base. Radius with 5 to 6 branches, the first of which separates into 3 or 4 twigs. Media with 3 to 4 offshoots directed backward to the apical and posterior borders. Cubitus with 1 furcate and 2 simple branches. The anal area is shorter than in the preceding genera, less than twice as long as high, and contains a large number (about 10 to 14) of veins. Structure leathery.

Type of genus, *Actinomylacris carbonum* (Scudder).

ACTINOMYLACRIS CARBONUM (Scudder).

Mylacris carbonum SCUDDER, Mem. Boston Soc., III, 1885, p. 304, pl. xxvii, fig. 10 (not figs. 6 and 7).

Locality.—Cannelton, Pennsylvania. Allegheny formation; Kitting group; roof of the Middle Kittanning coal.

ACTINOMYLACRIS VICINA, new species.

Locality.—Tremont, Pennsylvania. (Buck Mountain.) Anthracite series; mammoth coal; stage ?

Length of the front wing, 21 mm. The first branch of the radius

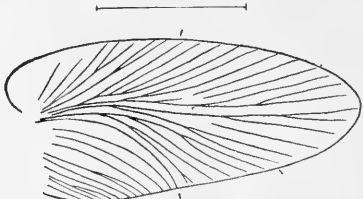


FIG. 79.—ACTINOMYLACRIS VICINA.

with 4 twigs, the second branch furcate, the 4 following offshoots simple. Media with 4 branches. Structure leathery, with a tendency to the formation of cross wrinkles.

Holotype.—Cat. No. 38750, U.S.N.M.

PHTHINOMYLACRIS, new genus.

Front wing cordate, scarcely twice as long as wide, with especially strongly developed costal area, which extends about five-sevenths the length of the wing, and whose bunches of veins emerge ray-like from one point. The radius is more strongly developed and occupies nearly the entire apical margin. Of its branches, the first separates into 2 or 3 twigs, while those following chiefly remain simple. The media is very much reduced and sends out but 2 short simple offshoots posteriorly toward the end of the inner border. The cubitus is also strongly reduced and forms only 3 to 4 branches. The anal area is consequently very large, more than half as long as the entire wing and more than twice as long as high. The structure can not be made out.

Type of genus, *Phthinomylacris cordiformis*, new species.

PHTHINOMYLACRIS CORDIFORMIS, new species.

Locality.—Port Griffith, Pennsylvania. Anthracite series; E coal.

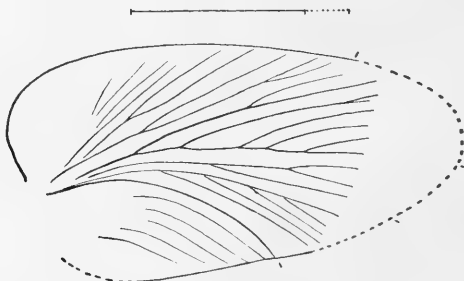


FIG. 80.—PHTHINOMYLACRIS CORDIFORMIS.

Length of the front wing, 28 mm. First branch of the radius furcate. Cubitus with 4 simple branches.

Holotype.—Cat. No. 38770, U.S.N.M.

PHTHINOMYLACRIS MEDIALIS, new species.

Locality.—Port Griffith, Pennsylvania. Anthracite series; E coal. Length of the front wing, 25 mm. First branch of the radius

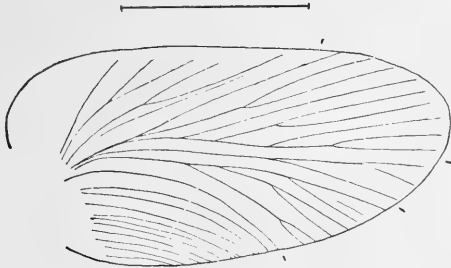


FIG. 81.—PHTHINOMYLACRIS MEDIALIS.

divides into 3 twigs. Cubitus with 3 forked offshoots. Anal area with 10 parallel veins.

Holotype.—Cat. No. 38765, U.S.N.M.

CHALEPOMYLACRIS, new genus.

Front wing of more elliptical or kidney-shaped outline, $2\frac{1}{3}$ times as long as broad, with the costal area not very much widened at the base and reaching not quite half the length of the wing; its veins all issue from the subcosta near the base. Just at the base of the wing, the radius divides into 2 main branches, each of which by repeated division separates into 7 or 8 branchlets, which take up nearly the entire anterior margin. The media also divides into 2 principal members, the superior of which, with its 5 twigs, occupies the apical border, and the inferior, with its 6 veinlets directed backward, takes up the terminal third of the inner margin. The feebly developed cubitus, with its 2 forked and 1 simple branches, occupies only a small portion of the posterior border. The anal area is more than twice as long as high, and extends over about three-sevenths of the inner margin; it contains only 6 or 7 veins. The structure is fine-grained leathery, without cross veins.

CHALEPOMYLACRIS PULCHRA, new species.

Locality.—Sharp Mountain Gap, 2 miles south of Tremont, Pennsylvania. Anthracite series; stage ?

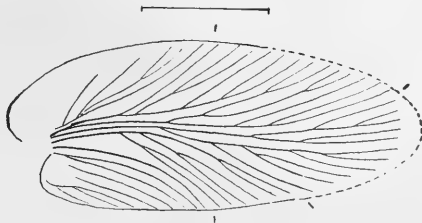


FIG. 82.—CHALEPOMYLACRIS PULCHRA.

Length of the front wing, 17 mm.

Holotype.—Cat. No. 38723, U.S.N.M.

BRACHYMYLACRIS, new genus.

Front wing broadly cordate, $1\frac{1}{2}$ to $1\frac{3}{5}$ times as long as broad. Costal area wide, more or less triangular to lancet shaped, extending three-fifths to two-thirds the length of the wing; its veins are united into bunches, which issue from the base. Radius with 3 to 7 offshoots branching off in various ways to the anterior border. Media always divided into 2 equally branched principal members. Cubitus with 3 to 7 branches, never reaching the apical margin. Anal area always less than twice as long as high and less than half as long as the wing. Structure fine-grained, leathery, cross wrinkled.

Type of genus, *Brachymylacris elongata*, new species.

BRACHYMYLACRIS ELONGATA, new species.

Locality.—Tremont, Pennsylvania. Anthracite series; stage ?

Front wing, 16 mm. long. Radius with 4 branches, of which the first and third always have three twigs, the second is furcate, and the

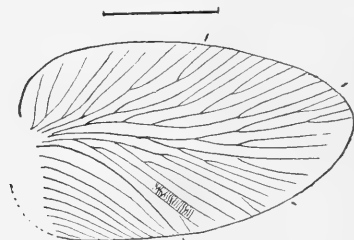


FIG. 83.—BRACHYMYLACRIS ELONGATA.

fourth simple. The superior branch of the media is divided into 6 offshoots; the inferior into 4 twigs. Anal area with 9 regular veins. Costal area with 8 veins, which form 3 groups.

Holotype.—Cat. No. 38753, U.S.N.M.

BRACHYMYLACRIS CORDATA, new species.

Locality.—Tremont, Pennsylvania. Anthracite series; stage ?

Front wing, 14 mm. long. Radius with 3 branches, of which the first forms 4 and the second 2 twigs. Media with 2 furcate, main

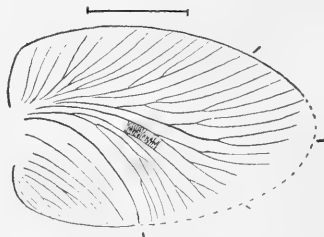


FIG. 84.—BRACHYMYLACRIS CORDATA.

branches. Cubitus with 3 offshoots, the first of which is twice forked; the second, furcate. Anal area with 9 in part compound veins. Costal area with 13 branches divided into 7 groups.

Holotype.—Cat. No. 38752, U.S.N.M.

BRACHMYLACRIS ROTUNDATA, new species.

Locality.—Sharp Mountain Gap, 2 miles south of Tremont, Pennsylvania. Anthracite series; stage ?

Length of the front wing, 14 mm. Radius with 7 branches, the first of which forms 3 twigs, while the second and third are furcate, and the following ones simple. Each main branch of the media forms 3

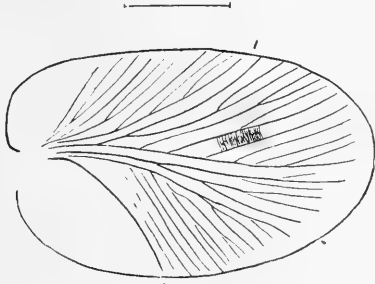


FIG. 85.—BRACHMYLACRIS ROTUNDATA.

twigs. Cubitus with about 8 offshoots, some of which are divided. The apical border of the wing is remarkably broadly rounded; the costal area contains about 12 veins, which are united into about 4 groups.

Holotype.—Cat. No. 38727, U.S.N.M.

BRACHMYLACRIS MIXTA, new species.

Locality.—Sharp Mountain Gap, 2 miles south of Tremont, Pennsylvania. Anthracite series; stage ?

Length of the front wing, 14 mm. Radius with 4 branches, the first of which forms 4 twigs and the second 3 offshoots. The superior

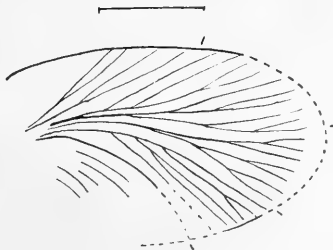


FIG. 86.—BRACHMYLACRIS MIXTA.

branch of the media with 3 veinlets, the inferior with 4. Cubitus with one simple and 3 furcate branches. Apical border broadly rounded.

Holotype.—Cat. No. 38736, U.S.N.M.

GONIOMYLACRIS, new genus.

A provisional genus founded on the basal portion of a mylacrid wing, which is distinguished by a strong curve of the subcosta, with the convexity directed anteriorly. The majority of the branches of this vein issue from the base; 3 from the vein itself. The costal area attains at least two-thirds the length of the wing. The radius appears to have had only 3 simple branches. The media separates into 2 main stems, with probably always 3 or 4 twigs. The cubitus also appears to have had but 3 to 4 offshoots. Anal area long and narrow, probably reaching half the length of the wing. Humeral angle very strongly produced. No structure to be seen.

GONIOMYLACRIS PAUPER, new species.

Locality.—Sharp Mountain Gap, 2 miles south of Tremont, Pennsylvania. Anthracite series; stage ?

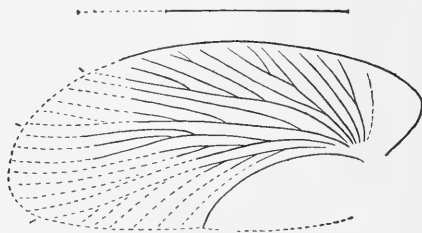


FIG. 87.—GONIOMYLACRIS PAUPER.

Probable length of the wing, 32 mm.

Holotype.—Cat. No. 38728, U.S.N.M.

MYLACRIS Scudder.

Mylacris anthracophila Scudder is to be regarded as the type of this genus.

Front wing 2 to $2\frac{1}{2}$ times as long as broad, with more strongly arched anterior margin and more slightly curved inner margin. Costal area wide, triangular, reaching three-fifths to two-thirds the length of the wing, with ray-like veins issuing from the base. Radius continuing to the tip of the wing, with 5 to 6 simple or furcate branches. Media stretching obliquely to the extremity of the posterior margin, with 3 to 4 offshoots branching forward and directed toward the apical margin. Cubitus with 4 to 6 more or less branched members. Anal area more than twice as long as high, almost half as long as the inner margin of the wing, and with about 7 to 8 in part branched veins. No distinct structure to be seen.

Prothorax much broader than long.

MYLACRIS ANTHRACOPHILA Scudder.

Mylacris anthracophila SCUDDER, Geol. Surv. Illinois, III, 1868, p. 568, figs. 5, 6;
Mem. Boston Soc., III, 1879, p. 45, pl. v, figs. 6 to 8; Bull. U. S. Geol. Surv.,
No. 124, 1895, p. 43, pl. i, figs. 1, 4.

Locality.—Colchester, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

MYLACRIS ELONGATA Scudder.

Mylacris elongata SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 41, pl. i, fig. 6.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Holotype.—Cat. No. 38049, U.S.N.M.

? MYLACRIS SELLARDSII, new species.

Mylacris elongata SELLARDS (not Scudder), Amer. Jour. Sci. (4), XVIII, 1904,
p. 125, fig. 8, pl. i, fig. 1.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

I am not convinced that the specimens investigated by Sellards belong to Scudder's *Mylacris elongata*. They appear to be larger and to have more copiously branched veins. The larvæ mentioned by Sellards I shall discuss separately.

MYLACRIS SIMILIS, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

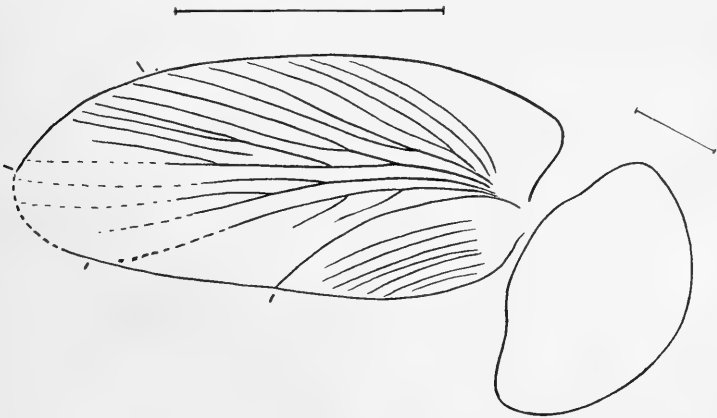


FIG. 88.—MYLACRIS SIMILIS.

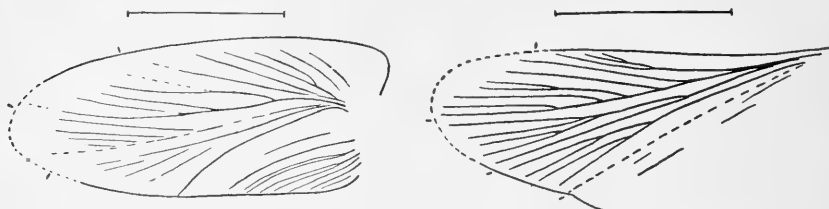
Front wing, 35 mm. long, shaped very much like that in *Mylacris elongata*. Radius with about 5 branches, the first 2 of which are furcate. Media and cubitus seem to be somewhat less strongly branched.

Daniels collection. Reverse of holotype in the U. S. National Museum: Cat. No. 35573.

? MYLACRIS DUBIA, new species.

Locality.—Lorberry Gap, 5 miles west of Tremont, Pennsylvania. Anthracite series; stage?

Front wing, about 25 mm. long, $2\frac{2}{3}$ times as long as broad. The venation is very indistinctly preserved, but as far as known agrees with that of the foregoing species. The anal area is also as long as in that form.



FIGS. 89, 90.—? MYLACRIS DUBIA.

The hind wing shows an anal area marked off by a fold, and extends about two-thirds the length of the wing. The radius sends 5 branches forward toward the tip of the wing; the media gives off 3 offshoots posteriorly, and the cubitus forms a double fork.

Cotypes.—Cat. No. 38746, U.S.N.M.

? APHELOMYLACRIS, new genus.

A provisional genus founded on an imperfectly preserved form, the venation of which appears to have great similarity to that of *Mylacris*. The front wing is cordate, twice as long as broad. The triangular costal area hardly extends beyond half the length of the wing, and contains but few veins. The radius forms 5 branches, the first 3 of which are furcate. The media appears to send out only 2 branches anteriorly; still this part of the wing is here indistinctly preserved. The cubitus forms about 8 uniform, simple branches. Anal area less than half as long as high. Traces of cross wrinkles are distinctly to be seen.

? APHELOMYLACRIS MODESTA, new species.

Locality.—Pawtucket, Rhode Island. Pennsylvanian; Ten-mile series; ? Allegheny or Conemaugh stage.

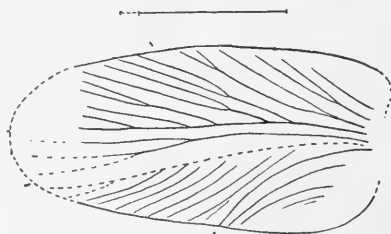


FIG. 91.—? APHELOMYLACRIS MODESTA.

Front wing, about 22 mm. long.

Holotype.—Cat. No. 38702, U.S.N.M.

LITHOMYLACRIS Scudder.

Front wing slender, almost lancet shaped, 3 times as long as broad. Costal area triangular, extending two-thirds the length of the wing, with veins issuing radially from one point. Radius continuing almost horizontally through the middle of the wing, with 6 branches, the second and third of which are furcate. Media stretching obliquely to the extremity of the inner margin, with 2 forked and one simple branches running out forward. Cubitus advancing obliquely to the inner margin, with one simple and 2 furcate branches. Anal area proportionally small, more than twice as long as high, and occupying only two-fifths of the posterior margin.

LITHOMYLACRIS ANGUSTA Scudder.

Lithomylacris angusta SCUDDER, Mem. Boston Soc., III, 1879, p. 48, pl. v, fig. 2.

Locality.—Port Griffith Switchback, near Pittston, Pennsylvania. Anthracite series; E coal.

Holotype.—Cat. No. 38094, U.S.N.M.

SPHENOMYLACRIS, new genus.

Front wing subcordate, with slightly curved anterior margin, and more strongly arcuate inner border, not quite twice as long as broad at the base. Costal area fully three-fifths of the length of the wing in extent, with several bunches of veins issuing from the base. Radius with 3 forked and one simple branches, the first 2 of which spring from one point. The last branches end in the apical margin. Media divided into 2 furcate offshoots. Cubitus strongly vaulted and, with its 3 forked and 2 simple veins, taking up the central portion of the posterior margin. Anal area not quite twice as long as high, extending three-sevenths the length of the wing, and limited by a quite straight fold, in which the first anal vein fuses; the 6 remaining anal veins are somewhat curved, and with their extremities turned toward the tip of the wing; they end, however, in the normal way in the inner margin. The structure consists of fine, indistinct, irregular cross lines. The humeral angle is broadly rounded, not produced into an angle.

SPHENOMYLACRIS SINGULARIS, new species.

Locality.—Port Griffith Switchback, near Pittston, Pennsylvania. Anthracite series; E coal.

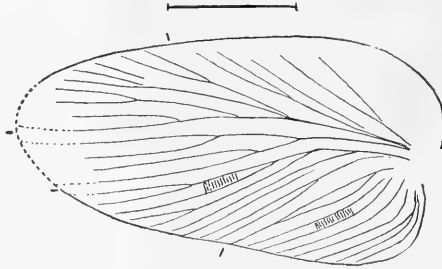


FIG. 92.—SPHENOMYLACRIS SINGULARIS.

Length of the front wing, 20 mm.

Holotype.—Cat. No. 38761, U.S.N.M.

AMBLMYLACRIS, new genus.

Front wing twice as long as broad, of nearly kidney-shaped form, with strongly arcuate front margin and very broadly rounded apical border. Humeral angle rounded, not produced into an angle. Costal area triangular, broad, with bunches of veins issuing radially from one point. Radius greatly developed, arcuate, and continuing to the apical margin, with 6 to 8 more or less branched, pectinately arranged offshoots. Media reduced, with but 2 to 3 branches directed forward toward the apical border. Cubitus with about 5 more or less compound offshoots occupying the entire free inner margin. Anal area defined by a curved vein, not quite twice as long as high and taking up less than half the inner margin. Anal veins normally curved to the inner border.

Type of genus, *Amblymylacris clintoniana* (Scudder).

AMBLMYLACRIS CLINTONIANA (Scudder).

Etblattina clintoniana SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 66, pl. IV, fig. 1.

Locality.—Clinton, Missouri. Cherokee shales; Kittanning (Allegheny) stage.

AMBLMYLACRIS HAREI (Scudder).

Promylacris harei SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 48, pl. II, fig. 3.

Locality.—Kansas City, Missouri. Chanute shales; Conemaugh? stage.

PROMYLACRIS Scudder.

A somewhat indefinite genus, the type of which may be regarded as *Promylacris ovalis* Scudder. Front wing probably cordate, with

strongly arcuate anterior margin and rounded humeral angle; about $2\frac{1}{3}$ times as long as broad. Costal area almost triangular, continuing somewhat beyond half the length of the wing, with 3 bunches of veins issuing from one point, the first of which shows about 6 twigs. The radius is quite distinctively formed, in that from one point not far from the base 4 ray-like branches run off successively; the first, second, and fourth of these branches always consist of 3 to 4 branchlets, while the third remains simple. According to the figure it may be concluded that the branches of the radius scarcely fill up the entire free anterior margin. The media forms about 3 or 4 offshoots, which are directed forward toward the apical border; and the cubitus about 5 branches, which in each case fill the entire free posterior margin. The anal area is about twice as long as high and half as long as the inner margin, and contains regular veins fusing in the posterior border.

PROMYLACRIS OVALIS Scudder.

Promylacris ovalis SCUDDER, Proc. Acad. Nat. Sci. Phila., 1885, p. 34; Mem. Boston Soc., IV, 1890, p. 403, pl. xxxi, figs. 1 to 4.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

MYLACRIDÆ OF DOUBTFUL SYSTEMATIC POSITION.

PAROMYLACRIS ROTUNDA Scudder.

Paromylacris rotunda SCUDDER, Proc. Acad. Nat. Sci. Phila., 1885, p. 35; Mem. Boston Soc., IV, 1890, p. 406, pl. xxxii, figs. 1, 2.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

This species is to be regarded as the type of the genus *Paromylacris*.
Holotype.—Cat. No. 38047, U.S.N.M.

(MYLACRIDÆ) PRISCOVOLANS (Scudder).

Mylacris priscovolans SCUDDER, Mem. Boston Soc., III, 1884, p. 307, pl. xxvii, fig. 9.

Locality.—Cannelton, Pennsylvania. Allegheny formation; Kittanning group; roof of the Middle Kittanning coal.

Cotypes.—Cat. No. 38055; U.S.N.M.

(MYLACRIDÆ) PAUPERATA (Scudder).

Lithomylacris pauperata SCUDDER, Mem. Boston Soc., IV, 1890, p. 409, pl. xxxii, fig. 5.

Locality.—Port Griffith, Pennsylvania. Anthracite series; E coal.
Holotype.—Cat. No. 38095, U.S.N.M.

(MYLACRIDÆ) PSEUDO-CARBONUM, new species.

Mylacris carbonum SCUDDER (part), Mem. Boston Soc., III, 1884, p. 304, pl. xxvii, fig. 6 (not fig. 7, 10).

Locality.—Cannelton, Pennsylvania. Allegheny formation; Kittanning group; roof of the Middle Kittanning coal.

Holotype.—Cat. No. 38900, U.S.N.M.

(MYLACRIDÆ) CARBONINA, new species.

Mylacris carbonum SCUDDER (part), Mem. Boston Soc., III, 1884, p. 304, pl. xxvii, fig. 7 (not fig. 6, 10).

Locality.—Empire Mine, Wilkes-Barre, Pennsylvania. Anthracite series; E coal.

Holotype.—Cat. No. 38052, U.S.N.M.

(MYLACRIDÆ) BRETONENSIS (Scudder).

Blattina bretonensis SCUDDER, Canad. Nat., VII, 1874, p. 271, fig. 1.

Mylacris bretonensis SCUDDER, Mem. Boston Soc., III, 1879, p. 41, pl. v, fig. 1.

Locality.—Sydney, Cape Breton. Middle Coal formation; Allegheny stage!

(MYLACRIDÆ) SIMPLEX (Scudder).

Lithomylacris simplex SCUDDER, Mem. Boston Soc., III, 1879, p. 51, pl. v, fig. 5.

Locality.—Danville, Illinois. Pennsylvanian; Conemaugh (or Freeport ?) stage.

(MYLACRIDÆ) PITTSTONIANA (Scudder).

Lithomylacris pittstoniana SCUDDER, Mem. Boston Soc., III, 1879, p. 50, pl. v, figs. 4, 10.

Locality.—Port Griffith, Pennsylvania. Anthracite series; E coal.

Holotype.—Cat. No. 38096, U.S.N.M.

(MYLACRIDÆ) PENNSYLVANICA (Scudder).

Mylacris pennsylvanica SCUDDER, Mem. Boston Soc., III, 1879, p. 44, pl. v, figs. 13, 14.

Locality.—Cannelton, Pennsylvania. Allegheny formation; Kittanning group; roof of the Middle Kittanning coal.

Cotypes.—Cat. No. 38102, U.S.N.M.

(MYLACRIDÆ) AMPLA (Scudder).

Mylacris ampla SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 45, pl. II, fig. 1.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage.

Holotype.—Cat. No. 38051, U.S.N.M.

(MYLACRIDÆ) GURLEYI (Scudder).

Mylacris gurleyi SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 43, pl. 1, fig. 5.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage.

(MYLACRIDÆ) RIGIDA (Scudder).

Promylacris rigida SCUDDER, Mem. Boston Soc., IV, 1890, p. 403, pl. xxxi, fig. 6.
Promylacris rigida SELLARDS, Amer. Jour. Sci. (4), XVIII, 1904, p. 221, fig. 36.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage.

Holotype.—Cat. No. 38045, U.S.N.M.

(MYLACRIDÆ) AMPLA (Scudder).

Paromylacris ampla SCUDDER, Mem. Boston Soc., IV, 1890, p. 408, pl. xxxi, fig. 7;
Bull. U. S. Geol. Surv., No. 124, 1895, p. 51, pl. iii, fig. 4.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage.

Holotype.—Cat. No. 38044, U.S.N.M.

Family DICTYOMYLACRIDÆ, new family.

In this group I unite several forms from the European and American Carboniferous, which, in the form of the costal area, recall the archimylacrids on the one hand and the mylacrids on the other. The costal area is here of almost triangular form, while most of the branches arise successively from the subcosta. The branches of the radius are directed obliquely forward; those of the media, on the contrary, slope backward. The cubitus occupies only a limited space, and the anal area is marked off by a curved suture, in which part of the anal veins end. The longitudinal veins are connected by distinct, remote cross veins. In the European forms the prothorax is very broad, transversely elliptical, and is characterized by ribs which run off radially to the periphery.

DICTYOMYLACRIS Brongniart.

Front wing somewhat more than twice as long as broad, subcordate, with strongly arched anterior margin, costal area occupying from four-sevenths to two-thirds the length of the wing, with from 5 to 7 veins arising successively from the subcosta and several feebly branched ones proceeding from the base.

DICTYOMYLACRIS MULTINERVIS (Sellards).

"Undescribed *Blattinaria*" SELLARDS, Amer. Jour. Sci. (4), XV, 1903, p. 312, pl. VII, fig. 6.

Schizoblattina multinervis SELLARDS, Amer. Jour. Sci. (4), XVIII, 1904, p. 217 fig. 28.

Locality.—Lawrence, Kansas. Upper Coal Measures; Le Roy (Lawrence) shales.

This form, described by Sellards, agrees completely with the genus *Dictyomylacris* Brongniart, founded on European forms, represented in the Stephanian of Commeny by several species. The erection of a new genus, therefore, I consider unnecessary.

Family NEOMYLACRIDÆ, new family.

This group appears to be nearly related to the dictyomylacrids and agrees with the latter to the extent that here also the first anal veins end in the suture of the anal area. The costal area is short and triangular, the subcosta not curving backward with the convexity, but forward; all its veins issue from the subcosta near the base. The humeral angle is not strongly produced, but rounded. Radius normal. Branches of the media directed backward. Cubitus normal. Anal area rather long and limited by a curved suture. Hitherto several species were made known from the upper portion of the Upper Carboniferous of America.

NEOMYLACRIS, new genus.

Front wing cordate about twice as long as wide. Costal area reaching from three-fifths to two-thirds the length of the wing, with only from 5 to 6 veins. Radius with 5 or 6 simple or furcate branches successively running out forward; part of these occupy the free portion of the anterior margin and part the apical border. Media with 2 ? to 4 branches diverging posteriorly. Cubitus with a small number of offshoots occupying almost the entire free inner margin. Costal area about twice as long as high, extending from two-fifths to nearly one-half the length of the wing, and limited by a curved suture; the first anal vein ends in the suture. Structure indistinct, either stippled like leather or with a tendency to the formation of cross wrinkles.

Type of genus, *Neomylacris major*, new species.

NEOMYLACRIS MAJOR, new species.

Locality.—Port Griffith Switchback, Pennsylvania. Anthracite series; E coal.

Length of the front wing, 22 mm. First, second, and fifth branches of the radius simple; third and fourth branches furcate. Media with

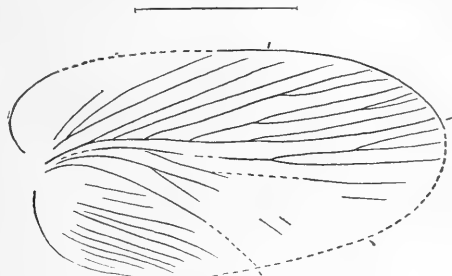


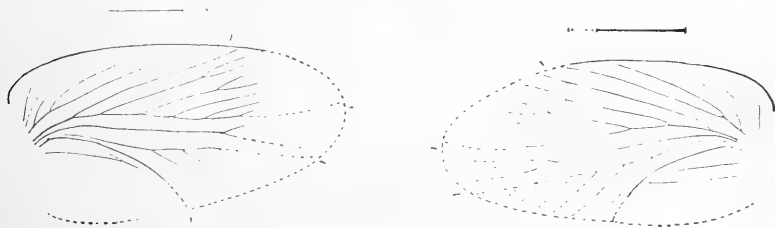
FIG. 93.—NEOMYLACRIS MAJOR.

4 offshoots, the first of which originates at one-third the length of the wing. Anal area with about 10 veins. No definite structure to be seen.

Holotype.—Cat. No. 38766, U.S.N.M.

NEOMYLACRIS PULLA, new species.

Locality.—Lorberry Gap in Sharp Mountain, near Tremont, Pennsylvania. Anthracite series; stage?



FIGS. 94 and 95.—NEOMYLACRIS PULLA.

Length of front wing, 16 mm. Radius with 6 branches, the second and third of which are forked. Media first divides in the last third of the length of the wing.

Cotypes.—Cat. Nos. 25476 and 38794, U.S.N.M.

NEOMYLACRIS PAUCINERVIS, new species.

Locality.—Lorberry Gap in Sharp Mountain, near Tremont, Pennsylvania. Anthracite series; stage?

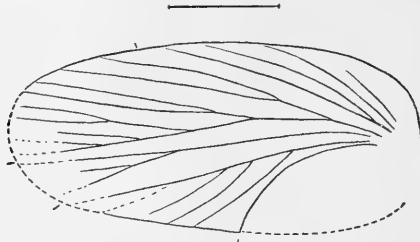


FIG. 96.—NEOMYLACRIS PAUCINERVIS.

Length of front wing, 16 mm. Very similar to the previous species. Radius with 3 furcate and 2 simple branches. Media first furcates in the last third of the length of the wing.

Holotype.—Cat. No. 38789; U.S.N.M.

Family PTERIDOMYLACRIDÆ, new family.

I erect this family on an aberrant blattoid form, whose heart-shaped wing, in respect to the shape of the costal area, conforms to that of the mylacrids; in its enormously lengthened anal area, which attains about four-fifths the length of the wing, however, it widely differs from all other blattid forms. The radius is developed in the normal way; the media and the cubitus, on the contrary, are much reduced. The veins of the anal area end in the inner border.

Indeed, no other blattid wing shows so striking a resemblance to the pinnae of a fossil fern, and I was for a long time in doubt whether the present specimen should really be regarded as the remains of an insect or as a plant. We here seem to have a form showing an extreme adaptation.

PTERIDOMYLACRIS, new genus.

Front wing cordate, $1\frac{3}{4}$ times as long as broad. Costal area triangular, attaining nearly two-thirds the length of the wing, with ray-like veins issuing from one point. Radius advancing to the apical border, with about 7 regular branches, probably simple throughout, extending to the anterior margin. Media arcuate, with one short terminal fork. Cubitus with one compound and one simple branch, which strike the end of the inner margin. Anal area strongly developed, reaching four-fifths the length of the wing, and marked off by a curved suture, with 10 veins ending in the posterior margin, several of which have a common origin. No structure to be seen.

PTERIDOMYLACRIS PARADOXA, new species.

Locality.—Lorberry Gap in Sharp Mountain, near Tremont, Pennsylvania. Anthracite series; stage ?

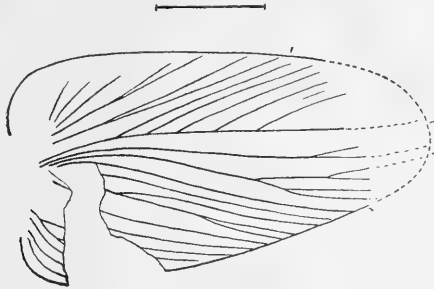


FIG. 97.—PTERIDOMYLACRIS PARADOXA.

Length of the front wing, about 18 mm.

Holotype.—Cat. No. 38733, U.S.N.M.

Family IDIOMYLACRIDÆ, new family.

For the type of this family, I take a highly specialized blattoid wing, which in the shape of the costal area agrees with the mylacrid series, but which appears to be distinguished by the unique disposition of the anal veins. The front wing is subelliptical, scarcely twice as long as broad, with strongly curved inner margin and gently curved anterior border. Costal area one-half as long as the wing, subtriangular, broad; humeral angle rounded. The branches of the subcosta arise at the base of the wing. Radius divided near the base into 2 main offshoots, each of which forms about 3 branchlets. The twigs of the superior branch end on the anterior border; those of the inferior, on the contrary, on the apical margin. The media likewise separates into 2 branches similar to those of the radius, the twigs of which (always 3) take up the last third of the inner margin. The cubitus with its 3 branches is limited to the middle portion of the posterior margin. The anal area occupies not much more than one-third the length of the wing, and is defined by a strongly curved suture. The anal veins are quite uniquely grouped, since from one stem 3 offshoots branch forward and 1 backward. The first branch ends in the second, the second in the third, and this, as well as those following, end in the inner margin. Structure finely stippled, like leather.

IDIOMYLACRIS, new genus.

IDIOMYLACRIS GRACILIS, new species.

Locality.—Lorberry Gap in Sharp Mountain, near Tremont, Pennsylvania. Anthracite series; stage ?

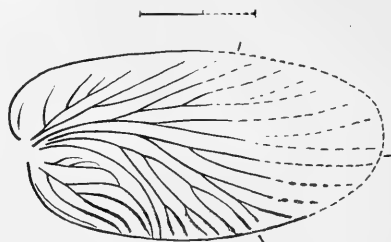


FIG. 98.—IDIOMYLACRIS GRACILIS.

Length of the front wing, about 15 mm.

Holotype.—Cat. No. 38793, U.S.N.M.

Family NEORTHROBLATTINIDÆ, new family.

I establish this family on a somewhat aberrant blattoid form, which unfortunately I can judge only from Scudder's figure and description. The venation somewhat recalls that of *Idiomylacris* from the Upper Carboniferous and permits itself very easily to be derived from the archimylacrid type. The outline of the wing appears to have been subreniform, with somewhat broadened base, and rather more than twice as long as wide. The short, broad costal area reaches over a little beyond the middle of the wing, and the form belongs to the band-shaped type (*Archimylacridæ*, etc.); the veins issue successively from the subcosta. The radius extends to the upper end of the apical border and sends out only a small number of branches toward the front margin. About in the middle of the wing, the media divides into 2 simple or furcate branches. The cubitus continues to the end of the posterior border and sends out several branches to it. The anal area is large, marked off by a bow-shaped fold, and contains a small number of veins, which branch off in a peculiar manner, similar to that in *Idiomylacris*, in part again uniting; they all end in the inner margin. On the impression, the surface of the wing appears very opaque; the veins, on the contrary, are preserved as thin broad stripes.

NEORTHROBLATTINA Scudder.

NEORTHROBLATTINA ALBOLINEATA Scudder.

Neorthroblattina albolineata SCUDDER, Proc. Acad. Nat. Sci. Phila., 1885, p. 109; Mem. Boston Soc., IV, 1890, p. 467, pl. XLII, fig. 2 (? 18).

Locality.—Fairplay, Colorado. Lower Permian.

Family POROBLATTINIDÆ, new family.

This family is founded on a number of small forms from the Uppermost Carboniferous and Lower Permian. These forms constitute a link between the archimyliacrids and the prevailing Mesozoic mesoblattinids, and are characterized by a strongly reduced costal area, which extends only from one-third to one-half the length of the wing and is of rather narrow lancet-like shape. In contrast with the mesoblattinids, however, the few branches of the subcosta are still distinctly developed, and arise from the subcosta serially as in the archimyliacrids. The radius very gradually takes the place of the subcosta and forms numerous simple or feebly divided branches directed forward. The media is free and sends out a small number of offshoots forward to the apical border; the cubitus gives off a variably large number of branches backward; rarely, also, one forward. The anal area is relatively large, limited by a strongly curved suture, and contains numerous veins, of which the first ones only end in the suture; all others, on the contrary, end in the inner border. No distinct cross veins.

POROBLATTINA Scudder.

Poroblattina arcuata Scudder is to be regarded as the type of this genus.

Front wing subelliptical, $1\frac{3}{4}$ to 2 times as long as broad. Radius very strongly arcuate, curving down to the middle of the wing and recurving to the apical border. Media first divides below the middle of the wing. Cubitus with few branches and not occupying the entire free posterior border, strongly vaulted. Anal area half as long as the wing and less than twice as long as high, with numerous oblique veins directed toward the apex of the area, the larger number of which end in the inner border. No structure to be seen (many oblique cross folds between the veins).

POROBLATTINA BRACHYPTERA, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

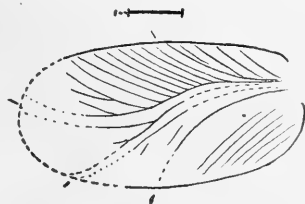


FIG. 99.—POROBLATTINA BRACHYPTERA.

Front wing, 9 mm. long; twice as long as broad. Radius with about 11 branches, the first 8 of which are simple.

Holotype.—Cat. No. 38637, U.S.N.M.

POROBLATTINA LATA, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

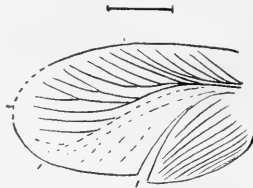


FIG. 100.—POROBLATTINA LATA.

Front wing, 9 mm. long; $1\frac{3}{4}$ times as long as broad. Radius with 2 simple, one 3-parted, and 2 furcate branches.

Holotype.—Cat. No. 38696, U.S.N.M.

POROBLATTINA ARCUATA Scudder.

Poroblattina arcuata SCUDDER, Proc. Acad. Nat. Sci. Phila., 1885, p. 39; Mem. Boston Soc., IV, 1890, p. 466, pl. xli, fig. 5.

Locality.—Fairplay, Colorado. Lower Permian.

POROBLATTINA RICHMONDIANA, new species.

Locality.—Wills Creek, near Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

Front wing, 9 mm. long; more than twice as long as wide. Radius

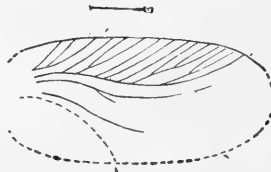


FIG. 101.—POROBLATTINA RICHMONDIANA.

with 7 branches, the first, third, fourth, and fifth of which are simple, the second and seventh furcate, while the sixth is thrice divided.

Holotype.—Cat. No. 38644, U.S.N.M.

POROBLATTINA LAKESII Scudder.

Poroblattina lakesii SCUDDER, Proc. Acad. Nat. Sci. Phila., 1885, p. 39; Zittel's Handbuch, 1885, p. 755, fig. 936; Mem. Boston Soc., IV, 1890, p. 466, pl. xli, fig. 11.

Locality.—Fairplay, Colorado. Lower Permian.

? SYSTOLOBLATTA, new genus.

A doubtful genus and perhaps to be united with the foregoing one. According to the drawing it is to be inferred that the wing which I here class is somewhat longer, being about $2\frac{1}{2}$ times as long as broad.

The radius appears to extend to the apical margin, but is gently curved, and notwithstanding this continues down toward the middle of the wing. The media divides about in the middle of the wing, and the cubitus is very much reduced. No cross veins.

? *SYSTOLOBLATTA OHIOENSIS* (Scudder).

Poroblattina ohioensis SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 138, pl. XI, fig. 2.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

Family MESOBLATTINIDÆ, new family.

This family, which is very feebly represented in the Paleozoic, but is very abundantly developed in the Mesozoic, is characterized by a most remarkable reduction of the costal area, the place of which the radius with its branches now fills. The media is free and is divided in various ways, as is also the cubitus. Most of the veins of the anal area reach to the inner margin. This group can be quite readily derived from the poroblattinids.

ACMÆOBLATTA, new genus.

Front wing pointed, nearly 3 times as long as broad. Radius reaching nearly to the tip, with very many branches. Media with about 6 simple offshoots branching out forward. Cubitus with about 9 simple (?) branches occupying the middle third of the inner margin. Anal area relatively long and narrow, its veins, at least in part, parallel with the posterior border. No cross veins visible. No intercalary veins.

ACMÆOBLATTA LANCEOLATA, new species.

Locality.—Wills Creek, near Steubenville, Ohio. Conemaugh formation; shales above the Ames limestone.

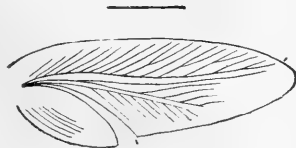


FIG. 102.—ACMÆOBLATTA LANCEOLATA.

Front wing, 10 mm. long. Radius with about 14 mainly simple veins. The first branch of the media originates near the base.

Holotype.—Cat. No. 38678, U.S.N.M.

DICHRONOBLATTA, new genus.

I regard as type of this genus Scudder's *Gerablattina minima*, the neuration of which, according to my view, has been quite erroneously interpreted.

The genus is distinguished from its allies principally by the shorter radius, which does not reach to the tip of the wing; by the more copiously divided media, which arises quite near the base, and by the structure of the cubitus, which, in about the middle of its course, sends out a branch forward and occupies the entire posterior margin. The form of the wing is elliptical, somewhat more than twice as long as broad. The anal area attains about two-fifths the length of the wing and includes numerous veins which end in the inner margin. Traces of cross veins are preserved. Intercalary veins wanting.

DICHRONOBLATTA MINIMA (Scudder).

Gerablattina minima SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, pl. XI, fig. 5.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

NEAROBLATTA, new genus.

Front wing subelliptical, $2\frac{1}{2}$ times as long as broad. Radius arcuate, reaching to the end of the front margin, with many oblique branches extending forward. Media divided into 2 principal branches, whose twigs take up the apical margin and a part of the inner border. Cubitus much reduced, with its few divisions occupying only the middle portion of the posterior margin. Anal area large, limited by a strongly curved fold, with numerous veins fusing in the inner border. Distinct, delicate cross veins. No intercalary veins.

Type of genus, *Nearoblatta parvula* (Goldenberg).

NEAROBLATTA ROTUNDATA (Scudder).

Neorthroblattina rotundata SCUDDER, Proc. Acad. Nat. Sci. Phila., 1885, p. 109; Zittel's Handbuch, I, 1885, p. 766, fig. 960; Mem. Boston Soc., IV, 1890, p. 467, pl. XLII, figs. 7, 8.

Locality.—Fairplay, Colorado. Lower Permian.

NEAROBLATTA LAKESII (Scudder).

Neorthroblattina lakesii SCUDDER, Proc. Acad. Nat. Sci. Phila., 1885, p. 109; Mem. Boston Soc., IV, 1890, p. 467, pl. XLII, figs. 9, 15.

Locality.—Fairplay, Colorado. Lower Permian.

EPHEBOBLATTA, new genus.

Very similar to the preceding genus, but differs in the shortened radius, which ends far above the apex of the wing; in the strongly

developed cubital vein, and also in the pointed form of the front wing, which is almost 3 times as long as broad. The anal area is proportionally short, and its veins run parallel with the anterior margin. Cross veins appear to be wanting. No intercalary veins.

EPHEBOBLATTA ATTENUATA (Scudder.)

Neorthroblattina attenuata SCUDDER, Proc. Acad. Nat. Sci. Phila., 1885, p. 110; Mem. Boston Soc., IV, 1890, pp. 467, 468, pl. XLII, fig. 1.

Locality.—Fairplay, Colorado. Lower Permian.

SCUTINOBLATTINA Scudder.

A somewhat doubtful genus. The front wings are pointed. The costal area is reduced and is replaced by the radius, which still reaches out to the posterior border somewhat across the tip. The media appears very much reduced; the cubitus, on the other hand, is normally developed. Anal area large, with numerous veins. Cross and intercalary veins appear to be wanting.

SCUTINOBLATTINA BRONGNIARTI Scudder.

Scutinoblattina brongniarti SCUDDER, Proc. Acad. Nat. Sci. Phila., 1885, p. 110; Mem. Boston Soc., IV, 1890, p. 469, pl. XLII, fig. 5.

Locality.—Fairplay, Colorado. Lower Permian.

Family **DIECHOBLATTINIDÆ**, new family.

This family agrees with the mesoblattinids in the striking reduction of the costal area, but is distinguished from them by a marked degeneration of the media; consequently, in place of the subcosta, the cubitus follows immediately after the encroaching radius, and thus the entire surface of the wing, aside from the normally preserved anal area, is filled up with the branches of these two main veins. The forms of this group are found in small numbers in the Permian and Jura formations.

NEPIOBLATTA, new genus.

Front wing lancet-shaped, more than $2\frac{1}{2}$ times as long as wide. Costal area restricted to a small swelling at the base of the anterior margin, without veins. Radius gently vaulted, extending to the tip, with about 7 in part compound branches directed forward. Cubitus parallel and passing near the main stem of the radius, with about 5 normal, in part furcate, branches running out posteriorly. Anal area large, marked off by a curved suture, in which the majority of the veins fuse. Intercalary veins wanting; cross veins are ? not preserved.

NEPIOBLATTA INTERMEDIA (Scudder).

Scutinoblattina intermedia SCUDDER, Proc. Acad. Nat. Sci. Phila., 1885, p. 111; Mem. Boston Soc., IV, 1890, p. 469, pl. XLII, fig. 4.

Locality.—Fairplay, Colorado. Lower Permian.

BREPHOBLATTA, new genus.

Front wing lancet-shaped, somewhat more than $2\frac{1}{2}$ times as long as wide. Radius and cubitus extend nearly parallel and straight through the middle of the wing, and always send out from 4 to 5 in part divided branches to the periphery. The anal area is slender and defined by a gently curved vein. The entire wing is delicately reticulate. Pronotum subcircular.

BREPHOBLATTA RECTA (Scudder).

Scutinoblattina recta SCUDDER, Proc. Acad. Nat. Sci. Phila., 1885, p. 111; Mem. Boston Soc., IV, 1890, p. 469, pl. XLII, figs. 3, 16.

Locality.—Fairplay, Colorado. Lower Permian.

BLATTOIDEA OF DOUBTFUL SYSTEMATIC POSITION.

A. FRONT WINGS.

(BLATTOIDEA) RICHMONDIANA (Scudder).

Gerablattina richmondiana SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 116, pl. x, fig. 1.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

(BLATTOIDEA) STIPATA (Scudder).

Etblattina stipata SCUDDER, Proc. Boston Soc. XXIV, 1889, p. 50; Bull. U. S. Geol. Surv., No. 124, 1895, p. 98, pl. VIII, fig. 3.

Locality.—Richmond, Ohio. Conemaugh formation; shales above the Ames limestone.

(BLATTOIDEA) LATEBRICOLA (Scudder).

Etblattina latebricola SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 108, pl. IX, fig. 11.

Locality.—East Providence, Rhode Island. Pennsylvanian; Ten-mile series; Allegheny or Conemaugh stage.

(BLATTOIDEA) sp. Scudder.

Etblattina sp. SCUDDER, Bull. U. Geol. Surv., No. 101, 1893, p. 18, pl. II, fig. h; No. 124, 1895, p. 77, pl. v, fig. 2.

Locality.—Pawtucket, Rhode Island. Pennsylvanian; Ten-mile series; ? Allegheny or Conemaugh stage.

(BLATTOIDEA) TRIASSICA (Scudder).

Anthracoblattina triassica SCUDDER, Amer. Jour. Sci. (3), XXVIII, 1884, p. 200; Mem. Boston Soc., IV, 1890, p. 464, pl. XLI, fig. 9.

Locality.—Fairplay Colorado. Lower Permian.

(BLATTOIDEA) sp. Scudder.

Etblattina sp. SCUDDER, Proc. Boston Soc., XXII, 1883, p. 59; Mem. Boston Soc., IV, 1890, p. 460, pl. XLII, fig. 20.

Locality.—Fairplay, Colorado. Lower Permian.

(BLATTOIDEA) ARCTA (Scudder).

Etblattina arcta SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 97, pl. VIII, fig. 5.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38082, U.S.N.M.

(BLATTOIDEA) EXIGUA (Scudder).

Etblattina exigua SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 76, pl. v, fig. 4.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38080, U.S.N.M.

(BLATTOIDEA) APERTA (Scudder).

Etblattina aperta SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 80, pl. v, fig. 9.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

Holotype.—Cat. No. 38195, U.S.N.M.

B. HIND WINGS.

(BLATTOIDEA) sp. Scudder.

Etblattina sp. SCUDDER, Bull. U. S. Geol. Surv., No. 101, 1893, p. 16, pl. II, fig. k; No. 124, 1895, pl. XII, fig. 4.

Locality.—Cranston, Rhode Island. Pennsylvanian; near base of section; stage?

The original is in the collection of the U. S. National Museum (Cat. No. 38070); occasionally many distinct cross veins may be seen.

(BLATTOIDEA) OVALIS (Scudder).

Myliacris ovalis SCUDDER, Mem. Boston Soc., III, 1885, p. 308, pl. XXVII, fig. 5.

Locality.—Cannelton, Pennsylvania. Allegheny formation; Kittanning group; roof of the Middle Kittanning coal.

Cotypes.—Cat. No. 38101, U.S.N.M.

(BLATTOIDEA) sp. Sellards.

Blattide ——— SELLARDS, Amer. Jour. Sci. (4), XV, 1903, pl. VII, fig. 7.

Etblattina sp. SELLARDS, Amer. Jour. Sci. (4), XVIII, 1904, p. 222, fig. 33.

Locality.—Lawrence, Kansas. Upper Coal Measures; Le Roy (Lawrence) shales.

This form also appears to have cross veins.

(BLATTOIDEA) sp. Scudder.

Etblattina sp. SCUDDER, Bull. U. S. Geol. Surv., No. 101, 1893, p. 13, pl. II, fig. c; No. 124, 1895, p. 110, pl. XII, fig. 2.

Locality.—East Providence, Rhode Island. Pennsylvanian; Ten-mile series; Allegheny or Conemaugh stage.

This wing also occasionally shows distinct cross veins.

Specimen in U. S. National Museum. Cat. No. 38072.

(BLATTOIDEA) PACKARDI (Clark).

Blatta americana CLARK, Proc. Newport Nat. Hist. Soc., II, 1884, p. 12.

Mylacris packardi CLARK, Rand. notes Nat. Hist., II, 1885, p. 64.

Mylacris packardi SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 41, pl. I, figs. 2, 3.

Locality.—Bristol, Rhode Island. Pennsylvanian; ? Allegheny or Conemaugh stage.

Likewise with distinct cross veins.

(BLATTOIDEA) sp. Scudder.

————— SCUDDER, Mem. Boston Soc., III, 1879, p. 128, pl. VI, fig. 13.

Locality.—Cannelton, Pennsylvania. Allegheny formation; Kittanning group; roof of the Middle Kittanning coal.

(BLATTOIDEA) sp. Sellards.

Etblattina sp. SELLARDS, Amer. Jour. Sci. (4), XVIII, 1904, p. 222, fig. 34, pl. I, fig. 9.

Locality.—Lawrence, Kansas. Upper Coal Measures; Le Roy (Lawrence) shales.

(BLATTOIDEA) sp. Sellards.

Etblattina sp. SELLARDS, Amer. Jour. Sci. (4), XVIII, 1904, p. 222, fig. 35, pl. I, fig. 8.

Locality.—Lawrence, Kansas. Upper Coal Measures; Le Roy (Lawrence) shales.

(BLATTOIDEA) sp. Scudder.

Etblattina sp. SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, pl. XII, fig. 7.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

This wing shows distinct cross veins, and anal area doubled under.

Specimen in U. S. National Museum. Cat. No. 38086.

(BLATTOIDEA) sp. Scudder.

Etblattina sp. SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, pl. XII, fig. 6.

Locality.—Cassville, West Virginia. Dunkard formation; Lower Permian.

C. BODY PARTS.

(BLATTOIDEA) sp. Scudder.

"*Body of cockroach*" SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 25, pl. XII, figs. 8 to 11.

Locality.—Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

(BLATTOIDEA) sp. Sellards.

"*Pronotum of a cockroach*" SELLARDS, Amer. Jour. Sci. (4), XVIII, 1904, p. 133, fig. 24.

Locality.—Lawrence, Kansas. Upper Coal Measures; Le Roy (Lawrence) shales.

D. YOUNG STAGES.

The connection between nymphs and imagoes appears to me in no case proved. Moreover we have as yet far too few stages to enable us to determine the genus of nymphs, because hitherto a relatively very small number of such fossils have been found and described. I therefore consider it advisable to cite here all the previously observed forms and leave their interpretation to the future.

(BLATTOIDEA) sp. Sellards.

?*Egg case of cockroach* SELLARDS, Amer. Jour. Sci. (4), XVIII, 1904, p. 134, fig. 25.

Locality.—Lawrence, Kansas. Upper Coal Measures; Le Roy (Lawrence) shales.

This fossil really looks very similar to an egg sack. Moreover, such forms have already been found in Europe.

(BLATTOIDEA) DIPELTIS DIPLODISCUS Packard.

Dipeltis diplodiscus PACKARD, Amer. Nat., XIX, 1885, p. 293; Mem. Acad. Nat. Sci., III, 1886, p. 145, pl. v, figs. 2, 2a.

Dipeltis diplodiscus SCHUCHERT (part), Proc. U. S. Nat. Mus., XIX, 1897, p. 672, pl. LVIII, figs. 2, 3 (not figs. 4, 5).

Mylaeris diplodiscus SELLARDS, Amer. Jour. Sci. (4), XV, 1903, p. 309, pl. VII, fig. 8.

Mylaeris (Dipeltis) diplodiscus SELLARDS (part), Amer. Jour. Sci. (4), XVIII, 1904, p. 124, fig. 4 (not figs. 2, 3), pl. I, fig. 3.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Even though the blattoid nature of this fossil can not be questioned, it still seems to me unproved that the specimen pertains to a mylaerid

nymph, because other equally wide blattoid forms occur, which do not belong to the mylacrids. The venation is not discernible (in the figures).

Holotype and plesiotype.—Cat. Nos. 25924 and 38864, U.S.N.M.

(BLATTOIDEA) MELANDERI, new species.

Mylacris (Dipeltis) diplodiscus MELANDER (not Packard), Jour. Zool. (2), XI, 1903, p. 185, pl. v, fig. 6; pl. VII, fig. 6.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

(BLATTOIDEA) SCHUCHERTIANA, new species.

Dipeltis diplodiscus SCHUCHERT (not Packard) (part), Proc. U. S. Nat. Mus., XIX, 1897, p. 672, pl. LVIII, figs. 4, 5 (not figs. 2, 3).

Mylacris (Dipeltis) diplodiscus SELLARDS (not Packard) (part), Amer. Jour. Sci. (4), XVIII, 1904, p. 124, fig. 2 (not figs. 3, 4).

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Holotype.—Cat. No. 25925, U.S.N.M.

(BLATTOIDEA) SELLARDSII, new species.

Mylacris (Dipeltis) diplodiscus SELLARDS (not Packard) (part), Amer. Jour. Sci. (4), XVIII, 1904, p. 124, fig. 3 (not figs. 2, 4).

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

All these larval forms may belong to different species.

(BLATTOIDEA) ANCEPS (Sellards).

Mylacridæ ——— SELLARDS, Amer. Jour. Sci. (4), XV, 1893, p. 309, pl. VII, fig. 9.

Mylacris anceps SELLARDS, Amer. Jour. Sci. (4), XVIII, 1904, p. 129, fig. 5.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

(BLATTOIDEA) SELLARDSIANA, new species.

Mylacris elongata (nymph) SELLARDS, Amer. Jour. Sci. (4), XVIII, 1904, p. 125, figs. 6, 7.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

The association of this nymph with *Mylacris elongata* Scudder appears to me not proved.

(BLATTOIDEA) CARRI (Schuchert).

Dipeltis carri SCHUCHERT, Proc. U. S. Nat. Mus., XIX, 1897, p. 671.

Dipeltis carri SELLARDS, Amer. Jour. Sci. (4), XV, 1903, p. 309.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

(BLATTOIDEA) sp. Sellards.

Etblattina sp. SELLARDS, Amer. Jour. Sci. (4), XV., 1903, pl. VII, fig. 5.

Locality.—Lawrence, Kansas. Upper Coal Measures; Le Roy (Lawrence) shales.

(BLATTOIDEA) SCHUCHERTI, new species.

Locality.—Sharp Mountain Gap, 2 miles south of Tremont (Mammoth), Pennsylvania. Anthracite series; stage?



FIG. 103.—BLATTOIDEA SCHUCHERTI.

A wing pad 7 mm. long, with pointed end. The 5 branches of the subcosta are distinctly seen radiating from one point as in typical mylacrids; further, the radius with 7 branches proceeding obliquely forward. The media sends several branches backward, as does the cubitus. The anal area is longitudinally extended and shows 4 veins.

Holotype.—Cat. No. 38740, U.S.N.M.

(BLATTOIDEA) sp. Handlirsch.

Etblattina mazona SELLARDS (part), Amer. Jour. Sci. (4), XV, 1904, p. 309, pl. VII, figs. 1, 2; XVIII, 1904, p. 129, fig. 14.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ?(Allegheny) stage.

? (BLATTOIDEA) sp. Handlirsch.

Etblattina mazona SELLARDS (part), Amer. Jour. Sci. (4), XV, 1903, p. 309, pl. VII, figs. 3, 4; XVIII, 1904, p. 129, fig. 13, pl. I, fig. 2.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ?(Allegheny) stage.

Unfortunately the photographic representation of this form (Plate I, fig. 2) is so indistinctly reproduced that I can not clearly distinguish the so-called "ovipositor," which is so very sharply defined in the schematic figure. For this reason I do not believe in its existence, and furthermore do not consider it determined that these larval forms belong to *Etblattina mazona* Sellards. It may be that they actually pertain to a protoblattoid form and not at all to a true blattoid; possibly to a Protorthopteron. On no account, however, does it seem to

me admissible, from such a specimen, to establish the hypothesis that the entire Protoblattariae had ovipositors and were accordingly derived from locust-like ancestors; for it could not perhaps be shown that the "ovipositor" in question is nothing but an excrement. Moreover, in regard to this, let it here be pointed out that in the protoblattoid *Euczenus imaginale* ovipositors are present, which suggests the idea that this larval form, in case it actually possesses an ovipositor, may belong to the Eucenidae.

(BLATTOIDEA) sp. Handlirsch.

Etblattina mazona SELLARDS (part), Amer. Jour. Sci. (4), XVIII, 1904, p. 129, fig. 10.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage.

(BLATTOIDEA) sp. Handlirsch.

Etblattina mazona SELLARDS (part), Amer. Jour. Sci. (4), XVIII, 1904, p. 129, fig. 11.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage.

This form was taken for a young individual by Sellards, although it is larger than the one designated as more mature.

(BLATTOIDEA) sp. Handlirsch.

Etblattina mazona SELLARDS (part), Amer. Jour. Sci. (4), XVIII, 1904, p. 129, fig. 12.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage.

(BLATTOIDEA) JUVENIS (Sellards).

Etblattina juvenis SELLARDS, Amer. Jour. Sci. (4), XVIII, 1904, p. 131, figs. 17 to 21.

Locality.—Lawrence, Kansas. Upper Coal Measures; Le Roy (Lawrence) shales.

A number of blattoid nymphs were included under this name.

(BLATTOIDEA) sp. Sellards.

——— SELLARDS, Amer. Jour. Sci. (4), XVIII, 1904, p. 134, fig. 23.

Locality.—Lawrence, Kansas. Upper Coal Measures; Le Roy (Lawrence) shales.

INSECTS OF DOUBTFUL POSITION.

PHTHANOCORIS OCCIDENTALIS Scudder.

Phthanocoris occidentalis SCUDDER, Proc. Boston Soc., XXII, 1883, p. 58; Mem. Boston Soc., III, 1885, p. 348, pl. xxxii, fig. 4.

Locality.—Kansas City, Missouri. Chanute shales; Conemaugh ? stage.

Through various manipulations the original is somewhat disfigured, and in consequence seems actually like a hemipteran wing, while the counterpart makes a quite different impression. In all probability it may belong to a Protorthopteron or to a similar form.

Cotypes.—Cat. No. 38157, U.S.N.M.

MEGATHENTOMUM PUSTULATUM Scudder.

Megathentomum pustulatum SCUDDER, Geol. Surv. Illinois, III, 1868, p. 570, fig. 1; Mem. Boston Soc., III, 1885, p. 346, pl. xxxii, figs. 1, 9, 10.

Megathentomum pustulatum Brongniart, Bull. Soc. Rouen (3), XXI, 1885, p. 60.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian, Kittanning ? (Allegheny) stage.

This gigantic insect has been placed by authors in most heterogeneous groups, but in my opinion it will only be rightly interpreted when an entire example, with the base and the posterior margin of the wing, is at hand.

Holotype.—Cat. No. 38145, U.S.N.M.

PROTODICTYON PULCHRIPENNE Melander.

Protodictyon pulchripenne MELANDER, Jour. Geol., XI, 1903, p. 196, pl. vi, fig. 1, pl. vii, fig. 17.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage.

The defective drawing renders this incapable of interpretation.

PARAHAPLOPHLEBIUM, new genus.

PARAHAPLOPHLEBIUM LONGIPENNIS Scudder.

Haplophlebiium longipennis SCUDDER, Proc. Amer. Acad., XX, 1885, p. 172; Bull. Soc. Rouen (3), XXI, 1885, p. 61.

Locality.—Pittston, Pennsylvania. Carboniferous.

Certainly does not belong in the genus *Haplophlebiium*.

Cotypes.—Cat. No. 38097, U.S.N.M.

(**GERARUS** ?) ——— Scudder.

Gerarus? SCUDDER, Mem. Boston Soc., III, 1885, p. 345, pl. xxxii, fig. 5.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian, Kittanning ? (Allegheny) stage.

Too imperfectly preserved.

PSEUDOPOLYERNUS, new genus.

PSEUDOPOLYERNUS LAMINARUM (Scudder.)

Polyernus laminarum SCUDDER, Mem. Boston Soc., III, 1885, p. 343, pl. xxxi, fig. 1.

Locality.—Pittston, Pennsylvania. (? Near top of Pottsville; Upper Transition group.)

At all events this should not be placed in the genus *Polyernus*. Probably a Protorthopteron or a protoblattoid.

Cotypes.—Cat. No. 38155, U.S.N.M.

PSEUDOGERARUS, new genus.

PSEUDOGERARUS SCUDDERI, new species.

Gerarus? SCUDDER, Mem. Boston Soc., III, 1885, p. 344, pl. xxxii, fig. 3.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage.

Holotype.—Cat. No. 38151. U.S.N.M.



FIG. 104.—PSEUDOGERARUS SCUDDERI.

CHRESTOTES Scudder.

CHRESTOTES LAPIDEA Scudder.

Chrestotes lapidea SCUDDER, Geol. Surv., Illinois, III, 1868, p. 567, fig. 2; Mem. Boston Soc., III, 1885, p. 341, pl. xxxi, fig. 2.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage.

This species is to be regarded as the type of the genus *Chrestotes*. The form may belong to the protorthopteres.

? CHRESTOTES DANÆ (Scudder).

Miamia danæ SCUDDER, Geol. Surv., Illinois, III, 1868, p. 566, fig. 1.

Gerarus danæ SCUDDER, Mem. Boston Soc., III, 1885, p. 345, pl. xxxi, fig. 5.

Chrestotes danæ BRONGNIART, Bull. Soc. Rouen (3), XXI, 1885, p. 66.

Gerarus danæ MELANDER, Jour. Geol., XI, 1903, p. 197.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage.

This form may belong in the genus *Chrestotes*.

AXIOLOGUS, new genus.

AXIOLOGUS THORACICUS, new species.

"Allied to *Hemeristia occidentalis*?" SCUDDER, Mem. Boston Soc., III, 1885, p. 342, pl. xxxi, fig. 8.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

An insect about 30 mm. long, with broad wings folded over one another, and a pear-shaped elongated pronotum. The venation of the hind wing only can be made out, and in this we distinguish the 3



FIG. 105.—AXIOLOGUS THORACICUS.

nearly parallel veins, costa, subcosta, and radius; further, a media furcating above the middle of the wing, and a long, arcuate cubitus curving backward, with several branches directed posteriorly. The anal area was evidently plaited, and contains a large number of veins spread out fanlike.

Probably this form belongs to the protorthopteres or protoblattoids.

Holotype.—Cat. No. 38137, U.S.N.M.

ENDOIASMUS, new genus.

ENDOIASMUS RETICULATUS, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

A portion of an insect about 45 mm. long. The wings lie over one another and cover the abdomen. On one wing, which I regard as a hind wing, are seen an abridged subcosta and an unbranched radius reaching nearly to the apex, the sector of which takes rise near the

base of the wing and sends out 3 oblique branches to the apical border. The media stretches obliquely to the inner margin and forms a large fork. After this follow several sloping veins, which I can not interpret.

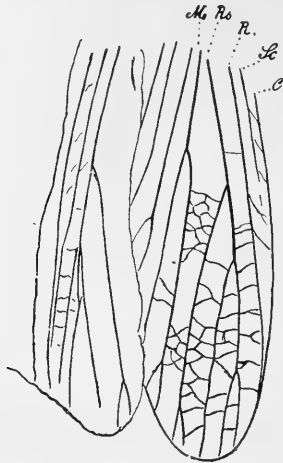


FIG. 106.—ENDOIASMUS RETICULATUS.

Between the veins, coarse, occasionally reticulate, curved, irregular cross veins are to be seen.

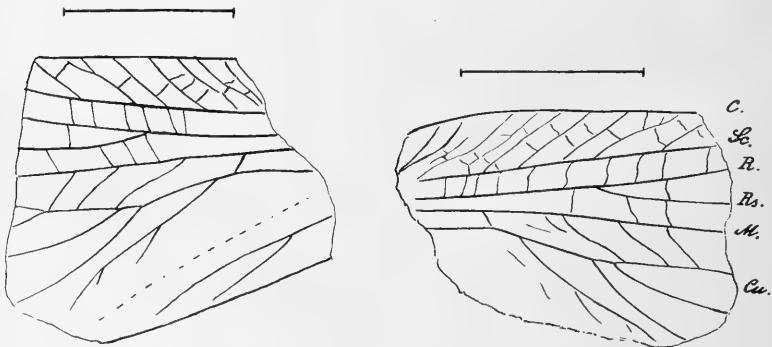
This form may belong to the protorthopteres or to the protoblattoids.

Holotype.—Cat. No. 38819, U.S.N.M.

ARCHIMASTAX, new genus.

ARCHIMASTAX AMERICANUS, new species.

Locality.—Lemons Coal Bank, near Fayetteville, Arkansas. Middle Pottsville; Lower Coal-bearing shale?



FIGS. 107, 108.—ARCHIMASTAX AMERICANUS.

A fragment, about 24 mm. long, of a wing at least twice this length. Costa marginal; costal area wide; subcosta with many oblique veinlets directed forward, which are united by cross veins. The radius sends

out its sector above the middle of the wing. The media, as far as visible, is not branched. Then follows a vein whose curve is slightly S-shaped, and which gives off several branches backward; this is probably the cubitus. Below this vein lies a broad open area through which a fold appears to extend, and still below this is to be seen a very sloping furcate vein (? anal 1) directed toward the posterior margin. Cross veins distant and irregular.

Holotype.—Impression and reverse in the U. S. National Museum: Cat. Nos. 38711, 38712.

This form may either belong to the protorthopteres or may constitute a distinct group of the Palaeodictyoptera, which might be united with the paoliins. It likewise somewhat recalls *Palaeomastax carbonis* from Belgium.

ARCHÆOLOGUS, new genus.

ARCHÆOLOGUS FALCATUS, new species.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage.

The basal portion of a front and hind wing, whose length may amount to about 45 mm. The anterior margin of the front wing is distinctly curved. Costa marginal; costal area broad; subcosta not reaching to the apex, with oblique veinlets directed anteriorly, between which cross veins may be observed. Radius not far removed from the subcosta. Radial sector arising below the middle of the wing. Media, as far as visible, not divided. Cubitus separating near the base into 2 main branches, the superior of which is joined to the media by an oblique cross vein. First anal vein not strongly arched. Hind wing evidently with enlarged anal area. Cross veins irregular, widely separated.

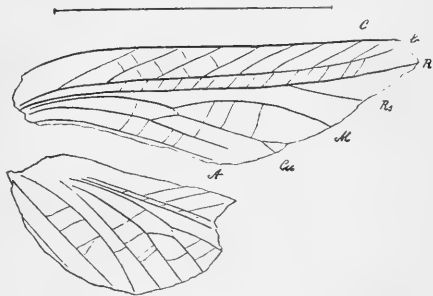


FIG. 109.—ARCHÆOLOGUS FALCATUS.

This form may belong to the protorthopteres or to the protoblattoids.

Holotype.—Cat. No. 38818, U.S.N.M.

HEMERISTIA OCCIDENTALIS Dana.

Hemeristia occidentalis DANA, Amer. Jour. Sci. (2), XXXVII, 1864, p. 35, fig. 2.

Hemeristia occidentalis SCUDDER, Mem. Boston Soc., I, 1866, p. 191, pl. VI, figs. 1, 3.

Locality.—Morris, Illinois. Pennsylvanian; Kittanning ? (Allegheny) stage.

This form is to be regarded as the type of the genus *Hemeristia*.

Plesiotype.—Cat. No. 38137, U.S.N.M.

? *Palæoblattaria* SCUDDER, Mem. Boston Soc., III, 1879, p. 128, pl. vi, fig. 11.

Locality.—Sydney, Cape Breton. Middle Coal formation; Allegheny stage?

A very imperfect fragment of a wing.

DIDYMOPHLEPS CONTUSA (Scudder).

Termes contusus SCUDDER, Proc. Boston Soc., XIX, 1878, p. 300.

Didymophleps contusa SCUDDER, Mem. Boston Soc., III, 1885, p. 330, pl. xxix, fig. 6.

Goldenbergia contusa BRONGNIART, Bull. Soc. Rouen (3), XXI, 1885, p. 61.

Locality.—Vermilion County, Illinois. Pennsylvanian; Allegheny stage?

Too imperfectly preserved.

Mantis? SCUDDER, Geol. Surv. Illinois, III, 1868, p. 567, fig. 3.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

Is probably an insect, but certainly no *Mantis*, yet can not be more accurately determined.

ARCHEGOGRYLLUS PRISCUS Scudder.

Archegogryllus priscus SCUDDER, Proc. Boston Soc., XI, 1868, p. 402; Mem. Boston Soc., III, 1885, p. 323, pl. xxix, figs. 2, 3.

Locality.—Tallmadge, Ohio. Upper Pottsville; Sharon shales. Scudder himself considered this form obscure, but nevertheless placed it in the group of the protophasmids.

CERCOPYLLIS JUSTICIÆ Scudder.

Cercopyllis justicie SCUDDER, Mem. Boston Soc., IV, 1890, p. 471, pl. xlii, fig. 6.

Locality.—Fairplay, Colorado. Lower Permian.

CERCOPYLLIS DELICATULA Scudder.

Cercopyllis delicatula SCUDDER, Mem. Boston Soc., IV, 1890, p. 471, pl. xlii, fig. 11.

Locality.—Fairplay, Colorado. Lower Permian.

CERCOPYLLIS ADOLESCENS Scudder.

Cercopyllis adolescens SCUDDER, Mem. Boston Soc., IV, 1890, p. 472, pl. xlii, fig. 12.

Locality.—Fairplay, Colorado. Lower Permian.

The 3 last-named forms were regarded as cercopids by Scudder, but why this was done no reason is to be found, for they could as well be fragments of blattoids.

FOSSILS WRONGLY IDENTIFIED AS INSECTS.

“EUEPHEMERITES SIMPLEX” Scudder.

Euphemerites simplex SCUDDER, Geol. Surv. Illinois, III, 1868, p. 571, fig. 8.

Euphemerites simplex LACOE, List Pal. Foss. Ins., 1883, p. 7.

Ephemerites simplex SCUDDER, Mem. Boston Soc., III, 1885, p. 350.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

“EUEPHEMERITES GIGAS” Scudder.

Euphemerites gigas SCUDDER, Geol. Surv. Illinois, III, 1868, p. 571, fig. 9.

Euphemerites gigas LACOE, List Pal. Foss. Ins., 1883, p. 7.

Ephemerites gigas SCUDDER, Mem. Boston Soc., III, 1885, p. 350.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

“EUEPHEMERITES AFFINIS” Scudder.

Euphemerites affinis SCUDDER, Geol. Surv. Illinois, III, 1868, p. 572, fig. 10.

Euphemerites affinis LACOE, List Pal. Foss. Ins., 1883, p. 7.

Ephemerites affinis SCUDDER, Mem. Boston Soc., III, 1885, p. 350.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

“EUEPHEMERITES PRIMORDIALIS” Scudder.

Euphemerites primordialis SCUDDER, Proc. Boston Soc., XIX, 1878, p. 248.

Locality.—Pennsylvania? Carboniferous.

All these fossils were finally pronounced plant remains by Scudder himself.

“MYLACRIDÆ?” ——— Scudder.

Mylacridæ sp. SCUDDER, Bull. U. S. Geol. Surv., No. 124, 1895, p. 55, pl. 11, fig. 4.

Archoblattina beecheri, SELLARDS, Amer. Jour. Sci. (4), XVIII, 1904, p. 218.

Locality.—Mazon Creek, near Morris, Illinois. Pennsylvanian; Kittanning? (Allegheny) stage.

I consider this fossil excluded from the insects.

“LIBELLULA CARBONARIA” Scudder.

Libellula carbonaria SCUDDER, Canad. Nat. (2), VIII, 1876, pp. 88–89, text fig.

Locality.—Cape Breton, Nova Scotia. Carboniferous.

Was later regarded as a spider by Scudder himself.

? ——— Scudder.

————— SCUDDER, Mem. Boston Soc., III, 1883, p. 350, pl. xxiii, fig. 2.

Locality.—Near Pittston, Pennsylvania. Coal C of the Boston Mine. Near top of the Pottsville series; Upper Transition group.

May be the remains of a plant.

Specimen in U. S. National Museum. Cat. No. 38099.

"ARCHÆSCOLEX CORNEUS" Matthew.

Archæscolex corneus MATTHEW, Trans. Roy. Soc. Canada, IV, 1889, p. 59, pl. iv, fig. 11.

Locality.—St. John, New Brunswick. Little River group.
Probably belongs to the myriapods.

"PODURITES SALTATOR" Matthew.

Podurites saltator MATTHEW, Trans. Roy. Soc. Canada (2), I (IV), 1895, p. 273, pl. II, fig. 10.

Locality.—St. John, New Brunswick. Little River group.
Can not possibly be a podurid and probably belongs to the arachnids
(*Geralinura*, etc.?).

"GERACUS TUBIFER" Matthew.

Geracus tubifer MATTHEW, Bull. Soc. New Brunswick, XV, 1897, p. 55.

Locality.—St. John, New Brunswick. Little River group.
In any event, this is neither a podurid nor an insect.

The horizontal distribution of American Paleozoic insects.^a

Orders and families of Paleozoic insects.	Pennsylvanian.						Permian. VII. Dunkard. (Lower Permian.)	Represented in the Mesozoic.	Represented in the European Paleozoic.
	Pottsville.			Coal measures.					
	I. Quinnimont. Lower Lykens series.	II. Sewell. Upper Lykens series.	III. Kanawha series. Mercer group. Connoqueensing shales. Upper Transition series.	IV. Allegheny (Kittanning) Anthracite series. Coal C. D.	V. Allegheny (Freeport) Anthracite series. Coal E.	VI. Conemaugh.			
Order Palaeodictyoptera	4	2	9	10	1	1	—	—	+
Family Dictyonuridae			2	4		1	—	—	+
Hypermegechthidae			1				—	—	+
Lithomantidae		1	1				—	—	+
Lycocercidae			1				—	—	+
Homothetidae			1				—	—	+
Heolidae			1		1		—	—	+
Polycreagidae				1			—	—	+
Eubleptidae				1			—	—	+
Metropatoridae	1						—	—	+
Paollidae	2			1			—	—	+
Enigmatoidae (Incerta sedis)	1	1	4	3			—	—	+
Order Protodonata			1		1		—	—	+
Order Megasecoptera				2			—	—	+
Order Hadentomoidea				1			—	—	+
Order Hapalopteroidea				1			—	—	+
Order Mixotermiotoidea			1			1	—	—	+
Order Protorthoptera			1	18			—	—	+
Family Spanioideridae			1	9		1	—	—	+
Edischiidae				2			—	—	+
Geraridae				7			—	—	+

^aSpecies of doubtful geologic age are placed in the strata in which they probably belong. The figures signify the number of known species; —, not represented; +, present.

The horizontal distribution of American Paleozoic insects—Continued.

Orders and families of Paleozoic insects.	Pennsylvanian.						Permian.	Represented in the Mesozoic.	Represented in the European Paleozoic.
	Pottsville.			Coal measures.					
	I. Quinnimont. Lower Lykens series.	II. Sewell. Upper Lykens series.	III. Kanawha series, Mercer group, Connoquenesing shales, Upper Transition series.	IV. Allegheny (Kittanning), Anthracite series. Coal C, D.	V. Allegheny (Freeport), Anthracite series. Coal E.	VI. Conemaugh.	VII. Dunkard. (Lower Permian.)		
Order Protoblattoidea				17		6		—	—
Family Oryctoblattidae				1		5		—	—
Ætrophlebidæ				1				—	—
Cheliphlebidæ				1				—	—
Eucenidæ				4				—	—
Gerapompidæ				3				—	—
Adiphlebidæ				2				—	—
Anthracothremmidæ				1				—	—
(Incertæ sedis)				4		1		—	—
Order Blattoidea			4	56	37	73	93	+	+
Family Archimylacridæ			4	19	6	12	60	+	+
Spiloblattinidæ						38	17	—	—
Mylacridæ				21	26	3		—	—
Dietyomylacridæ						1		—	—
Neomylacridæ					3			—	—
Pteridomylacridæ					1			—	—
Idiomylacridæ					1			—	—
Neorthroblattinidæ							1	—	—
Poroblattinidæ						4	2	—	—
Pteroblattinidæ						2	1	+	+
Diechoblattinidæ							2	—	—
(Incertæ sedis)				16		13	7	—	—
Summary of classified species	4	2	16	105	39	81	93		
Insects not classified		1	2	12	2	1	3		

The foregoing table presents a series of noteworthy facts. We here see that nearly all the orders occurring in America have likewise been already recognized in analogous European beds; in like manner almost all the families rich in forms have been identified in both parts of the world. In such groups as first exist in single individuals, no sort of conclusion as to their actual horizontal distribution can obviously be drawn, and it consequently follows that there is a striking agreement in the Paleozoic fauna in both continents. Only one order (Blattoidea) represented in the Paleozoic of America extends over into the Mesozoic, with two families, while all other orders are replaced in the younger formations by those more highly specialized.

Moreover, from a percentile comparison of the number of forms represented in the single orders in the various formations of the Paleozoic, it follows that the Paleodictyoptera, which on morphological grounds I consider the stem group of all winged insects, appear first and decrease from the oldest beds to the younger, while the more highly specialized orders (Prodonata, Megasecoptera, Hadenomoidea,

Hapalopteroidea, Mixotermioida, Protorthoptera, and Protoblattoidea), which I regard as connecting links between the Paleodictyoptera and modern insect groups, and which may be designated *transitional* groups, appear later than their conjectural ancestors, attain their maximum in the middle beds, and with the close of the Paleozoic again vanish. It follows finally that the single modern order, thus far found in the American Paleozoic, the Blattoidea, first makes its appearance toward the middle of this period and continues with progressive increase to the close.

The following table should make clear the fact last mentioned:

Orders of insects.	Pennsylvanian.						Permian.
	Pottsville.			Coal Measures.			
	I.	II.	III.	IV.	V.	VI.		VII.
	Quinnimont, Lower Lykens series.	Sewell, Upper Lykens series.	Kanawha series, Mercer group, Connoquenesing shales, Upper Transition series.	Allegheny (Kittanning); Anthraciteseries, Coal C, D.	Allegheny (Freeport), Anthracite series, E Coal.	Conemaugh.	Dunkard. (Lower Permian).
Paleodictyoptera.....	Per ct. 100	Per ct. 100	Per ct. 56.25	Per ct. 9.52	Per ct. 2.56	Per ct. 1.23	Per ct. 0
(Transitorial groups.)							
Protodonata, Megaseoptera, Haden- tomoida, Hapalopteroidea, Mixotermi- oidea, Protorthoptera, Protoblattoidea....	0	0	18.75	37.14	2.5	8.64	0
Blattoidea.....	0	9	25	53.33	94.87	90.12	100

ALPHABETIC LIST OF NAMES.

[The valid designations are printed in roman letters; the synonyms in italics.]

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<i>stipata</i> Scudder	796	<i>carri</i> Schuchert	800
<i>triassica</i> Scudder	796	<i>diplodiscus</i> Packard	799
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<i>eakiniana</i> Scudder	742	<i>sp.</i> Sellards	798
<i>exigua</i> Scudder	797	<i>sp.</i> Sellards	801
<i>exilis</i> Scudder	750	<i>sp.</i> Scudder	796
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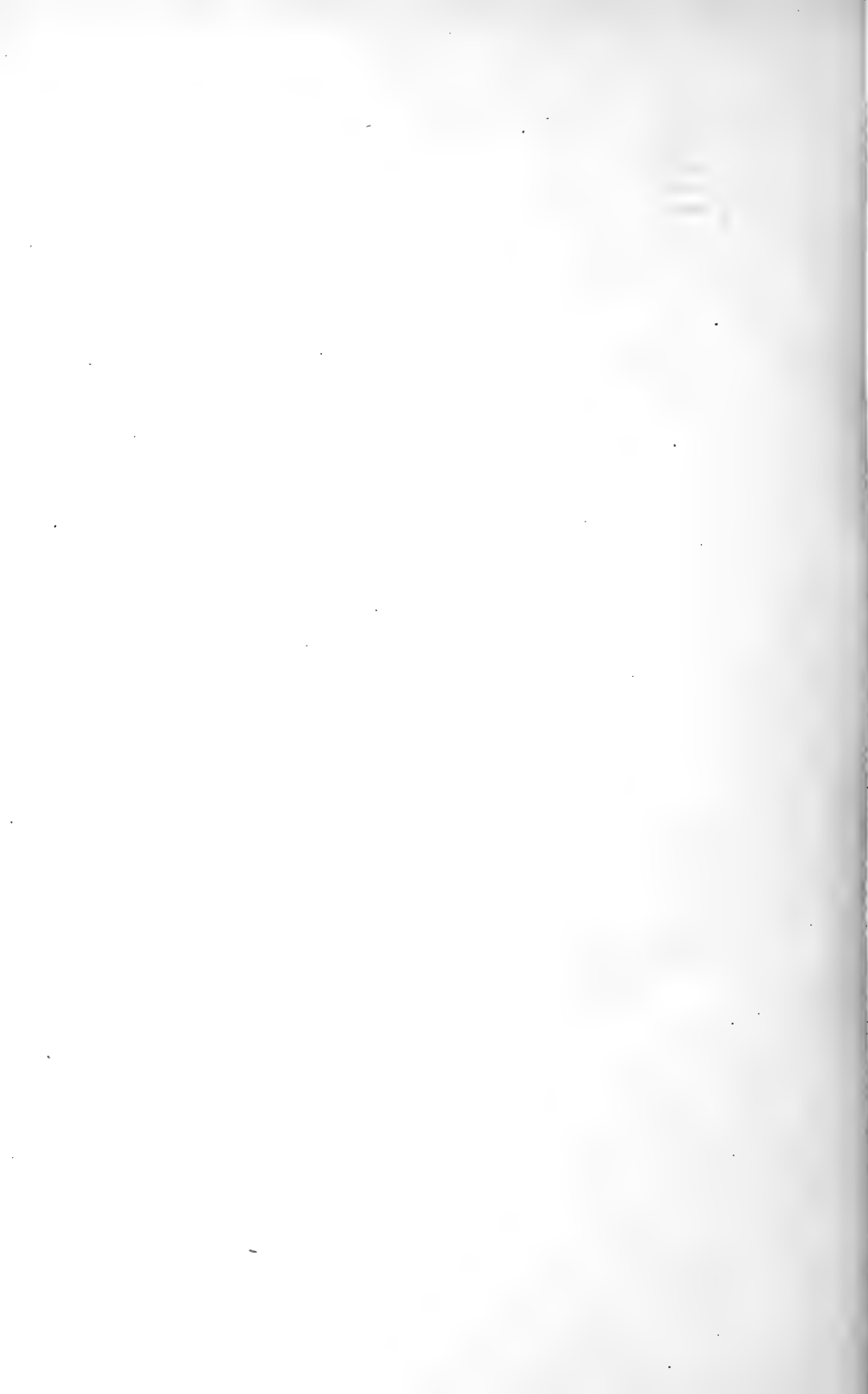
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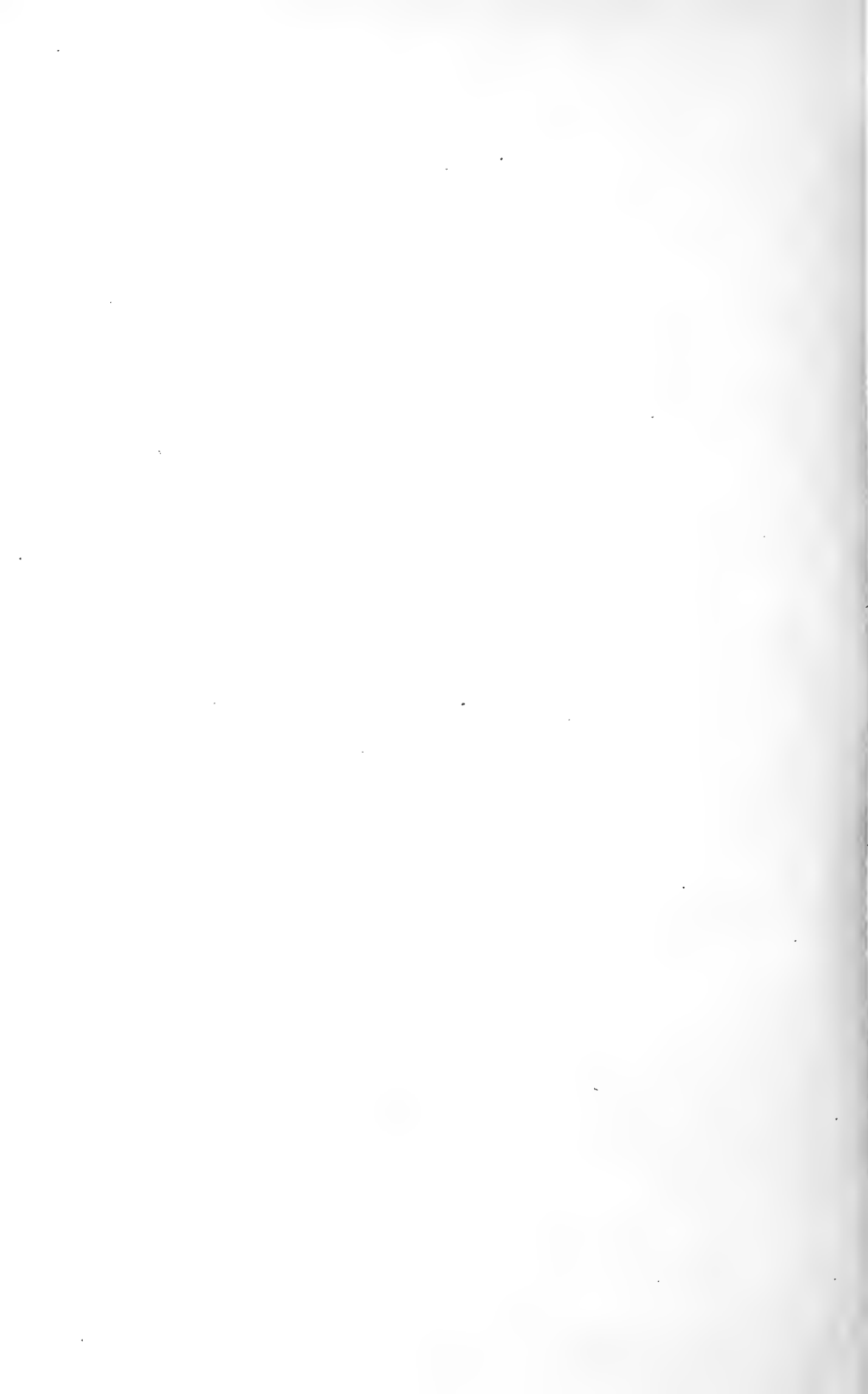
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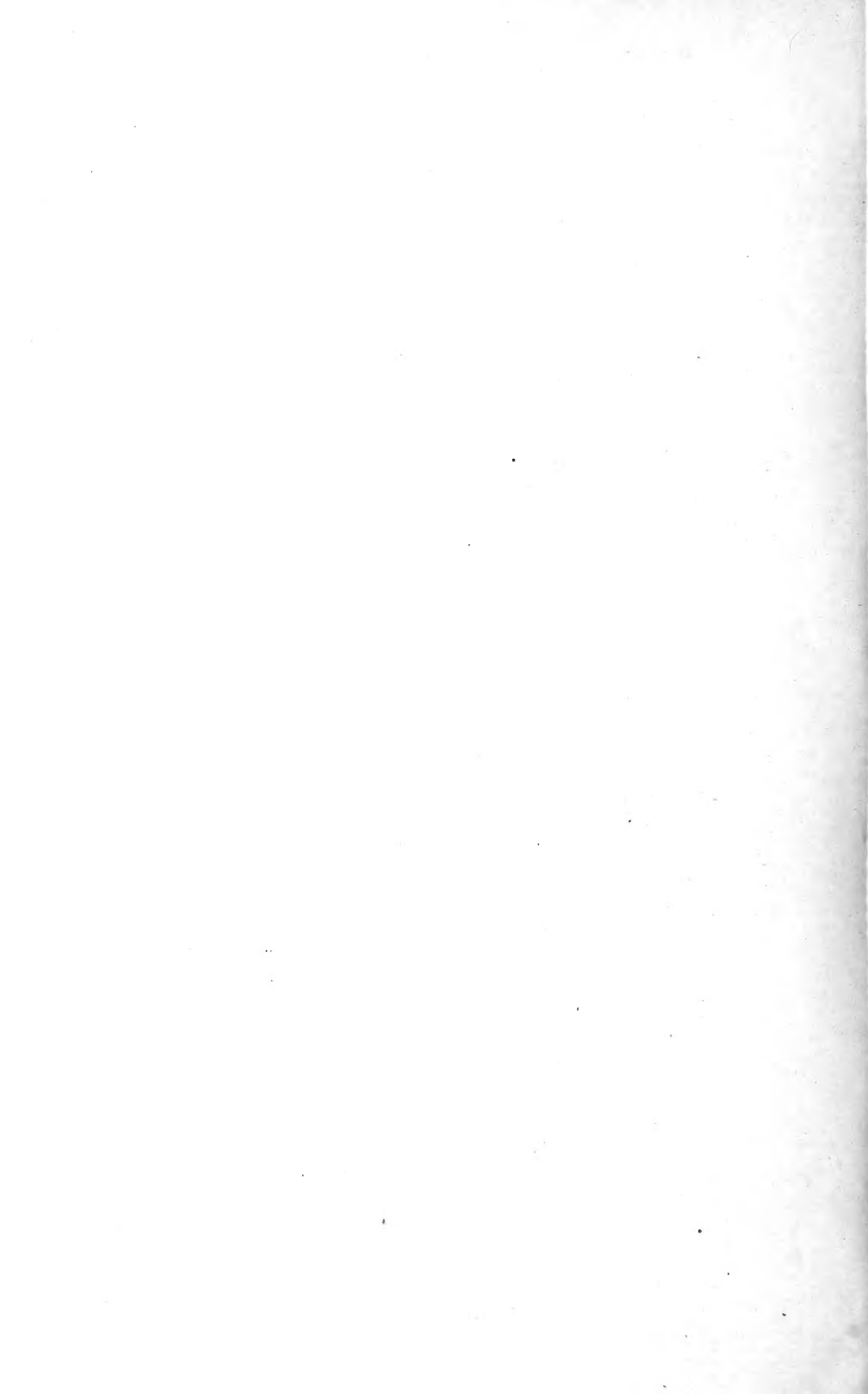












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